The Intersectionality of Arts, STEM, and Social-Emotional Learning: The Musical Sprouts Program

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The integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) concepts within the curriculum is a topic of great interest to educators, parents, and students alike. Since 2016, Musical Bridges Around the World (MBAW) has offered the Musical Sprouts program, a free educational and art performance program with the goal of introducing under-resourced students to the world's cultures integrated with STEAM curricula (see Musical Bridges, 2022). Prior to the COVID-19 pandemic, the Musical Sprouts program offered live musical performances at participating schools, along with the five STEAM lessons, pre-survey and post-survey. This program aims to combine STEAM learning in elementary schools with performing and visual arts programming. The educational curriculum was developed based on the Texas Essential Knowledge and Skills (TEKS) standards (Texas Education Agency, 2024) and the five STEAM (science, technology, engineering, arts, and mathematics) concepts.

The current study focuses on the third-year data of a three-year longitudinal study evaluating the impact of the Musical Sprouts program on students' STEAM learning outcomes and social emotional learning (SEL). The MBAW's Musical Sprouts program includes three segments per school year, and the segments are based on a specific country or culture of study. The segments included in this study are *Sister Cities* (San Antonio sister and partner cities), followed by *Japan*, *Ukraine*, and *The Quilt: A Living History of African American Music*. Each segment is eight weeks long and consists of a "Kids-to-Concert" musical performance, a pre-survey, five STEAM lessons, and a post-survey. The lessons are taught consecutively by the teacher at the rate of one lesson per week in classrooms of third, fourth, and fifth graders. Lessons were taught in multiple schools and different classrooms; participants varied among segments and are described in detail under methodology.

The purpose of the study is to investigate two research questions:

1. Does the Sprouts program help students improve their STEAM content knowledge?
2. Does the Sprouts program impact the social emotional learning (SEL) of students?

The arts integration approach is an educational model that puts a co-equal emphasis on the arts and the other core academic subjects (Burnaford et al., 2007, p. 22). This arts integration approach has been demonstrated to promote academic and prosocial behavior for students who were active participants in this model (May & Robinson, 2016, p. 19). Therefore, it is expected that there will be an increase in mean scores for the content knowledge assessment, as well as an increase in SEL scores.

Literature Review

STEAM: Arts Integrated Programs

The transition from a STEM (Science, Technology, Engineering, and Mathematics) education to an arts-integrated STEAM approach has been a growing conversation. According to Silverstein and Layne's (2010) definition, arts integration is an approach to teaching that connects art to other subject areas using the creative process. A vital aspect of arts integration is the interdisciplinary connections that can be made between the art form and a specific curriculum area. The Musical Sprouts program demonstrates this idea by aligning the lessons, activities, and survey items to the TEKS, allowing these connections to be assessed. Catchen (2013) suggested that the following key components of the STEAM approach should be included: creative expression, experiential design, imagination, and encouragement. Further, Catchen (2013) also

noted that the STEAM approach is "integrated and cross-curricular" and involves an experiential component that would cultivate innovation and creativity (p. 3). The Musical Sprouts program provides participants the opportunity to engage in experiential learning through activities that incorporate STEAM and cultural concepts. The existing literature on arts-integration suggests many benefits of an arts-integrated approach, including promoting creative problem-solving, in which students are encouraged to use their skills and knowledge to solve complex problems (Liao, 2016, p. 46). Further, Land (2013) noted that creativity and innovation do not come from STEM concepts alone but through the creative process utilized in art and design. Some challenges associated with effectively implementing a STEAM educational approach are co-equal and "mutually instrumental" emphases on the arts and STEM concepts (Meijas et al., 2020, p. 218). The structure of the Musical Sprouts program aims to address the challenge of equally emphasizing the arts and STEM concepts through creative activities, video lessons, and readings (see Appendix for lesson sequence). The Musical Sprouts program intends to take advantage of the benefits of STEM and arts-integrated programming to support the students in our schools. The three components of the Musical Sprouts program will be reviewed in the subsequent paragraphs: content knowledge, interest in language and culture, and social emotional learning.

Content Knowledge

One purpose of the current study is to assess the students' improvement in STEAM content knowledge as delivered through the arts-integrated curriculum. The literature has demonstrated a positive impact on exposure to the performing arts and fine arts instruction on academic achievement. In a traditional classroom setting, standardized testing is the measure of academic achievement. Holmes' (2018) quasi-experimental study in Houston Independent School District evaluated the State of Texas Assessments of Academic Readiness (STAAR) performance (i.e., the state-mandated content area assessment), attendance, and disciplinary action for students who received fine arts instruction. Participants in the treatment group were enrolled in a fine arts magnet school. In contrast, the comparison group consisted of students with similar background characteristics enrolled in a non-fine arts magnet school. Results suggested that students who were heavily involved in the fine arts had outperformed their peers in both the math and English STAAR 3rd-8th grade exam, had a lower number of absences, and had fewer instances of in-school and out-of-school suspensions (Holmes, 2018).

