A survey of piano teachers whose students have ADHD:
Their training, experiences, and best practices.

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
William David Mullins
Graduate Program in Music

The Ohio State University

2017

Committee:
Kenneth Williams, Advisor
Jan Edwards
Margaret Young
Abstract

ADHD has become increasingly prevalent over the past few decades. ADHD affects the executive functions of those who have it, in varying degrees of complexity. Researchers have studied its sources, finding biological and environmental causes. Key executive function deficits associated with ADHD have been identified to involve attention, working memory, processing, inhibition, preparation, and organization. Evidence-based treatments include medicinal, behavioral, and academic interventions. While research in academic classroom settings is abundant, research in music classes has been much less, and research in private lesson settings has been virtually non-existent when compared with the amount of literature in other areas.

The purpose of this study was to explore the experiences of piano teachers who teach students with ADHD. Factors investigated included teacher training and professional development, interventions used during lessons and while students practice at home, difficulties experienced by students throughout lessons and/or practicing, and barriers that students or their teachers faced.

The results of the questionnaire give insight into the world of piano teachers who teach students with ADHD and other disabilities. Responses indicated that teacher success stems from knowledge and use of evidence-based interventions, and that
students’ difficulties in private piano study are similar to those seen in academic classroom settings.
Acknowledgments

I would like to acknowledge the help and encouragement of my professors through the years. Their dedication to the craft of music and pedagogy has inspired me to pursue my studies. I am especially grateful for my committee members, Drs. Williams, Edwards, and Young, and for their professional expertise and insights in guiding me along this path. I also acknowledge, with gratitude, those teachers who participated in this study and shared their extensive knowledge of adaptive pedagogy. Lastly, I express profound gratitude for my family, whose encouragement, patience, and love have helped me through my studies and this dissertation.
Vita

1997................................................................. Elkhon High School

2005........................................ B.M. Piano Performance, Brigham Young University, Provo, Utah

2005-Present .................................................. Independent Piano Teaching

2007-2008 .. Graduate Research Associate, University of Oklahoma, Norman, Oklahoma

2008......... Graduate Teaching Associate, University of Oklahoma, Norman, Oklahoma

2008 ........ M.Mus.Ed. Music Education, University of Oklahoma, Norman, Oklahoma

2011-2014 .... Graduate Teaching Associate, The Ohio State University, Columbus, Ohio

2014-2015 ............................................ Instructor, Chadron State College, Chadron, Nebraska

2016-Present ................................................. Coordinator of Undergraduate Music Admissions,

Bowling Green State University, Bowling Green, Ohio

Fields of Study

Major Fields: Music

Specialization: Piano Pedagogy
Table of Contents

Abstract .................................................................................................................................................. ii

Acknowledgments ............................................................................................................................... iv

Vita .......................................................................................................................................................... v

List of Tables ........................................................................................................................................ x

List of Figures ....................................................................................................................................... xi

Chapter 1: Introduction ....................................................................................................................... 1
  Definitions ............................................................................................................................................ 6

Chapter 2: Literature Review ............................................................................................................. 9
  Prevalence of ADHD ......................................................................................................................... 9
  Etiology of ADHD ............................................................................................................................ 10
    Genetic Factors .............................................................................................................................. 10
    Physiological Attributes ................................................................................................................. 11
    Environmental Factors .................................................................................................................. 12
    Theories .......................................................................................................................................... 13
  Diagnosis of ADHD .......................................................................................................................... 14
    Diagnostic Criteria ......................................................................................................................... 14
    Changes in DSM Criteria ............................................................................................................... 15
Participant responses .................................................................................................. 66
Demographics ............................................................................................................. 66
Studio Description ..................................................................................................... 68
Education ................................................................................................................... 68
Student Success ......................................................................................................... 71
Strategies and Accommodations ............................................................................... 75
Barriers ..................................................................................................................... 78
Enjoyment .................................................................................................................. 79
Student/Parent Involvement ..................................................................................... 79
Assignment Accuracy and Completion ...................................................................... 80
Participant Perceptions .............................................................................................. 81
Teacher Training ....................................................................................................... 81
Professional Development Efficacy ........................................................................... 82
Barriers ..................................................................................................................... 83
Chapter 5: Discussion ............................................................................................... 85
Participant Responses ............................................................................................... 85
Study Limitations ...................................................................................................... 85
Training, Education, and Experience ........................................................................ 86
Behaviors Perceived and Impact .............................................................................. 90
Strategies and Interventions .................................................................................... 91
Other Factors ............................................................................................................ 93
Future Research ........................................................................................................ 93
References ................................................................................................................................. 95

Appendix A: ADHD Diagnostic Criteria from DSM-5 .......................................................... 115

Appendix B: Website Recruitment Posting ........................................................................ 119

Appendix C: Recruitment Email ........................................................................................... 120

Appendix D: Original The Ohio State University Consent to Participate in Research .... 122

Appendix E: Consent Form Used For the Online Survey .................................................. 124

Appendix F: Online Teacher Survey .................................................................................... 127

Appendix G: Perceptions on Teacher Training ..................................................................... 136
List of Tables

Table 1. Executive Function: Skills and Processes Involved........................................... 21
Table 2. Executive Function: Effects on Non-Academic Tasks ........................................ 22
Table 3. Executive Function: Effects on Academic Tasks .............................................. 23
Table 4. Class-wide Academic Interventions ..................................................................... 33
Table 5. Class-wide Behavioral Interventions ................................................................... 34
Table 6. Individual Academic Interventions ..................................................................... 36
Table 7. Individual Consequent Based Behavioral Interventions ...................................... 38
Table 8. Individual Antecedent Based Behavioral Based Interventions ......................... 39
Table 9. Professional Organizations to Which Participants Belong .................................. 67
Table 10. Level of Participants' Education ....................................................................... 69
Table 11. Accommodations Used by Participating Teachers .......................................... 76
Table 12. Rates of Accuracy and Completion on Assignments ....................................... 81
Table 13. Participants' Perceptions on Teacher Training .................................................. 137
List of Figures

Figure 1. Number of Years Teaching Piano................................................................. 67

Figure 2. Professional Development Activities.......................................................... 70

Figure 3. Ways participants learned to teach students with ADHD.......................... 71

Figure 4. Importance of developing technique to the success of piano students with
ADHD.......................................................................................................................... 72

Figure 5. Importance of repertoire selection to the success of piano students with ADHD.
................................................................................................................................. 72

Figure 6. Importance of making music away from the piano to the success of students
with ADHD.................................................................................................................. 73

Figure 7. Importance of using interventions to the success of piano students with ADHD.
................................................................................................................................. 73

Figure 8. Importance of performance opportunities to the success of piano students with
ADHD.......................................................................................................................... 74

Figure 9. Importance of group activities to the success of piano students with ADHD. . 74

Figure 10. Importance of using technology to the success of piano students with ADHD.
................................................................................................................................. 75
Chapter 1: Introduction

In 1902, Sir George Still described a condition that caused children to be restless. In 1932, German physicians Franz Kramer and Hans Pollnow identified this same hyperkinetic disease that was separate from other known disorders of the time. Since then, Attention-Deficit/Hyperactivity Disorder has been re-labeled numerous times with titles that have reflected the current understanding of the disorder, including “Organic Drivenness”, “Minimal Brain Damage”, “Hyperkinetic Impulse Disorder”, “Minimal Brain Dysfunction”, “Hyperkinesia”, “Hyperactive Child Syndrome”, “Attention Deficit Disorder (ADD)”, and “Attention-Deficit/Hyperactivity Disorder (ADHD)” (Barkley, 1990; Centers for Disease Control, 2015).

