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Music as an Instructional Modality to Increase Attending Behavior of Elementary Students

by

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A thesis/dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science
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ABSTRACT

Audio and audiovisual cues, when used as teaching tools, result in desirable learning outcomes for young learners when compared to visual cues alone (Havy et al., 2017; Kirkham et al., 2019; Sloutsky & Napolitano, 2003). Previous research has demonstrated that music can be an effective delivery method for teaching math in the elementary classrooms (An & Tillman, 2015; An et al., 2014; Azaryahu et al., 2020). However, the effectiveness of music at increasing attending behavior specifically has not been assessed in these studies. This study evaluated the effectiveness of music based instruction on students’ attending behaviors compared to non-music based instruction. A reversal design was implemented with four students in the same 1st grade classroom. Although there was some variability across phases, all four students showed higher overall levels of attending in the music based instruction condition, indicating adding music to classroom lessons may be beneficial in improving attending behavior during group instruction for elementary aged students.
CHAPTER ONE: INTRODUCTION

A one size fits all teaching approach will not be fruitful for all or even most learners (Sternberg et al., 2008). Claxton and Ralston (1978) suggest that learners can be categorized into distinct groups based on the type of stimuli that, when used as teaching tools, result in the best learning outcomes. There has been much deliberation surrounding the existence of different learning and teaching styles that work harmoniously with each other. Barbe et al. (1979) defined three “learning modalities” encompassing distinct types of learners: visual learners, often categorized by their preference through learning from graphs, figures, and displays; aural (or auditory) learners, who learn best through auditory means such as lectures, podcasts, or music; and kinesthetic (or tactile) learners, who prefer to learn through hands-on methods, such as participating in activities or manipulating objects. Fleming (1995) later added a fourth modality, reading and writing. Students questioned about academic pursuits which they struggled with most often pointed to the format with which the information in their classes was presented as the leading factor towards their difficulties with the material (Fleming & Mills, 1992). Adapting course material and its’ delivery to students’ learning styles has been demonstrated to increase motivation and reduce dropout among learners (Hassan et al., 2021).

Approximately 30% of learners classify themselves as primarily auditory learners (Raj, 2009). Auditory learners perform best in an academic setting that incorporates listening and talking; they have the best learning outcomes following instructions involving lectures, discussions, mnemonics, and other methods that stimulate their hearing (Barbe et al., 1979). Research suggests that toddlers and children show a bias toward auditory teaching compared to
adults who prefer the use of visual stimuli (Robinson & Sloutsky, 2004; Sloutsky & Napolitano, 2003). In a study by Robinson and Sloutsky (2004), auditory stimuli were found to be potent teaching tools at birth and in adolescence, but as the individual ages, their preference might switch to more visual learning methods. This suggests that an individual’s learning type could fluctuate over their lifespan. Additionally, when presented with audio and visual cues simultaneously, young children were more likely to process the audio stimuli (Sloutsky & Napolitano, 2003). This shift in preference might be due to the attention-grabbing qualities of auditory stimuli (Napolitano & Sloutsky, 2004) or to the forming of the learners' visual skills in later adolescence (Raviv & Amon, 2018). A study by Havy et al. (2017), which aimed to teach infants and adults new word-object pairings, found that while both groups could effectively learn the pairings in the auditory and audiovisual conditions, only the adults were able to learn the pairings in the visuals alone condition. In a study conducted with 61 participants, 10-year-old learners tasked with categorizing novel stimuli performed better in the auditory informative cues condition compared to the visual informative cues and the multisensory audiovisual cues conditions (Kirkham et al., 2019). Given these findings, incorporating auditory teaching methods into early childhood classrooms, early intervention packages, and other academic settings could improve academic performance.

A multimodal, audiovisual approach that combines both aural and visual modalities could be beneficial and instrumental in promoting learning compared to a monomodal delivery style (Brunken et al., 2004; Hassanzadeh, 2016; Kirkham et al., 2019). A study conducted with ten women in their early- to mid-20s found that audiovisual presentations promoted a greater acquisition of knowledge, compared to visual-only presentations of the same material (Brunken et al., 2004). In a study conducted with university students, watching TV talk shows, compared
to reading texts on the subject matter, improved the students’ acquisition of the material, and their ability to apply it to practical tasks (Hassanzadeh, 2016). In a study focused on young learners, 5-year-olds completing a sorting task showed greater efficacy when given audiovisual cues than in unisensory conditions (Kirkham et al., 2019). Given the wealth of research conducted on the applications of audio as a learning and teaching tool, it is critical to ask what role music, a purely auditory medium, could take in learning.

