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ABSTRACT

The purpose of this scoping review was to look at how music technology has been used in the elementary music classroom from 2020 to April 2025. Uses of technology were organized using the Substitution, Augmentation, Modification, and Redefinition (SAMR) model (Puentedura, 2006). Only articles that both described how technology was used and what the learning process looked like were included. A total of 26 articles met the criteria for inclusion. Multiple uses of technology across the four levels of the SAMR were represented from 14 different countries. An article from each of the four SAMR levels is described in depth to elucidate how uses of technology were categorized. Many cases of researcher-designed technology were found, especially at the redefinition level of the SAMR model, that provided students with transformative music making experiences such as exploring synthesizers using eye tracking, exploring an augmented reality musical pop-up book, and engaging in collaborative composition using iconic notation. I identified gaps in the literature, including the paucity of articles involving students with disabilities, preschool students, artificial intelligence, and phenomenological research methods.

Introduction

As music educators adapt their teaching to the needs of today's students, the implications of technology for music education have been issues of growing importance. For decades, scholars and practitioners have been calling on individuals in the field to reimagine the goals, practices, and pedagogies of music education in light of new technologies (D. A. Williams, 2011, 2015; D. B. Williams, 2012; Larson, 1997; Lum, 2016; Randles, 2022). Researchers have also emphasized technology's role in helping elementary music students develop 21st century skills (Vasil, 2020; Yoo, 2021). These voices point to the importance of including technology in music education, but what has technology use looked like in practice? Unfortunately, it is difficult to get a full picture from the literature. Technology in music education has been studied less than technology in any other subject in education (Chauhan, 2017), and the research that does exist mostly concerns secondary and post-secondary levels, not the elementary level (Emo, 2022; Kuhn & Hein, 2021; Tobias, 2010). While researchers have reviewed the literature on mobile technology (Liu et al., 2021) and technology's effect on creativity in K-12 music education (Lam, 2024), as far as can be determined, no researcher has undertaken a review of technology use in the elementary music classroom.

In this review, I help to answer how technology has been used in the elementary music classroom by searching the available literature and presenting the findings in a scoping review. A scoping review is appropriate for this paper given the relative lack of available literature and the wide variety of geographic and cultural contexts of the studies. Researchers use scoping reviews to explore "key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects...where an area is complex or has not been reviewed comprehensively before" (Mays et al., 2001, p. 194). I will further organize the findings using the Substitution, Augmentation, Modification, and Redefinition (SAMR) model.

The SAMR Model

There are many models for technology use in education, but of these, the SAMR model (Puentedura, 2009, 2013, 2020) is uniquely well-suited for examining technology integration in practice. The model places activities and technologies along a continuum from enhancement of learning at one end to transformation of learning at the other. Scholars have defined enhancement as "improvement or iteration of educational practice without changing established actions and roles for teachers and students" (Blundell et al., 2022, p. 8) and transformation as "a process of exploring actions and roles that are different relative to the baseline" (p. 8). In the original iteration of the model, enhancement is divided into two categories, substitution and augmentation, while transformation is divided into modification and redefinition. Substitution occurs when technology acts as a direct replacement of another tool with no functional change taking place. Augmentation occurs when technology acts as a direct replacement but with added functional improvements. Modification occurs when technology allows an activity or task to be significantly redesigned, fundamentally changing it. And finally, redefinition occurs when technology allows for the creation of entirely new tasks and activities, ones that were previously inconceivable (Puentedura, 2006).

Despite researchers' extensive use of the SAMR model, scholars have criticized its use. First, they have pointed out that the model is often used to evaluate the products, rather than the process, of learning (Hamilton et al., 2016). Second, the model has been criticized for not sufficiently taking teaching context into account (Blundell et al., 2022; Hamilton et al., 2016). Lastly, some researchers say that the language to differentiate between the levels of the model is too vague to provide consistent use across the literature (Geer et al., 2017; Marcovitz & Janiszewski, 2016).