Attention-Deficit/Hyperactivity Disorder (ADHD) has quickly become one of the most diagnosed mental disorders in children today. According to the American Psychiatric Association (APA), ADHD is a neurodevelopmental disorder with “a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development” (APA, 2013, p. 59). During the last few decades, ADHD was mentioned rather frequently in the news. Major newspapers and television news outlets ran articles and news segments about ADHD, its symptoms, potential causes, and possible treatments.
In a 2011 report, the Centers for Disease Control (CDC) reported that an estimated 11% of children ages 4-17 in the United States were, at that time, diagnosed with ADHD (Centers for Disease Control, 2015). The prevalence of ADHD has increased by approximately 3% per year and varies from a low of roughly 4% in Nevada to a high of nearly 15% in Kentucky. As many as 86% of children currently diagnosed with ADHD take medication for it as well. The National Center for Education Statistics (NCES) also reported increasing numbers of students with ADHD, rising from 7.7% in 1999 to 11% in 2008 (National Center for Education Statistics, 2012). With ADHD growing by such proportions, researchers are perplexed at this increase in prevalence. As later noted (see Chapter 2; *Etiology of ADHD*), possible causes include genetic and hereditary elements, environmental factors, changes in diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM), the influence of medical companies advertising their products, and the possibility that ADHD is socially constructed.

Aside from these considerations, legal progress has also brought increased attention to the disorder. In 1975, President Gerald Ford signed Public Law 94-142, known as the Education for All Handicapped Children Act (EHA) into law. The purpose of this law was to ensure an appropriate education for students with disabilities. This law, now known as the Individuals with Disabilities Education Act (IDEA), has changed the way special education services are delivered in schools, requiring individualized education programs (IEPs) for students with disabilities. Evidence-based interventions are also required, which has led to an explosion in special education research (U.S. Department of Education, 2011).
The ramifications of these laws are widespread today. Because IDEA opened new opportunities, students with disabilities now participate in a variety of extracurricular activities such as sports leagues, clubs, and music lessons. As this population participates in these activities, they face difficulties associated with their disorders. Behavioral, academic, and social challenges exist for those with ADHD. Medication and interventions help to minimize the severity of these deficits, but the fact is they still remain. Coaches, teachers, and others associated with the extracurricular activities in which these students participate need to know how to interact with and help these students overcome the effects of their disorder when possible. When teaching any student with special needs, there are a range of factors teachers must consider, including the physical environment, the individual, their disabilities and abilities, the student’s needs, and interventions that may prove effective.

There has been more research on students with ADHD and appropriate interventions in academic settings than in extra-curricular pursuits. ADHD impacts one’s educational experience in important ways. First, it interferes with learning by affecting a person’s ability to remain on task, and divide or sustain their attention. Second, it reduces their ability to accomplish complex tasks through understanding, planning and organization, execution of plans, and sustaining mental effort throughout a task’s duration. Last, in consideration of the effects of ADHD, teachers need to successfully implement interventions in their teaching that will enable students with ADHD to succeed in their learning.

Among pre-college piano students, there is a relatively small but significant cohort of students whose aptitude for learning is impaired by various physical and
cognitive challenges. While these students are capable of enjoying rich and fulfilling musical experiences, they require special attention in guiding and fostering their musical development. Nurturing the musical growth of students with special needs can be immensely fulfilling for the piano teacher who is equipped with an understanding of the students’ abilities and limitations and has developed particular skills for teaching them.

Traditional piano lessons are uniquely appropriate for instructing students with special needs since the tutorial format with one-on-one interactions offers the opportunity for customized instruction and selection of repertoire, materials and pacing as well as control of the learning environment.

Teacher training that focuses on the pedagogical needs of teachers who work with these students is usually not included in courses and curricula that prepare pianists for a career in piano teaching. Pianists typically prepare for careers in teaching through intensive study in piano performance with supportive pedagogy courses that survey repertoire at different levels, the development of piano technique and approaches to reading musical notation. Courses in piano pedagogy also usually include exposure to fundamental concepts in educational psychology and learning theory. Preparation for teaching students with special needs tends to be a required component in degree programs in music education which prepare undergraduate music majors for careers in classroom music teaching in the public schools rather than independent music studios. Piano teachers typically seek more specialized training for working with special needs students as in-service professionals who desire a new dimension to their educational offerings.
Since it is not feasible for these in-service independent piano teachers to return to school for additional training, there is a need to educate these teachers in offerings that are more flexible and accessible. The challenge is for these practitioners to gain access to the latest research conducted by neurologists and other specialists and to find ways to make applications in their own teaching. As interest grows in this specialized form of teaching, there seems to be an increasing number of articles in journals for practitioners and presentations through workshops and conferences. Interested teachers also exchange ideas and information through blogs and focus groups on social media. While there is a wealth of research on various learning disabilities and their causes, especially in academic settings, there is relatively little research on teaching piano to students with special needs and the acquisition of the particular skills needed for effective instruction.

The goal of this study is to investigate the challenges encountered by piano teachers who work with students who have one specific type of disability – Attention Deficit Hyperactivity Disorder. To better understand the challenges they face and the ways they have learned to overcome them in piano teaching, we will consider the complex history of diagnoses for the disorder and the complex issue of increasing incidences and diagnoses of the disorder in recent decades. This study will include the findings of a survey of a small group of independent music teachers who describe their own pre-service and in-service training experiences and how they implement strategies for guiding the musical development of their students.
Definitions

The terms defined in this section are working definitions for this study. They are generally accepted terms in the fields of education, special education, and psychology, among others, and can be found in dictionaries, textbooks, journals, or on websites devoted to these professions.

Academic Intervention: An intervention (see Intervention) for students with ADHD and other learning or developmental disabilities, that helps students succeed in math, language skills, and other subjects. Examples include peer tutoring and content enhancements.

Accommodation: An accommodation changes how a student learns material, increasing the accessibility of learning to the student and allowing them to demonstrate their knowledge and understanding. Accommodations often involve changes to the physical environment.

Active Student Response: An observable student response made to an instructional antecedent.

Adaptive Pedagogy: Pedagogy focused on teaching students with special needs or disabilities, and the use of adaptive instruction, accommodations, or modifications in the curriculum.

Attention Deficit Hyperactivity Disorder (ADHD): A neurodevelopmental disorder with a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development.
**Autism Spectrum Disorder:** A developmental disability marked by impaired social interaction, impaired communication, and/or restricted, repetitive, and stereotyped patterns of behavior.

**Behavioral Intervention:** A strategy to help educators increase classroom productivity by helping with behavior modification.

**Behavior Intervention Plan (BIP):** A plan of action for incorporating the findings of a Functional Behavior Assessment to manage a student’s behavior.

**Comorbid:** The simultaneous presence of two chronic diseases or conditions.

**Disability:** When impairment limits the ability to perform certain tasks.

**Etiology:** A hypothetical cause for a disability.

**Explicit Instruction:** Carefully planned, clear, and direct teaching with systematic feedback.

**Handicap:** Problems a person with a disability faces when interacting with the environment.

**Impairment:** Reduced functioning of or loss of a body part or organ.

**Intervention:** Program, actions, or strategies specifically designed to address an identified deficiency and monitored to ensure outcome improvement.

**Learning Disability:** A significant discrepancy between general ability and achievement that requires special education services. Often involves difficulty with reading, writing, math, speaking, or listening not resulting from low intelligence.

