Fall 11-22-2020

Identifying Music Interventions to Support Students with ADHD in the Classroom

Mandy Frantz

Identifying Music Interventions to Support Students with ADHD in the Classroom

Mandy Frantz
EDCI 590 Individual Research
November 22, 2020

Signature of Project Advisor

Peter J. Vernimb, EdD

Assistant Professor of Education

Identifying Music Interventions to Support Students with ADHD in the Classroom

Abstract

Educators across the country are struggling to effectively manage disruptive behaviors associated with students with Attention Deficit Hyperactivity Disorder (ADHD) while creating a productive learning environment. When classroom and music teachers work with special education teachers to understand the behaviors associated with ADHD and incorporate facets of music education and therapy proven beneficial to students with ADHD into their lesson plans, they should see a decrease in undesired behaviors as well as an increase in student engagement. The goal of this research is to determine how ADHD affects students' learning and the classroom environment, examine studies which demonstrate the benefits of music in its various forms for those who experience symptoms of ADHD and/or related to the comorbidities associated with AHDH , and to provide music and classroom teachers tools they can use in their classrooms to support students with ADHD while effectively managing the classroom environment.

A meta-analysis of recent research and data will be conducted in order to identify challenges existing for students with ADHD, their peers and their teachers, and the benefits of music in a variety of forms on ADHD and its comorbidities. Through careful examination of research on these topics, both needs and possible solutions will be identified which will provide the foundation for further research.

Table of Contents

Introduction 1
Purpose 1
Problem Statement 1
Rationale 2
Definitions 3
Current Data and Statistics on ADHD in the Classroom 8
Literature Review 10
- Effects and Classroom Challenges of ADHD 11
  - Effects and Challenges of Students with ADHD 11
  - Effects and Challenges for Peers of Students with ADHD 12
  - Teacher Challenges and Perceptions 14
- Classroom Interventions for ADHD 16
  - In the General Classroom Setting 16
  - In the Music Classroom Setting 17
- The Benefits of Music 19
  - Cognitive Benefits 20
    - General Music Activities 20
  - Physical Benefits 23
    - Vocal Music 23
    - General Music Activities 24
    - Music Therapy 25
  - Socioemotional Benefits 25
    - Vocal Music 26
    - Drumming 27
    - General Music Activities 28
    - Improvisation in Music Therapy 28

Methodology 29
- Method of Inquiry 30
- Data Collection and Analysis 30

Data Analysis 30
Findings and Conclusions 33
- Recommendations for Further Study 36
- Limitations 37

References 38

Introduction

Educators across the country are struggling to effectively manage disruptive behaviors associated with students with Attention Deficit Hyperactivity Disorder (ADHD) while creating a productive learning environment. When classroom and music teachers work with special education teachers to understand the behaviors associated with ADHD and incorporate facets of music education and therapy proven beneficial to students with ADHD into their lesson plans, they should see a decrease in undesired behaviors as well as an increase in student engagement.

Purpose

There are number of studies which have shown how effective music can be for managing behaviors associated with ADHD (Maucieri, 2016). Based on this research, effective, targeted music education could provide input and feedback which would lessen the severity of distracting and undesired behaviors students with ADHD display when their sensory needs are not properly met. It is beneficial to examine the effect targeted music education can have on students with ADHD in the elementary school setting because, as with any disability, the earlier challenges are discovered and addressed, the better the chances for student success.

Problem Statement

Can the targeted use of music interventions in the classroom setting provide support for students with ADHD and cause a reduction of instances of undesired behaviors?

Rationale

In today's educational climate, the importance of calm, structured classrooms and strong instruction are crucial to student success. Students with ADHD are present in many classrooms, and the behaviors and mannerisms these students display can interrupt learning, disrupt the classroom structure, and effect peer and teacher relationships as well as the self-esteem and self-worth of students with ADHD. Music has the ability to elicit a variety of reactions from those who listen to or participate in music making. Educators should consider the potential benefits of targeted musical interventions on students with ADHD.

Definitions

Adrenocorticotropic Hormone (ACTH) – A hormone produced in the pituitary gland that stimulates the production and release of cortisol. ACTH is activated by stress and raises cortisol levels.

Attention Deficit Hyperactivity Disorder (ADHD) – A condition that presents as recurrent inattention, hyperactivity, and impulsivity. There are three types of ADHD: primarily inattentive (main symptoms include inattention, disorganization, and distraction), primarily hyperactive/impulsive (inability to be still, frequent fidgeting, reckless behavior), and combined (symptoms from both are present).

Auditory Learning – Learning style where the person learns through listening, including speaking, music, aural cues.

Autism – (Autism Spectrum Disorder/ASD) A developmental disability varying in severity, that causes social, communication, and behavioral challenges including repetitive or restricted patterns of thought and/or behavior.

Behavioral Intervention – The use of positive and negative reinforcement and supports to modify unwanted behaviors.

Choristers – Member of a choir

Cognitive Behavior Modification - Method of therapy centering on identifying maladaptive behaviors and working to find methods to change those behaviors.

Cognitive Function – Any mental activity engaging symbolic operations such as perception, memory, imagery, thinking, awareness, and judgment.

Cortisol – The main stress hormone in the body. Cortisol is produced in the adrenal glands, and helps to control one's temperament, and fear; responsible for triggering a "flight or fight response."

Diaphragmatic Breathing – A form of deep breathing engaging the diaphragm muscle where the diaphragm expands on inhalation, and contracts during exhalation. Diaphragmatic breathing is the primary method of breath control and support for singers.

Dopamine – A neurotransmitter used by the body's nervous system to send messages through the body through nerve cells and plays a large part in the ways in which humans feel pleasure. Dopamine is made in the brain. Too much or too little dopamine can affect a number of health issues including kidney function, sleep cycles, attention, mood, and pain centers.

Dyslexia – A learning disorder involving challenges with reading as a result of problems detecting speech sounds and understanding their relationship to words and letters.

Dyspraxia - Diminished ability to perform coordinated movement, may present as clumsiness.

Evidenced-Based Practices – A scientific approach whereby a plan is generated and followed considering all of the following: current research, professional knowledge, and family and community feedback.

Executive Function – The cognitive process including one's skill to make decisions, employ effective time management, structure thoughts and activities, and to prioritize tasks.

Inclusion – Including students with disabilities along with the general student population in educational settings.

Individualized Education Program – (IEP) A document identifying the goals, objectives, accommodations, and services a child with a disability requires to appropriately access their education.

Inhibition Planning – An executive function where one exhibits the ability to control impulsive responses or behavior.

Kinesthetic Learning – Method of learning where the learner engages in physical movement in order to process material (walking, jumping, hopping etc.).

Kodaly Method – A music education technique using culture-specific folk songs, hand signs, specific rhythm symbols and syllables. Created by composer and music educator Zoltan Kodaly in Hungary in the early/mid 20th century. The focus is on simple, singable folk melodies prominent in the local culture.

Metacognition – Awareness and exploration of one's thinking and/or learning processes.

Music Tempo/Tempi – The speed with which a passage of music is played. Tempi is plural, meaning a variety of different speeds.

Music Therapy – A related medical practice involving the therapeutic use of music (including listening, performing, or composing music) to help alleviate some mental health conditions and pain, improve physical abilities, and assist in the development of interpersonal skills.

Musical Improvisation - A form of music composition where the composer(s) generate new music in the moment, while singing or playing an instrument. Can be carried out individually or with a group of musicians while following a basic music structure.

Neurological Damage – Injury to or impairment of the brain or nervous system, which can impact normal development or responses in the brain. May impact executive function abilities, as well as memory, coordination, and communication skills.

Neurotypical – Refers to people do not have a developmental disorder such as autism spectrum disorder. One who demonstrated typical neurological development.

Oppositional Defiant Disorder – (ODD) A psychiatric disorder including disruptive, defiant, hostile, and disobedient behavior, often directed towards those in positions of authority. ODD is frequently identified in childhood, and can continue into adulthood.

Optimal Stimulation Theory – A scientific concept where individuals have an ideal level of arousal for their bodies, and will seek out various methods of sensory input to attain and maintain that level.

Oxytocin – A hormone generated in the pituitary gland which is important in the following human behaviors: trust, anxiety, sexual arousal, and mother-child bonding.

Processing Speed – The time it takes for a person to complete a mental task, including the speed that one understands and reacts to the input/information that they receive.