The effects of music on cognitive functioning, specifically memory, provoke further discussion. Schäfer et al. (2013) evaluated the functional properties of listening to music with 834 respondents. Researchers identified three distinct dimensions for listening to music: self-awareness, social relatedness, and arousal and mood regulation. Increasing “self-awareness,” closely resembling functional properties to cognitive functioning, was ranked as the second most common function of listening to music, behind arousal and mood regulation. When asked about the role of music in the collegiate experience of 433 Chinese university students, 80% of students attested that the benefits of listening to music while studying outweighed any potential harm, with increased relaxation and concentration being the most noted benefits (Hu et al., 2021).

Many students play music in the background while studying or completing other academic tasks (Goltz & Sadakata, 2021). When researchers at Western Michigan University studied the role of background music in learning, they found positive correlations between playing light music in the background of the classroom environment and student comfort, confidence, and learning retention (Langan & Sachs, 2013). Kotsopoulou and Hallam (2010) administered questionnaires to 600 students, between the ages of 12 and 21, in Japan, the UK, Greece, and the US. The results showed that the effects of background music on studying were dependent on the learner’s age, culture, task, and preferred type of music. Other research has supported the idea that the
positive developmental effects of music will only be applicable if the listener prefers the music (Hallam, 2010). This could be a limitation to using music in an academic group setting.

Previous research suggests formal music training corresponds with improved academic performance and working memory (Anvari et al., 2002; Bialystok & DePape, 2009; George & Coch, 2011; Holochwost et al., 2017; Sala & Gobet, 2017). In terms of early development, researchers have found a significant correlation between musical perception skills and both phonological awareness and reading development/ability in preschool-aged children (Anvari et al., 2002). Music may also result in improved learning and academic performance. In a study examining 265 children attending primary school, students in the music program performed better on standardized tests, had higher grades in both English and math, and performed better in both executive functioning and short-term memory tasks, compared to the control group, with students who had spent longer amounts of time in the music program showing the most significant differences in scores (Holochwost et al., 2017). In a similar study with young adults, musicians outperformed non-musicians in executive function tasks involving spatial conflicts, and auditory/linguistic conflicts (Bialystok & DePape, 2009). This was true for vocalists (i.e., singers) and instrumentalists (e.g., pianists, guitarists). It is important to note that participation in formal musical training is more common in individuals from a high-socioeconomic status (SES) background, which may be a confounding variable in these studies (Sala & Gobet, 2017). Additionally, white, suburban students from high-SES have more opportunities to experience musical instruction integrated into their academic subjects than students of color from low-SES backgrounds in urban or rural areas (Miksza & Gault, 2014).

Previous research has explored music as a teaching tool in the general education classroom. In a study by Parsad and Spiegelman (2011), teachers from 1,802 elementary schools
were surveyed to determine how the arts were used as an educational tool in their classrooms during the 2009-2010 school year. Of the 3,427 teachers surveyed, 81% of public elementary school classroom teachers claimed to incorporate musical instruction when teaching non-music subjects, such as math or social studies. However, the overall implementation (e.g., frequency across the week, total duration) of music was not evaluated. In a more comprehensive follow-up, only 54% of public elementary school music specialists reported that their musical instruction was incorporated into academic subjects (Parsad & Spiegelman, 2012).

Most research conducted on the use of music in the classroom has been focused on using music to teach math, which could be due to the mathematical foundations of music (Loy, 2006), and/or the viability of developing and implementing music based mathematics lessons (An et al., 2013). An et al. (2014) conducted a between-subject analysis of two groups of 3rd-grade students, which assessed their basic math skills. Following this, one class received music-mathematics integrated lessons, while the other class received traditional lecture and textbook-based instruction. The music-mathematics lessons consisted of hands-on small group activities which utilized music composition or music playing to teach a mathematical concept through the fundamentals of music theory. In posttests, students who received the music-mathematics lessons showed significantly higher mathematics disposition test scores than their peers in the typical mathematics classroom.