**Maintenance:** The extent to which students apply what they learn over time.
Modification: A modification changes what a student is taught or expected to learn.

Modifications involve changes in expectations of content knowledge and/or assessment.

Music Therapy: The clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program (www.musictherapy.org).

Punishment: Something that makes future occurrences of a behavior decrease. Examples include penalties such as fines, loss of privileges, or time-out.

Reinforcement: Something that makes future occurrences of a behavior increase. Examples include praise, increased privileges, or other rewards.

Strategy: A research-based method or activity designed to teach a learning objective.

Therapy: Treatment designed to relieve or heal a disorder.
Chapter 2: Literature Review

Prevalence of ADHD

Before exploring specific challenges associated with ADHD in the piano studio, we will consider the current research on the prevalence of the disorder and its diagnoses, suggested sources of the disorder, and some common therapies. ADHD is the most commonly diagnosed mental disorder in minors, with approximately one out of every 10 to 15 children having received this diagnosis (Mayes, Bagwell, and Erkulwater, 2008). While it is estimated that 3-7% of school-age children in the United States have a diagnosis of ADHD (Amen & Carmichael, 1997; APA, 2000; APA, 2013; Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007; Simon, Czobor, Bálint, Mészáros, & Bitter, 2009; Vereb & DiPerna, 2004), this number appears to be rising. As of 2007, about 9.5% of kids ages 4-17 (5.4 million) were diagnosed with ADHD, with boys being about 3 times more likely to be diagnosed than girls (CDC, 2015).

Between 2003 and 2011, parent-report of ADHD increased by 43%, prescriptions for ADHD medications rose by 28%, and roughly 2 million additional children were diagnosed with ADHD (Visser et al., 2014). Diagnostic and prevalence rates have been found to be affected by numerous factors including societal and cultural values, (Helle-Valle, A., Binder, P.-E., & Stige, B., 2015; Mayes et al., 2008; Panksepp, 1998; Perrin, Kuhlthau, McLaughlin, Ettner, & Gortmaker, 1999), changes in diagnostic criteria among
the different editions of the DSM (Gomez & Vance, 2008), reporting methods (CDC, 2015; NCES, 2012), incomplete testing or diagnostic procedures (Mayes et al., 2008), geographic location (CDC, 2015; Faraone, Sergeant, Gillberg, & Biederman, 2003; Mayes et al., 2008), racial or ethnic background (Morgan, Staff, Hillemeier, Farkas, & Maczuga, 2013), and international differences in diagnostic measures, (Faraone, Sergeant, Gillberg, & Biederman, 2003; Gomez & Vance, 2008; Jick, Kaye, & Black, 2004; Rohde et al., 2005). Regardless of these differences, ADHD exists and appears to have become more prevalent over time, increasing the likelihood of students, including piano students, to have ADHD. In their attempts to better understand this disease, researchers have given great focus to its causes.

**Etiology of ADHD**

Aside from the prevalence of ADHD, many researchers are also exploring the possible causes, or etiologies, of this disorder. While some believe that the rates of ADHD may be influenced by societal factors, others have found that a number of genetic, physical, and environmental influences interact to magnify the neurological and biological underpinnings of ADHD and produce symptoms of varying degrees of severity in individuals (Gresham, 2002; Maag & Reid, 1994; Mayes et al., 2008; Willcutt, Pennington, & DeFries, 2000).

**Genetic Factors**

Tuvblad, Zheng, Raine, and Baker (2009) found that each subtype of ADHD has unique genetic and environmental influences, suggesting some etiological distinction and independence of subtypes. Based on current research, it appears that inattentiveness is inheritable, and the severity of one’s inattentiveness influences hyperactivity and
impulsivity more than genetics do (Chhabildas, Pennington, & Willcutt, 2001; Willcutt et al., 2000).

People with ADHD have a 55-80% chance of inheriting it (Rhee, Waldman, Hay, & Levy et al. 1999; Rietveld, Hudziak, Bartels, van Beijsterveldt, & Boomsma, 2003; Thapar, Harrington, Ross, & McGuffin, 2000; Tuvblad et al., 2009). Seidman et al., (1995) also determined that among people with ADHD, the highest levels of neuropsychological impairment were in those with a family history of ADHD, lending credence to the idea of some types of ADHD being inheritable. Genetics, however, are not the only factor that determines whether or not someone exhibits ADHD symptoms.

**Physiological Attributes**

Neurological researchers have discovered a variety of alterations in the brains of individuals with ADHD, as compared to people without ADHD, including decreased brain size (Panksepp, 1998), structural asymmetries between the right and left frontal areas (Castellanos et al., 1996; Serrallach, B., et al., 2016), reduced frontal lobe functions (Ernst et al., 1997), differences in brain function (Teicher et al., 2000), abnormal brain activity in the prefrontal cortex (Amen & Carmichael, 1997), and decreased levels of activity in the frontal regions (Chabot & Serfontein, 1996). While physical differences exist in people with ADHD, the causal relationship between these variances and ADHD is still unclear.

The differences in brain structure, function, and activity in the frontal areas of the brain between people with and without ADHD are vital to understanding some of the behaviors and challenges associated with this disorder. When presented with intellectual challenges, people with ADHD experience deactivation in the pre-frontal cortical area of
the brain, as opposed to increased activity in the same region for people without ADHD (Amen & Carmichael, 1997). Executive functions occur in the prefrontal cortex, and require healthy structure and functioning in that area of the brain. Raiker, Rapport, Kofler, and Sarver (2012) found that central executive deficits are a key cause for core ADHD behavioral and functional impairments. Healthy executive functions are essential for music study. Learning a new piece of music, including analyzing style, form, dynamics, and other musical elements, can be intellectually challenging, and ADHD could cause difficulties with this.

**Environmental Factors**

Rohde et al., (2005) suggested "...the quality of the environment is crucial in shaping the expression of the biological vulnerability to the disorder" (p. 1436). Several environmental factors contribute to the manifestation and severity (Tuvblad et al., 2009) of ADHD symptoms and behaviors, including parenting stress (Graziano, McNamara, Geffken, and Reid, 2011), lower levels of paternal sensitivity or positive maternal regard (Keown, 2012), intrusive and controlling parental behaviors (Keown, 2012), maternal alcohol consumption during pregnancy (Landgren, Svensson, Strömland, and Grönlund, 2010), and prenatal tobacco or childhood lead exposures (Froehlich et al., 2009; Getahun et al., 2013; Silva, Colvin, Hagemann, & Bower, 2014). Induced labor, and labor complications such as preterm labor, preeclampsia, birth asphyxia, respiratory distress syndrome, and other ischemic-hypoxic conditions also increase the risk of ADHD, although early term deliveries increased the risk only marginally (Getahun et al., 2013; Silva et al., 2014).
There is considerable research on the negative impact of screen time on all children. Watching television and playing video games are each associated with higher levels of attention problems in childhood, late adolescence and early adulthood (Swing, Gentile, Anderson, & Walsh, 2010). According to the Entertainment Software Rating Board (ESRB), 67% of U.S. households play video games, with the average gamer spending 8 hours per week playing (2010). Christakis, Zimmerman, DiGiuseppe, and McCarty (2004) associated exposure to television at an early age (ages one through three years) with attention problems by age seven. This is particularly concerning, given that a Nielsen Company study in 2009 showed children between the ages of two and five years watched nearly 25 hours of television each week, with a total of 32 hours of screen time watching TV, movies, and playing video games. This is roughly four hours more screen time per week than children ages 6-11 years (McDonough, 2009).