To remedy these concerns, I look at whether the learning process was changed by the use of technology, rather than just looking at the product of learning (Crompton and Burke, 2020). The issue of not taking context into account is addressed using a scoping review rather than a systematic review. A scoping review "does not seek to synthesize or aggregate findings from the studies … there is no attempt made to present a view regarding the 'weight' of evidence" (Arksey & O'Malley, 2005, p. 27). Since the synthesis of findings is not the goal of a scoping review, it would be inappropriate to generalize findings across contexts.

Methodology

I base this scoping review on Arksey and O'Malley's (2005) methodological framework in which they propose five distinct steps:

- Identifying the research question
- Identifying relevant studies
- Study selection
- Charting the data
- Collating, summarizing, and reporting the results

Identifying the Research Question

The research question I explore through this review is: How is technology used in the elementary music classroom? I use the SAMR model to categorize and organize the answer to this research question.

Identifying Relevant Studies

For this review, I searched the following databases: (a) ERIC; (b) RILM; (c) Web of Science; and (d) SCOPUS. The published date range was 2020 through April of 2025. I selected this limited date range because 2020 marked the period of lockdown due to the COVID pandemic, which disrupted music education practice and "prompted important conceptual and epistemological shifts in both theory and practice" (Camlin & Lisboa, 2020, p. 137) including an increase in the use of digital audio workstations (DAW) like SoundTrap (Knapp et al., 2023). Additionally, Liu et al. (2020) surveyed literature on technology and music education through 2019 (Liu et al., 2020), leaving 2020 onwards unexplored. I used the following terms to search the databases: "Music education" AND (tech* OR "music production" or application) AND (elementary OR primary).

Study Selection

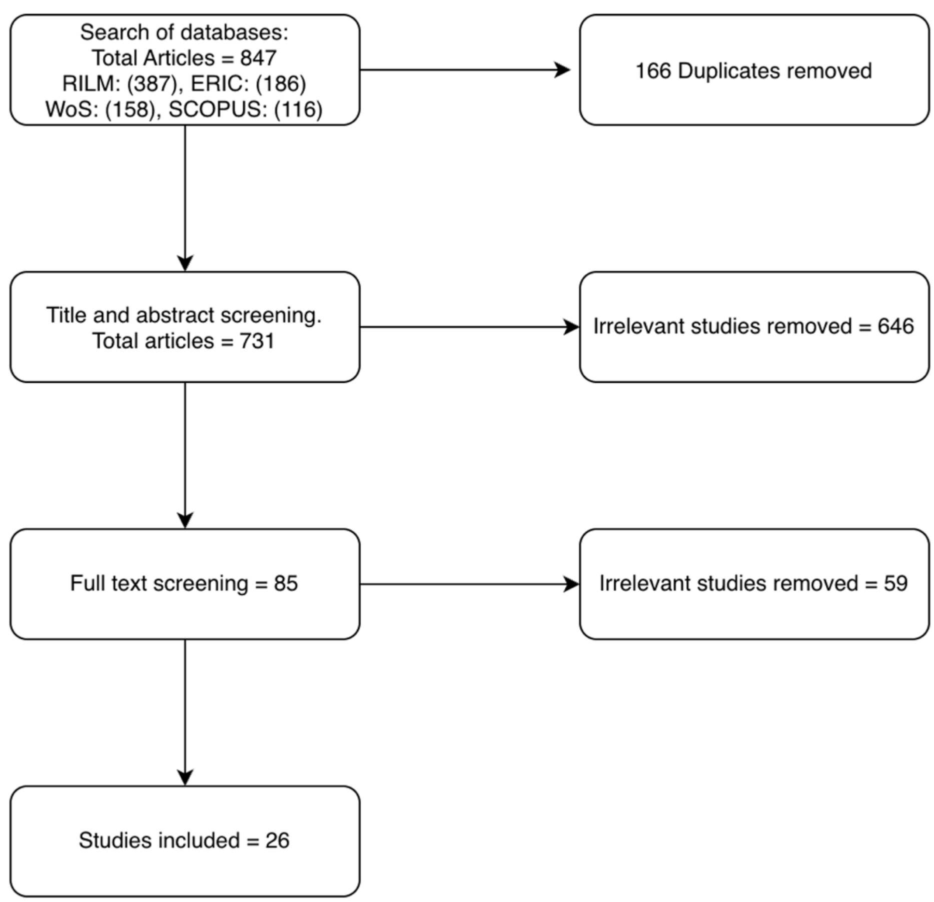
I developed the following criteria for article inclusion in this review:

1. Articles were published between January 2020 and April 2025.
2. Articles are in English.
3. Articles are published in peer-reviewed journals.
4. Articles were only included if they were primary research or design cases (Boling, 2010); thus, literature reviews and theoretical articles were excluded.
5. Elementary music teachers or students (for the purposes of this review, elementary students include grades pre-K to 6th grade) were directly involved in the study.
6. How technology was used in the learning process was discussed. This criterion excluded some studies that only addressed which technologies were being used, but not how they were used.

The initial search of the databases returned 847 results, with 116 duplicates being removed, resulting in 731 articles to be reviewed for inclusion. In the first phase, titles and abstracts were screened using the inclusion criteria which yielded 85 articles eligible for a full-text screening. Of these 85 articles, 59 were removed because they did not adequately describe how the technology was used in the learning process or because the study did not directly involve elementary students or teachers. This left 26 articles for inclusion in the review, as seen in Figure 2.

Figure 2

Flowchart of Study Selection



Findings and Discussion

Overview

In this review, I examined articles from 14 different countries, including seven from the United States of America, three from Romania and Taiwan, two from Finland and China, and one from each of the following countries: Ireland, Australia, Netherlands, Greece, Slovenia, New Zealand, Japan, Serbia, and the United Kingdom.

I found eight different methodologies across the articles in this review, as seen in Table 2. The most common methodology was experimental design, followed by mixed methods. Other methodologies included design cases, action research, case studies, and ethnography. Three studies did not specify a methodology, since they detailed activities that had been used in the classroom (Brown, 2024; Norman, 2020; Vasil, 2020).

Table 2

Overview of the Studies

Study	Location	Participants	Research Method
Baek & Taylor (2020)	USA	Grade 4 (96) & 5 (95)	ED
Banut & Albulescu (2023)	Romania	Grade 4 (25)	AR
Banut & Albulescu (2024a)	Romania	Grade 4 (87)	ED
Banut & Albulescu (2024b)	Romania	Grade 4 (127)	ED
Brown (2024)	USA	Grade 5	N/A
Danso et al. (2021)	Finland	Aged 8-9 (42)	MM
Evans (2020)	USA	Aged 10-14 (57)	E
Fanchamps (2024)	Netherlands	Aged 10-13 (21)	MM
Gubbins (2024)	Ireland	Grades 2-6 (137) & teachers (7)	AR
Hart & Williams (2021)	UK	Aged 7-8 & 9-10	DC/AR
Ho et al. (2023)	Taiwan	Grade K (497)	DC/S
Huovinen & Rautanen (2020)	Finland	Grades 4-6 (40)	MM

Jeremić et al. (2020)	Serbia	Grade 4 (129)	ED
Kang & Yoo (2021)	USA	Grade 4 (21) & 5 (16)	ED
Koong et al. (2025)	Taiwan	Grade 3 (92)	ED
Lesser (2020)	USA	Grade 5 (34) & 6 (48)	ED
Lyu & Sokolova (2023)	China	Aged 5-6 (48)	ED
Mygdanis & Papazachariou-Christoforou (2023)	Greece	Aged 6-7 (4)	CS
Norman (2020)	Australia	Aged 10-11	N/A
Petrie (2022)	New Zealand	Aged 11-12 (22)	CS
Roman et al. (2024)	USA	Unspecified	DC
Teng (2024)	China	Grade 5 (120)	ED
Terauchi (2022)	Japan	Grade 5	MM
Vasil (2020)	USA	Grades 3-5	N/A
Wang (2021)	Taiwan	Aged 10-12 (34)	ED
Zadnik (2022)	Slovenia	Primary Teachers (9) & master's students (16)	MM

Note. AR – Action Research, CS – Case Study, DC – Design Case, E – Ethnography, ED – Experimental Design, LD – Lesson Design, MM – Mixed Methods, S – Survey

Table 3 shows each article's research purpose, technology tools used, and findings. Since this is a scoping review, no comments on the quality of the studies or reliability of the findings are included.