Pro-Sociality – Behaviors meant to benefit others.

Psychosocial – A psychologic approach that considers how one's psychologic state is related to their social interactions and behaviors.

Rhythm – The pattern of strong and weak beats that make up phrases of music. Considers only note duration and the pattern of such, not the melodic pattern of music.

Self-Regulation – The ability of one to control their behavior through self-monitoring, including employing self-management and self-control.

Social Resilience – The ability of one to cope, tolerate, respond and adapt or adjust to social and environmental threats.

Socioeconomic – The organization of groups of people based primarily on their financial status.

Tactile Learning – Method of learning through employing fine motor skills; learning by touching and interacting with materials.

Verbal Fluency – The speed at which one speaks. Verbal fluency is a tool used to identify various speech, language, and articulation disorders.

Visual Learning – Method of learning in which the learner sees the material in order to comprehend; learns using graphs, charts, and other visually stimulating material.

Current Data and Statistics on Attention Deficit Hyperactivity Disorder (ADHD) in the Classroom

Teachers in schools today report a dramatic increase of disruptive behaviors in their classrooms (Manasiev et al., 2019, p. 1). Manasiev et al. (2019) surveyed approximately 2,000 teachers, administrators, and support staff (p. 1). According to the survey, 71% of classroom teachers report an increase in the frequency of disruptive behaviors, with 38% reporting a significant increase (Manasiev et al., 2019, p. 5). Manasiev et al. (2019) found this increase does not just impact the classroom climate but also the average amount of instructional time lost, which was estimated to be 144 minutes a week, or 14.5 days out of the school year (p. 7). The results of this survey highlight the need for research to understand and find solutions for classroom disruptions such as ADHD.

According to the Center for Disease Control and Prevention, ADHD is most often diagnosed in childhood ("What is ADHD," 2020). Children who are diagnosed with ADHD often display some or all of the following symptoms: Difficulty focusing, frequent day-dreaming, squirming and fidgetiness, frequently misplacing items, forgetfulness, excessive talkativeness, making careless mistakes, taking unnecessary risks, trouble taking turns, difficulties getting along with others, and poor impulse control ("What is ADHD," 2020). There are three type of ADHD: 1) predominately inattentive where students struggle with organization, finishing tasks, and focus; 2) Predominately hyperactive/impulsive where students frequently fidget, talk out of turn, are restless and impulsive, have a hard time waiting for their turn or listening to directions, are more likely to interrupt, grab, or speak at inappropriate times, are more accident or injury prone; and, 3) A combination of both inattentive and hyperactive/impulsive ADHD where students exhibit characteristics of both ("What is ADHD," 2020).

Attention Deficit Hyperactivity Disorder, or ADHD, is a disability affecting a large number of the student population. According a study released by the National Health Interview Survey (NHIS) in 2015-2016, 7.7% of children ages four to 11 have been diagnosed with ADHD (up from 5.3% in1997-1998) ("General Prevalence of ADHD," 2020). Based on the statistics mentioned above, there appears to be a significant increase in ADHD diagnoses; however researchers are unsure if the increase of children diagnosed with ADHD demonstrates true growth or simply higher rates of diagnosis due to increased awareness of the symptoms associated with ADHD ("Is There an Increase in ADHD," 2020). The National Survey of Children's Health interviewed parents of children ages two to 17 in 2016 ("General Prevalence of ADHD," 2020). This survey found that 8.9% of children ages six to 11 have a diagnosis of ADHD and of the 8.9%, 14.5% were diagnosed with severe ADHD, 43.7% were diagnosed with moderate ADHD, and 41.8% were diagnosed with mild ADHD ("General Prevalence of ADHD," 2020). That same survey found many children with ADHD have been diagnosed with comorbidities in addition to their ADHD diagnosis; and, one half of children ages two to 17 have behavioral or conduct problems, one third of diagnosed children also have anxiety, and one in six have been diagnosed with depression ("General Prevalence of ADHD," 2020). In addition, 90% of school-aged children with ADHD receive some type of support services or accommodations in school ("Data and Statistics About ADHD," 2019, para. 1). With such large numbers of students diagnosed with and receiving services for ADHD, teachers need to be adequately prepared to meet the needs of these students in their classroom.

Whatever the reason for the increase in diagnoses of students with ADHD, teachers are tasked with both supporting these students and creating an effective learning environment for all students in their classrooms and this responsibility may be taking a toll. According to a 2012

Primary Sources poll of 10,000 educators conducted by Scholastic along with the Bill and Melinda Gates Foundation found 62% of teachers who have been teaching in the same school for at least five years noted an increase in behavioral issues interfering with teaching and learning in the classroom ("Classroom Behaviors Increasing, Teachers Say," 2012). Additionally, over half of the teachers surveyed expressed a desire to spend less time on classroom discipline (2012). Students and teachers are facing behavioral challenges in the classroom, and music interventions may provide the tools both groups require to alleviate these difficulties.

Literature Review

In order to understand the variety of challenges and perceptions students with ADHD, their peers, and teachers experience, and to identify techniques which will effectively support everyone in the classroom, it is important to consider literature focusing on a number of topics. First, one must target the difficulties not only those students with ADHD face, but also their peers and teachers. Additionally, perceptions of and management strategies developed for students with ADHD, and ways that ADHD is addressed in the music classroom should be considered. Literature focusing on the benefits of a variety of music experiences including singing, drumming, broader music making, listening, general music education, and music therapy should identify activities which may support students with ADHD in a number of ways. ADHD is a complex condition which effects cognitive, physical, and socio-emotional development. Looking for trends in academic literature where specific musical techniques support positive growth and reduction in undesired behaviors similar to those demonstrated in students with ADHD could provide teachers in both the general education and music classrooms tools to more effectively support students with ADHD while employing more effective classroom management techniques.

Effects and Classroom Challenges of ADHD

Students with ADHD face a number of challenges in the school setting and one challenge which has the most detrimental long-lasting effect involves creating and maintaining positive relationships. When looking at studies about ADHD, Gardner and Gerdes (2013) found students diagnosed with ADHD had difficulties with peer relationships and were affected by serious social skill deficits. Students with ADHD often engage in high rates of unexpected, immature, and inappropriate behaviors which clash with social expectations (Henker & Whalen, 1999). In general, people with ADHD struggle to navigate the social world; this struggle begins during childhood and lasts well into adulthood, creating interpersonal and occupational troubles (Henker & Whalen, 1999). In general, students with ADHD suffer from low self-worth and exhibit higher incidents of socially unexpected behavior leading to poor relationships. When children rated the quality of their peer relationships considering symptoms of loneliness and self-worth, students with ADHD scored significantly lower than their peers (Diamantopoulou et al., 2005). Diamantopoulou et al. (2005) obtained teacher ratings of students with ADHD and, according to teachers, the symptoms of ADHD including social deficits, conduct problems, and low levels of pro-sociality led to higher levels of dislike for students with ADHD.

The symptoms of ADHD discussed in the introduction of this paper lead to behaviors which create social challenges for students with ADHD and lead to frequent classroom disruptions as well as negative interactions with peers and teachers in the classroom setting. Students with ADHD frequently show signs of inattention; they have difficulty maintaining an appropriate level of attention and are easily distracted (de l'Etoile, 2005 p. 39). Those with hyperactivity demonstrate a more intense level of physical activity than what is expected for others of the same age, they may squirm, not be able to sit still, have trouble staying in their

seats, and may be more talkative than their peers (p. 39). Generally, students with ADHD have great difficulty delaying gratification; they act first-think later, may speak out of turn, have trouble waiting, and may attempt to touch items without permission (p. 39). Optimal Stimulation Theory suggests students strive to maintain an optimal level of stimulation; and, there is a specific level of stimulation necessary for ideal learning and behavior (de l'Etoile, 2005, p. 39). Students with ADHD struggle to maintain their optimal level of stimulation, and they require a higher level of stimulation than their neurotypical peers (de l'Etoile, 2005, p. 39). During longer instructional periods, tasks which require high levels of concentration, or repetitive tasks, students with hyperactivity do not receive as much stimulating input as other students, and their challenging behavior may be an attempt to gain more stimulatory input (de l'Etoile, 2005, p. 40).