The National Endowment for the Arts (2012) conducted a longitudinal study assessing children and teenagers participating in arts education programs. It examined the outcomes of academic achievement and civic engagement. This study focused on students with a low socioeconomic status (SES) background and considered "at-risk" for failure. Results suggested that low-SES eighth graders who had participated intensively in arts engagement throughout elementary school had higher test scores in science and writing than students with lower engagement levels. Further, students in the low-SES group with more intensive arts experiences demonstrated higher civic engagement, such as being more likely to read a newspaper, join student government, and volunteer more often. They were also more likely to vote or participate in a political campaign. Given that these studies involve similar age groups and SES groups, it is expected that the current research will obtain similar outcomes. The Musical Sprouts program aims to add to the current literature by including a cultural component to the arts-integration and STEAM curricula.

Culture and Language

Language and culture are fundamentally inextricable, affecting and affected by one another. Kramsch (1998) outlined how culture and language are connected in that language expresses, embodies, and symbolizes cultural components and social identity. This idea is established in the Sapir-Whorf hypothesis, also known as linguistic relativism, which states that language influences cognitive processes and guides our perceptions of reality (Hussein, 2012). For example, a study of the Hopi tribe language found that the tribe's concept of time is described as an ongoing process. In contrast, Western societies define time in measurable and recurrent terms, such as minutes, hours, and days (Hussein, 2012). There are many benefits to learning and integrating culture and language into the school curriculum, including increased self-efficacy, enhanced awareness, and improved learning outcomes (Ng, Van Dyne, & Ang, 2009, p. 518- 519). As a result, cultural intelligence (CQ) is attained, allowing the individual to effectively function in culturally diverse settings (Early & Ang, 2003).

One study by Miftakh and Wachyudi (2019) assesses how intercultural language learning fosters tolerance in students. Participants included 20 sixth-grade students, from which data were collected qualitatively through observation and interviews. Results suggested that there was an observed increase in tolerance through the use of engaging and stimulating activities about a target language or culture. Another study conducted by Genc and Bada (2005) examined the effects of a culture class on variables such as language skill, cultural awareness, attitude toward target culture, and contribution to the teaching professions. Participants included students in a teaching program ranging in age from 21-25 years old. Results suggested a significant improvement in students' language skills, such as speaking, expanding vocabulary, and ability to teach grammar. Further, familiarization and positive attitudes toward a target culture were also identified as the result of participation in a cultural class. This study demonstrated the efficacy of implementing culture and language for students to improve in a myriad of areas. Sparse studies examine the potential benefits of using an intercultural approach for teaching language as an effective strategy for developing elementary-age students' understanding of cultural diversity, embracing differences, and fostering acceptance and understanding (Radić-Bojanić, 2013, p. 13). The Musical Sprouts program aims to address this gap in the literature by including participants from the third to the fifth grade while incorporating STEAM concepts into the arts curriculum.

Social and Emotional Learning

Social and emotional learning (SEL), as defined by Zins and Elias (2007), is the "capacity to recognize, and manage emotions, solve problems effectively, and establish positive relationships with others" (p. 1). All these skills are critical for students to excel in the school environment and beyond, especially during the COVID-19 pandemic when isolation was more prevalent. The Collaborative for Academic, Social, and Emotional Learning (CASEL) outlines five key competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (2003). Two competencies focus on our relationship with ourselves, which includes self-awareness and self-management. Self-awareness involves understanding our own emotions, values, and behaviors. While self-management regulates emotions, values, and behaviors to achieve established goals, the social awareness and relationship skills competencies target our relationships with others. Social awareness involves understanding diversity, empathy, and compassion. Relationship skills are putting those ideas into practice to form relationships with others, complete with healthy communication, support, and cooperation. Finally, responsible decision-making combines the competencies to promote caring choices that benefit individuals and groups (CASEL, 2003). Several interventions have

been effective in improving SEL competence. Yet, one of the most essential factors in a program's success is a positive attitude and devotion to the program from the teacher (Schonert-Reichl, 2017). Overall, the Musical Sprouts program intends to address the growing needs of students by providing exposure to and appreciation of culturally specific visual and performing arts with the purpose of improving the overall SEL of students (see Appendix for lesson sequence).

Methodology

Participants

The institutional review boards of the participating school districts and the university approved the study. Participants were recruited by direct contact with the principals of prospective schools; presentations were provided to include program details, expectations, and an opportunity to ask any remaining questions. Schools invited to participate are all federally designated Title I schools in that each is in an under-resourced community and shares similar demographics. Schools were selected based on the following criteria: accessibility, relationship, school culture, and needs. For schools that met the criteria and agreed to participate, the program was implemented in third, fourth, and fifth grade classrooms. Several factors were considered when deciding which schools were appropriate for the treatment and control groups, such as ease of communication, existing relationships, and level of commitment. Due to challenges from the pandemic, some schools and teachers requested to be included as control schools to limit the amount of commitment to the program while still assisting with the study. The number of treatment and control schools varied depending on the segment. Below, we provide more details about the participants, including demographic information on treatment and control schools by segment. The same schools and classrooms participated in the Sisters Cities and Japan segments and are listed separately below for additional clarity. The Ukraine and The Quilt segments were offered at different schools but within the same classrooms and are also listed separately below for clarity.

Sister Cities and Japan Segments

The Sister Cities and Japan segments occurred in the Spring of 2021 and included three treatment schools (n = 60) and one control school (n = 94). Based on data collected from teacher surveys, the demographics of participating schools are outlined in Table 1.