In another study incorporating music for math instruction, a pair of 3rd-grade homerooms received similar lessons in their math classes, one music based and one purely math-based, this time with multiple pretests, midtests, and posttests implemented to glean more comprehensive data (An & Tillman, 2015). Results showed similar positive impacts on the music instruction lessons as the An et al. (2014) study. Similarly, Azaryahu et al. (2020) showed that fourth-grade
students learning basic fractions demonstrated greater gains after participating in music based interventions when compared to their peers who received typical lessons on fractions. This study tested two distinct music based interventions, which both involved students notating rhythms in a 4/4 time signature- however, only one intervention had students listen to authentic music while notating the rhythms. Groups that received the music based interventions showed higher pre- to post-intervention gains on fraction test scores than the control group, with the group that listened to authentic music while notating rhythms showing the highest gains. All of these studies evaluated scores on tests of math abilities to determine the effects of music based instruction. Improved test scores suggests that students are engaged and attending to the instruction more often in music based lessons; however, no studies have specifically measured engagement or attending behaviors during academic instruction that incorporates music. Therefore, the purpose of this study was to evaluate whether the use of music based instruction for elementary-aged students would increase attending to academic lessons over non-musical instructional methods. Specifically, this study addressed the following research questions: (a) to what extent will music based instruction result in increases in student’s attending behaviors compared to non-music based instruction, and (b) to what extent will teachers and students prefer music based instruction over non-music based instruction.
CHAPTER TWO: METHODS

Participants and Settings

Four children were recruited from a 1st grade general education classroom in a public elementary school in Tampa, Florida. For this study, the participating students and teacher were identified using the following inclusion and exclusion criteria. Student inclusion criteria to participate in this study included: (a) they had a history of infrequent attending to group instructions based on teacher reports; (b) they were enrolled in a general education classroom; (c) parents signed informed consent and students provided assent; and (d) they had no physiological barrier to attend to audible stimuli (i.e., hard of hearing) based on teacher report. Students were excluded if they: (a) were frequently absent from school (more than 5 absences in the past 3 months); and/or (b) engaged in high-intensity problem behavior, such as aggression, elopement, property destruction, or self-injurious behavior. To participate in the study, the teacher was required to meet the following inclusion criteria: (a) they agreed to devote 5 minutes of class time to implement either the music based or non-musical lessons; (b) they were the lead teacher for the student’s classroom; and, (c) they were willing to periodically meet with the researcher. Teachers who commonly incorporated music as an instructional tool in their classroom were excluded.

Four students from the same first grade general education classroom participated in this study. Pseudonyms are used to describe the students. Bobby was an 8-year-old male student, Ricky was a 6-year-old male student, and Laurie and Zoe were both 7-year-old female students. The teacher reported why each individual student was chosen to participate: Bobby was reported
as a “class clown,” and was often talking with his peers during group instruction. Ricky was easily distracted by any interruptions in the room. Laurie reportedly had the lowest level of attending in the class, with the teacher reporting that she was often off-task for the entirety of an activity. Zoe was “hit-or-miss,” with the teacher indicating that she sometimes was a model student, but frequently had days where she seemed less willing to attend to group lessons. All students were academically functioning at a first-grade level. The teacher participant was a 23-year-old female, who was in her first year of teaching. She indicated prior to the study that she was having difficulties maintaining student attention during group instruction. The teacher had 16 students enrolled in her class at the time of the study.

Sessions were conducted four to five times per week in the classroom in the morning at 11:15 am. This time was chosen because the teacher indicated that music based lessons could be incorporated into the typical academic math lesson at that time, and student attending behavior was reported as low during this time.

**Recruitment Procedures and Informed Consent**

After obtaining permission from the school’s principal, the researcher met with kindergarten, first-, and second-grade teachers, and presented the study to identify any teachers who were interested in participating. After identifying teachers who were interested in the study, the researcher met with each one to determine if they had students in their classroom who met the inclusion criteria. The teacher participant sent home consent forms with six students who were identified by teacher report as having met the inclusion criteria. Of the six consent forms sent out, four were returned signed by the student’s parents and those four were included in the study. All students in the class were exposed to the class-wide intervention, but only the student participants had data collected on their behavior. The researcher obtained verbal assent from
each student participant prior to beginning the study.