Kofler et al. (2007) conducted a study of classroom observations and found there are significantly higher deficits in classroom attention in students with ADHD when compared to their neurotypical peers. Students with ADHD are on task approximately 75% of the time in the classroom compared to 88% of their peers (Kofler et al., 2007). Those with ADHD exhibit deficiencies in visual attending to compulsory stimuli in general, but even more so while participating in group work in the classroom (Kofler et al., 2007). Students with ADHD suffer not only from social and behavioral struggles, but academic ones as well. Those with ADHD tend to earn low grades, perform poorly on reading and math standardized tests, and have poor academic outcomes which can lead to higher levels of grade level retention (Loe & Feldman, 2007). In addition to the struggles that students with ADHD face in school, their behavior can also be detrimental to other students in the classroom setting and can affect peer relationships and academic performance.

Effects and Challenges for Peers of Students With ADHD

Blank and Shavit (2016) identify the components which create a classroom climate: the students' attitudes and general behavior, the constancy of classroom rules, and the manner in which teachers manage disciplinary problems (p. 1). Classroom composition (e.g. social economic status, race and gender diversity), teacher quality, and the teacher's interactions with students and expectations also contribute to the classroom climate and can play a part in determining student engagement (p. 2). Blank and Shavit (2016) note an orderly and organized classroom climate sets the stage for effective learning (p. 1). When a student disrupts class, the teacher must stop instruction for a time to address the challenging behavior. When a teacher is disciplining a disruptive student, the other students in class are not learning which may lead to a decrease in classroom achievement as a whole (2016, p. 1).

Blank and Shavit (2016) theorize the behavioral, motivational, and cognitive outcomes of students are directly influenced by the classroom climate (p. 2). They note any distraction, including noise and classroom disruptions, detract from learning, and that it only takes a few disruptive children to distract the class and impact instruction (2016, p. 2). Blank and Shavit reference a study completed by Carrell and Hoekstral (2010) which showed adding one troubled boy into a classroom of 20 students decreased the test scores of the entire class by two percentile points (as cited in Blank & Shavit, 2016, p. 2).

According to the Blank and Shavit, there are numerous studies which have found a negative relationship between classroom disruptions and achievement (p. 3). Factors such as socioeconomic status, gender (classrooms with a higher number of girls tend to have less disruptive behaviors), and school discipline policies (schools with high expectations and a clear,

enforced disciplinary code have less classroom disturbances) directly contribute to the classroom climate (Blank & Shavit, 2016, p. 3).

Blank and Shavit (2016) conducted their research in Israel where there is an increasing trend of violence, disruptive behavior, and a lack of respect for school authority (p. 4). They followed several groups of fifth graders through their eighth grade year. Every two years, the groups participated in assessments in core subjects, and answered survey questions addressing their classroom climate (pp. 4-6). When analyzing collected data, Blank and Shavit (2016) considered student achievement and assessment scores prior to the fifth grade year, and made adjustments based on factors such as student home life (parent education level, both parents live in home), socioeconomic status, and class size (the larger the class, the more opportunity for disruptive behavior) (p. 10). Once the variables were addressed, they identified evidence classroom disruptions directly affect student achievement negatively (p. 10). They note even seemingly benign behavior such as talking in class can amass and cause as much educational damage for the whole class as absenteeism or tardiness (p. 11).

The negative effects of classroom disruptions are immediate and long-term. When a teacher stops instruction to address disruptive behavior, learning stops for a length of time. If the teacher has to interrupt a lesson multiple times, the entire class is quickly behind schedule. Students also become disengaged and/or lost when instruction stops and restarts frequently, so logically their level of comprehension will decrease. One should take notice of the results of Blake and Shavit's (2016) study when considering ADHD classroom management strategies in the music room. Students with ADHD often engage in disruptive behavior and though the behavior is out of their control (a result of their disability), the effects of disruptive behavior impact everyone in the classroom.

Teacher Challenges and Perceptions

When faced with the behavioral and academic challenges of ADHD, many teachers feel their class is out of control and may feel overwhelmed when attempting to address what is happening. According to Gaastra et al. (2016), school-aged children with ADHD often demonstrate problem behavior which teachers struggle to manage in the classroom. As the numbers of students with ADHD seem to be increasing markedly, teachers often lack the skills and knowledge necessary to appropriately manage the behaviors of those students in the classroom (Gaastra et al., 2016). In a survey of elementary and middle school teachers in North and South Carolina, teachers described their knowledge and education related to ADHD as inadequate (Kay et al., 2017, p. 143). Teachers further elaborated the classroom strategies they developed to address ADHD were created to address specific needs, and were not taught to them (Kay et al., 2017, p. 147). When teachers do not adequately address behavioral challenges in their classrooms, learning can be impacted. Because of their behavioral outbursts, students with ADHD are more likely to be issued detentions, suspensions and expulsions which can further negatively impact their academic success (Loe & Feldman, 2007).

Because of the high incidences of classroom disruptions students with ADHD exhibit, one has to be concerned about the effect these frequent outbursts have on teachers. Kay et al. (2017) found teachers believed managing classroom disruptions related to students with ADHD disrupted learning for other students and, over time, frequent interaction and disruptions negatively affected teachers' perceptions of and interactions with students with ADHD (p. 142). Greene et al. (2002) used the Index of Teaching Stress (an instrument assessing a teacher's subjective stress level and frustration level in response to teaching and interacting with one particular student) to determine if general education elementary school teachers rate those

students with ADHD as significantly more stressful to teach. Students with ADHD who are also diagnosed with oppositional defiant disorder, exhibit aggressive behavior, or suffer from severe social impairments are significantly more stressful to teach than those with ADHD alone (Greene et al., 2002).

In their study of teacher's knowledge, beliefs, and classroom management practices with regard to ADHD, Blotnicky-Gallant et al. (2014) realize educators are more familiar with the symptoms of ADHD than how to effectively manage it in the classroom. There is a direct relationship between a teacher's beliefs about ADHD and the use of evidence-based behavioral management practices (Blotnicky-Gallant et al., 2014). Educators must be well informed in order to provide effective assistance and instruction to students with ADHD. In their study of 21 elementary education teachers, Arcia et al. (2000) discover teachers use a wide range of techniques to address disruptive behaviors and underachievement in their classrooms but lack information necessary to develop a comprehensive plan for classroom management when dealing with students with ADHD. Arcia et al. (2000) believe extensive training is necessary for teachers who work with students with ADHD.

Classroom Interventions for ADHD

There are numerous articles, recommendations, and methods to try to help teachers effectively manage ADHD in their classrooms. Teachers set the tone for their classrooms, and the manner in which they address challenges has a great impact on learning. In order for effective classroom management for students with ADHD, teachers need to be aware of not only the challenges of students with ADHD, but of the resources available to them.

In the General Classroom Setting

In order for teachers to effectively implement behavioral interventions for students with ADHD in their classrooms, they must understand ADHD. Because ADHD has a considerable impact on student emotional, academic, and social performance in the school setting, teachers are in a position enabling them to provide quality interventions to produce positive outcomes for those students (Blotnicky-Gallant et al., 2014).

Students with ADHD or other disabilities often access the services of a special education teacher in addition to their primary teacher in the school setting. DuPaul and Weyandt (2006) note children with ADHD have significant social, behavioral, and academic difficulties in the school setting. They further discuss the use of targeted behavioral interventions to decrease off-task and disruptive behavior. Social skill and friendship intervention programs can help foster successful relationships (Gardner & Gerdes, 2013). Teachers should employ targeted behavioral interventions which encourage self-regulation in order to reduce problem behaviors in the classroom (Gaastra et al., 2016). When teachers employ these classroom interventions, they benefit all students in the class, not just those with ADHD, and can generate more successful behavioral and academic outcomes (Gaastra et al., 2016). One such behavioral intervention, behavioral self-monitoring of attention and self-monitoring of performance, produced positive outcomes in a study involving elementary students in task and spelling study behaviors (Harris et al., 2005). The classroom outbursts students with ADHD exhibit not only affect their peers but also their teachers as well, so it is imperative strategies be implemented to address those behaviors.

In the Music Classroom Setting

With inclusion, students with disabilities are thrust into music classrooms where teachers are unsure how to adequately meet their needs (de l'Etoile, 2005, p. 37). Many disabilities do not present themselves outwardly; the signs and symptoms are internal and students may have average or even above average intelligence and exhibit challenging behaviors. These behaviors can both frustrate and surprise music teachers (de l'Etoile, 2005, p. 37). In order for music teachers to provide quality instruction meeting the needs of all students without disrupting their classrooms, music teachers must understand the intricacies of various disabilities and be able to discern if a behavior is of a neurological origin or is a learned response (de l'Etoile, 2005, p. 37).