**Theories**

As researchers have sought to account for etiological foundations, presentation of symptoms, and effectiveness of interventions in ADHD, two main classes of models have emerged. One class of models explains behavioral deficits in ADHD as the result of deficiencies in inhibitory processing, and the other suggests that behavioral deficits stem from deficient resource allocations or reduced arousal (Barkley, 1996a, 1996b, 1997; Cepeda, Cepeda, & Kramer, 2000; Pennington & Ozonoff, 1996; Quay 1988; Rapport et al., 2008; Schachar, Tannock, & Logan, 1993; Schachar, Tannock, Marriott, & Logan, 1995; Teeter & Semrud-Clikeman, 1995, 1997; Zentall, 1985; Zentall & Zentall, 1983). Despite differences between the models, each explains etiological and symptomatic issues related to ADHD, thus illustrating the complicated nature of this disorder.
Diagnosis of ADHD

A diagnosis of ADHD often begins with a parent or teacher noticing certain behaviors in children, including inattentiveness, hyperactivity, impulsiveness, and a variety of academic difficulties. The American Academy of Pediatricians (AAP) recommends that any child between the ages of 4-18 who presents symptoms of ADHD and has academic or behavioral problems be evaluated for ADHD. A doctor must ensure that the criteria in the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) are met (see Appendix A), and that probable alternative causes (i.e. another medical condition) are accounted for (AAP, 2011).

Diagnostic Criteria

In addition to appearing in the DSM, diagnostic criteria also appear in the International Statistical Classification of Diseases and Related Health Problems (ICD). While the ICD is used by the World Health Organization, the DSM is most commonly used in the United States. Since 1952, there have been five main editions of the DSM, with several sub-editions. Revised editions include increasing attention to severity of symptoms, cultural context, and factors leading to diagnoses. In DSM-III, inattention, impulsivity, and hyperactivity were three different constructs. In DSM-III-R, all three were treated as a single construct labeled ADHD. However, in DSM-IV, inattention was separated from hyperactivity/impulsivity. This division remains in place in DSM-5. The specific types of diagnoses for ADHD include the following: predominantly inattentive (ADHD-IA), predominantly hyperactive/impulsive (ADHD-HI), or as having combined presentation (ADHD-C) (Pillow, Pelham, Hoza, Molina, & Stultz, 1998). Although the
diagnoses have become more specific, a combination of symptoms remains, by far, the most prevalent (Wilens, Biederman, & Spencer, 2002).

Diagnostic criteria also appear in the ICD, though they differ from the DSM. In the latest edition, ICD-10, ADHD is classified as Hyperkinetic Disorder and the diagnostic criteria are different from those in DSM-5. For ICD-10 criteria, a specified number of behaviors must be present in inattentiveness (6), hyperactivity (3), and impulsivity (1) for at least six months, to a degree that is not developmentally typical and that is maladaptive. This is similar to DSM-5, except that all three types of symptoms must be present, whereas DSM-5 allows for only one type of symptoms to be present. The symptoms need to occur in multiple settings (ie: home and school), and must start no later than 7 years of age. These symptoms must cause impairment in social, academic, or occupational functioning, and cause significant distress.

Changes in DSM Criteria

When preparing the DSM-5, editors made several changes that reflect an evolving understanding of the methods through which medical professional view, diagnose, and treat ADHD. In the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders, changes in diagnostic guidelines include age of onset (changed from 7 years to 12 years of age), behavior specifiers replace subtypes of ADHD, comorbid diagnosis with Autism Spectrum Disorder is now allowed, and the cutoff for adult symptoms has been reduced (APA, 2013, p. 809).
DSM-5 includes indications of the severity of symptoms, including mild, moderate, severe, or partial remission. DSM-5 also has diagnoses of Other Specified and Unspecified Attention-Deficit/Hyperactivity Disorder for those patients who do not meet the full criteria for ADHD, still suffer clinically significant social, occupational, or other distress or impairment, and their symptoms are not explained by another condition (APA, 2013).

In addition to outlining the symptomatology and diagnostic criteria for ADHD, the DSM-5 expands the cultural formulation section from the DSM-IV. This section is “a framework for assessing information about cultural features of an individual’s mental health problem and how it relates to a social and cultural context and history” (APA, 2013, p. 749). These considerations are very important because culture, race, and ethnicity not only provide for different attitudes towards various mental health disorders, they also “are related to economic inequities, racism, and discrimination that result in health disparities” (APA 2013, p. 749), often leading to differential and inaccurate rates of diagnosis.

**Diagnostic Process**

Diagnosing ADHD is a time-consuming procedure. Conditions such as learning disabilities, depression, oppositional defiant disorder, and anxiety disorder can mimic or exist comorbid with ADHD. Due to the complexities of ADHD, doctors must use certain measures to distinguish ADHD from these other conditions and ensure the proper treatment is administered (Jimenez & Guevara, 2013). Medical professionals must perform a thorough investigation into a person’s behaviors, consulting with the patient, their parents and teachers, and administering a battery of psychometric tests. Parent and
teacher ratings are an important part of the diagnostic process since they often spend the most time with the patient (Brown et al., 2001; Buitelaar & Rothenberger, 2004; Mannuzza et al., 2002). During this process, however, differences may arise in how parents and teachers rate the ADHD behaviors of children. Typically, these discrepancies are a result of parents and teachers observing different ADHD behaviors in different environments, with varying degrees and types of stressors (Hartman, Rhee, Willcutt, & Pennington, 2007).

Teachers have a unique perspective on student aptitude and behavior, and are often the first to recognize and identify symptoms of ADHD. The more stringent classroom environment may also allow teachers to recognize behaviors that may relate to ADHD more easily (Hartman et al., 2007). For these reasons, assessments made by teachers may be more reliable than those made by parents. Narad et al., (2015) suggest that the level of agreement between parent and teacher ratings is usually no higher than a moderate level. They also found parents were more likely to report a greater severity of ADHD symptoms than teachers; that younger children were more likely to be reported as hyperactive-impulsive; that inattention was consistently reported across age groups; and that agreement between parents and teachers was higher on hyperactive-impulsive behaviors than inattentive ones. Despite the potential for discrepancies, both parent and teacher ratings are necessary for a proper diagnosis to be given.

Several other factors complicate the diagnostic process. Some of these include the subjectivity of the diagnostician, cultural considerations, and diagnostic tests. Most diagnoses often rest on information given by children, parents and teachers to a doctor. Despite triangulating data through this technique, Heward (2013) contends that these
criteria are highly subjective and that two doctors treating the same patient might give two different diagnoses. Since doctors are unable to prove the existence of ADHD with a medical test, much like they can with other diseases, it is difficult to accurately diagnose ADHD (Mayes et al., 2008). Complicating this process is a lack of valid, independent, diagnostic tests for ADHD, once again showing the complexity of this disorder (Buitelaar & Rothenberger, 2004; Heward, 2013; Mayes et al., 2008).

**Diagnostic Tools**

Tests such as the Tower of London, Digit Span, Children’s Colors Trails Test 1 and 2, Conner’s Comprehensive Behavior Rating Scales (CBRS), Conner’s Continuous Performance Test (CPT 3), Conner’s Teacher Rating Scale-Revised (CTRS-R), ADHD Rating Scale IV, Emory Combined Rating Scale (ECRS), and Behavior Assessment System for Children, 2nd Edition (BASC-2) are just a few of the many tests used by psychiatrists during the diagnostic procedure (Gapin, 2009; Harrington & Waldman, 2010). These tests measure and/or describe such characteristics as planning, working memory, processing speed, sustained attention, divided attention, sequencing, and inhibition, but they do not diagnose a disability. Though they are individually insufficient to predict whether students have ADHD (Charach, Chen, Hogg-Johnson, & Schacher, 2009), when combined in a thorough examination, the tests allow doctors to better understand the psychological characteristics of an individual, and come to their own conclusion and diagnosis about whether a person has ADHD.