**Materials**

An Apple iPhone installed with the latest operating system (iOS 15.5) was utilized throughout the study to collect data on participants’ attending behavior. The latest version of a data collection app, TallyFlex (Version 1.13), was utilized to collect and score sessions. A Jawbone Big JAMBOX Bluetooth speaker was used to play the songs used during music based group lessons. Visuals displaying the information relevant to the lessons (e.g., PowerPoint slides, tangibles) were used at the teachers’ discretion in both the non-music and music based lessons.

Before the initiation of the study, the teacher was given a list of songs relevant to the math lessons they decided to implement the intervention in, and approved each one to be used in music based lessons (see Appendix A). Every song included on the list was used in at least one session. Some of the songs included in the list had an accompanying video, but for those songs, the video was not visible to the students, and only the audio was used.

**Target Behavior**

The target behavior for this study was attending, which was defined as the participant having their head oriented towards the teacher or instructional visuals during group instruction. The student had to be sitting at their desk with their head upright and eyes looking at the teacher and/or visuals that the teacher was using. Attending was measured using momentary time sampling across all four participants. The observer scored an occurrence of attending if the participant was attending during the 2 seconds following a 10-second interval. If attending was not observed during the specified 2 seconds, a nonoccurrence was scored. Following each 10-second interval, the observer collected data on a subsequent participant, until all participants had
an occurrence or nonoccurrence scored, at which point the observer returned to scoring the first participant. Data on each participant was always collected in this order: Ricky, Bobby, Zoe, Laurie. After each session, the researcher calculated the percentage of intervals in which the participant was attending out of the total opportunities to attend.

**Interobserver Agreement**

A second observer was trained using behavioral skills training (BST) to collect data on the participant attending behavior and teacher implementation of the lessons. BST consisted of instruction, modeling, rehearsal, and feedback until the observer reached 90% agreement or higher with the primary researcher on the target behavior. Interval-by-interval interobserver agreement (IOA) was calculated for attending, with a second observer collecting data independent of the primary observer for 40% of sessions in the baseline conditions and 50% of sessions in the intervention conditions. Interval-by-interval agreement was calculated for each participant by dividing the number of intervals in which the observers were in agreement in each session by the total number of intervals in that session and multiplying it by 100 to convert the results into a percentage. Average IOA for percentage of intervals in which Ricky was attending was 95.7% agreement, with a range of 80%-100%. Average IOA for percentage of intervals in which Zoe was attending was 96.8% agreement, with a range of 85.7%-100% agreement. Average IOA for percentage of intervals in which Bobby was attending was 92.2% agreement, with a range of 75%-100%. Average IOA for percentage of intervals in which was Laurie was attending was 92.5%, with a range of 71.4%-100%.

A second observer also collected data on teacher treatment integrity for at least 40% of baseline sessions and 50% of intervention sessions. Trial-by-trial agreement was calculated by dividing the number of steps in agreement by the total number of steps (i.e., agreements plus
disagreements) and converting the results to a percentage by multiplying by 100. Teacher integrity IOA was 100% agreement across all conditions.

**Social Validity**

Social validity was assessed through a 4-question questionnaire provided to the classroom teacher during the second intervention phase to obtain information on their views of the interventions’ feasibility and acceptability (Appendix B). The questionnaire used a 5-point Likert-type scale with answers ranging from “Strongly Disagree” (1) to “Strongly Agree” (5). The teacher responded to each item on the questionnaire as follows: “I am confident that music based lessons were effective in keeping students engaged: Agree (4),” “I will use music based lessons in the future: Agree (4),” “This study took too much time: Disagree (2),” and “I would recommend music based lessons to other teachers: Agree (4).”

Student participants were also given questionnaires to assess their opinions of the intervention (Appendix C), with the statements: “Music lessons are fun,” “I want more music in class,” and “Music helps me learn.” Students answered by circling a “smiley,” “neutral,” or “frowny” face after each statement. All student participants responded with “smiley” faces to all questions, with the exception of Ricky, who responded to “Music lessons are fun” with “neutral” face, and to “I want more music in class” and “Music helps me learn” with “smiley” faces.