Table 3

Research Purpose, Technology Used, and Findings for Each Study

Study	Purpose	Tech used	Findings
Baek & Taylor (2020)	Are there effects resulting from groupings by gender or in structure in group robotics activities on attitudes toward music, attitudes toward group work, and music composition?	Lego Mindstorms EV3	There was no significant difference between groups by work structure. There was a difference between gender groups. Collaboration resulted in a higher score in the attitude toward music than cooperation for the mixed gender groups.
Banut & Albulescu (2023)	Analyze the effectiveness of using computer programming in the process of learning music theory.	Sonic Pi	47.8% of students received a full score on a knowledge check at the end of the lessons. 78% scored high on the test.
Banut & Albulescu (2024a)	To see if Sonic Pi can help students learn music theory concepts.	Sonic Pi	Students showed improvements on the post test.
Banut & Albulescu (2024b)	To analyze the effects of digital instruction based on an inductive teaching strategy.	Sonic Pi	Test results show that Sonic Pi used in an inductive way was effective.
Brown (2024)	Presents a music activity using Google Keep, a note and list application not typically used to teach music, and the steps for integrating technology and providing feedback using student discourse	Google Keep	Students used a variety of means to engage with music listening activities. Students drew melodic contour, searched for images online to represent the dynamic level of songs, and used emojis to show the form of songs.

Danso et al. (2021)	Investigate the difference in musical knowledge, the ease of use, and the concentration of students before and after using an iPad or the KAiKU music glove.	iPad, KaiKU Music Glove, Virtual Keyboard app.	The iPad group performed better overall, both are rated similarly before use, and both were perceived as more difficult to use as time went on. Concentration behaviors were better in the glove group.
Evans (2020)	What creative labor performed by students in the program aids their critical media literacy? Which practices, cultivated by this project translate to social development?	Pro Tools, GarageBand, Logic, MIDI	The program allowed students to explore their own interests rather than conforming to a set curriculum. Students could also explore relevant sociopolitical issues in their raps.
Fanchamps (2024)	Whether the self-creation of electronic music using music production software has an effect on computational thinking (CT) development.	FL Studio Mobile	Students scored better on all the measured CT characteristics in the post-test compared to the pre-test.
Gubbins (2024)	Can Musical Futures facilitate changes in teacher beliefs and practice? Can it enhance music learning and pupil engagement?	Musical Futures	Teachers changed their beliefs on student-ownership of music and on assessment. Students showed improved listening skills, instrumental skills, and improved engagement.
Hart & Williams (2021)	Facilitate group composition for students with no formal music training.	Paynter	The ability to work with musical phrases and recorded sounds in an iconic way helped these students contribute.
Ho et al. (2023)	To create an augmented reality-enhanced pop-up	AR-enhanced pop-up book	Students ranked the book at a 4.9980/5.

	book to help students explore musical concepts.		
Huovinen & Rautanen (2020)	To compare processes of group creativity between students using traditional musical instruments and students operating iPads.	GarageBand	Traditional musical instruments encouraged group music making, peer teaching, and communication using music. The tablet groups seemed less satisfied with their compositions.
Jeremić et al. (2020)	To examine music learning with the help of music technology software.	MIDI, Sibelius, Practica Musica	Significant improvement in music literacy, performance, and listening skills in the technology group versus the no-technology group.
Kang & Yoo (2021)	Compare student compositions, preferences, and perceptions of composing music with and without the aid of notation-based software.	MuseScore	Creativity was higher in the MuseScore group, but craftsmanship was higher in the handwritten group. 76% of students preferred MuseScore.
Koong et al. (2025)	Compare the rhythm ability, learning motivation, and cognitive load of students learning with a Dynamic Technology-Assisted Rhythm Teaching System versus a non-dynamic system.	The Dynamic System	Experimental group scored higher on rhythm ability tests and had a significant difference in the intrinsic motivation. No difference between the two groups in extrinsic motivation or cognitive load.
Lesser (2020)	Investigate the effectiveness of video games specifically designed to teach musical knowledge.	Rhythm Cat, Blob Chorus, Staff Wars, Flashnote Derby	Students who had both technology and tech-free music activities had the most improvement, followed by the non-technology group, then the iPad-only group showed the least.