Mayes et al., (2008) argue since the formation of diagnoses are in the hands of teachers, parents, and medical professionals, a large amount of subjectivity, variance, and debate over what is ADHD and what is a typical childhood behavior has occurred.
Another challenge in accurately diagnosing ADHD is that diagnoses are based on the presence of specific behaviors that are common in children: inattentiveness, hyperactivity, and impulsiveness. However, the degree to which these behaviors exist is an important consideration, as children with ADHD exhibit these symptoms at levels that interfere with their ability to function.

**Executive Function**

Executive function consists of the mental processes and skills required to plan, focus attention, self-regulate, remember instructions, and accomplish the necessary elements for setting and reaching goals. These functions take place in the frontal lobe of the brain. Executive function is much like the conductor of an orchestra. While the conductor does not play an instrument, he/she plays a critical role, nonetheless. It is the conductor that organizes and directs the musicians, enabling the orchestra to perform complex music. The brain’s executive functions work similarly, organizing, focusing, integrating, and directing the brain in its work (Moran & Gardner, 2007; Smith, 2002). Skills associated with executive function allow students to remember and process instructions, prioritize, plan, initiate, and accomplish tasks, manage time, and organize themselves. All of these functions are crucial in music study. Executive function continues to develop into middle adulthood, and executive function impairments are a definitive characteristic of ADHD, as they contribute to many of the symptoms (Gapin, 2009; Smith, 2002).

Drawing on the writings of other researchers, Johnson and Reid (2011) clearly identify what executive functions are, their purpose and importance, and the challenges to which executive function deficits can lead.
Executive Functions are cognitive processes necessary for complex goal-directed behavior (Loring, 1999). Executive functions include metacognitive knowledge regarding strategies and tasks, attention and memory systems that support these processes (e.g., working memory), and self-regulatory processes such as planning and self-monitoring (Meltzer, 2007). Students with ADHD often have executive function deficits (Biederman et al., 2004). This is a serious concern because executive functions involve planning, organizing, maintaining effort, and monitoring activities (Meltzer, 2007), all of which are necessary for academic success (Johnson & Reid, 2011, p. 62).

While it is possible for people to have ADHD and not experience executive function deficits (Martinussen & Major, 2011), this is often the exception. Researchers have identified several key deficits experienced by people with ADHD, which could also impede music study: working memory (Gremillion & Martel, 2012; Oosterlaan, Sheres, & Sergeant, 2005), planning (Meltzer, 2007; Oosterlaan et al., 2005), temporal and semantic processing (Chhabildas et al., 2001; Clark, Prior, & Kinsella, 2002; Gilden & Hancock, 2007; Karalunas & Huang-Pollock, 2013; Pocklington & Mayberry, 2006; Solanto et al., 2007; Tannock, Martinussen, & Frijters, 2000), control of inhibitory mechanisms (Cepeda, Cepeda, & Kramer, 2000; Luman et al., 2009), and the ability to perform new tasks (Cepeda et al., 2000). As with other disorders, short-term, within-person variances in behavioral performance are common to ADHD (Rosch, Dirlikov, & Mostofsky, 2013). Tables 1 through 3 connect executive function deficits that impede learning with research studies that focus on those specific deficits.
Table 1. *Executive Function: Skills and Processes Involved*

<table>
<thead>
<tr>
<th>Skills and Processes Involved</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working memory</td>
<td>Germillion &amp; Martel, 2012; Oosterlaan, Sheres, &amp; Sergeant, 2005</td>
</tr>
<tr>
<td>Planning</td>
<td>Oosterlaan et al., 2005</td>
</tr>
<tr>
<td>Word recognition</td>
<td>Clark, Prior, &amp; Kinsella, 2002</td>
</tr>
<tr>
<td>Control of inhibitory mechanisms</td>
<td>Cepeda, Cepeda, &amp; Kramer, 2002; Luman et al., 2009</td>
</tr>
<tr>
<td>Ability to perform new tasks</td>
<td>Cepeda et al., 2002; Cepeda, Cepeda, &amp; Kramer, 2000</td>
</tr>
<tr>
<td>Temporal/Semantic processing</td>
<td>Luman et al., 2009</td>
</tr>
</tbody>
</table>
Table 2. *Executive Function: Effects on Non-Academic Tasks*

<table>
<thead>
<tr>
<th>Effects on Non-Academic Tasks</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing speed</td>
<td>Chhabildas, 2001; Pocklington &amp; Mayberry, 2006; Gilden &amp; Hancock, 2007; Solanto et al., 2007</td>
</tr>
<tr>
<td>Vigilance</td>
<td>Chhabildas et al., 2001</td>
</tr>
<tr>
<td>Inhibition</td>
<td>Chhabildas et al., 2001; Karalunas &amp; Huang-Pollock, 2013; Pennington &amp; Ozonoff, 1996; Rucklidge, 2006; Shachar, Tannock, &amp; Logan, 1993; Cepeda, Cepeda, Kramer, 2000; Luman et al., 2009</td>
</tr>
<tr>
<td>Increased response time</td>
<td>Solanto et al., 2007; Karalunas &amp; Huang-Pollock, 2013</td>
</tr>
<tr>
<td>Semantic processing</td>
<td>Tannock et al., 2000</td>
</tr>
<tr>
<td>Speed naming colors, letters, digits</td>
<td>Rucklidge, 2006; Tannock et al., 2000</td>
</tr>
<tr>
<td>Smaller/impaired working memories</td>
<td>Karalunas &amp; Huang-Pollock, 2013; Rucklidge, 2006</td>
</tr>
<tr>
<td>Alternating familiar/unfamiliar tasks</td>
<td>Rubinstein et al., 2001</td>
</tr>
<tr>
<td>Motor control impairments</td>
<td>Pennington &amp; Ozonoff, 1996; Rosch, 2013</td>
</tr>
<tr>
<td>Re-engaging after inhibition of a behavior</td>
<td>Shachar, Tannock, &amp; Logan, 1993</td>
</tr>
</tbody>
</table>
Table 3. *Executive Function: Effects on Academic Tasks*

<table>
<thead>
<tr>
<th>Effects on Academic Tasks</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack consistency and accuracy in schoolwork</td>
<td>Hinshaw, 2002</td>
</tr>
<tr>
<td>Organization</td>
<td>Gureasko-Moore, DuPaul, &amp; White, 2007</td>
</tr>
<tr>
<td>Writing down assignments</td>
<td>Gureasko-Moore, DuPaul, &amp; White, 2007</td>
</tr>
<tr>
<td>Prepared for class</td>
<td>Gureasko-Moore, DuPaul, &amp; White, 2007</td>
</tr>
<tr>
<td>Proper materials for assignments</td>
<td>Gureasko-Moore, DuPaul, &amp; White, 2007</td>
</tr>
<tr>
<td>Turning in assignments on time</td>
<td>Gureasko-Moore, DuPaul, &amp; White, 2007</td>
</tr>
<tr>
<td>Score lower on IQ (time involved?)</td>
<td>Barkley, 2005</td>
</tr>
<tr>
<td>Score lower on achievement tests</td>
<td>Barkley, 2005</td>
</tr>
<tr>
<td>Need remedial tutoring</td>
<td>Barkley, 2005</td>
</tr>
<tr>
<td>Repeat grades</td>
<td>Barkley, 2005</td>
</tr>
<tr>
<td>Behavior</td>
<td>Manuzza et al., 2002</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>Manuzza et al., 2002</td>
</tr>
<tr>
<td>Academic performance</td>
<td>Manuzza et al., 2002</td>
</tr>
</tbody>
</table>