**Treatment Integrity**

Treatment integrity data were collected on the number of steps in a checklist correctly performed by the classroom teacher. There were two checklists on which data were collected, one checklist for non-music based lessons (Appendix D) and another for music based lessons (Appendix E). A “Y” indicated that the teacher performed that step correctly, while an “N”
indicated that the teacher did not perform that step or performed it incorrectly. The treatment integrity score was calculated by dividing the number of “Y’s” by the total number of steps in the checklist and multiplying by 100 to reach a percentage. Treatment integrity was 100% throughout all conditions. If the teacher was not meeting 100% fidelity in either condition, additional BST sessions would have been conducted; however, these additional sessions were not necessary, as teacher fidelity never fell below 100%.

**Experimental Design**

An ABAB reversal design was used to evaluate the effects of music based lessons on attending and demonstrate experimental control over non music based lessons.

**Procedures**

Across conditions, lessons were approximately the same duration, with the teacher deciding on a designated length of 2 to 5 minutes per lesson. Lessons were conducted at the same time each day and during the same instruction activity across conditions. Students sat at their designated desks during lessons in all conditions. The researcher met with the teacher before data collection and provided some examples of the types of lessons in which music could be incorporated to assist the teacher in deciding what might work best in their classroom.

Following the second music based session, the teacher began reminding students before each session of the classroom rules, which included “being safe,” “being organized and prepared,” “being an active learner,” and being respectful.” This was implemented as students started to bang hard on their desks when listening to the music. The teacher reminded students that they could earn tickets towards a schoolwide token economy which was already in place at the school if they could follow the rules during math lessons. Any student who was not banging
on their desk during the lesson was given one ticket following the lesson. Attending behavior was not required to earn tickets. The teacher implemented this for the rest of the first music based lesson phase, the second baseline phase, and the return to music lesson phase.

**Baseline**

During baseline, the teacher taught the math lesson from their curriculum as they typically would, which sometimes included the use of visuals. During this study, the classroom math curriculum covered 3D shapes, then place values, skip counting, and comparing numbers. While the focus of the math lessons changed over time, the researcher never changed phases on the same day that the teacher was implementing a new math topic. The teacher presented the material using contextually appropriate, non-musical prosody. No modifications were made to the typical classroom routine. The teacher was instructed to ignore all non-attending behavior of students and address other problem behavior how they typically would.

**Music Based Lessons**

Before the first session, the researcher utilized BST to teach the teacher how to implement music based lessons. First, the researcher explained how to conduct a music based lesson, and that the teacher should ignore all non-attending behavior as they did in baseline. The researcher then conducted a music based lesson as a model for the teacher. Following the model, the teacher conducted a mock music based lesson for the researcher, and the researcher provided feedback on the mock session. The teacher conducted all steps correctly in the first mock session, with the only corrective feedback from the researcher being that she should be slightly less animated during music based instruction, as she was not as animated while conducting the baseline sessions.
Prior to each session, the teacher was given a choice from a pre-selected list of songs (Appendix A) to be used during the lesson. The songs were within the 2 to 5 minute length that the teacher had designated for their lessons. No two consecutive music based lessons used the same song. All of the supplemental materials and visuals used during baseline, such as powerpoints, tangibles, and the whiteboard, were available for the teacher to continue using. The selected song was played on a Bluetooth speaker placed behind the teacher for the entire class to hear. The teacher told students that they could sing along to the song if they would like to and know the lyrics. If the song being played had an accompanying video, it was not visible to the students. As in baseline, the teacher was instructed to ignore all non-attending behavior of students and address other problem behavior as they typically would.
CHAPTER THREE: RESULTS

Figure 1 shows the results of this study for all student participants. All participants showed a higher average number of intervals in which they were attending during the initial intervention phase when compared to the initial baseline phase.

Ricky

During the initial baseline phase, Ricky attended for an average of 51.4% of intervals per session, with a range of 29%-71% of intervals in which he was attending. In the initial intervention phase, Ricky attended for an average of 77% of intervals per session, with a range of 50%-100% of intervals in which he was attending. Ricky was absent from school for the first day of the initial intervention phase, so he was only exposed to 5 music based lessons in that phase, as opposed to the other participants, who were all exposed to 6 music based lessons.