Table 1

Sister Cities and Japan Demographics

School	Total Students	%Hispanic	%Male	%Female	%Low Income
Treatment 1	448	65%	53%	47%	58%
Treatment 2	679	93%	53%	47%	99%
Treatment 3	503	96%	54%	46%	94%
Control 1	599	73%	52%	48%	82%

Ukraine and The Quilt Segments

The Ukraine and The Quilt segments occurred in the Fall of 2021 and Winter of 2022, respectively, which included three treatment schools (n = 173) and two control schools (n = 59). Based on data collected from teacher surveys, the demographics of participating schools are detailed in Table 2.

Table 2*Ukraine and The Quilt Demographics*

School	Total Students	% Hispanic	% Male	%Female	%Low Income
Treatment 1	417	65%	52%	48%	50%
Treatment 2	487	95%	51%	49%	98%
Treatment 3	630	89%	56%	44%	78%
Control 1	599	73%	52%	48%	82%
Control 2	428	99%	53%	47%	95%

Treatment

Prior to the start of the segments, signed consent forms were obtained from parents/guardians of all students in participating classrooms. Parents/guardians were given the opportunity to allow their student the option to participate or deny participation with the condition that students would be given an alternate task decided by the classroom teacher. We did not receive any parental denials.

One of the central components of the Musical Sprouts program is arts integration within the context of diverse cultures from countries and regions around the world. The curriculum for each segment was created by a team of at least two Texas certified teachers with curriculum, standards, and grade-level expertise and knowledge. They worked with the guidance of a curriculum coordinator and external consultant for each segment. Each segment follows this sequence: 'Kids-to-Concert' musical performance, pre-survey, five STEAM lessons, and post-survey. The delivery of the lessons was standardized using the e-book and videos played for students by their teacher. Teachers were provided with detailed instructions and all necessary materials for each hands-on activity. Given the iterative research design, specific improvements were made between segments to address the study's limitations. Some limitations include the COVID-19 pandemic and the ever-changing context of participating classrooms due to the high mobility of Title I schools. The lessons included various topics related to the country/culture of study. Topics included language, clothing, cultural instruments, and infrastructure. Given the time constraints, lessons included concepts that provided overarching cultural themes, which introduced the students to various countries/cultures from around the world.

COVID-19 Adaptations

In March 2020, the COVID-19 pandemic halted normal life for everyone worldwide, and schools were especially prone to interruption. The concerts and lessons were adapted in the Spain segment in the Fall of 2020 to meet the needs of the schools. Unfortunately, due to many technical difficulties with the Spain segment, it is not included in the study. Instead, it serves as an exploratory segment to confirm the aspects of the study that needed adjustments due to the pandemic. The following adaptations were made to address the needs of the schools in a virtual platform: e-books were developed, concerts were recorded, and surveys were sent and received via Google Forms. To ensure lesson delivery consistency and quality, the team created videos for teachers to play for the students, focusing on the experiential learning component. Specific examples of these topics and improvements among segments are outlined in the subsequent sections.

Iteration 1: Sister Cities

The Sister Cities explored the partner cities of San Antonio, Texas, and were divided into four regions: Pan America, Europe and the Middle East, China, and Africa and South Asia. This segment included the most significant number of changes that came out of the COVID-19

pandemic, which consisted of difficulties narrowing down five lesson plans that included several cities from all over the world. As part of the online transition, the videos sent as part of the program consisted of Musical Bridges staff starring in the videos while discussing various topics. This segment included four participating schools (three treatment and one control) and was the first segment to include SEL questions. Further, this segment was temporarily delayed due to the historic winter storm of February 2021.

Iteration 2: Japan

The Japan segment saw various changes to the online delivery, including an improvement in the video lessons. The information in this segment was developed and curated by the U.S.-based Musical Sprouts team, which collaborated with Japanese cultural experts as consultants. The segment included the introduction of an animated character and a human host to discuss the various topics related to Japan. Feedback from both teachers and students about the videos was positive, with some even saying that the videos felt like an educational TV show. Both students and teachers were engaged in the videos, with teachers sharing the videos with non-Musical Sprouts classrooms to share the video quality. As part of the effort to be more interactive, students had the opportunity to email the animated character. This segment had five participating schools (four treatment and one control). In the Japanese lessons, the students watched a performance of musicians playing traditional Japanese instruments, such as the shinobue and taiko, Japanese flute, and drums, respectively.

Iteration 3: Ukraine

The Ukraine segment continued using a virtual concert, an e-book for the video lessons, and an online pre- and post-survey. The information in this segment was developed by the U.S.-based Musical Sprouts team in collaboration with Ukrainian cultural experts as consultants. This segment was the first to have a corresponding webinar as a resource for teachers to ask questions and receive reminders of essential aspects of the study. Students were exposed to different languages associated with the segment's country or region of study. For example, the Ukraine segment included a vocabulary lesson teaching the students common greetings, phrases, and numbers. Although the Musical Sprouts program is not a comprehensive foreign language curriculum, the literature demonstrates that early exposure to a foreign language positively impacts language proficiency later in life (Jaekel et al., 2017, p. 649). Further, each segment includes an experiential learning component. For example, in the Ukraine segment, students had the opportunity to dress a paper doll in traditional Ukrainian clothing and taste Ukrainian tea. A study assessing the effect of experiential learning on cultural competence found that participation in an experiential learning exercise promoted cultural knowledge and awareness (Kratzke & Bertolo, 2013. p. 111).