**Characteristics of Executive Function Deficits**

**Working memory.**

Working memory is important to successful learning. It is the brain system responsible for “temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning, and reasoning” (Baddeley, 1992). Working memory also helps us better plan for and remain involved in
a task, and can be used to “keep [our] goal in mind, resist distractions and inhibit impulsive choices” (University College London Institute of Cognitive Neuroscience, 2009). According to Martinussen and Major (2011), working memory has auditory and visual components and involves attentional control. For example, when writing, one must keep the overall goals in mind during the writing process, much like composing or performing music. Martinussen and Major also pointed out that working memory has a load limit, making novel or complex tasks potentially difficult, and breaking down tasks into manageable parts essential.

Oosterlaan et al., (2005) linked deficits in working memory with academic difficulties in mathematics and reading, while others have found that people with ADHD have smaller and impaired working memories (Karalunas & Huang-Pollock, 2013; Rucklidge, 2006). These impairments to such a critical system contribute to the difficulties people with ADHD have with planning, remaining focused, avoiding distractions, and impulsivity in their academic pursuits. Impairments in working memory could cause piano students to struggle with completing their assignments between piano lessons, planning and remaining engaged in practicing while keeping the overall goal in mind, and resisting distractions.

**Temporal and semantic processing.**

People with ADHD have processing deficits, including semantic processing impairments, where one processes the meaning of words and their relationships to each other (Tannock et al., 2000); deficits in speed naming colors, letters, and digits (Rucklidge, 2006; Tannock et al., 2000); difficulty processing speech and other sounds (Lanzetto-Valdo et al., 2017); and slower response times (Karalunas & Huang-Pollock,
2013; Luman et al., 2009). Additionally, Luman et al., (2009) explained that time goes by more quickly for children with ADHD, causing them to have faster internal clocks and underestimate time durations due to temporal processing impairments.

**Inhibitory control.**

Closely related to other EFs is inhibition. Inhibitory control requires an ability to process and discern appropriate answers or responses in a given situation, often very quickly. Inhibitory control, or a lack thereof, has extensive academic, social, and behavioral implications. People with ADHD have difficulty stopping inappropriate or incorrect behaviors, with males being more prone than females to have impaired inhibition. These behaviors include failing to avoid improper social behaviors, inability to ignore a distraction, stopping and altering inappropriate strategies, unsuccessfully inhibiting incorrect answers, and increased impulsivity (Schachar, Tannock, Marriott, & Logan, 1995; Chhabildas et al., 2001; Karalunas & Huang-Pollock, 2013; Pennington & Ozonoff, 1996; Rucklidge, 2006; Shachar, Tannock, & Logan, 1993). Ideally, piano practice should be goal-oriented with errors detected and analyzed, and accurate movements repeated for reinforcement. In piano study, difficulty with inhibition can have far-reaching implications: inability to ignore distraction will limit progress during practice sessions; poor practice strategies may not be stopped, possibly leading to a significant lack of progress on weekly assignments or learning music incorrectly; and wrong notes may not be recognized and/or corrected, leading to lower accuracy on assigned pieces. All of these can lead to increased frustrations for teachers, parents, and students.
**Organization and planning.**

Closely related to inhibitory control are the abilities to organize and plan one’s work. Hinshaw (2002) found that students with ADHD lacked consistency and demonstrated a degree of carelessness in their schoolwork, and others agree that students with ADHD have difficulties with organization. This is commonly manifested through difficulty with writing down assignments, being prepared for class, having proper materials for assignments, and submitting assignments on time (Gureasko-Moore, DuPaul, & White, 2007). In piano study, this can lead to incomplete assignments, students not bringing appropriate materials to lessons, or poor organization and planning when practicing at home, especially if the student is unsupervised during their practice sessions. The result is likely to be a lack of progress, an increase in frustration, and students being more likely to quit studying piano.

**Inefficient motor control.**

Students with ADHD often experience motor control impairments (Pennington & Ozonoff, 1996; Rosch et al., 2013). Rosch et al., (2013) found inefficient (slower and more variable) motor control – especially in boys. This has implications in regard to levels of hyperactivity or impulsivity that may be developmentally inappropriate. It is natural for children to move around, be fidgety, and not sit still. This finding suggests that boys may continue to exhibit these behaviors at a later age than will girls. The study done by Rosch et al., (2013) required students to perform a finger task, which could also have implications for piano study. If fine motor skills are slower or more variable, students with ADHD may experience difficulty in mastering the dexterity necessary for successful piano playing.
Executive Function Variance and Subtypes

Executive function deficits can vary among those with different types of ADHD. Chhabildas et al., (2001) determined that symptoms of inattentiveness rather than hyperactivity/impulsivity are associated with neuropsychological impairment. People with inattentive and combined subtypes of ADHD had similar profiles of impairment on tasks involving processing speed, vigilance, and inhibition, but those with the hyperactive/impulsive subtypes showed no significant level of impairment on the same tasks. Processing speed in students with ADHD is slower and more prone to disruption than in students without ADHD (Chhabildas et al., 2001; Gilden & Hancock, 2007; Pocklington & Mayberry, 2006; Solanto et al., 2007).

Solanto et al., (2007) also found this to be especially true for people with the inattentive subtype, whereas those with the combined subtype presented the greatest levels of impulsivity during tests requiring vigilance and executive function. To play piano, one must visually process the written note on the page, visually process the keys on the piano and select the correct one to play, kinesthetically process movements associated with playing, play the note on the piano, aurally and cognitively process the sound of the note played on the piano for correctness, and make corrections if necessary. If sight-reading, this must be done in time. Whether sight-reading or practicing, this sequence can be overwhelming to someone with slower or disrupted processing, making piano playing a complicated and dreaded process.

Academic Implications

Executive function impairments play an important role in the academic struggles of students with ADHD since they involve skills that are crucial for academic success.
(Johnson & Reid, 2011). Amen and Carmichael (1997) found that the areas of the brain affected in people with ADHD are the same areas that control attention span, concentration, judgment, activity level, critical thinking, and impulse control. These processes are also part of the brain’s executive functions and are critical to academic success. With deficits in these areas, academic performance becomes increasingly difficult.

The components of executive function related to academics include inhibiting improper behaviors and strategies, choice making, planning, monitoring, goal setting and anticipation (Meltzer, 2007; Schachar, Tannock, Marriot, & Logan, 1995), and the ability to use interrelated skills to accomplish a task, usually requiring sustained attention or concentration for the duration of that task (Pennington & Ozonoff, 1996; Smith, 2002). Students with ADHD may also have difficulty with word recognition (Clark et al., 2002) and the ability to perform new tasks (Cepeda et al., 2000), both of which are also important to academic success. Some researchers have found that students with ADHD also have difficulty alternating between familiar and unfamiliar tasks (Rubinstein et al., 2001), and often struggle to re-engage in a task after an incorrect behavior, answer, or strategy has been inhibited (Schachar et al., 1993). This could have implications in piano practicing when sustained attention is required to practice; planning and goal setting are required to learn a new piece; learning new pieces, techniques, or concepts is difficult; using interrelated skills to accomplish goals; or re-engaging in practice after a parent or teacher corrects an undesirable behavior or wrong note.
Interventions for ADHD

When treating ADHD, a combination of treatments are often more effective than using one treatment by itself. The age of the patient should determine the path of treatment. The American Academy of Pediatrics (AAP) states that preschool-aged children need evidence-based behavior therapy and, if necessary, medicine while elementary school-aged children need a combination of both behavior therapy and medication, and adolescent children need medicine more than behavior therapy (AAP, 2011).

