Music Educators' Attitudes Toward Integrating Science into Curricular Ensemble Rehearsals

by

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A thesis presented to the Honors College of Middle Tennessee State University in partial fulfillment of the requirements for graduation from the University Honors College

Fall 2018

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Abstract

This survey of Tennessee music educators asks: 1) What are the attitudes of Tennessee music educators in regards to integrating science into their curricular ensembles? 2) How do these attitudes differ based on gender, experience, ensemble type, school district type, and level of education? To answer these questions, the researchers developed and distributed a survey to all Tennessee Music Education Association (TMEA) members. The respondents indicated that they see the benefits of integrating science into their curricular ensemble rehearsal as beneficial, but they do not have adequate time or resources to do so successfully. In addition, teachers in rural districts, younger teachers, teachers with fewer years of teaching experience, and teachers with less education reported less confidence and therefore need even more time and resources to effectively integrate science into their ensemble rehearsals.

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Introduction

Music is an essential part of a child's education and holds a host of benefits for children and young people, such as more highly developed language and reasoning, coordination skills, emotional development, and opportunities for meaningful expression (National Association of Music Education, 2018). In addition to being essential to a child's education, music is also an important part of a child's development, making quality music education essential to the development and continuation of modern society. Subject integration's role in modern education is a result of the standards movement. Today, music education is guided and driven by music education standards, which provide teachers with "learning goals" for each grade level (Common Core State Standards Initiative, 2018). Before 1970, national music education standards did not exist. In the 1970s and 1980s, all curricular subjects began to create and adopt standards (State University Education Encyclopedia, 2011). The National Association for Music Education (NAfME), at the time called the Music Educator's National Conference (MENC), requested a grant from the U.S. Department of Education, the National Endowment for the Humanities, and the National Endowment for the Arts to research and develop national standards for music (Fehr, 2015).

In 1994, NAfME (then called MENC) debuted nine national music education standards. These nine standards were broad and applied to all subjects and grade levels within music education. Each standard had a set of grade level and subject specific sub-standards (Fehr, 2015). In 2014, NAfME released a new set of music education standards, which focus on fostering music literacy (National Core Arts Standards, 2014). Music literacy is deconstructed into four foundations – Perform, Create, Respond, and

Connect. Each of these foundations is deconstructed into standards and sub-standards which are specific to subject and grade level (National Core Arts Standards, 2014). As the fourth foundation within the 2014 music education standards is “connect,” music educators are clearly being encouraged to integrate other subjects into their classroom. In addition, one of the middle and high school ensemble standards under the connect foundation states that students must be able to “demonstrate understanding of relationships between music and the other arts, other disciplines, varied contexts, and daily life” (National Core Arts Standards, 2014). This standard further suggests that music educators integrate other subjects into their classrooms, making integration an essential part of music education.

Bresler (1995) reports that research has not focused on the practical implications of integrating within a classroom setting, such as professional development aimed at increasing teachers’ effectiveness when engaging in subject integration, administrator oversights, and teachers planning time and resources. These aspects of subject integration are imperative to consider in order that students receive the most thoughtful instruction possible. This study seeks to address the practical side of integration by asking teachers how they perceive integration in light of teacher cooperation, administrative support, and student musicianship in their school.

In 1998, NAfME (then MENC) published a report titled “A Research Agenda for Music Education: Thinking Ahead.” This article listed 53 questions in the field of music education that were not adequately answered. NAfME (then MENC) asks its greatest minds, “What are some ways that music can be integrated with other school subjects, such as language arts, visual arts, mathematics, science, social studies, and physical education? How can teachers maintain high standards of music education within interdisciplinary settings?" This question is the foundation of this study. While integration and interdisciplinary curricula are often defined as two different entities, for the purposes of this study, integration and integrated curriculum will both be defined as "addressing standards of two or more disciplines within one classroom." Additionally, the terms school subjects and disciplines will be used interchangeably.

Janet Barrett (2007) notes in her article "Music Teachers' Lateral Knowledge" that music teachers integrate reading, language arts, and math most often into their classrooms. In addition, most of the integration literature that exists pertains to integrating other subjects into the general music classroom and not the ensemble classroom. Furthermore, there is little literature available on integrating science into the music classroom (Aaron, 1994). Considering the 1998 question posed by NAfME (then MENC) and the above information about current research on integration into a music ensemble class, researching a topic in the field of integrating science into the music ensemble classroom follows naturally. While investigating methods of integrating science into ensemble classrooms is a worthwhile cause, it only strikes the surface of the issue of integration in ensemble classrooms. Educators' attitudes and beliefs on integrating science into an ensemble classroom drive their methods and practices. Research investigating the attitudes of music educators regarding integrating science into their music ensemble classroom would be particularly useful to the body of subject integration research.

Recently, Zdzinski, Ogawa, Dell, Yap, Adderly, and Dingle (2007) surveyed Japanese and American teachers on their attitude and practices of integrating music with other subjects in a study that focused on the comparisons between the cultures under several different distinctions. Zdzinski et al. (2007) focused on the difference in attitudes between American and Japanese teachers when integrating music with other academic subjects, finding that American teachers had higher attitude ratings toward integration when compared to Japanese teachers and that American teachers were more likely to integrate music with history and social sciences than Japanese teachers. I used the survey in the study conducted by Zdzinski et al. (2007) as a basis for creating the survey in my study. However, instead of analyzing the difference between attitudes different cultures take in regards to integration in the music classroom, this study will analyze the attitudes of Tennessee music educators on integrating science into their ensemble rehearsals in order to compare attitudes across the lines of age, experience, district type, degree type, and ensemble type in this study.