Iteration 4: The Quilt

The Quilt segment maintained the use of virtual performance, an e-book for STEAM lessons, and an online pre- and post-survey. The live performances unraveled African American history through music, such as blues, ragtime, the Harlem Renaissance, soul, and hip hop. An informational webinar was recorded to include segment-specific details and sent to all participating teachers to maintain consistency of the research design. The webinar was an opportunity for teachers to ask questions and to be reminded of the sequence of research components.

Control

The control school group students received the virtual cultural performance and completed the pre- and post-survey. Control schools were selected based on the desired level of participation and the best match with the treatment group.

Measures

Content area assessments

The Musical Sprouts program teaches students to apply critical and creative thinking inspired by music and STEAM lessons to the content in which students must excel (see Appendix for a sample of the curriculum). The goal of the program is to assist schools in supporting students' learning and be a conduit for the incorporation of the TEKS-based objectives. Each segment comprises five STEAM lessons (two math/engineering, two science, and one art lesson). Each lesson and content knowledge survey item has a corresponding item in the TEKS (see Tables 3, 5, 7, and 9 for specific TEKS, which will be presented in the results section separated by segment). The content area assessment includes 10 items, along with three demographic questions (email, student ID, and school name), and takes approximately eight to ten minutes to complete. The student ID was not attached to the specific students engaged in the study. The student ID was used to match the pre- and post-data. The Musical Sprouts curriculum team created survey items to reflect the content items taught within the lessons.

SEL Assessment

Participating schools were given each of the program's components via school-provided email and had one week to administer to their students. The teachers were given the pre-survey, 'Kids-to-Concert' musical performance, the five STEAM lessons, and the post-survey. All of the materials for the lessons were provided to the teachers. Treatment schools were given all the materials, while control schools were only given the pre-survey, 'Kids-to-Concert' performance, and post-survey.

As discussed above, the survey items for the SEL measure were added to the end of the post-survey (see Tables 4, 7, 8, & 10 for survey items, which will be discussed in the results section separated by segment). In this manner, the teachers received only one pre- and post-survey, along with content materials. The four questions corresponded with two of the five CASEL core competencies: self-awareness and social awareness. To establish this, researchers consulted a program staff member with extensive training in SEL, and it was agreed that these two competencies were the most relevant areas aligned with the mission of this program.

Data Analysis

Data for this study was analyzed quantitatively from the surveys collected and were examined using SPSS. For the content knowledge, data was assessed using a paired samples t-test. Passing rate was calculated, and due to non-equivalent groups, a Wilcoxon Signed-Ranks test was conducted, and a Z-score was calculated. For the SEL scores, Likert scale responses were converted to scores and averaged across all four questions, and mean scores were compared between treatment schools and control schools.

Results

The Musical Sprouts program was expected to positively impact the participants' content knowledge and SEL. Indeed, the results revealed a statistically significant growth in mean scores between the pre- and post-survey for the content knowledge for the Sister Cities, Japan, Ukraine, and The Quilt segment. The SEL outcomes demonstrated a consistent percent increase (2.07%), while the control schools showed an average percent decrease (-1.68%). Below, we present the results by segment.

Sister Cities

For the content knowledge review section in the Sister Cities segment, a paired samples t-test was run to compare the means of the scores. For the three treatment schools, there was a significant difference in the scores for the pre-survey (M = 54.03, SD = 23.85) and post-test (M = 61.45, SD = 21.94) scores; $t(61) = -2.227$, $p = .030$. For the control school, there was also a significant difference in the mean scores for the pre-survey (M = 64.62, SD = 20.41) and post-survey (M = 69.14, SD =20.09) scores; $t(92) = -2.157$, $p = .034$. See Table 3 for survey items and corresponding TEKS and STEAM areas.

Table 3
Sister Cities Pre- and Post-Survey

Survey Question	TEKS	STEAM Area
1. What is your student ID #?	– –	– –
2. What is the name of your school?	– –	– –
3. Monarch butterflies migrate north from Guadalajara, Mexico, as milkweed becomes available. Once caterpillars hatch, they can eat up to 20 leaves a day. How many leaves will a monarch butterfly consume in 8 days?	3.10B, 4:10C, 5:9C	Mathematics
4. The process that breaks down rocks and other materials on Earth's surface is called _____.	3.7C-5.7C	Science
5. Maglev trains in Darmstadt, Germany, operate using a magnetic force to keep the train from derailing. What is magnetism?	3.5(A)	Technology
6. As many as 15,515 butterflies can be on a single branch--so many that the branch actually bends under their weight! How is this number written in expanded form?	3.10B, 4:10C, 5:9C	
7. Taking a high-speed train in Europe can be costly. Diane and her family took a one-way train from Las Palmas to Santa Cruz, Spain. If each ticket costs $91.24 per person, what would the total cost be for her family of four?	3.5(A)	Mathematics
8. Which of the following is an advantage of quarrying?	3.7C-5.7C	Engineering
9. Mt. Everest is the world's highest peak at 29,035 feet. The Himalayas are the highest mountain chain in the world and create a natural border between South Asia and China. How is 29,035 rounded to the nearest thousand?	3.7C-5.7C	Mathematics
10. Japan is changing how prosthetics are perceived by creating 3D printed robotic arms. What form of energy is needed to operate the robotic arms?	3.7C-5.7C	Technology
11. Monarch butterflies travel an average of 1800 miles from the United States and Canada to the oyamel forests in Michoacán. What are the stages of the life cycle of a butterfly?	3.10B, 4:10C, 5:9C	Science
12. A quarry is a type of open-pit mine in which stone, rock, sand, gravel, or slate is excavated from the ground. Limestone, a sedimentary rock, is one type of rock that is excavated from quarries. What	3.7C-5.7C	Science

process is used to form sedimentary rocks?