Lyu & Sokolova (2023)	Determine if the New Way of Music program contributes to the better acquisition of musical/piano skills by students.	New Way of Music	Study group was 31% more accurate in "error-free reproduction of the musical text," 30% higher rhythmic accuracy, and slightly better performances.
Mygdanis & Papazachariou-Christoforou (2023)	Explore students' engagement with and acquisition of skills using Synth4Kids.	Synth4Kids, Makey-Makey	Children's engagement was positive throughout most sessions. They developed skills including pitch, pulse, and meter.
Norman (2020)	Compose sounds effects and music for a cartoon using traditional instruments, everyday objects, and GarageBand.	GarageBand, iMovie	Students enjoyed the activity and students who typically lacked engagement in music activities participated fully.
Petrie (2022)	How Computational Thinking (CT) supports learning outcomes in both music and programming.	Sonic Pi	Students' knowledge of CT concepts such as sequences, loops, parallelism and data supported their music compositions using Sonic Pi. No evidence for the CT concept conditions and operators was found.
Roman et al. (2024)	To create a tool that scaffolds notation through color coding and lets students practice playing independently.	SpectrumPlay	Students found success playing with the color coding and the colors helped them notice new aspects of music.
Teng (2024)	Does the use of big data technologies and education improve attendance? Does using big data technology influence the basic literacy skills of students?	Soundraw	Use of Soundraw had the highest attendance rate and literacy scores.

Terauchi (2022)	This study determines the positive pedagogical possibilities of using Sanka Play for elementary school music classes.	Sanka Play	The application allowed audience members to engage with performers in new ways and students were able to improvise in new ways because of the app.
Vasil (2020)	Explore popular music pedagogies in the Grades 3-5 music classroom.	EDJing	Students learned the merry-go-round technique and created their own mixes.
Wang (2021)	How did various designs of game-based learning materials affect students' music learning?	Music Fun Game	No learning differences overall, except users of the simplified game design scored better on melodic identification. Students with lower pre-test scores benefitted most.
Zadnik (2022)	To discover how and with which digital tools did active teachers and masters students achieve learning objectives during asynchronous distance learning	Word, PowerPoint, PDFs, YouTube	Teachers and education master's students both used Word, PowerPoint, and PDFs. Teachers mostly prepared materials to direct students to their textbooks. Students were more balanced in the types of activities they used.

How Technology is Used

In this section, I detail how I categorized articles into the categories of the SAMR model, based on how technology was used and how technology affected the learning process. For each of the four levels of the SAMR model, I selected three representative articles to explore.

Substitution

Danso et al. (2021) undertook a mixed methods study to investigate the change in musical knowledge of 42 Finnish elementary students, aged 8 to 9, after using either the KaiKU music glove or an iPad piano application to play children's songs. Students played pitches using the KaiKU music glove by touching pads that were spread around their hands. While the glove itself may allow for augmentation through its easy-to-use interface and unique tactile functionality, the learning process of playing notated music on the glove functions as a direct substitute for playing on a keyboard. Both the technology used and the learning process need to be in alignment according to the expanded SAMR model. Therefore, this use of technology falls into the substitution category.

In a study by Jeremić et al. (2020), 129 Serbian 4th grade students used the notation software Sibelius as part of a teaching approach designed to determine the effectiveness of music technology on vocal abilities. They collected data using a scale measuring vocal abilities. In this approach, students learned songs "according to the sheet music with the help of Notation Software … learning a song from the sheet music consists of recognizing notes in the sheet music displayed on a monitor, followed by pupils reciting the notes through solmization" (p. 268). This description of the learning process could just as easily have been replicated with students looking at physical sheet music. As no added functionality provided by Sibelius seems to have been used to enhance the learning activity, this qualifies as a substitution using the SAMR model.