As stated above, the national standards for music education suggest that music educators relate their music instruction to other subjects. In addition, integrated curriculum is a prevalent ideal in education literature today. Furthermore, some subjects are more commonly integrated into music instruction than other subjects. Science, in particular, is a subject that is infrequently integrated into a music lesson. In light of these facets, this study will investigate:

1) What are the attitudes of Tennessee music educators in regards to integrating science into their curricular ensembles?
2) How do these attitudes differ based on gender, experience, ensemble type, school district type, and level of education?

Review of Literature

Educational philosophers hold many different ideas on integration. Integration expert James Beane holds the belief that there should be no separation between disciplines. Howard Gardner, on the other hand, believes that distinguishing between different disciplines benefits student learning (Wiggins, 2001). Bennett Reimer holds a purist approach in regards to music education. He believes that music study should not be "devalued or diluted" when it is integrated with other subjects (Rosenbloom, 2004). The utilitarian philosophy, held by Joseph W. Polisi, states that music is only valuable to the extent that it can assist students in learning other subjects (Rosenbloom, 2004). Sandra T. Field's organic philosophy is a middle ground between purist and utilitarian philosophy (Rosenbloom, 2004). Organic philosophy contends that subjects can retain their individual integrity while being integrated with other subjects in interdisciplinary curriculum (Rosenbloom, 2004). These differing ideas express many perspectives on the important matter of integration.

In her 1995 article, "The Subservient, Co-Equal, Affective, and Social Integration Styles and their Implications for the Arts," Liora Bresler categorizes arts integration into four categories: subservient, co-equal, affective, and social integration. In the subservient approach, one subject is used to "spice" another subject. Integrating in this style focuses on lower-level thinking skills. In the co-equal, or cognitive integration style, two subjects are taught together, as equals. The co-equal style of integration requires the teacher to have specialized knowledge in more than one subject. Due to the fact that many teachers simply do not have specialized knowledge in more than one subject area, Bresler found this integration style to be the least commonly practiced. Bresler differentiates between two kinds of affective integration: mood-change affective integration and creative affective integration. In mood-change affective integration, students are exposed to another subject for a change of pace. An example of mood-change affective integration would be an elementary classroom teacher playing music for students to help them relax during reading time. In creative affective integration, teacher supply students with a stimulus and allow students to create. This kind of integration puts very few restraints or rules on students and allows them to express themselves. In the social integration style, arts are used to enhance the social functions of a school. An administrator would be implementing the social integration style if he or she added a music program or a student art show to an event he or she wanted parents to attend, such as parent-teacher conference night. Bresler notes that in practice, integration will rarely fit squarely into one category (Bresler, 1995).

While education experts disagree on exactly what model of integration yields the most benefits, they do agree on a few central facets that must be present in integrated education. First, educators who are attempting to integrate within a school need to agree on their philosophy of integration. Philosophies do not need to be the same from school to school, but all the educators working together with the same group of students need to be on the same page (Wiggins, 2001). Castanos (1997) echoes that a successful interdisciplinary environment will only exist in a school where reflection and teacher collaboration are fostered. Additionally, educators and researchers agree that the connections made in integrated education need to be natural and unforced (Aaron, 1994). Forced and superficial connections do not increase student learning. These approaches are not true integration (Wiggins, 2001; Roberts, 2004; Barrett, 2001). Furthermore, integration works to teach children in the way that their brains work. Much of the research in brain function supports the philosophy of interdisciplinary education. The human brain learns information by associating in patterns. Learning subjects in isolation and without subject integration goes against the way students learn most naturally (Snyder, 2001). Sorel (2005) notes that when subjects are taught with integration, students gain perspective and subjects gain relevancy.

The National Association of Secondary School Principals published a paper in 1998 that reported the benefits of interdisciplinary education. The study found that students learn real life skills at a faster rate with a higher retention rate when using integration. In addition, teachers who successfully implement integration in their classrooms benefit from better student behavior and teacher collaboration and a "sense of togetherness" (Burton, 2001). Furthermore, Castanos (1997) reports that interdisciplinary and integrated education prepare students for the "real world" after school.

Research suggests that music educators understand the benefits of integration but cannot or do not integrate for a variety of reasons. Gail Burnaford reports that general music teachers see the benefits of integrating other subjects into their classroom but see their students for so few minutes per week that integration is often practically impossible (Burnaford, 1993). Wiggins suggests that well-intentioned integration efforts often lead to an unequal relationship between the subjects, with one subject constantly serving another subject. Bresler would describe this kind of integration as subservient integration (Wiggins, 2001; Bresler, 1995). Barrett (2001) mentions that educators are turned off from meaningful interdisciplinary education by forced and superficial integration prominently displayed in their school setting. Castanos (1997) adds that secondary educators are limited by 50-minute classes. Both Bresler (1995) and Castanos (1997) note that some forms of integration require educators fundamentally to change their curriculum or classroom practices, which is time-consuming and unappealing, especially to well-seasoned educators.

The literature on integration provides a plethora of examples for music educators to borrow. These examples allow music educators to give their students the opportunity to make meaningful connections between subjects. A music teacher could integrate information on Germany into a lesson about the music of Wagner (Aaron, 1994). Lessons on musical acoustics, sound waves, harmonics, and intervals lend themselves to integrating with math and science concepts (Rogers, 2004). Research encourages music teachers to pick music composed and sung during the time period their students are studying in history class. Small efforts to make sure students are singing music that accurately reflects the time period they are studying in another class fosters meaningful connections and increases their learning and understanding (Rosenbloom, 2004).

While examples can be helpful, Bresler notes that most of the literature surrounding integration focuses on what she calls co-equal integration. Co-equal or cognitive integration is the most difficult kind of integration to accomplish because it requires the teacher to have expert knowledge on two subjects and teach them in conjunction. An example of co-equal integration is a history teacher with a musical background teaching history in conjunction with music history, including recordings of meaningful compositions of the era. In addition, much of the literature focuses on "intellectual motivations for integration" and gives little thought to the practical considerations involved in integration (Bresler, 1995).