Pharmacological Interventions

Pharmaceuticals are commonly prescribed to assist in the management of ADHD symptoms (Cross, Kimko, & Abernethy, 1999). Approximately 70-80% of youth diagnosed with ADHD use medicine to treat it (CDC, 2015). Increases in the use of medication suggest it is now considered a first-line treatment (Ryan, Katsiyannis, & Hughes, 2011). Three main categories of pharmaceuticals are used in the treatment of ADHD symptoms: stimulants, antidepressants, and anti-hypertensives. Each class of medicine works differently, producing benefits and side effects particular to that class.

Despite the benefit these medications provide, using them is risky. Potential side effects include addiction, physical symptoms, behavioral changes, severe reactions, increased risk for drug abuse, and death depending on which medicine is being used (Buitelaar & Rothenberger, 2004; Dulcan, 2007). Variations in genetic makeup affect how one’s liver metabolizes medications, thus affecting how well the body absorbs the medicine, and, in turn, its therapeutic effect on the body (Arehart-Treichel, 2006; Bray, Clark, Brennan, & Muncey, 2008; Ryan et al., 2011).
It must be clear that medications do not cure ADHD, but aid in the management of symptoms associated with this disorder. Medicine can provide short-term assistance to individuals with ADHD by decreasing the severity of symptoms, improving a person’s ability to function in various environments, and enhance the efficacy of behavioral and academic interventions (Austin, 2003; Carlson & Bunner, 1993; Cepeda et al., 2000; Crenshaw, Kavale, Forness, & Reeve, 1999; Evans & Pelham, 1991; Lanzetto-Valdo et al., 2017; Milich, Carlson, Pelham, & Licht, 1991; Panksepp, 1998; Ryan et al., 2011; Tannock, Schachar, Carr, Chajczyk, & Logan, 1989).

Only a handful of studies, however, have examined the long-term benefits of medication on academic improvement and the results suggest that while medicine has some effect on academic learning, it is not large enough to close the learning gap between students with and without ADHD (Scheffler et al., 2009). In fact, Austin (2003) pointed out that although stimulant medications were successful in improving focus and control of impulsivity, behavioral interventions were still the most effective way to moderate hyperactivity. A combination of medicine and behavior and/or psychoeducational treatments appeared to be most effective at overcoming the academic and behavioral effects of ADHD (Carlson & Bunner, 1993; Pelham, 1993).

**Behavioral Interventions**

Though medications may prove useful in countering the inattentiveness commonly associated with ADHD, other interventions are still needed to address the behavioral symptoms, and the resulting academic difficulties that medicines may not help with. Because the symptoms of each sub-type respond differently to various treatments (Gong et al., 2014), a multi-faceted treatment approach including a combination of
medical, behavioral, and academic interventions is most effective at combatting the symptoms and effects of ADHD.

Behavioral interventions are implemented on a regular basis in the United States. It is reported that 40 to 50% of children with ADHD use behavioral interventions as part of their treatment (CDC, 2015). Behavioral interventions are often based on Applied Behavior Analysis (ABA), using principles of psychology to increase desired behaviors and decrease undesired ones. The principles and methods of ABA provide teachers and parents with practical strategies for managing the symptoms of ADHD (Pelham & Fabiano, 2008). Through research, a variety of behavioral interventions have been found to be effective at reducing undesirable behaviors, such as off-task behaviors in academic settings, and at increasing desired behaviors in students with ADHD. These evidence-based interventions are frequently implemented in academic settings. Though each intervention may work differently and target different behaviors, the desired results are the same; improved behavior.

Academic Interventions

Although academic interventions assist the student academically, many researchers have found that behavioral and academic improvements often occur together. For instance, when off-task behaviors are decreased through a behavioral intervention, academic progress may occur. Several interventions demonstrate concomitant benefits. Maag, Reid, and DiGangi (1993) found that self-monitoring on-task behavior, productivity, and accuracy led to academic improvements in mathematics. In particular, self-monitoring one’s productivity or accuracy produced better results than monitoring behavior. Results varied among age groups, with self-monitoring of productivity proving
most effective for elementary school students, and monitoring accuracy yielding the best results for middle school students.

Harlacher, Roberts, and Merrell (2006) stated class-wide interventions can be behavioral (target behaviors of the disorder such as staying in seat, off-task behavior, etc.) or academic (target low academic performance, task completion, or accuracy).