The passing rate for the content knowledge section for treatment schools increased from 20% to 70%, demonstrating a 50% increase, while the control schools saw an increase of only 23% from 31% to 54%. During data analysis, groups were found to be non-equivalent regarding their reading and academic achievement levels. Given the non-equivalent groups, a Z-score was calculated to account for the group differences and normalize data. Wilcoxon Signed-Ranks test indicated that the treatment group (Z = -2.55, p = .011) was more effective than the control group (Z = -2.14, p = .032), as reflected in their knowledge review scores.

SEL scores were calculated by averaging the scores associated with the Likert scale responses (All of the time – 4; Most of the time – 3; Some of the time – 2; Never – 1). Across all four SEL items, the average score for the treatment schools increased from 2.83 to 2.86. For the control schools, there was a decrease from an average score of 2.81 to 2.74. See Table 4 for SEL survey items.

Table 4

Sister Cities SEL Questions

Survey Question	All Times	Most Times	Some Times	Never
1. I feel happy, interested, and energized when learning more about the world, culture, and fine arts.	Pre: 38%	28%	33%	1%
	Post:29%	38%	28%	5%
Control:	Pre: 29%	43%	26%	2%
	Post:29%	35%	29%	7%
2. I feel like I have a good understanding of cultures other than my own.	Pre: 25%	35%	35%	5%
	Post:20%	32%	32%	16%
Control:	Pre: 11%	37%	36%	16%
	Post:16%	32%	35%	17%
3. I feel an interest in traveling to other countries and experiencing different cultures when I have the opportunity.	Pre: 33%	25%	32%	10%
	Post:42%	33%	18%	7%
Control:	Pre: 47%	26%	19%	8%
	Post:35%	33%	23%	9%
4. I feel like I have a relationship with the world outside my own Community.	Pre: 33%	27%	25%	15%
	Post:30%	23%	40%	7%
Control:	Pre: 24%	34%	33%	9%
	Post:26%	29%	30%	15%

Japan

For the four treatment schools, there was a significant difference in the content area knowledge mean scores for the pre-survey (M = 61.83, SD = 18.10) and post-test (M = 72.92, SD = 21) scores; $t(119) = -5.22$, $p = .000$. For the control school, there was only a slightly significant difference in the scores for the pre-survey (M = 65.26, SD = 17.666) and post-survey (M = 73.42, SD = 25.814) scores; $t(37) = -2.036$, $p = .049$. See Table 5 for survey items and corresponding TEKS and STEAM area.

Table 5

Japan Pre- and Post-Survey

Survey Question	TEKS	STEAM Area
1. What is your student ID #?	– –	– –
2. What is the name of your school?	– –	– –
3. An island is a landmass that is surrounded by water on all sides, however _____ is the name given to a group of islands.	Social Studies 3.4(A), 3.4(C) 3.3(A)	Science
4. A _____ is a distinctive three-dimensional geometric figure that has a flat surface and a curved surface, and is pointed towards the top.	Math 3.6(A) Fine Arts 3.2 (C) 3.3 (C)	Engineering Mathematics Fine Arts
5. Japan is a string of islands located in Asia. Using this map of continents, Asia is _____ of America.	Social Studies 3.4(A), 3.4(C) 3.3(A)	Science
6. If Robert is listening to music in his room, how is the sound of the music reaching his ear?	Fine Arts 3.2(C) ELAR 3.30	Fine Arts Science
7. Japan is a large island country. Compared to the city of San Antonio, about how many populations of San Antonio (2.3 million) would we need to equal the population of Japan (37.4 million)?	Social Studies 3.4(A), 3.4(C) 3.3(A)	Science
8. The art of beautifully arranging cut stems, leaves, and flowers in a vase, or other containers that evolved in Japan is called _____	Fine Arts 3.2(C) 3.3 (C) Math 3.6 (A)	Fine Arts Science Mathematics
9. Frank wants to make a cube made of paper. His teacher has placed different shapes on a table. Which 2-D figures should he grab to complete his project?	Fine Arts 3.2 (C) 3.3 (C) Math 3.6 (A)	Fine Arts Science Mathematics
10. _____ is a form of Japanese storytelling using puppets.	Fine Arts 3.2(C) Technology 3-5.A	Fine Arts Technology
11. The goal of origami is to transform a flat square sheet of paper into a finished sculpture through _____ and _____.	Math 3.6(A) Fine Arts 3.2(C) 3.3 (C)	Mathematics Fine Arts Technology
12. Miki was walking to school one day. As she walked through the park, she noticed that	Social Studies 3.3(C) Science 3.4 (A), 3.4(C)	Technology

the duck pond was polluted with trash and old soda cans. What type of pollution did Miki observe?	Technology 3.1(C)

The passing rate for the content knowledge section for treatment schools increased from 31% to 41%, a 10% increase, while the control schools saw only an increase of 6% from 57% to 63%. Scores were converted into Z-scores to account for group differences and to normalize data. A Wilcoxon Signed-Ranks test indicated that the treatment group ($Z = -9.19$, $p = .00$) was just as effective as the control group ($Z = -3.77$, $p = .00$), as reflected in their knowledge review scores.