Methodology

I measured Tennessee music educators' attitudes toward integrating science into their ensemble rehearsals with an 18-item online survey that collected demographic information and information on five facets of integration: benefits, collaboration efforts, quality of education, received training, and perceived administrative support. I received Institutional Review Board (IRB) approval for the study on the basis of the proposed design and recruitment materials. The Tennessee Music Educators Association (TMEA) executive board reviewed the survey and recruitment materials and distributed the recruitment tools to all TMEA members via the TMEA listserv. Data collection continued for 40 days. At the end of 40 days, data was compiled and analyzed both as a whole and based on the demographic information collected in the survey, such as gender, district type, age, number of years of teaching experience, and type of ensemble instructor (band, orchestra, or choir).

The youngest respondent in this survey was 23 and the oldest is 71 (Table 1). The average number of years of teaching experience of all respondents in this survey was 19.27. The range of years of teaching experience went from 1 to 47 (Table 1). Approximately half of the participants were female and half of the participants were male (Table 2). Approximately half of respondents reported that they teach in suburban school districts. Approximately one quarter of respondents reported that they teach in rural school districts. The fewest number of respondents reported that they teach in urban school districts (Table 3).

Table 1

Age and Years of Teaching Experience

	Mean	Standard deviation	Minimum	Maximum
Age	46.2	13.89	23	71
Years teaching	19.27	4.72	1	47

Table 2

Gender

Gender	Male	Female	Other
Percent	46.42%	50.00%	3.57%
Count	26	28	2

Table 3

School District Type

School District Type	Suburban	Rural	Urban	Town	Did not indicate
Percent	53.57%	23.21%	7.14%	12.50%	3.57%
Count	30	13	4	7	2

Over half of respondents reported that they teach band. Approximately one quarter of participants reported that they teach choir. The other respondents reported that they teach either orchestra or multiple curricular ensembles (Table 4). The greatest number of respondents reported a master’s degree as their highest level of education. Just over 40 percent of participants reported a bachelor’s degree as their highest level of education (Table 5).

Table 4

Ensembles taught

Ensembles	Band	Choir	Orchestra	Multiple	Did not Indicate
Percent	57.14%	26.79%	5.36%	5.36%	5.36%
Count	32	15	3	3	3

Table 5

Highest Level of Education

Highest Level of Education	Bachelor's	Bachelor's with work toward a Master's	Master's	Master's plus additional graduate work	Educational Specialist Degree	Doctorate
Percent	23.21%	21.42%	30.36%	14.29%	5.36%	5.36%
Count	13	12	17	8	3	3

Results

The 56 respondents to this survey were asked to give their opinions on a variety of facets of subject integration. The benefits of integrating science into curricular ensemble rehearsals are described first. Opinions on teacher collaboration and training concerning integrating science into curricular ensemble rehearsals are discussed second. Respondents' perceptions of their administration's attitude concerning integrating science into curricular ensemble rehearsals is reported next. Then, the effect integrating science in curricular ensembles has on various aspects of individual student music education is stated. Lastly, individual statements that garnered a wide variety of responses are broken down into results based on demographic data, such as ensemble type, school district type, number of years of teaching experience, and amount of education.

Participants were asked to consider how beneficial integrating science in their curricular ensemble rehearsals is in a variety of difference circumstances. Respondents reported a lower mean value for the statement "Connections made by students in ensemble rehearsals between music and science are artificial" than any other statement concerning the benefits to integrating science into their curricular ensembles (Table 6). The most common response for the statement "Connections made by students in ensemble rehearsal between music and science are artificial" was "disagree." In addition, the mean response for the statement "Integrating science into my ensemble rehearsal is beneficial to my students" was higher than the mean response for the statement "Integrating science into my ensemble rehearsal is beneficial to my teaching" (Table 6). While the mean response for the statement "Integrating science into my ensemble rehearsal is beneficial to my teaching" was 3.45, indicating a mean response of "neither disagree or agree," the most common response for that statement was "agree."

Table 6

Perceived Benefit

Item	Mean	Standard deviation
Average agreement with the statement "Integrating science into my ensemble rehearsal is beneficial to my students."	3.63	0.91
Average agreement with the statement "Integrating science into my ensemble rehearsal is beneficial to my teaching."	3.45	0.88
Average agreement with the "Connections made by students in ensemble rehearsals between music and science are artificial."	2.38	0.92
Average agreement with the statement "Integrating science into my ensemble rehearsal helps my students make connections that they otherwise might miss."	3.80	0.95

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

Participating teachers were asked to consider collaboration and training within the context of integration. The means of all statements concerning collaboration and training were below 3 (Table 7; Table 8). Out of all statements measuring attitude towards collaboration in integrating science in the curricular ensemble classroom, the statement with the lowest mean response was "My students' science teachers reach out to me in order to facilitate integration" (Table 7). The mean response for the statement "My students' science teachers reach out to me in order to facilitate integration" is lower than the mean response for the statement "I reach out to my students' science teachers in order to facilitate integration" (Table 7). While the mean response for the statement "I reach out to my students' science teachers in order to facilitate integration" was 2.14 and the most common response for that statement was "disagree," nine respondents indicated the response "agree". In addition, the mean response for the statement the statement "I have received specific training (professional development, workshops, etc.) on how to integrate science into my ensemble classroom" was less than 2 (Table 8). Interestingly, there were very few "neither disagree or agree" responses to the statement "My school provides opportunities for collaboration between science and music teachers." Most respondents indicated that they either agreed or disagreed with that statement.