Zadnik (2022) examined what forms of technology were used during asynchronous music instruction by nine Slovenian primary music educators. After collecting and coding the teaching materials used, she found in-service teachers using productivity tools such as PowerPoint and Word as substitutions for more traditional teaching materials. Zadnik noted that 86% of teachers used PowerPoint and Word to direct their students to which section of their physical textbooks to use during asynchronous distance learning. Both the use of technology and the learning process functioned as substitutions in this case.

Augmentation

Roman et al. (2024) detailed the design process of a piece of technology called SpectrumPlay. They designed it to help all students learn to read and write music notation through reducing barriers using color coding. While the authors noted that the study took place at a K-5 elementary school in the southeastern United States, they did not specify which grade levels or how many students used the application. Students viewed color-coded notation with differing levels of scaffolding depending on their learning needs. Additionally, they could view colored ovals that reflect the notes and duration without any notation lines or could view traditional notation with the colored ovals overlayed on the notation. The ability of students to independently choose the level of scaffolding that would meet their learning needs and the ability to listen to the notation using the app places SpectrumPlay and the learning process it enables in the augmentation category.

Kang and Yoo (2023) had 37 students in grades 4 and 5 in the United States compose music using both MuseScore and handwritten notation. The researchers gathered student comments about their experiences using both approaches after completing the compositions to discover the impact of notation software on classroom composition activities. Students largely preferred composing with MuseScore (76%) and they cited its ability to play their notation as its best feature. Interestingly, MuseScore's auto-complete feature, in which it fills measures with rests so that users cannot write incomplete measures, caused confusion for students and detracted from their composition process. The playback feature changes the learning process, allowing students to hear exactly what they notated without needing to also be able to perform it on a physical instrument. This use of technology represents an example of augmentation.

Huovinen and Rautanen (2020) conducted a study that compared group composition using GarageBand to composition using physical instruments. Forty Finnish students in grades 4-6 were asked to compose a soundscape for a silent film called Space Adventure. Researchers recorded and coded the interactions between members of the student groups, noting how the students interacted with one another and with the technology. The learning process of the two groups were similar, but GarageBand gave groups access to additional sounds and allowed them to input and play back figures using MIDI that might have been too difficult to perform on physical instruments. The learning process was enhanced in some ways by students being able to play multiple parts at once on their iPads and share them with other students. It is interesting that in this study, the groups who used GarageBand were found to have less multimodal communication (students communicating using both words and music) when compared to the traditional instrument group, and students using GarageBand were less satisfied with their compositions overall. The access to additional sounds and the ability to use MIDI made this use of technology more than a substitution, and the ability to share the entire song with other group members enhanced the learning process, placing this article in the augmentation category.

Modification

Koong et al. (2025) tested a rhythm assessment game with 92 third graders in Taiwan to see if students' rhythm abilities improved when compared to traditional teaching methods. This game asked students to read and perform rhythm patterns by tapping on a tablet. It then provided feedback on students' performance and gave up to three levels of scaffolding if they performed it incorrectly. In the first level the notes would light up to help students visually track the notation while reading. In the second level a visual representation of the rhythmic values would appear in the form of gray bars of different lengths and the user's answer would appear as another set of bars above. The third level of scaffolding was a recording of the teacher chanting the rhythm syllable names of the notation. The game allowed students to work at their own pace, and the real-time scaffolding provided by the game constituted a redesign of the learning process, but it was not a totally new type of musical activity. Students taking rhythm dictations with additional forms of scaffolding provided by the instructor is a common activity in a general music classroom, making this technology use case a modification but not a redefinition.

Terauchi (2022) designed an application called Sanka Play that allowed audience participation during fifth-grade student improvisations. The audience could send messages that would be displayed to the improvisers, allowing the performers to incorporate the requests into their playing. Terauchi investigated the pedagogical possibilities unlocked by this new technology. The ability of audience members to clearly articulate requests to performers transforms the nature of being an audience member or a performer, therefore this technology falls into the modification category.