SEL scores were calculated by averaging the scores associated with the Likert scale responses (All of the time – 4; Most of the time – 3; Some of the time – 2; Never – 1). Across all four SEL items, the average score for the treatment schools increased from 2.60 to 2.69. There was a small increase for the control schools from 2.84 to 2.85. (See Table 6 for SEL survey items)

Table 6

Japan SEL Questions

Survey Question	All Times	Most Times	Some Times	Never
1. I feel happy, interested, and energized when learning more about the world, culture, and fine arts.	Pre: 33%	31%	32%	4%
	Post:32%	25%	35%	8%
Control:	Pre: 32%	34%	34%	0%
	Post:29%	34%	34%	3%
2. I feel like I have a good understanding of cultures other than my own.	Pre: 18%	31%	38%	13%
	Post:22%	25%	32%	21%
Control:	Pre: 24%	32%	32%	12%
	Post:24%	39%	32%	5%
3. I feel an interest in traveling to other countries and experiencing different cultures when I have the Opportunity.	Pre: 29%	23%	33%	15%
	Post:30%	23%	31%	16%
Control:	Pre: 42%	24%	24%	10%
	Post:32%	42%	21%	5%
4. I feel like I have a relationship with the world outside my own community.	Pre: 27%	25%	33%	15%
	Post:23%	24%	30%	23%
Control:	Pre: 26%	37%	24%	13%
	Post:26%	29%	32%	13%

Ukraine

This segment had five participating schools (three treatment, two control). For the three treatment schools, there was a significant difference in the scores for the pre-survey (M = 48.73, SD = 19.84) and post-test (M = 72.43, SD = 25.30) scores; $t(172) = -12.565$, $p = .000$. For the control school, there was also a significant difference in the scores for the pre-survey (M = 54.07, SD = 25.27) and post-survey (M = 65.08, SD = 26.15) scores; $t(58) = -2.962$, $p = .004$. See Table 7 for survey items and corresponding TEKS and STEAM area.

Table 7
Ukraine Pre- and Post-Survey

Survey Question	TEKS	STEAM Area
1. What is your student ID #?	– –	– –
2. What is the name of your school?	– –	– –
3. What content is Ukraine located on?	4.6A	Science
4. Micah and his family saved enough money to take a trip to Ukraine. They want to visit the Lutsk Castle, which costs $18 per person. How much will it cost for his family of four to visit this castle?	4.6A ELPS.c.3E	Mathematics
5. What is the name of the stringed instrument that is considered the national musical instrument of Ukraine?	Music 4.1B, 4.5C	Arts
6. Most of Ukraine has grassy, fertile plains; however, the west region has uplands, mountains and valleys. What region in Texas is comparable to this land in Ukraine?	4.6A 4.6B	Science
7. Mr. Gonzalez, who lives in Texas, is planning a trip to Ukraine to visit his friends. Which ocean will he travel across to get to his destination?	4.6A 4.6B	Science
8. Sergei Korolev, from Ukraine, was the chief designer of the R-7 Rocket. He studied how to make an object launch with _____.	Science 4.2B 4.6D, 3.6B	Science Engineering Technology
9. A student blows air into a straw to launch his paper rocket. He notices that it goes up and then comes down after 3 seconds. Which force acted upon the rocket, causing it to fall?	Science 4.2B 4.6D, 3.6B	Science Engineering Technology
10. _____ is a type of tradition Ukrainian clothing, embroidered with meaningful designs.	Social Studies 3.4(E) 3.13(A), 3.13(B)	Arts
11. What makes the Pysanky Eggs, from Ukraine, so special?	Arts 4.2C, 4.6E ELAR 4.6E	Arts
12. Giselle has a budget of $100 to spend on recreational activities for the day in Ukraine. She created a list of fun places to go, including prices. How much money will she have at the end of the day, if she does everything on her list?	Math 4.4A 4.1A, 4.1B, ELA 4.1D ELPS.c.3E	Mathematics

The passing rate for the content knowledge section for treatment schools increased from 43% to 67%—a 24% increase—while the control schools only saw an increase of 13% from 55% to 68%. Scores were converted into Z-scores to account for group differences and to normalize data. A Wilcoxon Signed-Ranks test indicated that the treatment group (Z = -9.19, p = .00) was more effective than the control group (Z = -2.90, p = .004), as reflected in their knowledge review scores.

SEL scores were calculated by averaging the scores associated with the Likert scale responses (All of the time – 4; Most of the time – 3; Some of the time – 2; Never – 1). Across all four SEL items, the average score for the treatment schools increased from 2.73 to 2.75. For the control schools, there was also an increase from 2.86 to 2.89. (See Table 8 for SEL items.)