Bobby

During the initial baseline phase, Bobby attended for an average of 51.2% of intervals per session. Bobby’s baseline data were very variable, with a range of 14%-71% of intervals in which he was attending. In the initial intervention phase, Bobby attended for an average of 77.8% of intervals per session. Bobby’s data were much more stable in the intervention phase when compared to the first baseline phase, with a range of 67%-100% of intervals in which he was attending.
Zoe

During the initial baseline phase, Zoe attended for an average of 51.4% of intervals per session, with a range of 29%-71% of intervals in which she was attending. In the initial intervention phase, Zoe attended for an average of 60.5% of intervals per session, with a range of 25%-83% of intervals in which she was attending. Towards the beginning of the 5th session of the initial intervention phase, during which Zoe was only attending for 25% of intervals, one of Zoe’s classmates whispered something to her which appeared to upset her, leading her to put her head down and cry for the rest of the session. If this session was excluded, then Zoe would have had an average of attending for 67.6% of intervals across all sessions. Regardless of this session, while Zoe’s data showed a spike in attending at the beginning of the initial intervention phase, there was a downward trend in attending data throughout the phase.

Laurie

During the initial baseline phase, Laurie’s attending behavior was low, with an average of only 19% of intervals per session in which she was attending, and a range of 14%-43% in which she was attending. In the initial intervention phase, Laurie attended for an average of 48.7% of intervals, with a range of 25%-67% of intervals in which she was attending.
CHAPTER FOUR: DISCUSSION

This study aimed to evaluate the effectiveness of music based instruction when compared to traditional group lectures. All student participants had higher average levels of attending in each intervention condition when compared to the preceding baseline condition. These findings are consistent with the findings of Kirkham et al. (2019), who determined that audiovisual cues were more effective with young learners than visual or audio cues alone. This may recontextualize previous research on music based lessons in the classroom (An & Tillman, 2015; An et al., 2014; Azaryahu et al., 2020), as while previous research also indicated that music based instruction was effective, in those studies, the metric used to determine the effectiveness of the instruction was student test scores. This study may indicate that the increase in test scores shown in previous studies may have been due to the attention-grabbing qualities of auditory stimuli when used with young children (Napolitano & Sloutsky, 2004).

One participant, Zoe, showed an increase in overall attending during music based lessons when compared to non-music based lessons, however, her data had a downward trend in the initial intervention condition. This may be due to the lack of teacher redirects during sessions. The teacher also reported that Zoe had been experiencing some bullying from other peers, which may have influenced her behavior in the classroom.

During the initial baseline and reversal phases, Bobby’s attending was very variable, with a large range of attending from 14%-86% of intervals. The teacher reported that Bobby was a “class clown,” and loved to tell jokes and distract his peers, but that he was also very bright, and that when he was interested in something, he could be a model student. The researcher observed
this, as there were some sessions in the baseline phases in which Bobby was talking with his peers rather than attending, and some days in which Bobby was much more focused. In the initial intervention phase, Bobby’s lowest data point was 67%, and there was one session in which Bobby was attending for 100% of intervals. This shows that for Bobby, attending to music based instruction may have been more enticing than socializing with his peers, while traditionally delivered lessons were sometimes ignored in favor of socializing. Bobby’s levels of attending were also lower in the second intervention phase when compared to the initial intervention phase. This may show that while music based lessons were initially effective in maintaining his attention, as time went on and the novelty of the lessons wore off, he began to attend less from session to session. Thus, for some learners, it may be appropriate to use music as a teaching tool sparingly, so as to not expose those learners to educational music to the point where it might become mundane.

During this study each session was conducted at the same time every day, which was right after the students and teacher returned from lunch to the classroom. Though having a consistent time to conduct each session increased the internal validity of this study, each session taking place directly following the student’s lunch period resulted in some unforeseen consequences. Given that lunch is a very social event, some students had conflicts with other peers, or were reprimanded by faculty for their behavior during lunch. This resulted in students occasionally engaging in emotional behaviors such as crying, teasing others, or arguing with peers upon returning to the classroom. This can be seen in the data with Laurie’s 9th session, in which she had her head down and was sulking for almost the entire session. The teacher reported that prior to the 9th session, Laurie had gotten in trouble at lunch, and the principal had spoken to her, so she was still visibly upset. Zoe’s 10th session, in which she was crying with her head
down for the last two thirds of the session, was another example. According to Zoe, who was asked what was wrong following the lesson, she had an argument with a peer at the lunch table before returning to the classroom. After the lesson began, that peer, who sat close to Zoe, whispered something to her, which led to her crying for the rest of the lesson. Future research might evaluate music based teaching at different times of the day, such as at the beginning of the day or later in the afternoon.