Table 7

Perceived Collaboration

Item	Mean	Standard deviation
Average agreement with the statement "I work with my students' science teachers in order to integrate science into my ensemble class."	2.04	0.83
Average agreement with the statement "I reach out to my students' science teachers in order to facilitate integration."	2.14	1.02
Average agreement with the statement "My students' science teachers reach out to me in order to facilitate integration."	1.78	0.88
Average agreement with the statement "My school provides opportunities for collaboration between science and music teachers."	2.21	1.23

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

Table 8

Perceived Training

Item	Mean	Standard deviation
Average agreement with the statement "I have received specific training (professional development, workshops, etc.) on how to integrate science into my ensemble classroom."	1.75	0.86

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

Participants were asked consider their school administration's attitude and its effect on integrating science into curricular ensemble rehearsals. Participants reported a higher mean response for the statement"My administration supports the science program at my school" than the statement "My administration supports the music program at my school" (Table 9). However, the most common response for both the statement "My administration supports the science program at my school" and the statement "My administration supports the music program at my school" was "strongly agree." Six respondents indicated a higher numerical response for the statement "My administration supports the music program at my school" than the statement "My administration supports the science program at my school." Fifteen respondents indicated the opposite – a higher numerical response for the statement "My administration supports the science program at my school" than the statement "My administration supports the music program at my school." A majority of participants indicated the same response for the statements "My administration supports the science program at my school" and "My administration supports the music program at my school." In addition, the mean response for the statement "I only integrate science into my rehearsal when my principal/advisor is present" is below 2 (Table 9). The most common response for the statement "I only integrate science into my rehearsal when my principal/advisor is present" was "strongly disagree."

Table 9

Perceived Administrative Attitude

Item	Mean	Standard deviation
Average agreement with the statement "My administration expects me to integrate science into my ensemble class."	2.21	0.91
Average agreement with the statement "My administration helps me with efforts to integrate science into my ensemble classroom."	1.95	0.76
Average agreement with the statement "My administration supports the music program at my school."	4.04	1.07
Average agreement with the statement "My administration supports the science program at my school."	4.31	0.92
Average agreement with the statement "I only integrate science into my rehearsal when my principal/ advisor is present."	1.75	0.88

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

Respondents considered the impact integrating science into their ensemble rehearsals has on a number of facets of student musicianship. The mean response for the statement "What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education" was the highest out of all statements concerning student musicianship (Table 10). The most common response for the statement "What impact does integrating science into your curricular ensemble rehearsal have on: student performance ability" was "neutral impact" while the most common response for the statement for "What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education" was "somewhat positive impact." While the most common response for the statement "What impact does integrating science into your curricular ensemble rehearsal have on: amount of available rehearsal time" was "somewhat negative impact," 35.08% of respondents indicated the response "neutral impact." For the statement, "What impact does integrating science into your curricular ensemble rehearsal have on: amount of available lesson planning time," seven respondents indicated "negative impact."

Table 10

Perceived Quality of Student Musicianship

Item	Mean	Standard deviation
Average impact integrating science into curricular ensemble rehearsals has on student performance ability.	3.64	0.75
Average impact integrating science into curricular ensemble rehearsals has on student overall music education.	3.95	0.84
Average impact integrating science into curricular ensemble rehearsals has on amount of available rehearsal time.	2.55	0.83
Average impact integrating science into curricular ensemble rehearsals has on amount of available lesson planning time.	2.54	0.88

Note: Responses were recorded on a Likert scale where 1=negative impact, 2=somewhat negative impact, 3=neutral impact, 4=somewhat positive impact, and 5=positive impact)

The responses for the statement "my administration supports the music program at my school" had a large spread. Respondents in rural school districts reported a much lower mean response for the statement “my administration supports the music program at my school” more than respondents from all other school district types (Table 11). While the most common answer for the statement “my administration supports the music program at my school” was “strongly agree” for both the entire participant pool and participants that teach in a rural school district, a majority of the participants that indicated the responses “disagree” or “strongly disagree” also reported that they teach in rural school districts.

Table 11

My administration supports the music program at my school.

	Mean	Standard Deviation
All (n=56)	4.04	1.07
Rural (n=13)	3.85	1.41
All other school district types (n=43)	4.15	0.96

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

The statement “My school provides opportunities for collaboration between science and music teachers” generated a variety of responses. Participants from rural school districts reported a lower mean value for the statement “My school provides opportunities for collaboration between science and music teachers” more than participants from all other school district types (Table 12). No participants from rural school districts reported the response “strongly agree” when asked to consider the statement “My school provides opportunities for collaboration between science and music teachers.”

Table 12

My school provides opportunities for collaboration between science and music teachers.

	Mean	Standard Deviation
All (n=56)	2.21	1.23
Rural (n=13)	2.08	1.19
All other school district types (n=43)	2.26	1.26

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

The statement “I reach out to my students’ science teachers in order to facilitate integration” generated diverse responses. Within the participant pool, younger teachers and teachers with the fewest years of teaching experience reported a lower mean for the statement “I reach out to my students’ science teachers in order to facilitate integration” than older teachers and teachers with the most years of teaching experience (Table 13). In addition, participants with the greatest number of years of teaching experience reported a high mean value for the above statement. Participants with the fewest number of years of teaching experience reported a low mean value for the same statement.

Table 13

I reach out to my students’ science teachers in order to facilitate integration.

	Mean	Standard Deviation
All (n=56)	2.14	1.02
Below 30 years of age	1.45	0.52
60 years of age and above	3.00	1.05
Teaching between 1 and 10 years	1.53	0.62
Teaching 41 years or more	3.50	0.71

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

While the most common response for the statement for “What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education” was “somewhat positive impact,” not all respondents reported this response. Respondents who teach choir reported a higher mean value for the statement “What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education” than respondents that teach band (Table 14). In addition, the most common response to the statement “What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education” for band teachers was “somewhat positive impact” while the most common response to the same statement for choir teachers was “positive impact.”

Table 14

What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education.