Table 8

Ukraine SEL Questions

Survey Question	All Times	Most Times	Some Times	Never
1. I feel happy, interested, and energized when learning more about the world, culture, and fine arts.	Pre: 36%	30%	31%	3%
	Post:33%	34%	28%	5%
Control:	Pre: 34%	32%	29%	5%
	Post:31%	46%	22%	1%
2. I feel like I have a good understanding of cultures other than my own.	Pre: 20%	34%	30%	16%
	Post:14%	37%	32%	17%
Control:	Pre: 27%	27%	42%	4%
	Post:29%	27%	37%	7%
3. I feel an interest in traveling to other countries and experiencing different cultures when I have the Opportunity.	Pre: 35%	21%	29%	15%
	Post:43%	24%	23%	10%
Control:	Pre: 32%	31%	27%	10%
	Post:39%	31%	25%	5%
4. I feel like I have a relationship with the world outside my own community.	Pre: 26%	23%	35%	16%
	Post:24%	25%	36%	15%
Control:	Pre: 29%	36%	27%	8%
	Post:25%	31%	32%	12%

The Quilt: A Living History of African American Music

This segment had five participating schools (three treatment, two control). For the three treatment schools, there was a significant difference in the scores for the pre-survey (M = 35.43, SD =19.37) and post-survey (M = 43.83, SD = 18.48) scores; $t(80)$ = -3.41, p = .001. For the control school, there was not a significant difference in the scores for the pre-survey (M = 41.46,

SD = 16.93) and post-survey (*M* = 40.85, *SD* = 19.13) scores; $t(81) = .263$, $p = .793$. (See Table 9 for survey items and corresponding TEKS and STEAM area.)

Table 9
The Quilt Pre- and Post-Survey

Survey Question	TEKS	STEAM Area
1. What is your student ID #?	– –	– –
2. What is the name of your school?	– –	– –
3. The quilt is a symbol used during this segment. What does the quilt have to do with music?	ELA 4.6E Music 4.5D	Arts
4. Jason and his family want to make a song using the 12 bar blues pattern. What is something that he must consider when putting his song together?	Music 4.1D Math 4.1A	Arts Math
5. What is the main instrument played in Ragtime music?	Music 4.1B Music 4.5C	Arts
6. What American trumpeter and vocalist was known as one of the first, great influencers of Jazz Music?	Music 4.5C SS 3.4E	Arts
7. What historical center in San Antonio, Texas was known to bring in well-known singers from across the world, no matter what race or ethnicity?	SS 4.17A ELPS.c.3.E	Arts
8. Who was the second African American to make flight into space, and the first to attempt to play the saxophone in space?	Science 4.3C Music 4.5D	Science Arts
9. A student designs a model of a lunar lander in science class. After testing her design three times, she realizes her design does not have a good shock-absorbing system, so she changes her design. What steps did she follow after she designed her model?	Science 4.2B Science 4.2D	Science Technology Engineering
10. What kind of music gave African Americans hope during the Civil Rights Movement?	SS 3.13A Music 4.5C	Arts
11. Which era exploded with art, music, and literature during a time when big bands played in New York at the Cotton Club, while many singers and dancers wore upscale clothing?	SS 3.13A Music 4.5C	Arts
12. What genre of music was written in the late 1800s in the South, which was written about tough times and overcoming a broken heart?	Music 4.5D Music 4.5C	Arts

The passing rate for the content knowledge section for treatment schools increased from 4% to 12%—an 8% increase—while the control schools only saw an increase of 2%, from 7% to

9%. Scores were converted into Z-scores to account for group differences and to normalize data. A Wilcoxon Signed-Ranks test indicated that the treatment group (Z = 3.015, p = .003) was significantly more effective than the control group (*Z* = -.378, *p* = .706), as reflected in their knowledge review scores.

SEL scores were calculated by averaging the scores associated with the Likert scale responses (All of the time – 4; Most of the time – 3; Some of the time – 2; Never – 1). Across all four SEL items, the average score for the treatment schools increased from 2.68 to 2.76. For the control schools, there was a decrease from 2.7 to 2.55. See Table 10 for SEL survey items.

Table 10

The Quilt SEL Questions

Survey Question	All Times	Most Times	Some Times	Never
1. I feel happy, interested, and energized when learning more about the world, culture, and fine arts.	Pre: 36% Post:33%	30% 34%	31% 28%	3% 5%
Control:	Pre: 34% Post:31%	32% 46%	29% 22%	5% 1%
2. I feel like I have a good understanding of cultures other than my own.	Pre: 20% Post:14%	34% 37%	30% 32%	16% 17%
Control:	Pre: 27% Post:29%	27% 27%	42% 37%	4% 7%
3. I feel an interest in traveling to other countries and experiencing different cultures when I have the opportunity.	Pre: 35% Post:43%	21% 24%	29% 23%	15% 10%
Control:	Pre: 32% Post:39%	31% 31%	27% 25%	10% 5%
4. I feel like I have a relationship with the world outside my own community.	Pre: 26% Post:24%	23% 25%	35% 36%	16% 15%
Control:	Pre: 29% Post:25%	36% 31%	27% 32%	8% 12%

Discussion

The results of this study demonstrate that arts integration programs can positively impact a student's knowledge of content and connection to the community. The results consistently suggest an improvement in content knowledge mean scores from the pre- and post-survey for both the treatment and control schools. However, there was a more significant improvement for the treatment schools, as demonstrated by a 50% increase in the difference of the scores.