A secondary goal of this study was to evaluate the student and teacher social validity of music based instruction. Both the teacher and student participants responded positively to music based instruction on social validity measures. Students in the classroom that the intervention was implemented in seemed to strongly favor the music based lessons when compared to typical instruction. During the first session of the initial baseline phase, when the teacher began her lesson, many students raised their hands and protested that they wanted to do a music lesson, and when the teacher informed the class that they would not be doing a music lesson that day, there was an audible groan from the class. However, while teacher and student reports on music lessons were favorable, the teacher of the neighboring classroom was initially not as pleased with the intervention. Following the second session, the teacher from the neighboring classroom asked the researcher and teacher participant to keep the volume level down in the future. According to that teacher’s report, the music was loud enough in those sessions to distract her students and disrupt her classroom. Educators planning to use music based teaching methods should keep this in consideration when implementing their lessons.

There were several limitations to this study. All student participants were in the same classroom, and with music based lessons being a group intervention, all participants had to be moved between conditions at the same times. This led to some participants progressing between
conditions before their data were stable or trending upwards or downwards. Likewise, if a participant's data were stable, they may have been exposed to more sessions of a condition than was necessary before progressing to the next condition. Additionally, momentary time sampling data was collected as it was not possible to observe all four students at the same time. This type of data may not be representative of overall attending behavior. Sessions were also relatively short, so each participant may not have had many intervals in which they were observed in a given session, leading to some variability in the data. Future research could replicate this study using participants in different classrooms, use an alternating treatments design to evaluate music based and non-music based lessons, and/or collect duration data on attending behavior for each student. The lessons were also very short (i.e., 2.5 to 5 mins in length) so it is unknown whether music would be helpful for longer lessons. Additional studies could evaluate longer academic lessons incorporating music.

The classroom teacher participating in this study was a 23-year old first year teacher, who had expressed concerns to the researcher about lack of instructional control in her classroom. Future research could be conducted in a classroom with a veteran teacher who is well versed in behavior management techniques, which might yield higher levels of attending in the baseline condition and recontextualize the results of music based lessons.

Like many previous studies (An & Tillman, 2015; An et al., 2014; Azaryahu et al., 2020), this study evaluated music as a tool for teaching math to young learners. However, the effectiveness of music based instruction as a tool for teaching other subjects has seldom been assessed. Future studies could conduct assessments on attending behavior when using music based instruction to teach language, science, or social studies. All of studies listed above were also conducted with elementary learners, and thus deal with subject matter which is relatively
basic. Future research could evaluate the effectiveness of music based instruction when teaching older learners and more complex concepts. In conclusion, the results of this study indicate that music based instruction could be beneficial in improving attending behavior during group instruction for elementary aged students.
REFERENCES


https://doi.org/10.1111/1467-8624.00570

https://doi.org/10.1111/j.1745-6924.2008.00095.x
Figure 1. Percentage of intervals in which Ricky was attending throughout all phases
Figure 2. Percentage of intervals in which Zoe was attending throughout all phases
Figure 3. Percentage of intervals in which Bobby was attending throughout all phases
Figure 4. Percentage of intervals in which Laurie was attending throughout all phases
APPENDICES
### Appendix A: Music Selection