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent and challenging disabilities students and teachers face. Special education teachers and music teachers should collaborate together in order to provide the highest quality of education to all students. In their article, McCord and Watts (2006) provide a number of suggestions on how these teachers can collaborate. The special education teacher should share necessary student information and needs to the music teacher so the frequency of unexpected behaviors can be mitigated (McCord & Watts, 2006). The music teacher should have access to the student's Individualized Education Plan (IEP), and be aware of any accommodations to be provided in order for the student to succeed (McCord & Watts, 2006). Special education and music teachers must collaborate so the music teacher is aware of the student's needs and is best prepared to meet them (McCord & Watts, 2006). The music classroom is an excellent place to meet the various needs of all students; material is often presented in a variety of modes, which is beneficial to all learners, but the music teacher should be aware of the needs of special education students and should consider creating learning materials to best support those needs (McCool & Watts, 2006).

de l'Etoile (2005) expounds upon a number of theories and strategies which music educators should explore to foster meaningful, less-disruptive classroom experiences for students with ADHD. In Cognitive Behavior Modification (CBM), teachers can model desired behaviors, incorporate behavior modification as well as social learning (p. 38). Metacognition can help students with ADHD understand classroom expectations, self-regulation, and develop problem-solving skills (p. 38). A visual schedule or outline of the lesson discussed with students before beginning instruction helps keep students on task and lets them know what is coming next (p. 38). Mnemonics are frequently used in music (most notably when learning the notes on the staff), but de l'Etoile (2005) suggests using and posting mnemonics procedurally; a reminder of how to stand when singing or what is expected while waiting for instruction (p. 39). Teachers should have music classroom conditions that are well structured and predictable, where students know expectations as well as consequences, and where distractions are minimized (de l'Etoile, 2005, p. 40). Transitions can be problematic in any classroom and must be addressed in the music room. In order to create smooth transitions which do not derail instruction, de l'Etoile (2005) believes teachers should plan for and prepare students for transitions (p. 40). Also beneficial is using a countdown or auditory cue to alert and guide students through a transition so there is minimal downtime (p. 40). Downtime can lead to disengagement and a surge of undesired behavior. The teacher should highlight important terms or phrases for students with ADHD. Putting vocabulary or other pertinent text in bold or a bright color will help students recognize what they should focus on (p. 40).

The Benefits of Music

Before one can examine the effect music may have on ADHD, it is necessary to discuss the cognitive, physical and socioemotional benefits music provides. Music is a broad category,

and there are significant data supporting positive results engaging in various aspects of music study. Vocal, drumming, and instrument study, music therapy, listening, and general music education all have proven positive results on individuals who experience symptoms similar to or related to ADHD.

Cognitive Benefits

One of the greatest challenges students with ADHD face is the ability to focus across a variety of settings. Music may help with focus and increase comprehension and engagement in the classroom. Music can support cognitive function beyond simply listening to classical music during silent reading.

General Music Activities. Zuk et al. (2014) conducted an experiment where 27 musically trained and untrained children who were otherwise similar were put through a standardized executive function battery of tests. Children who were musically trained demonstrated greater performance when assessed in their verbal fluency, processing speed, and efficient task switching (Zuk et al., 2014). Through analysis of these data, Zuk et al. (2014) find musically trained children demonstrate superior performance in several constructs of executive functioning and conclude musical training may promote the development and maintenance of executive functioning skills. Through their research, Jaschke et al. (2018) sought to determine the effects of music education on cognitive functioning of elementary school students. They followed 147 children over two and a half years to thoroughly research their cognitive academic achievement as related to music education. The students were divided into four groups, two of which received music education, one received visual arts education while the last group did not receive specialized arts education (Jaschke et al., 2018). Jaschke et al. (2018) assessed executive performance as well a verbal intelligence and inhibition planning. When the results were

examined, the students who were in the music groups scored significantly higher in all areas compared to the non-music groups, which supports the theory long-term music education has a positive influence on cognitive abilities in children (Jaschke et al., 2018).

A literature review by Hogenes et al. (2014) sought to determine the empirical effects of music education on cognitive, social, and emotional functioning in children. Five studies investigated the effect of music education on academic performance (Hogenes et al., 2014, p. 1514). A study by Geoghegan & Mitchelmore (1996) explored the impact of music education on mathematical achievement in preschool children (as cited in Hogenes et al., 2014, p. 1514). Students were divided into two groups, one a control which received no music education, the other group received music education based on Kodaly techniques for one hour a week over 10 weeks (as cited in Hogenes et al., 2014, p. 1514). On assessment, the group of students with music education scored higher than the control group (as cited in Hogenes et al., 2014, p. 1514). In an older study, Geoghegan & Mitchelmore (1996) divided the music education group of students into two groups, one where music was in the home, the other where music was not present in the home (as cited in Hogenes et al., 2014, p. 1514). The groups were assessed, and the group with no music in the home scored the same as the control group, while the group with music in the home scored much higher (as cited in Hogenes et al., 2014, p. 1514). Music study across a variety of settings leads to demonstrated higher academic achievement.

Bastien (2002) completed a six-year study seeking to determine whether students aged eight to eleven years old would perform better in the subjects of spelling and math with music education as opposed to those without music education (as cited in Hogenes et al., 2014, p. 1514). Students were administered IQ tests and Bastien noted students with music education scored higher in math, abstract reasoning, and general development (as cited in Hogenes et al.,

2014, p. 1514). Bastien observed in students who had an average IQ, music education made no noticeable difference during the first five years of school, but after five years in school with four years of music lessons, these students had significantly higher IQs than those in the control group (as cited in Hogenes et al., 2014, p. 1514).

Hogenes et al. (2014) reviewed a study by Abikoff, Courtney, Szeibel, and Koplewicz (1996) which examined the effect of listening to one's favorite music on academic performance of students with ADHD. In the study, students took a test while engaged in each of three activities: ten minutes of listening to preferred music, ten minutes of listening to background speech, and ten minutes of silence (as cited in Hogenes et al., 2014, p. 1519). Abikoff et al. (1996) found students answered twice as many questions correctly while listening to their preferred music than the other activities (as cited in Hogenes et al., 2014, p. 1519).

Ulfarsdottir and Erwin (1999) conducted a study to examine the influence of music education on social cognitive skills (as cited in Hogenes et al., 2014, p. 1521). Preschool students were divided into two groups, a control group which received no music instruction and one that participated in a music therapy program where students tried different rhythms, volume levels, sources of sound, and created their own instrumental, melodic music with lyrics (as cited in Hogenes et al., 2014, p. 1521). According to Ulfarsdottir and Erwin (1999), initially there were no significant differences between the groups, however when students were re-evaluated seven months later, students in the music therapy group demonstrated drastic improvement in alternate solution and consequential thinking (as cited in Hogenes et al., 2014, p. 1521). After reviewing the research gathered for their literature review, Hogenes et al. determine that music education has a positive effect on cognitive functioning. Of the 18 cognitive functioning studies, 15 indicated substantial to moderately positive effects (Hogenes et al., 2014, p. 1522).

One of the challenges affecting those with ADHD is effective time estimation and management (Carrer, 2015). In his study, Carrer (2015) found students with ADHD scored significantly lower when estimating time than their neurotypical peers except when estimating the duration of note values in music which indicates music may provide a pathway to better time estimation and management in students with ADHD. Learning an instrument provides a wealth of positive benefits for neurotypical students. Rose et al. (2018) examined an eight-year-old boy with ADHD, autism spectrum disorder, sensory processing challenges, dyslexia, and dyspraxia as he learned a musical instrument over the course of one year. The pre-test showed the child had a high musical aptitude but average IQ and low motor, executive functioning, and social-emotional skills (Rose et al., 2018). When the student was re-evaluated at the end of one year of music instruction, drastic improvements in fluid intelligence and motor skills were noted and he demonstrated good musical progress (Rose et al., 2018).

Physical Benefits

The cognitive benefits of music across a variety of delivery methods are clear and important, but students with ADHD face more than cognitive struggles. Many with ADHD exhibit hyperactive symptoms which means they struggle to sit still, with impulse control, and can be clumsy or injury prone. Music may be able to relieve some of these symptoms. Making music involves physical activity, deep breathing, rhythmic movements, coordination, and focus that can allow movement in safe, expected ways and can help with self-regulation.