Banut & Albulescu (2023) sought to determine to what extent music theory concepts could be taught through digital music composition. To compose the music, students used Sonic Pi, a tool that has redefinition potential; users can create loops of music using code, the parameters of which can be edited in real time. This affords the user a level of control with only a few keystrokes that would be much more complicated to implement using other production technologies like a DAW. In this study, 25 Romanian fourth-grade students used Sonic Pi to reproduce musical scores of Romanian folk songs, children's songs, and famous melodies from the classical Western canon. While this activity was unique and would not have been possible to replicate without the technology due to the ability to manipulate music as text and numbers, it did not fundamentally transform the learning process into something previously inconceivable, making this an example of modification but not redefinition.

Redefinition

Mygdanis and Papazachariou-Christoforou (2023) had four Greek music students, aged 6-7, work with a researcher-designed tool called Synth4Kids. The application Synth4Kids is a synthesizer that allows young students to experience aspects of analogue synthesizers such as using different waveforms, changing the envelope, using an arpeggiator, and adding effects like reverb, delay, and distortion. The transformative nature of this application comes through how users could control the application. Users could change the pitch by swiping their finger on the touchscreen, tilting the device from side to side, moving their eyes thanks to eye-tracking, moving their face using facial tracking, or by drawing in pitches on the touchscreen. These activities would not be conceivable without the use of technology; hence, this example falls into the redefinition category.

Hart and Williams (2021) conducted a study in which two groups of British students, aged 7-8 and 9-10, with little to no prior musical training, participated in a collaborative composition project using the Paynter application. The researchers designed the application to encourage students to learn composition through social participation. Students used Paynter to draw notes onto the page using iconic notation and play them back. Students could also add prerecorded sound clips represented as images to their iconic score. The size of any note or image could be changed to affect the dynamic level, and students could change parameters like mode, speed, and timbre easily. Students worked in groups, and even those with no musical experience at all were able to participate fully in the composition process. Students recorded sound effects and drew shapes to create their own melodic gestures, without the need for notation. The activity involved students creating music to convey a story, and many students recorded Foley-type sounds with common classroom objects. While the technology itself was transformative, the various entry points into the compositional process made the learning activity transformative as well, placing it into the redefinition category.

Ho et al. (2023) created an augmented reality pop-up book with which young children could explore musical concepts and learn about the instruments of the orchestra. They tested the book out on Taiwanese kindergarteners and gathered data on their satisfaction with the book through a five-point Likert scale. They found that students ranked their satisfaction very high: 4.998 out of 5. A companion application was developed which allowed students to interact with virtual elements that appeared when the tablet was pointed at pages of the pop-up book. The book itself gave students opportunities to experience aspects of the instruments physically. For example, the page that included percussion instruments had wood from a wood block, metal from a cymbal, and the drum head of a timpano incorporated into the page so students could touch each material. Students could then view the page through a tablet using an augmented reality application to play each of the instruments themselves. The learning experience was further redefined through the storytelling elements. Actors portraying famous Taiwanese children's characters appeared on the page when using the augmented reality application and guided students through the story. These characters were created by recording the actors using volumetric capture, which involved 32 cameras capturing the actors from a variety of angles. The combination of tactile experience with the book, storytelling using live actors, and the ability to interact with musical elements on the page in augmented reality created a transformative learning experience that would not be possible without this technology, placing this article into the redefinition category.

I organized each article into one of the four tiers of the SAMR model in Table 4. Articles were organized according to how the technology was used and how the learning process was affected by the technology.

Methodologies

Researchers overwhelmingly used experimental designs (11 articles), but none used a purely qualitative approach, such as phenomenology. Some researchers used mixed methods to observe student interactions with technology (Danso et al., 2021; Huovinan & Rautanen, 2020; Terauchi, 2022) or to analyze technology-infused lesson activities (Zadnik, 2022), but phenomenological studies were absent. Scholars have called for more qualitative research, specifically phenomenological research (Cilesiz, 2011; Valentine et al., 2018), in the field of educational technology, and the use of phenomenology in music education has been thoroughly examined (Hourigan & Edgar, 2014; Joubert & Van Der Merwe, 2020; Randles, 2012). Researchers have used phenomenology to see how teachers' beliefs around the value of technology affected its implementation in their classrooms (Ottenbreit-Leftwich et al. 2010), and a similar study looking at music educators could be beneficial.