<table>
<thead>
<tr>
<th>Academic Subject</th>
<th>Song Title</th>
<th>Author/Artist/YouTube Channel</th>
<th>Time</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Shapes</td>
<td>3D Shapes I Know</td>
<td>Harry Kindergarten Music</td>
<td>3:02 min</td>
<td><a href="https://youtu.be/2cg-Uc556-Q">https://youtu.be/2cg-Uc556-Q</a></td>
</tr>
<tr>
<td></td>
<td>3D Shapes Song</td>
<td>The Singing Walrus</td>
<td>3:31 min</td>
<td><a href="https://youtu.be/guNdJ5MtX1A">https://youtu.be/guNdJ5MtX1A</a></td>
</tr>
<tr>
<td></td>
<td>for Kids</td>
<td>NUMBEROCK</td>
<td>4:18 min</td>
<td><a href="https://youtu.be/ZnZYK83utu0">https://youtu.be/ZnZYK83utu0</a></td>
</tr>
<tr>
<td></td>
<td>Place Value Song-Numbers to the Millions</td>
<td>Mr. R’s Songs for Teaching</td>
<td>4:13 min</td>
<td><a href="https://youtu.be/qJJugG1bTf4">https://youtu.be/qJJugG1bTf4</a></td>
</tr>
<tr>
<td>Skip Counting</td>
<td>COOL COUNTING! (Skip-counting by 2s, 5s, and 10s)</td>
<td>Harry Kindergarten Music</td>
<td>2:57 min</td>
<td><a href="https://youtu.be/DS3W9WLIXlQ">https://youtu.be/DS3W9WLIXlQ</a></td>
</tr>
<tr>
<td></td>
<td>Skip Counting</td>
<td>Koo Koo Kanga Roo</td>
<td>2:20 min</td>
<td><a href="https://youtu.be/8TGj0NPb3YE">https://youtu.be/8TGj0NPb3YE</a></td>
</tr>
<tr>
<td>Topic</td>
<td>Song Title</td>
<td>Artist</td>
<td>Duration</td>
<td>URL</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------</td>
<td>---------------------------------</td>
<td>----------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Counting by 5s</td>
<td>The Counting by 5s Song</td>
<td>Scratch Garden</td>
<td>2:39 min</td>
<td><a href="https://youtu.be/EemjeA2Djjw">https://youtu.be/EemjeA2Djjw</a></td>
</tr>
<tr>
<td></td>
<td>Mr. Alligator Can Chomp</td>
<td>Jack Hartmann Kids Music Channel</td>
<td>3:29 min</td>
<td><a href="https://youtu.be/xGvrG6049wE">https://youtu.be/xGvrG6049wE</a></td>
</tr>
</tbody>
</table>
Appendix B: Teacher Social Validity

I am confident that music based lessons were effective in keeping students engaged.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>N/A</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

I will use music based lessons in the future.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>N/A</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

This study took too much time.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>N/A</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

I would recommend music based lessons to other teachers.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>N/A</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>
Appendix C: Student Social Validity

Music lessons are fun!

I want more music in class!

Music helps me learn!
## Appendix D: Non-Music Based Treatment Integrity Checklist

<table>
<thead>
<tr>
<th>Steps</th>
<th>Non-Music Condition Steps</th>
<th>Completed (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher instructs students to sit in the designated area that lessons are delivered in.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Teacher delivers lesson using only non-musical speaking and visuals.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Teacher does not redirect non-attending behavior.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Teacher responds to problem behavior as they typically would.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Teacher ends lessons after 2-5 minutes.</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix E: Music Based Treatment Integrity Checklist

<table>
<thead>
<tr>
<th>Step</th>
<th>Music Condition Steps</th>
<th>Completed (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher instructs students to sit in the designated area that lessons are delivered in.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Teacher plays song related to the lesson on a Bluetooth speaker, with the speaker behind them, any accompanying video out of students’ sight, and any necessary visuals present.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Teacher ignores all non-attending behavior.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Teacher responds to problem behavior as they typically would.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Teacher ends the lesson after 2-5 minutes.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix F: Institutional Review Board Approval

January 30, 2023
Zachary Grossman

Dear Mr. Zachary Grossman:

On 1/28/2023, the IRB reviewed and approved the following protocol:

<table>
<thead>
<tr>
<th>Application Type:</th>
<th>Initial Study</th>
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<tbody>
<tr>
<td>IRB ID:</td>
<td>STUDY004896</td>
</tr>
<tr>
<td>Review Type:</td>
<td>Expedited 7</td>
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<tr>
<td>Title:</td>
<td>Music as an Instructional Modality to Increase Attending</td>
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<tr>
<td>Funding:</td>
<td>None</td>
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<td>IND, IDE, or HDE:</td>
<td>None</td>
</tr>
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Approved Protocol and Consent(s)/Assent(s):
- Protocol;
- Parent Consent;
- Student Assent;
- Teacher Consent;

Approved study documents can be found under the ‘Documents’ tab in the main study workspace. Use the stamped consent found under the ‘Last Finalized’ column under the ‘Documents’ tab.

Within 30 days of the anniversary date of study approval, confirm your research is ongoing by clicking Confirm Ongoing Research in BullsIRB, or if your research is complete, submit a study closure request in BullsIRB by clicking Create Modification/CR.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

Bhupinder Sra
IRB Research Compliance Administrator