	Mean	Standard Deviation
All (n=56)	3.95	0.84
Band (n=32)	3.78	0.83
Choir (n=15)	4.33	0.82

Note: Responses were recorded on a Likert scale where 1=negative impact, 2=somewhat negative impact, 3=neutral impact, 4=somewhat positive impact, and 5=positive impact)

The most common response for the statement “Connections made by students in ensemble rehearsal between music and science are artificial” was “disagree;” however, not all respondents answered this way. Participants with more education than a bachelor’s degree reported a lower mean for the statement “Connections made by students in ensemble rehearsals between music and science are artificial” than participants who possess only a bachelor’s degree (Table 15). Interestingly, the most common answer for the statement “Connections made by students in ensemble rehearsals between music and science are artificial” for both respondents with more education than a bachelor’s degree and individuals who possess only a bachelor’s degree was “disagree.

Table 15

Connections made by students in ensemble rehearsals between music and science are artificial.

	Mean	Standard Deviation
All (n=56)	2.38	0.92
Bachelor’s Degree (n=13)	2.58	1.08
Individuals with more education than a master’s degree (n=43)	2.15	0.69

Note: Responses were recorded on a Likert scale where 1=strongly disagree, 2=disagree, 3=neither disagree or agree, 4=agree, and 5=strongly agree)

Discussion

Responses in the area of perceived benefit were generally positive. Surveyed teachers reported a mean response of 2.38 for the statement "Connections made by students in ensemble rehearsals between music and science are artificial" (Table 6), indicating an average response of "disagree." This could be, as noted by Bresler (1995) and Castanos (1997), a result of educators being well-informed of the benefits of integrated education. Bresler (1995) and Castanos (1997) also report that educators often see integrating within their classroom to be time-consuming, which could explain why participants' mean response for the statement "Integrating science into my ensemble rehearsal is beneficial to my students" was higher than the statement "Integrating science into my ensemble rehearsal is beneficial to my teaching," indicating that respondents agreed with the latter statement more than the former (Bresler, 1995; Castanos 1997).

In regards to cooperation and perceived training, responses were generally negative. Participants reported a mean response of 1.78 for the statement "My students' science teachers reach out to me in order to facilitate integration" and a mean response of 2.14 for the statement "I reach out to my students' science teachers in order to facilitate integration" (Table 7). These results indicate that participants think they reach out to their students' science teachers more than their students' science teachers reach out to them. This opinion could be the result of music's status as a non-tested subject in schools. The Tennessee Department of Education administers TNReady tests for English Language Arts, Mathematics, Science, and Social Studies (Tennessee Department of Education, 2018). Since music is a non-tested subject, participants could feel pressure to learn about what their students are learning in science class and integrate that information into their curricular ensemble rehearsals. This attitude makes subject integration a one way street where non-tested subjects cater to the needs of tested subjects. The one way street philosophy of integration does not benefit student learning to the greatest degree possible (Bresler, 1995). Similarly, respondents reported low mean responses for the statements "I work with my students' science teachers in order to integrate science into my ensemble class" and "My school provides opportunities for collaboration between science and music teachers." The low mean responses indicate that participants disagree with the above statements. This disagreement could indicate a disconnection between music and science teachers. According to current research, this disconnection is not be beneficial to student learning (Wiggins, 2001).

When focusing on administrative attitude, participants' responses varied widely. The statement "My administration expects me to integrate science into my ensemble class" had a mean response of 2.21 while the statement "I have received specific training (professional development, workshops, etc.) on how to integrate science into my ensemble classroom" had a mean response of 1.75 (Table 8; Table 9). Due to the fact that the mean response for the statement "My administration expects me to integrate science into my ensemble class" was higher than the mean response to the statement "I have received specific training…on how to integrate science into my ensemble classroom," respondents indicated that they agree with the former statement more than the latter. These results lead to the conclusion that school administrators are expecting the teachers participating in this study to integrate science into their curricular ensemble rehearsals but are not giving teachers the tools to do so.

Interestingly, participants reported a higher mean response for the statement "My administration expects me to integrate science into my ensemble class" than the statement "I reach out to my students' science teachers in order to facilitate integration." These results indicate that participants agree with the statement "My administration expects me to integrate science into my ensemble class" more than the statement "I reach out to my students' science teachers in order to facilitate integration," which points to the fact that participants in this study think they are not receiving enough training or professional development telling them how to integrate science into their ensemble rehearsals. At the same time, participants are not reaching out to their school's science teachers for help. While it is unclear why participants are not reaching out to their schools' science teachers, these results could stem from the fact that participants in this study see their students for so few minutes a day (Castanos, 1997).

Opinions on administrative support are generally positive. However, respondents reported a higher mean response for the statement "My administration supports the science program at my school" than the statement "My administration supports the music program at my school" (Table 9), indicating that respondents agree with the former statement more than the latter statement. In light of this information, participants have little reason to want to integrate science into their ensemble rehearsals even if they are expected to by their administration because they think their program is less supported and less valuable to their administration than other programs. These feelings lead to participants using artificial, unnatural, and forced moments of 'integration' in their curricular ensemble classroom, which do not help students learn (Aaron, 1994). At the same time, respondents reported a low mean response for the statement "I only integrate science into my rehearsal when my principal/advisor is present" (Table 9), indicating that participants disagree with this statement. These results could have many implications. The resuls sshow that participants understand that they need to be integrating science into their curricular ensemble rehearsals on a regular basis. It may be that teachers may be attempting to integrate science into their curricular ensmbles but are doing it poorly. It may be that teaches simply do not have the resources to integrate science successsfully.