Table 4

How Technology is Used According to the SAMR Model

SAMR Category	Studies
Substitution	Danso et al. (2021); Gubbins (2024); Jeremić et al. (2020); Zadnik (2022)
Augmentation	Baek & Taylor (2020); Banut & Albulescu (2023); Banut & Albulescu (2024a); Brown (2024); Gubbins (2024); Huovinen & Rautanen (2020); Kang & Yoo (2023); Lesser (2020); Roman et al. (2024); Wang (2021)
Modification	Banut & Albulescu (2024b); Evans (2020); Fanchamps et al. (2024), Koong et al. (2025); Lyu & Sokolova (2023); Petrie (2022); Terauchi (2022); Vasil (2020)
Redefinition	Hart & Williams (2021); Ho et al. (2023); Mygdanis & Papazachariou-Christoforou (2023); Norman (2020); Teng (2024)

Participants

While there was a wide range of participants represented across the articles in this review, two groups of students were largely absent: preschool students and students with disabilities. Not one article included preschool music students as participants. This is an important omission because a variety of studies have shown benefits of well-designed technology use at the preschool level in subjects including science (Herodotou, 2018; Hsu et al., 2011), math (Bullock et al., 2017), and music (McKinnon, 2005; Panagiotakou & Pange, 2010). Students with disabilities were also largely absent from the articles; only one article (Roman et al., 2024) included a discussion of the possible benefits of technology use for these students. This could be a fruitful area for future research due to the connection between technology and accessibility.

Technology has been identified as a powerful means of giving all students multiple options for how information is represented and how they can interact with it (Gordon, 2024).

Technologies Used

Finally, there are two potential research areas involving the types of technologies used. First, the lack of commercial music technologies, such as digital audio workstations or paid subscription music instruction programs, especially at the redefinition level, is noteworthy. Only two of the five articles at the redefinition level used commercially available technologies; the other three were researcher-designed technologies. The second area of research is artificial intelligence (AI) in the elementary music classroom. Only one researcher in this review (Teng, 2024) used AI. This is a critical area for further research since AI's role in music education has been a growing topic of research (Cheng, 2025; Li & Wang, 2023; Zhang et al., 2024; Zhou & Kim, 2024; Zulić, 2019), but AI use in elementary music education is still largely unaddressed.

It is important for researchers to further investigate the nature of technology in elementary music education, especially considering the proliferation of new technologies like AI in the last few years that have the potential to transform education. My hope is that this scoping review will both provide future researchers with a lay of the land that has not been available up to this point and provide a glimpse into how teachers have used technology in their classrooms.

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David Casali is a music education Ph.D. candidate at the University of Massachusetts Amherst and an early childhood music educator in the Springfield Public Schools in Springfield, Massachusetts. He has his Bachelors in double bass performance from UMass Amherst and his Masters in double bass performance from Indiana University. While he still plays the double bass when subbing with the Springfield Symphony Orchestra, he switched his focus to music education in 2015 after discovering the joys of teaching and has developed a passion for teaching at the early childhood level. He has spent the last three years exclusively teaching students in preschool, focusing on play, accessibility, and opening up new musical possibilities for students through technology.

David has spoken on music technology in the elementary music classroom at many conferences including the 2024 ATMI conference, the Massachusetts Music Educators

Conference, the Michigan Music Conference, the NAfME National Conference, and the 2025 New Directions in Music Education conference.

His work as a doctoral candidate focuses on music technology in the early elementary music classroom. His recent projects include introducing early elementary students to music production concepts through applications he has built using the Max programming language and creating choreographed dances to electronic music for preschool and kindergarten students. His future areas of research include how elementary music teachers use generative artificial intelligence to increase accessibility in their teaching.