Vocal Music. There are a number of studies and articles which discuss the positive benefits of group singing. Keeler et al. (2015) examined the potential benefits of group singing by studying a jazz ensemble. The concentrations of oxytocin and adrenocorticotropic hormone (ACTH) were measured in two different singing situations; pre-composed and improvised

(Keeler et al., 2015). A significant decrease of ACTH and a significant increase of oxytocin were noted in the improvised singing situation, and there was a marked decrease of ACTH and a slight increase of oxytocin in the pre-composed singing trial (Keeler et al., 2015). Keeler et al. (2015) determined group singing reduces stress and arousal levels. Singing in a group reduces cortisol levels while improving breathing, muscle tension, and posture (Launay, 2015, para. 2-5). Theorell (2014) notes there are real physical effects demonstrated when singing; the concentration of oxytocin in the blood increases during singing, and singing has been shown to have a positive impact on various endocrine and immune factors. Theorell (2014) also comments there are numerous studies finding singers feel an increased sense of vitality and relaxing after singing.

General Music Activities. There is more to music than singing when considering the potential benefits. Williamson & Bonshor (2019) generated a wellbeing survey of brass band players to determine if group playing provides positive gains. Through a survey sent to 346 adult brass band players across Great Britain, Williamson & Bonshor (2019) ascertain the musicians note positive impacts in several areas, physical, psychosocial, social, and spiritual. Those surveyed saw benefits in their physical and social wellbeing, enhanced respiratory function, better posture, lower stress, and improved general mental health due to regular social interaction (Williamson & Bonshor, 2019).

Listening to music can provide some remarkable benefits. Thomas et al. (2013) conducted a study in which 60 females were randomly assigned to one of three groups; one where they listened to relaxing music, one where they listened to rippling water, and one where they listened to silence. After listening, the women were subjected to a standardized psychosocial stress test which raised cortisol levels. Those who listened to music returned to

their pre-test base level significantly faster than those who listened to the other selections (Thomas et al., 2013).

Music Therapy. Various methods of music therapy can benefit students with ADHD or other disabilities. In her survey, Jackson (2003) sought to discover what musical therapy techniques are effective for students with ADHD. Music therapy sessions are successful when therapists generate individual lesson plans specific to the needs of the student and include leeway for flexibility so adjustments can be made based on the immediate needs of the student (Jackson, 2003). To further determine the effective aspects of music therapy for students with ADHD, Rickson (2006) conducted a study examining whether instructional (pre-planned, specific music lessons where specific concepts are taught) or improvisational (lessons where the current wants and needs of the student are more readily addressed, and there is no explicit lesson plan) music therapy provided better outcomes in students with ADHD. There were no hard data one method surpassed the other. Rickson (2006) did note both may lead to a decrease of restless and impulsive behaviors in the classroom. The instructional and improvisational methods of music therapy help decrease the frequency of tapping, which speaks to effective self-regulation (Rickson, 2006). The results of Rickson's (2006) study suggest music therapy may play a role in the reduction of a number of ADHD symptoms in the classroom.

Socioemotional Benefits

Perhaps one of the most detrimental aspects of ADHD involves negative peer relationships and low self-esteem. As documented earlier, students with ADHD are often unable to engage in normal peer interactions, are frequently in trouble in school, and tend to struggle academically. These challenges lead to poor self-esteem and trouble appropriately relating to

peers. Music may be able to provide demonstrable socioemotional benefits which will positively impact students with ADHD.

Vocal Music. A study released from the Norwich Medical School in the United Kingdom and the organization Sing Your Heart Out found group singing provided a number of benefits, participants noted a reduction of symptoms of anxiety, depression, and loneliness while feelings of general well-being, and a sense of increased belonging (Bergland, 2017 b, para. 2-5). Participating in a choir has been shown to help emotional regulation and can have a positive impact on social relationships (Bergland, 2017 a, para. 3). Singing with others can decrease a flight or fight stress response because the diaphragmatic breathing used while singing involves a slow, long exhale and a controlled inhale, both of which have a calming effect (Bergland, 2017 b, para. 7-8). Moss et al. (2017) used an online questionnaire distributed to 1,779 choristers over four months to determine the perceived health benefits of choir singing. The singers reported social, physical, and spiritual benefits, and identified six key areas where group singing proves beneficial: cognitive stimulation, mental health, transcendence, social connection, physical and physiological stimulation (Moss et al., 2017). When considering the benefits of singing in a school setting, Mathews (2012) has found singing during transitions in the classroom quite effective in keeping students engaged while allowing for a smoother and faster transition.

In their self-reporting study of 62 participants (39 of whom had mental health problems, 23 who did not), Dingle et al. (2017) found those who participated in arts-based groups including choir singing noted positive emotional benefits and a significant decrease in negative emotions in those with mental health diagnoses and those without. In a study where community singing was included as part of mental health recovery, 20 interviews with participants of the Sing Your Heart Out Project (where those with mental health diagnoses joined in group singing exercises)

were conducted over a six-month period (Shakespeare, 2017). All 20 of those surveyed reported an improvement of or maintenance of their mental health and wellbeing as a result of involvement in the singing workshops (Shakespeare, 2017). The combination of singing and social engagement generates ongoing feelings of wellbeing and belonging, and the structure support of group singing improves mood and social functioning (Shakespeare, 2017).

Drumming. Group drumming has also been studied and there is evidence demonstrating effectiveness in managing symptoms which exist with ADHD as well as the disorders accompanying the diagnosis. Ho et al. (2011) conducted a study to determine the impact of group drumming on social and emotional behavior in low income children. Low-income students often experience high levels of chronic stress and can demonstrate reactionary behaviors similar those of ADHD (Ho et al., 2011). Students who met the study criteria were divided into two groups: one participating in twelve-week social worker-led group drumming, and a control group (Ho et al., 2011). Ho et al. (2011) theorized drumming would provide a non-verbal way to communicate which would decrease the stigma related to therapy groups. At the end of the twelve weeks, teachers completed report forms, and those in the drumming group demonstrated significant improvements in the areas of inattention, depression, oppositional defiant disorder, ADHD, disengagement, and general social-emotional behavior, while those in the control did not demonstrate any marked improvement (Ho et al., 2011). Group drumming has been shown to improve the mental health outcomes of those who suffer from depression and anxiety (which often occur with ADHD) (Fancourt et al., 2016). An exploratory study sought to examine the effect of group drumming on the anxiety and depression of mental health service users (Fancourt et al., 2016). Adults were divided into two groups and monitored over ten weeks. One group participated in group drumming while the other group did not (Fancourt et al., 2016). When

participants were re-evaluated after ten weeks, those who had participated in group drumming demonstrated significant decreases in depression and anxiety, along with an increase in mental wellbeing and social resiliency while those in the control did not (Fancourt et al., 2016). In their study of how group drumming can mediate recovery for mental health patients, Perkins et al. (2016) find those who engage in group drumming report drumming to be a grounding experience which nurtured a sense of connection as well as feelings of belonging and acceptance.

General Music Activities. Winsler et al. (2011) studied the effects of music education on the self-regulation of preschool aged children. A group of 89 three and four year-olds were divided into two groups: 42 were enrolled in Kindermusik (which is a structured early childhood music class), 47 were not enrolled (Winsler et al., 2011). All of the children were put through a battery of self-regulation tests, and those enrolled in Kindermusik showed higher levels of self-regulation than those who had not (Winsler et al. 2011). All of the students were placed in a room with a gift on the table and were instructed not to touch or examine the gift. Those who had been enrolled in Kindermusik used singing or humming to keep from touching the gift, while those not enrolled were more likely to touch the gift before the allotted time was up (Winsler et al., 2011). Additionally, those who were enrolled in Kindermusik were less likely to call out or interrupt during testing and used more relevant speech during the process (Winsler et al., 2011). Bastien (2002) noted before the study began, the group which would be the control group had students with less concentration challenges, but when the study finished, more students in the control group struggled with concentration than the music education group (as cited in Hogenes et al., 2014, p. 1515). Bastien (2002) concludes music education can help students who struggle with concentration challenges (as cited in Hogenes et al., 2014, p. 1515).