Responses concerning the perceived quality of student musicianship were generally positive. Surveyed teachers indicated a higher mean response for the statement "What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education" than the statement "What impact does integrating science into your curricular ensemble rehearsal have on: student performance ability" (Table 10). In addition, the most common response for the statement "What impact does integrating science into your curricular ensemble rehearsal have on: student performance ability" was "neutral impact" while the most common response for the statement for "What impact does integrating science into your curricular ensemble rehearsal have on: student overall music education" was "somewhat positive impact." These results together indicate that on average, respondents think that integrating science into a curricular ensemble rehearsal has a more positive impact on student overall music education than student musicianship. Furthermore, participants report low mean responses for the statements "What impact does integrating science into your curricular ensemble rehearsal have on: amount of available rehearsal time" and "What impact does integrating science into your curricular ensemble rehearsal have on: amount of available lesson planning time" (Table 10). A low mean response for both of the above statements indicate that on average, respondents believe that integrating science into their curricular ensemble rehearsals has a negative impact of available rehearsal time and available lesson planning time. These results together show that although participants understand the benefits students receive when they integrate science in their curricular ensemble rehearsals and music educators do not think they are given enough time to plan their lessons, rehearse their music, develop each student's individual playing ability, and integrate science into their rehearsal.

The statement "My administration supports the music program at my school" garnered a wide variety of responses. Participants in rural school districts reported a lower mean response to the statement "My administration supports the music program at my school" than participants from all other school district types (Table 11). This result indicates that respondents that teach in rural school districts believe their school administration does not support their music program as well as the respondents that do not teach in rural schools believes their administration supports their music programs. In addition, participants that teach in rural school districts reported a lower mean response to the statement "My school provides opportunities for collaboration between science and music teachers" than music educators from all other school district types (Table 12), which indicates that participants in rural areas think they have fewer school-sponsored opportunities to collaborate with their schools' science teachers than participants from non-rural school districts. These outcomes could be the result of the challenges inherent in teaching in a rural environment, such as "geographic isolation, low teacher pay and fewer community assets" (Azano, 2016).

Two very different opinions emerged between surveyed teachers concerning the statement, “I reach out to my students’ science teachers in order to facilitate integration.” Younger respondents and teachers with the fewest number of years of teaching experience reported a lower mean response for the statement “I reach out to my students’ science teachers in order to facilitate integration” than older teachers and teachers with the largest number of years of teaching experience (Table 13). In fact, participants with the greatest number of years of teaching experience reported a mean response of 3.50 for the statement “I reach out to my students’ science teachers to facilitate integration,” while participants with the fewest number of years of teaching experience reported a mean response of 1.53 (Table 13). This difference in the opinion between older and younger teachers and teachers with more teaching experience and less teaching experience could be the result of the “different cultures” between these two groups of people (Angelides, 2004). No matter the reason, all educators should be encouraged to reach out to and cooperate with other teachers. Younger educators and educators with fewer years of teaching experience are therefore at a disadvantage.

The statement “What impact does integrating science in your curricular ensemble rehearsal have on: student overall music education” was answered differently by band teachers and choir teachers. Participants who teach choir reported a higher mean response for the statement “What impact does integrating science in your curricular ensemble rehearsal have on: student overall music education” than participants who teach band (Table 14), indicating that choir teachers in this study think that integrating science into curricular ensemble rehearsals has a more positive impact on student overall music education than band teachers in this study. This result could be due to the practical differences in subject matter between band and choir. Band teachers are tasked with teaching a variety of skills and techniques to students playing a variety of different instruments. Vocal technique, while challenging, remains the same across voice types. It may be that band teachers think that if they choose to integrate science into their curricular ensemble rehearsal, they are choosing to neglect teaching a group of performers about technique on their instrument. This difference between band and choir could explain why band teachers think that integrating science in their rehearsal has a more negative impact on student overall music education than choir teachers.

Differences of opinion arose over the statement “Connections made by students in ensemble rehearsals between music and science are artificial.” Respondents with more education than a bachelor’s degree reported a lower mean response for the statement “Connections made by students in ensemble rehearsals between music and science are artificial” than individuals in this study who possess only a bachelor’s degree (Table 15), indicating that individuals with only a bachelor’s degree think that connections made by students in ensemble rehearsal between music and science are more artificial than individuals in this study with more education than a bachelor’s degree. The statement “Connections made by students in ensemble rehearsals between music and science are artificial” has been proven false by the current research in subject integration. When a genuine and relevant connection is made between music and science in a curricular ensemble rehearsal, students are more likely to understand and learn the material (Snyder, 2001; Aaron, 1994). Since the results of this study indicate that individuals with only a bachelor’s degree think that connections made by students in ensemble rehearsal between music and science are more artificial than individuals in this study with more education than a bachelor’s degree, educators with only a bachelor’s degree may have less opportunity and availability to locate and digest current research on integration than their colleagues with more education than a bachelor’s degree.

Recommendations

Based on the results of this survey, music educators think they do not have adequate professional development and specialized training to effectively integrate science into their curricular ensemble rehearsals. In light of this, schools need to offer more professional development and specialized training opportunities specifically for music educators. A music classroom is unlike a math, English, science, or a social studies classroom. Music teachers need specific information, strategies, and techniques in order to integrate other subjects into their classroom in a way that is beneficial to student learning and maintains the integrity of a music classroom. Music educators also need to see viable examples of integration in a music classroom to understand the differences between superficial integration that does not benefit student learning and true integration. Administrators should seek out opportunities to bring celebrated music educators to their school districts and should send their music educators to as many conferences and special trainings as possible. Music teachers should work together on a campus-wide, district-wide, and state-wide basis to share ideas and techniques for successfully integrating science into their curricular ensemble rehearsals.

Additionally, the results of this survey indicate that music educators think they do not have enough time to integrate science into their curricular ensemble rehearsals the way they think their administration expects them to integrate. Therefore, music educators only need to be responsible for integrating an appropriate amount of other subject material into their music classes. The amount of other subject material that is expected to be integrated must be considered in proportion to the length of class time and the number of times students come to music class a week. Music educators, like all other educators, have a subject to teach and a limited amount of time in which to teach it. Unfair expectations by other teachers or administrators regarding integration can lead to bitterness between music educators and the rest of the school which will result in less student learning. In addition to having the proper resources to plan and teach integrated lessons, music educators need to have the proper amount of time to do so.