All three segments saw an increase in average SEL scores for the treatment schools. This finding was expected, as the segment's curriculum and activities allow the students to be immersed in that segment's culture of study. For the control schools, one segment saw a decrease in average SEL scores, while the other two segments saw a slight increase in SEL scores. One possible explanation for the slight increase in scores can be attributed to the concert students attended in the control schools. Students may feel more connected to a culture by simply watching a cultural musical performance that captures their interests and emotions. The concert videos were set up by the teacher and viewed together as a class, which could have contributed to the "connectedness" of the activity. A potential explanation for the content post-test results suggests that the two control schools had a STEM teacher present. Thus, students were likely to have more assistance with the STEAM content, which may have affected the results.

Limitations

The COVID-19 pandemic generated many challenges for conducting research during this school year. Most teachers had to split their time between in-person and virtual students, and unfortunately, emails from Musical Sprouts were among many online responsibilities that the teachers had that year. There were many adaptations, including changing the survey from Scantron to an online medium and an adapted curriculum and delivery model. The updated lessons included online videos provided to teachers to ensure the consistent quality of the lessons and allowed the teachers to focus on the activity rather than planning the lessons. Other challenges included the loss of a curriculum writer and principals/staff moving to different schools and leaving the schools entirely. Musical Sprouts staff had to reestablish relationships with the teachers and principals of each school, which impacted the timeline of the lessons in their classrooms.

The historic winter storm of February 2021 left many stranded in their homes for weeks without power or water. The impact of this storm lasted beyond the snow on the ground, as many students were in hotel rooms for weeks after the winter storm, and teachers had trouble reaching some students to ensure that they were returning to school. This storm, in addition to online learning, provided extra stress on teachers and impacted the response rate and participation level in the Musical Sprouts lessons, videos, and activities. Further, the timeline had to be pushed back and adjusted to accommodate students' and teachers' out-of-school and recovery time.

Another limitation of the research design was the process of program facilitation in the assigned schools. Researchers were partially constrained by some schools' unwillingness to commit to the eight-week segment required for the treatment group. Some teachers hesitated to commit to completing the entire program, given the difficulties due to the COVID-19 pandemic.

Given the ever-changing environment of a school setting, attrition became another limitation of this research design. Attrition rates varied among segments from 38% to 46% of responses that could be matched from pre- and post-survey (See Table 13 for response frequencies.) These rates can be attributed to various reasons, including inconsistency with survey distribution, student absences, and technology errors. Attrition was accounted for by utilizing only data from the matched pairs. Training webinar content improved using a streamlined online medium, which contributed to decreased attrition rates.

Despite the limitations, we contend that positive outcomes were observed. As our communities acclimate to the new normal, this ongoing research will include a separate survey to gauge participants' interest in culture and language. The research team could assist in creating a psychometrically sound survey that measures students' interest in culture and language.

Table 11
Response Frequency

Segment	Pre-Survey	Post-Survey	Matched Pairs(%)
Sister Cities	333	282	154 (46%)
Japan	375	209	158 (42%)
Ukraine	488	520	232 (47.5%)
The Quilt	425	354	163 (38%)

Future Research

The current study has undergone many changes and challenges due to the COVID-19 pandemic and weather-related emergencies. As the world attempts to take lessons learned during the pandemic, it is our hope that students and teachers have more opportunities to engage in the Musical Sprouts program. Future research can continue to address the need for mental health support in young people, expand to more schools, and reach more students. Given the iterative design of this study, the research and curriculum team are consistently making improvements to the curriculum and survey items. For example, the SEL measure is being adapted to mirror the five key competencies outlined by CASEL, including self-awareness, social awareness, responsible decision-making, self-management, and relationship skills (2003). Hence, subsequent studies could examine the program's impact with the improved SEL measure. Further, the modality of the study will adapt to the ever-changing status of the pandemic, with some potential of having more in-person concerts and musical performances. The Musical Sprouts program will take the lessons learned, modify the curriculum as needed, and continue to introduce music and the world's culture to classrooms in the hope that this program inspires young people in their pursuit of knowledge and creativity.

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Appendix
Lesson Sequence

Table A1
Timeline of Curriculum

Week #	Control Schools	Treatment Schools
1	Kids-to-Concert Musical Performance	Kids-to-Concert Musical Performance
2	Pre-Survey	Pre-Survey
3	--	Lesson 1
4	--	Lesson 2
5	--	Lesson 3
6	--	Lesson 4
7	--	Lesson 5
8	Post-Survey	Post-Survey

Sister Cities e-book: https://www.flipsnack.com/msspn/updating-2024-sister-cities-teacher-s-edition/full-view.html
Japan e-book: https://www.flipsnack.com/msspn/ebook-for-musical-sprouts-japan/full-view.html
Ukraine e-book: https://www.flipsnack.com/msspn/teacher-ukraine-e-book/full-view.html
The Quilt e-book: https://www.flipsnack.com/msspn/the-quilt-musical-sprouts-segment/full-view.html