Improvisation in Music Therapy. MacDonald and Wilson (2014) examine the benefits of musical improvisation in their study of individuals with ADHD and other conditions. Musical improvisation is unique in that it is spontaneous music-making in a group setting, it is a creative, social, and non-verbal process which happens in real time (MacDonald & Wilson, 2014). In this study, improvisation was examined in the music therapy setting because it allowed for more clearly defined parameters (MacDonald & Wilson, 2014). MacDonald and Wilson (2014) found patients with neurological damage, autism, or ADHD benefit from improvisation in music therapy and note improvements in those participants' mental health, a reduction of stress and anxiety and improved communication (a condition in ADHD). Musical improvisation can be effective for a number of reasons, the potential link of conscious and subconscious processes, the complete demand for attention and engrossment which can happen during the creative process, non-verbal social and creative interaction, and the capacity to express difficulty emotions in a non-verbal fashion.

Methodology

This research was conducted using systematic review and meta-analysis of studies in order to identify trends and possible best practices while addressing ADHD in the music and general education classroom settings.

Systematic reviews and meta-analyses employ a scientific approach to examine, analyze, and synthesize data collected in previous studies in order to identify trends, commonalities, and spawn new insight or theories (Littell et al., 2008, p. 1-2). Meta-analysis is an effective way to look at a variety of studies and research on one topic ,and synthesize this material into one cohesive document however meta-analysis is not without limitations (Littell et al., 2008, p. 4-5). One must consider variances in the methods in which studies were conducted, the size and

population engaged in the research, the age of the research, and bias or errors existing in data interpretation (Littell et al., 2008, p. 5, 10). In order to conduct a successful systematic review and meta-analysis of data, the researcher should have a clear, concise hypothesis, and use the hypothesis to drive a targeted search of available literature and studies (Littell et al., 2008, p. 31). When performing a systematic review and meta-analysis of data, one must consider and address variations in the types of research, size of studies, and populations engaged so the data are authentic and meaningful (Littell et al., 2008, p. 34-35). While not without limitation, systematic review with meta-analysis is an effective way to look at larger sets of data collected in a variety of ways in order to identify trends, problems, and possible solutions and best practices.

Method of Inquiry

A clear problem statement was created and then edited to increase clarity and provide a more concise, targeted goal for research.

Data Collection and Analysis

Data were collected through published research already completed. Research considered was that which had been completed within the past twenty years in order to analyze the most relevant data. Studies discussing the effect of ADHD on students themselves, peers of students with ADHD, and the perceptions of teachers regarding students with ADHD were examined in order to identify particular challenges existing in classrooms. Additionally, studies which examined the effect of music in its various forms and the potential benefits on specific symptoms of ADHD and its comorbidities were surveyed in order to determine if there are aspects of music or music therapy which could be adapted and implemented into both the music and general education classroom in order to support and effectively manage challenging behaviors frequently accompanying students with ADHD.

Data Analysis

In order to best assess and assimilate data gleaned from the research, an overview of pertinent information is imperative to develop an accurate view of the subject matter. People with ADHD who study music demonstrate an increase in memory retention, are better able to focus, score higher on executive functioning evaluations, are better able to multi-task and collaborate with peers, and demonstrate higher levels of self-confidence (Maucieri, 2016, para. 10-12). Music can provide structure; it has a beginning, middle, and end, which can support students with ADHD through transitions, can be used to establish and identify schedules and routines, and can support executive functioning (Rodgers, 2020, para. 5, 14-16). Music therapists are using music to address challenges with students with ADHD. Music therapists use techniques such as drumming and ensemble playing to develop important skills including listening, taking turns, anticipating and making changes, reading cues, and impulse control (Rodgers, 2020, para. 12-17). Listening to and practicing music has been shown to increase dopamine levels in people, which could be key to helping students with ADHD as they tend to have lower levels of dopamine often relying on medication to raise dopamine levels (Maucieri, 2016, para. 13). Music therapists use songs of varying tempi and rhythm to slow or speed up a child's mental and physical processes. Music tempo can be used to target and address non-music behavior, slower music can help a student calm their body and mind, while faster music can energize, and a dramatic change in tempo or rhythm can pique a student's interest and attention (Rodgers, 2020, para. 12-13).

According to de l'Etoile (2005), the music classroom provides a plethora of opportunities for the various ways students learn; there is the opportunity for kinesthetic, auditory, visual, and tactile learning. In order to keep students engaged and satisfy their stimulatory needs, music

teachers should employ all of these modalities in each lesson (p. 40). Planned movement breaks throughout class will also give students who need it a chance to move and expend energy while providing positive sensory input (de l'Etoile, 2005, p. 40). Movement breaks along with plans incorporating different learning styles should lead to calmer, more appropriate behavior throughout the class (de l'Etoile, 2005, p. 40).

Both students with ADHD and the teachers who work with them face daily challenges in the school setting. According to Gaastra et al. (2006), students with ADHD exhibit problem behaviors which teachers struggle to manage in the classroom. Elementary classroom teachers feel the professional development they receive in order to appropriately teach students with ADHD is inadequate. Kay et al. (2017) note these teachers feel ill-equipped to manage the challenges they face and this takes a toll on their ability to effectively manage their classrooms. Blotnicky-Gallant et al. (2014) notes the direct relationship between a teacher's understanding of the symptoms of ADHD and the implementation and use of effective classroom management. In order to generate successful behavioral and academic outcomes for students with ADHD, teachers must be able to effectively support students with ADHD in their classrooms (Gaastra et al., 2016).

According to Bergland (2017) and Launay (2015), the use of music in various settings has shown to have positive effects on physical and emotional self-regulation and has been shown to decrease stress and promote positive social interactions. Hogenes et al. (2014) and Bastien (2002) demonstrated the use of music in academic settings provides cognitive benefits. Both Shakespeare (2017) and Ho et al. (2011) determine singing and drumming provide measurable benefits to those with ADHD; both music activities lead to effective self-regulation, greater impulse control, positive social interactions, higher levels of engagement, and an increased sense

of wellbeing, all characteristics challenging students with ADHD. Music therapists work with students with ADHD and use a variety of techniques proven to have a beneficial effect (Jackson, 2003). Music therapists use planned lessons that engage students in playing musical instruments, listening to music, and other music activities while working on improving symptoms of ADHD such as inattentiveness, fidgeting, impulse control, and generating healthy peer relationships (Rickson, 2006).

Findings and Conclusions

Students with ADHD struggle with a number of social, emotional, behavioral, and physical challenges (Henker & Whalen, 1999). These students have trouble maintaining attention during learning, are easily distracted, and feel the need to squirm or move and talk during times when it is not appropriate to do so, and as a result, their learning and academic performance may be stunted (de l'Etoile, 2005). Unfortunately, the academic shortcomings do not only effect students with ADHD, but their peers as well. Blank & Shavit find students who are in classrooms with students with ADHD score lower on tests and content-learning as a result of the disruptions and redirections which occur during instruction (2016).

Classroom and music teachers feel they are undereducated and unprepared to be able to support students with ADHD while effectively managing their classrooms (Gaastra et al., 2016). Kay et al. (2017) surveyed teachers on their perceptions of managing classrooms which include students with ADHD and found repetitive disruptions and frequent negative interactions with these students lead to increased frustration, while surveys conducted by Loe & Feldman (2007) indicate higher levels of official disciplinary action including detentions and suspensions which can negatively impact academic performance. Teachers also report higher levels of stress and frustration while teaching in classrooms with students with ADHD, which lead to adverse

feelings toward this population of students (Greene er al., 2002). Based on the research presented, students with ADHD, their peers, and their teachers struggle to succeed in the school setting, and the need to consider viable tools with which to effectively manage classrooms is crucial.

When examining the studies, there are obvious musical strategies which could be considered as part of effective classroom management and instruction in the music and general education classrooms. A carefully structured classroom environment where expectations are straightforward, clearly posted and referred to is crucial (de l'Etoile, 2005). Classroom procedures should be predictable and well-rehearsed, and teachers should consider all students with learning challenges, including those with ADHD, when planning for instruction and presenting material (de l'Etoile, 2005). Both de l'Etoile (2005) and Mathews (2012) found using music to cue and support transitions to be an effective way to keep students with ADHD engaged and on task.

Listening to and performing music has academic benefits to consider. Data gathered by Bastien (2002) demonstrated students who received music education scored higher on a battery of tests including math, abstract reasoning, and general development (as cited in Hogenes et al., 2014). Additionally, a study by Abikoff, Courtney, Szeibel, and Koplewicz (1996) provided evidence listening to music had a positive effect on academic performance; students who listened to music answered twice as many questions correctly on an assessment than their peers who listened to background noise or silence (as cited in Hogenes et al., 2014).