The results of this survey indicate the respondents are not reaching out to their schools' science teachers for help and support in integrating science into their curricular ensemble rehearsals. This result is likely due to the fact that music teachers and science teachers rarely have planning times in common. In fact, core teachers often have their planning time when their students are in elective courses, such as music. If music teachers are to reach out to their school's science teachers, current scheduling dictates that this will need to happen outside of school hours. Administrators could help this issue by facilitating co-curricular meetings in their school. Even a meeting between the science department head and the music faculty once a semester would provide all parties with resources and assistance to effectively use subject integration in their classrooms.

The results of this survey indicate that young teachers and teachers with fewer years of experience think they are lacking in knowledge, experiences, and resources to successfully integrate science into their curricular ensemble rehearsals. As a result, young teachers and teachers with fewer years of experiences need to take initiative, ask for help, and complete their own research on integration. Administrators should pay special attention to young music educators and music educators with only a few years of teaching experience and, as much as is possible, give these teachers additional professional development and training opportunities. Older music educators and more experienced music educators should also pay special attention to young music educators in their schools or districts and help these young educators when appropriate. When younger music educators and music educators with fewer years of experience do not integrate science in their ensemble rehearsal because they do not know how to do so, the students suffer.

Due to the fact that the results of this survey indicate that young teachers and teachers with fewer years of experience think they are lacking in knowledge, experiences, and resources to successfully integrate science into their curricular ensemble rehearsals, teacher education programs may need to make changes. Music education teacher candidates could eventually enroll in a integrated general education course, where they learn both the general education material and how to integrate that material into the music classroom. At the very least, the basics of integration must be taught to teacher candidates in their music education courses. In addition, teacher education programs need to prioritize teaching their students how to find valid sources for information. If a young teacher who has solid researching skills is faced with a lack of information on integration, the young teacher can conduct his or her own research and find the information he or she needs.

This survey shows that music educators in rural schools think less administrative support for their music program and think they have fewer school-sponsored opportunities for collaboration between music and science teachers than their non-rural colleagues. As such, teachers in rural school districts are at a distinct disadvantage when it comes to resources, help, and support. Rural music educators need to ask for help and attend as many professional development sessions and trainings as possible so they are able to teach and integrate other subjects in their curricular ensemble rehearsal to the optimum level. Administrators in rural school districts should, to the extent that they are able, sponsor and encourage collaboration between music teachers and science teachers. Music educators in suburban or town areas near rural areas can assist by communicating with their colleagues in rural areas and offering help and resources. Students in rural schools deserve the same education that students in urban, suburban, and town schools do. Educators and administrators can achieve this by working collaboratively and keeping the students' best interest as their focus.

Looking forward, further research could investigate similar research questions in different state or a larger regional area. Future research could also investigate what kinds of integration resources and professional development sessions are the most helpful to music educators. Particularly, it would be helpful if research determined what kinds of professional development, training, and resources would be most helpful to young music educators, music educators with little teaching experience, and music educators teaching in rural areas. In addition, a similar study from the perspective of science teachers integrating music into their classroom would allow for common conclusions to be drawn. Research that investigates structures for how integration works from the perspective of science teachers integrating arts into their lessons or perspective structures that would situate arts and science teachers as co-equal collaborators in the process of interdisciplinary teaching would also further the purpose of this study and the increase the body of subject integration research.

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Appendix A

A Survey for Music Educators

Filter Question: Do you teach at least one ensemble class during the school day?

Yes [1]

No [2] – Thank you for your willingness to take part in this survey! We are specifically interested in studying the teachers' attitude toward science integration in curricular ensembles.

1) What is your gender?
   Male [1]
   Female [2]
   Prefer not to say/other [3]

2) In what year were you born?
   [Drop down menu of years 1998-1940, "before 1940"]

3) How would you describe the school district in which you teach?
   Urban [1]
   Suburban [2]
   Rural [3]
   Town [4]

4) What ensembles do you teach during the school day? Check all that apply
   Band [1]
   Orchestra [2]
   Choir [3]
   Other [4] – please list:

5) Including this school year, how many years have you been a full-time school music teacher?
   [blank box]

6) What is the highest degree you possess?
   Bachelor's [1]
   Bachelor's with some work toward a Master's [2]
   Master's [3]
   Master's with some work toward doctorate [4]
   Educational Specialist Degree [5]
   Doctorate [6]

Indicate how much you agree with each of the following statements within this scale in reference to your ensemble classes:
[Strongly Disagree, Disagree, Neutral (neither agree or disagree), Agree, Strongly Agree]

Perceived Benefit
[1] Integrating science into my ensemble rehearsal is beneficial to my students.
[2] Integrating science into my ensemble rehearsal is beneficial to my teaching.
[3] Connections made by students in ensemble rehearsals between music and science are artificial.
[4] Integrating science into my ensemble rehearsal helps my students make connections that they otherwise might miss.

Collaboration
[5] I work with my students' science teachers in order to integrate science into my ensemble class.
[6] I reach out to my students' science teachers in order to facilitate integration.
[7] My students' science teachers reach out to me in order to facilitate integration.
[8] My school provides opportunities for collaboration between science and music teachers.

Training
[9] I have received specific training (professional development, workshops, etc.) on how to integrate science into my ensemble classroom.

Administration
[10] My administration expects me to integrate science into my ensemble class.
[11] My administration helps me with efforts to integrate science into my ensemble classroom.
[12] My administration supports the music program at my school.
[13] My administration supports the science program at my school.
[14] I only integrate science into my rehearsal when my principal/advisor is present.

Quality
What impact does integrating science into ensemble rehearsals have on the following?

Negative impact		Neutral Impact		Positive Impact
1	2	3	4	5

[15] Student performing ability
[16] Student overall music education
[17] Amount of available rehearsal time
[18] Amount of available lesson planning time

Appendix B

IRB Approval letter

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Thursday, May 10, 2018

Investigator(s): Mikaela Ray; Christopher Dye
Investigator(s') Email(s): mdr5b@mtmail.mtsu.edu; christopher.dye@mtsu.edu
Department: Music

Study Title: Music Educators' Attitudes Toward Integrating Science into Curricular Ensemble Rehearsals
Protocol ID: **18-1254**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category *(2) Educational Tests* A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	EXEMPT from furhter IRB review***	
Date of expiration	NOT APPLICABLE	
Participant Size	1200 (One thousand two hundred)	
Participant Pool	**Adults 18+**	
Mandatory Restrictions	1. Participants must be age 18+ 2. Informed consent must be obtained 3. Identifying information may not be collected/stored with responses	
Additional Restrictions	**None**	
Comments	None	
Amendments	**Date**	**Post-Approval Amendments**
		None

***This exemption determination only allows above defined protocol from further IRB review such as continuing review. However, the following post-approval requirements still apply:

- Addition/removal of subject population should not be implemented without IRB approval
- Change in investigators must be notified and approved
- Modifications to procedures must be clearly articulated in an addendum request and the proposed changes must not be incorporated without an approval
- Be advised that the proposed change must comply within the requirements for exemption
- Changes to the research location must be approved – appropriate permission letter(s) from external institutions must accompany the addendum request form
- Changes to funding source must be notified via email (irb_submissions@mtsu.edu)

IRBN007 Version 1.2 Revision Date 03.08.2016

- The exemption does not expire as long as the protocol is in good standing
- Project completion must be reported via email (irb_submissions@mtsu.edu)
- Research-related injuries to the participants and other events must be reported within 48 hours of such events to compliance@mtsu.edu

The current MTSU IRB policies allow the investigators to make the following types of changes to this protocol without the need to report to the Office of Compliance, as long as the proposed changes do not result in the cancellation of the protocols eligibility for exemption:

- Editorial and minor administrative revisions to the consent form or other study documents
- Increasing/decreasing the participant size

The investigator(s) indicated in this notification should read and abide by all applicable post-approval conditions imposed with this approval. Refer to the post-approval guidelines posted in the MTSU IRB's website. Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident.

All of the research-related records, which include signed consent forms, current & past investigator information, training certificates, survey instruments and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the sacure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

Click here for a detailed list of the post-approval responsibilities.
More information on exmpt procedures can be found here.

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Appendix C

Recruiting materials

Email Invitation

Subject Line: Music Educators and Science Integration

Dear TMEA Member,

We are writing to ask for your help by participating in a survey of K-12 music educators who lead curricular ensembles. The survey is part of an effort to learn more about music teachers' perceptions and attitudes about the integration of science into the ensemble rehearsal.

Your participation is voluntary and should take about 5-7 minutes. All of your responses are completely confidential and will not be used in ways that can identify you as a participant. If you have any questions or comments about this study, please contact us using the information provided below.

To participate, please follow this link: Music Educators and Science Survey

Or you may cut and paste the following URL into your browser:
https://goo.gl/forms/i6vDDUPgeeee8aS33

Thank you very much for your help in this important study.

Sincerely,

Mikaela Ray
Middle Tennessee State University
Phone: (248) 494-2702
Email: mdr5b@mtmail.mtsu.edu

Dr. Christopher Dye, faculty advisor
Middle Tennessee State University
Phone: (615) 494-8714
Email: christopher.dye@mtsu.edu

Facebook Recruitment Language

Please consider participating in a survey of K-12 music educators who lead curricular ensembles. The survey is part of an effort to learn more about music teachers' perceptions and attitudes about the integration of science into the ensemble rehearsal.

Your participation is voluntary and should take about 5-7 minutes. All of your responses are completely confidential and will not be used in ways that can identify you as a participant. If you have any questions or comments about this study, please contact using the information provided below.

Thank you very much for your help in this important study.

Sincerely,

Mikaela Ray
Middle Tennessee State University
Phone: (248) 494-2702
Email: mdr5b@mtmail.mtsu.edu

Dr. Christopher Dye, faculty advisor
Middle Tennessee State University
Phone: (615) 494-8714
Email: christopher.dye@mtsu.edu

{Embedded link in post}

Appendix D

Informed Consent

Project Title: Music Educators' Attitudes Toward Integrating Science into Curricular Ensemble Rehearsals

Purpose of Project: The purpose of this study is to investigate the attitudes of music educators about integrating science into their curricular ensemble rehearsals.

Procedures: If you agree to be in the study, you will take a one-time, 18 question online survey. This will take approximately 5-7 minutes to complete.

Risks/Benefits: The information collected in this survey will provide the music education profession with important feedback about how science integration is perceived in music ensembles and how future curricular efforts and professional development could be designed. There are no anticipated risks to participating in this voluntary study.

Confidentiality: Your name and contact information are not being collected as part of this study. All responses will be reported in the aggregate.

Principal Investigator and Faculty Advisor Contact Information: For questions about this study, contact the researcher, Mikaela Ray, at (248) 494-2702 or mdr5b@mtmail.mtsu.edu, or faculty advisor Christopher Dye at (615) 494-8714 or Christopher.dye@mtsu.edu.

Participating in this project is voluntary, and refusal to participate or withdrawing from participation at any time during the project will involve no penalty or loss of benefits to which you might otherwise be entitled. All efforts, within reason, will be made to keep the personal information in your research record private but total privacy cannot be promised. For example, your information may be shared with the Middle Tennessee State University Institutional Review Board. In the event of questions or difficulties of any kind during or following participation, you may contact the Principal Investigator as indicated above. For additional information about giving consent or your rights as a participant in this study, please feel free to contact the MTSU Office of Compliance at (615) 494-8918.

Consent

I have read the above information and my questions have been answered satisfactorily by project staff. I believe I understand the purpose, benefits, and risks of the study and give my informed and free consent to be a participant.

{Check box}