When considering music and the effect on people with ADHD and comorbidities, there are definite positive relationships; students who studied music demonstrate better inhibition planning (Jaschke et al., 2018). Winsler et al. (2011) studied preschool-aged children and found

when compared with a group not receiving music education, students who study music have better impulse control and were less likely to call out or interrupt during the assessment process. Students with ADHD often struggle with anxiety, higher stress levels and the inability to self-regulate. Launay (2015) conducted research measuring the levels of cortisol in participants with high levels of anxiety and stress and found cortisol levels are lower after participants engage in singing. Additionally, Bergland (2017) conducted a survey where participants identified their taking part in group singing led to better emotional regulation and had a positive impact on social relationships. Listening to music can lower cortisol levels as well. Thomas et al. (2003) studied the cortisol levels of 60 females, divided into three groups. Each group was put through a standardized psychosocial stress test raising cortisol levels, after which one group listened to relaxing music, one listened to rippling water, and the final group listened to water (Thomas et al., 2003). Thomas et al. (2003) measured the length of time necessary for all of the participants' cortisol levels to return to their base level, and found the cortisol levels of those who listened to music returned to their base level faster than the other two groups of women.

The use of drumming can be a powerful tool in managing some of the behaviors associated with ADHD. Ho et al. (2011) conducted a study involving at-risk youths who lived in poverty and were exhibiting behaviors similar to those of ADHD. They divided the youth into two groups and presented their teachers with surveys to complete about the groups before the study began. The same surveys were administered again after one group participated in group drumming for twelve weeks while the other did not (Ho et al., 2011). When they analyzed the results of the teacher surveys, those in the drumming group showed significant improvements in the following areas: inattention, depression, oppositional defiant disorder, ADHD, disengagement, and social-emotional behavior (Ho et al., 2011).

Music has proven beneficial in supporting many of the challenges that face students with ADHD, but many teachers are unaware of this information. Teachers should consider using music as part of an effective classroom management technique. Classroom, music, and special education teachers must collaborate with each other to share valuable information. When teachers share knowledge with each other, they are better able to support students with ADHD. There are a number of benefits of music, both listening to and practicing, which directly address deficits caused by the symptoms of ADHD in students. With ever-increasing levels of classroom disruptions, teachers need tools to effectively meet the needs of the high population of elementary school students with ADHD, and effective music education may just provide the instruments necessary to do so.

Recommendations for Further Study

The research presented provides background knowledge about ADHD, the perceptions of students with ADHD, the effects ADHD has on those diagnosed as well as the peers and teachers of those with ADHD. There is clearly a deficit in teachers' knowledge of ADHD and their ability to effectively manage classrooms, establish positive student relationships, and support the needs of students with ADHD in the classroom. In their quest to create and maintain a successful classroom environment while meeting the needs of student with ADHD, teachers have shared they feel high levels of stress, frustration, and burnout. Music in all of its forms provides a variety of ways to mitigate the behavioral, emotional, social, and physical challenges students with ADHD often exhibit in the classroom. In order to determine which musical techniques are the most effective in a classroom setting, data should be collected through a study in which two elementary classrooms of similar makeup (same grade level, both containing students with ADHD, similar student population and test scores) are examined. Both classes should begin with

a baseline collection of data including office referrals, academic performance, the time it takes to complete instruction of the same lesson, and a survey for teachers and students addressing various elements of the classroom structure and peer relationships. After baseline data are collected, one group will use targeted musical interventions such as using music to cue transitions and activities, participation in group drumming and singing in the classroom tied into learning exercises, and assessments with classical music playing in the room. The other class will continue as they are with no changes in classroom management. After a specified period of time (eight or 12 weeks), the same survey that was given in the beginning of the research will be given to both classes and the results analyzed to see if the musical interventions provided any benefit. Additionally, including a third class which employs traditional behavioral modification techniques suggested by a special education teacher and based on evidence-based practices should be considered. The addition of the third group would further identify the benefits of music interventions when compared with more traditional behavior modification approaches.

Limitations of Study

The methods used to compile data differed in the studies presented in this paper which led to a challenge in presenting the findings equally. Several of the studies included in this meta-analysis relied on surveys issued to various populations of people; teachers, adults, those with identified disabilities, and others which could be considered subjective and, without careful consideration and analysis, could be misconstrued. Finally, there are limited data on the effects of music in a classroom setting because there has not been significant research done on this subject; further exploration and study is warranted.

References

Arcia, E., Frank, R., Sánchez-Lacay, A., & Fernáindez, M. C. (2000). Teacher understanding of ADHD as reflected in attributions and classroom strategies. *Journal of Attention Disorders*, *4*(2), 91–101. https://doi: 10.1177/108705470000400203

Bergland, C. (2017a, July 19). Arts-based activities boost emotion regulation, study finds. https://www.psychologytoday.com/us/blog/the-athletes-way/201707/arts-based-activities-boost emotion-regulation-study-finds

Bergland, C. (2017b, December 26). Singing your heart out has surprising psychological benefits. https://www.psychologytoday.com/us/blog/the-athletes-way/201712/singing-your-heart-out-has-surprising-psychological-benefits

Blank, C., & Shavit, Y. (2016). The association between student reports of classmates' disruptive behavior and student achievement. *AERA Open*, *2*(3), 1-17. https://doi: 10.1177/2332858416653921

Blotnicky-Gallant, P., Martin, C., Mcgonnell, M., & Corkum, P. (2014). Nova scotia teachers' ADHD knowledge, beliefs, and classroom management practices. *Canadian Journal of School Psychology*, *30*(1), 3–21. https://doi: 10.1177/0829573514542225

Centers for Disease Control and Prevention. (2020, April 8). *What is ADHD*. https://www.cdc.gov/ncbddd/adhd/facts.html

Children and Adults With Attention Deficit/Hyperactivity Disorder. (2020). *General prevalence of ADHD.* https://chadd.org/about-adhd/general-prevalence/

Children and Adults With Attention Deficit/Hyperactivity Disorder. (2020) *Is there an increase*

in ADHD. https://chadd.org/adhd-weekly/is-there-an-increase-in-adhd/

Classroom Behavior Problems Increasing, Teachers Say. (2012). Retrieved from https://www.scholastic.com/teachers/articles/teaching-content/classroom-behavior-problems-increasing-teachers-say/

Diamantopoulou, S., Henricsson, L., & Rydell, A.-M. (2005). ADHD symptoms and peer relations of children in a community sample: Examining associated problems, self-perceptions, and gender differences. *International Journal of Behavioral Development*, *29*(5), 388–398. https://doi: 10.1177/01650250500172756

Dingle, G. A., Williams, E., Jetten, J., & Welch, J. (2017). Choir singing and creative writing enhance emotion regulation in adults with chronic mental health conditions. *British Journal of Clinical Psychology*, *56*(4), 443–457. https://doi: 10.1111/bjc.12149

Dupaul, G. J., & Weyandt, L. L. (2006). School based intervention for children with attention deficit hyperactivity disorder: Effects on academic, social, and behavioural functioning. *International Journal of Disability, Development and Education*, *53*(2), 161–176. Https://doi: 10.1080/10349120600716141

Fancourt, D., Perkins, R., Ascenso, S., Carvalho, L. A., Steptoe, A., & Williamon, A. (2016). Effects of group drumming interventions on anxiety, depression, social resilience and inflammatory immune response among mental health service users. *PloS One*, *11*(3), 1-16. https://doi: 10.1371/journal.pone.0151136

Gaastra, G. F., Groen, Y., Tucha, L., & Tucha, O. (2016). The effects of classroom

interventions on off-task and disruptive classroom behavior in children with symptoms of attention-deficit/hyperactivity disorder: A meta-analytic review. *PloS One*, *11*(2), https://doi: 10.1371/journal.pone.0148841

Gardner, D. M., & Gerdes, A. C. (2013). A review of peer relationships and friendships in youth with ADHD. *Journal of Attention Disorders*, *19*(10), 844–855. https://doi: 10.1177/1087054713501552

Greene, R. W., Beszterczey, S. K., Katzenstein, T., Park, K., & Goring, J. (2002). Are students with ADHD more stressful to teach? *Journal of Emotional and Behavioral Disorders*, *10*(2), 79–89. https://doi: 10.1177/10634266020100020201

Harris, K. R., Friedlander, B. D., Saddler, B., Frizzelle, R., & Graham, S. (2005). Self-monitoring of attention versus self-monitoring of academic performance. *The Journal of Special Education*, *39*(3), 145–157. https://doi: 10.1177/00224669050390030201

Ho, P., Tsao, J. C. I., Bloch, L., & Zeltzer, L. K. (2011). The impact of group drumming on social-emotional behavior in low-income children. *Evidence-Based Complementary and Alternative Medicine*, *2011*, 1–14. https://doi: 10.1093/ecam/neq072

Hogenes, M. (2014). The impact of music on child functioning. *The European Journal of Social & Behavioural Sciences*, *10*(3), 1507–1526. https://doi: 10.15405/ejsbs.135

(2020) *Is there an increase in ADHD*. https://chadd.org/adhd-weekly/is-there-an-increase-in-adhd/

Jackson, N. A. (2003). A survey of music therapy methods and their role in the treatment of early elementary school children with ADHD. *Journal of Music Therapy*, *40*(4), 302–323. https://doi: 10.1093/jmt/40.4.302

Jaschke, A. C., Honing, H., & Scherder, E. J. A. (2018). Longitudinal analysis of music

education on executive functions in primary school children. *Frontiers in Neuroscience*, *12*(103), 1-11. https://doi: 10.3389/fnins.2018.00103

Jorgensen Carrer, L. R. J. (2015). Music and sound in time processing of children with ADHD. *Frontiers in Psychology*, *6*(127), 1–7. http://dx.doi.org/10.3389/fpsyt.2015.00127

Keeler, J. R., Roth, E. A., Neuser, B. L., Spitsbergen, J. M., Waters, D. J. M., & Vianney, J. M. (2015, September 23). The neurochemistry and social flow of singing: Bonding and oxytocin. *Frontiers in Human Neuroscience*, *9*. https://doi: 10.3389/fnhum.2015.00518

Kofler, M. J., Rapport, M. D., & Alderson, R. M. (2008). Quantifying ADHD classroom inattentiveness, its moderators, and variability: a meta-analytic review. *Journal of Child Psychology and Psychiatry*, *49*(1), 59–69. https://doi: 10.1111/j.1469-7610.2007.01809.x

Launay, J. (2015, October 25). *Choir singing improves health, happiness – and is the perfect icebreaker*. University of Oxford. http://www.ox.ac.uk/research/choir-singing-improves-health-happiness-–-and-perfect-icebreaker

Lawrence, K., Estrada, R. D., & Mccormick, J. (2017). Teachers Experiences With and Perceptions of Students With Attention Deficit/hyperactivity Disorder. *Journal of Pediatric Nursing*, *36*, 141–148. https://doi: 10.1016/j.pedn.2017.06.010

Letoile, S. K. D. (2005). Teaching music to special learners: children with disruptive behavior disorders. *Music Educators Journal*, *91*(5), 37–43. https://doi: 10.2307/3400141

Littel, J., Corcoran, J., & Pillai, V. (2008). *Systematic reviews and meta-analysis.* Oxford.

Loe, I. M., & Feldman, H. M. (2007). Educational and academic outcomes of children with ADHD. *Journal of Pediatric Psychology*, 32(6), 643-654. https://doi: 10.1037/e721392007-008

Macdonald, R. A., & Wilson, G. B. (2014). Musical improvisation and health: a review. *Psychology of Well-Being*, *4*(1). https://doi: 10.1186/s13612-014-0020-9

Manasiev, L., Court, B., Jain, V., Stoneham, K., & Talbot, P. (2019). *Breaking bad behavior: The rise of classroom disruptions in early grades and how districts are responding.* EAB Global. http://pages.eab.com/rs/732-GKV-655/images/BreakingBadBehaviorStudy.pdf

Mathews, S. E. (2012). Singing smoothes classroom transitions. *Dimensions of Early Childhood*, *40*(1), 13–17.

Maucieri, L. (2016, January 3). *Music for your ADHD ears: Why music is so good for ADHD*. Psychology Today. https://www.psychologytoday.com/us/blog/the-distracted-couple/201601/music-your-adhd-ears

McCord, K., & Watts, E. H. (2006). Collaboration and access for our children: music educators and special educators together. *Music Educators Journal*, *92*(4), 26–33. https://doi: 10.2307/3401109

McFerran, K. (2009). Quenching a desire for power: The role of music therapy for adolescents with ADHD. *Australasian Journal of Special Education*, *33*(1), 72–83. https://doi: 10.1375/ajse.33.1.72

Moore, P. (2009, August). Confronting ADHD in the music classroom. *Teaching Music*, 17(1), 57.

Moss, H., Lynch, J., & O'Donoghue, J. (2017). Exploring the perceived health benefits of singing in a choir: an international cross-sectional mixed-methods study. *Perspectives in Public Health*, *138*(3), 160–168. https://doi: 10.1177/1757913917739652

Music and health. (2011, July). *Harvard Men's Health Watch*, *15*(2), 1–5. https://www.health.harvard.edu/staying-healthy/music-and-health

Ouellet, Sylvie (2012) Music therapy as support in the development of a child with attention deficit hyperactivity disorder (ADHD). *Canadian Journal of Music Therapy*, 18(1), p79-90.

Perkins, R., Ascenso, S., Atkins, L., Fancourt, D., & Williamon, A. (2016). Making music for mental health: how group drumming mediates recovery. *Psychology of Well-Being*, *6*(1), 1-17. https://doi: 10.1186/s13612-016-0048-0

Quay, H. C., & Hogan, A. E. (1999). *Handbook of disruptive behavior disorders*. Springer Science Business Media.

Rickson, D. J. (2006). Instructional and improvisational models of music therapy with adolescents who have attention deficit hyperactivity disorder (ADHD): A comparison of the effects on motor impulsivity. *Journal of Music Therapy*, *43*(1), 39–62. https://doi: 10.1093/jmt/43.1.39

Rodgers, A. L. (2020, March 27). Music Therapy: Sound Medicine for ADHD. Retrieved from https://www.additudemag.com/music-therapy-for-adhd-how-rhythm-builds-focus/

Rose, D., Bartoli, A. J., & Heaton, P. (2018). Learning a musical instrument can benefit a child with special educational needs. *Psychomusicology: Music, Mind, and Brain*, *28*(2), 71–81. https://doi: 10.1037/pmu0000209

Rozsics, M. (2010). Sally Smith's art methods applied: Music education for adolescents with learning disabilities and ADHD. *Learning Disabilities: A Multidisciplinary Journal*, 16(2), 73-77.

Shakespeare, T. (2017). Sing your heart out: Community singing as part of mental health recovery. *Medical Humanities*, *44*(3), 153–157. https://doi: 10.1136/medhum-2017-011195

Theorell Töres. (2014). *Psychological health effects of musical experiences theories, studies and reflections in music health science*. Springer.

Thoma, M. V., Marca, R. L., Brönnimann, R., Finkel, L., Ehlert, U., & Nater, U. M. (2013). The

effect of music on the human stress response. *PLoS ONE*, *8*(8), 1. https://doi: 10.1371/journal.pone.0070156

U.S. Department of Education. (2009, February 13). *Identifying and treating attention deficit hyperactivity disorder: A resource for school and home.* https://www2.ed.gov/rschstat/research/pubs/adhd/adhd-identifying_pg4.html

Williamson, V. J., & Bonshor, M. (2019). Wellbeing in brass bands: The benefits and challenges of group music making. *Frontiers in Psychology*, *10*, 1176-1191. https://doi: 10.3389/fpsyg.2019.01176

Winsler, A., Ducenne, L., & Koury, A. (2011). Singing one's way to self-regulation: The role of early music and movement curricula and private speech. *Early Education & Development*, *22*(2), 274–304. https://doi: 10.1080/10409280903585739

Zhang, F., Liu, K., An, P., You, C., Teng, L., & Liu, Q. (2012). Music therapy for attention deficit hyperactivity disorder (ADHD) in children and adolescents. *Cochrane Database of Systematic Reviews*. https://doi: 10.1002/14651858.cd010032

Zuk, J., Benjamin, C., Kenyon, A., & Gaab, N. (2015). Correction: Behavioral and neural correlates of executive functioning in musicians and non-musicians. *PloS One*, *10*(9). doi: 10.1371/journal.pone.0137930