*Tables 4 and 5 contain lists of common class-wide interventions, the key features of each intervention, and their advantages and disadvantages.*
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Key Features</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Class-wide Peer Tutoring     | • Pair students together  
• Alternate tutor-learner roles  
• Provides immediate corrective feedback | • Teacher can monitor whole class  
• Peer attention  
• Immediate feedback  
• Self-selected pace  
• Inexpensive | • Set-up time  
• Initial training period |
| Instructional Modification   | • Altering the assignment | • Personalized to target students’ needs | • Time consuming  
• Challenging to find adequate modifications |
| Computer-Assisted Instruction | • Use of computer programs to supplement instruction  
• Align with curriculum | • Provides additional instruction  
• Fun, engaging  
• Builds fluency | • Expensive  
• Need computer access  
• Some programs may not be appropriate |
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Key Features</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contingency Management</td>
<td>• Positively state rules&lt;br&gt;• Clear expectations and guidelines&lt;br&gt;• Identify reinforcers and punishers</td>
<td>• Effective&lt;br&gt;• Flexible&lt;br&gt;• Adaptive&lt;br&gt;• Engaging, fun</td>
<td>• Requires consistency to be effective&lt;br&gt;• Set-up time</td>
</tr>
<tr>
<td>Therapy Balls</td>
<td>• Replacing child’s seat with a gym ball</td>
<td>• Effective&lt;br&gt;• Socially valid&lt;br&gt;• Simple to implement</td>
<td>• Costly ($$)&lt;br&gt;• May not be practical for whole class</td>
</tr>
<tr>
<td>Self-Monitoring</td>
<td>• Identify target behavior&lt;br&gt;• Explicitly teach rating scale&lt;br&gt;• Decisions on when and how to monitor behavior</td>
<td>• Teaches autonomy and responsibility&lt;br&gt;• One-to-one teacher attention&lt;br&gt;• Inexpensive</td>
<td>• Set-up time&lt;br&gt;• Gradual shift toward positive behavior</td>
</tr>
<tr>
<td>Peer Monitoring</td>
<td>• Outline appropriate and inappropriate behaviors&lt;br&gt;• Practice system before use&lt;br&gt;• Clear guidelines and rules</td>
<td>• Focus on prosocial behaviors&lt;br&gt;• Use of peers to improve behavior</td>
<td>• Requires vigilance and practice to prevent peer rejection</td>
</tr>
<tr>
<td>Instructional Choice</td>
<td>• Teacher-developed menu of assignments or tasks&lt;br&gt;• Student choice of task</td>
<td>• Simple to implement&lt;br&gt;• Inexpensive</td>
<td>• Preparation&lt;br&gt;• Possible student expectancy</td>
</tr>
</tbody>
</table>
Tables 6, 7, and 8, respectively, contain lists of evidence-based academic and behavioral interventions used for an individual rather than an entire class. It is important to note the versatility of these interventions, as some are effective for individuals and for entire classes.
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Supporting Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional cueing</td>
<td>Kercood, Zentall, Vinh, &amp; Tom-Wright, 2012</td>
</tr>
<tr>
<td>Training in specific skills or learning strategies</td>
<td>Evans, Pelham, &amp; Grudberg, 1994; Harris &amp; Pressley, 1991; Jacobson &amp; Reid, 2010; Johnson &amp; Reid, 2011; Lienemann &amp; Reid, 2008; Martinussen &amp; Major, 2011; Mastropieri &amp; Scruggs, 1994; Salend, et al., 2003; Volkow &amp; Swanson, 2013</td>
</tr>
<tr>
<td>Daily report card</td>
<td>Melago, 2014; Volkow &amp; Swanson, 2013</td>
</tr>
<tr>
<td>Computer-assisted instruction</td>
<td>Bul et al., 2016; Volkow &amp; Swanson, 2013</td>
</tr>
<tr>
<td>Give complete and thorough directions</td>
<td>Mastropieri &amp; Scruggs, 1994; Salend et al., 2003</td>
</tr>
<tr>
<td>Active Response to monitor understanding</td>
<td>Salend et al., 2003</td>
</tr>
<tr>
<td>Culturally responsive teaching practices</td>
<td>Salend, Elhoweris, &amp; van Garderen, 2003</td>
</tr>
<tr>
<td>Direct/explicit instruction</td>
<td>Jacobson &amp; Reid, 2010; Lienemann &amp; Reid, 2008; Mastropieri &amp; Scruggs, 1994; Volkow &amp; Swanson, 2013</td>
</tr>
<tr>
<td>Content enhancements</td>
<td>Salend, et al., 2003; Munk, Bruckert, Call, Stoehrmann, &amp; Randandt, 1998</td>
</tr>
<tr>
<td>Response cards (active response)</td>
<td>Gardner, Heward, &amp; Grossi, 1994</td>
</tr>
<tr>
<td>Mnemonic devices</td>
<td>DuPaul &amp; Stoner, 1994; Scruggs &amp; Mastropieri, 1990</td>
</tr>
<tr>
<td>Self-regulation</td>
<td>Jacobson &amp; Reid, 2010; Lienemann &amp; Reid, 2008; Martinussen &amp; Major, 2011; Volkow &amp; Swanson, 2013</td>
</tr>
</tbody>
</table>
The purpose of consequent-based interventions is to provide aversive stimuli to reduce undesirable behaviors and rewards to increase the occurrence of desirable ones. When using contingency-based interventions to adjust behavior, there are several options available to educators. Token economies reward students for desired behaviors, while response-cost economies also take away rewards for undesirable behaviors. These can be combined together. In addition, interventions such as self-regulation and time-out from rewards have proven effective in shaping behaviors (DuPaul et al., 2011; Reid, Trout, & Schartz 2005).

A meta-analysis by Gaastra, Groen, Tucha and Tucha, (2016), showed that classroom interventions do reduce off-task behaviors and other disruptive behaviors in children with ADHD. The largest effects were seen in consequence-based interventions and those focusing on self-regulation. Additionally, these interventions also seemed to benefit the behaviors and academic success of the students’ classmates’ as well.
Table 7. Individual Consequent Based Behavioral Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Supporting Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response cost</td>
<td>Alberto &amp; Troutman, 2013; DuPaul et al., 2011</td>
</tr>
<tr>
<td>Time-out</td>
<td>DuPaul et al., 2011</td>
</tr>
<tr>
<td>Self-regulation (SM, SM+R, SMGT, SR)</td>
<td>DuPaul et al., 2011; Reid, Trout, &amp; Schartz 2005</td>
</tr>
<tr>
<td>Self-monitoring</td>
<td>Kern et al., 1994; Martella, Leonard, Marchand-Martella, &amp; Agran, 1993; Reid, 1996; Tramel, Schloss, &amp; Alper, 1994; Wehmeyer, Palmer, Argan, Mithaug, &amp; Martin, 2000; Wehmeyer &amp; Schalock, 2001; Wolfe, Heron, &amp; Goddard, 2000; Wood, Murdock, Cronin, Dawson, &amp; Kirby, 1998</td>
</tr>
<tr>
<td>Functional Behavior Assessment (FBA)</td>
<td>Dunlap &amp; Kern, 1994; Kern et al., 1994; Kern, Gallagher, Starosta, Hickman, &amp; George, 2006; Lo &amp; Cartledge, 2006; Reid &amp; Maag, 1998; Stahr, Cushing, Lane, &amp; Fox, 2006</td>
</tr>
<tr>
<td>Self-management</td>
<td>Barry &amp; Messer, 2003; DuPaul et al., 2011; Olympia, Sheridan, Jenson, &amp; Andrews, 1994</td>
</tr>
</tbody>
</table>

Antecedent-based behavioral interventions focus on preventing undesirable behaviors from occurring. These include conspicuously posting and reviewing classroom rules, ensuring they are phrased in a positive manner. In fact, the fewer the rules there are, the better. For students with ADHD, placing a copy of the rules on their desk may be a helpful reminder (DuPaul, et al., 2011). Reducing assignment length can prevent off-task behavior. Additionally, when teachers allow students to choose their assignment, students are more likely to remain engaged and complete the assignment. In piano study,
it is conceivable that piano teachers can also provide rules for their students, pace lessons quicker, and allow students to choose their songs from a list of acceptable options.

Table 8. *Individual Antecedent Based Behavioral Based Interventions*

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Supporting Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom rules</td>
<td>DuPaul &amp; Weyandt, 2006; DuPaul et al., 2011</td>
</tr>
<tr>
<td>Reduced assignment length</td>
<td>DuPaul et al., 2011</td>
</tr>
<tr>
<td>Choice making interventions</td>
<td>DuPaul et al., 2011; Dunlap, dePerczel, Clarke, Wilson, White, White, et al., 1994; Olympia et al., 1994</td>
</tr>
<tr>
<td>Exercise or recess</td>
<td>Berwid, &amp; Halperin, 2012; Memarmoghaddam, Torbati, Sohrabi, Mashhadi, &amp; Kashi, 2016; Packard, 2007; Pellegrini &amp; Bjorklund, 1997; Pellegrini &amp; Smith, 1998; Tomprowski, 2003; Wigal, Emmerson, Gehricke, &amp; Galassetti, 2012.</td>
</tr>
<tr>
<td>Behavior Intervention Plan (BIP)</td>
<td>Lo &amp; Cartledge, 2006</td>
</tr>
<tr>
<td>Catch students doing good</td>
<td>Pfiffner, Barkley, &amp; DuPaul, 2006</td>
</tr>
<tr>
<td>Social skills training</td>
<td>Mikami, et al., 2013</td>
</tr>
</tbody>
</table>

Reinforcements must occur frequently, and as close to the target behavior as possible, need to be meaningful to the student, and should be varied over time to avoid loss of effectiveness. Following are explanations of some of the interventions considered in this study.
**Attentional cueing.**

Highlighting key words (attentional cueing) in math problems helped students focus, minimized fidgeting and off-task behavior, and leads to improved academic performance (Kercood et al., 2012). Accumulated evidence suggests that students with ADHD have insufficient physiological activation, which they attempt to optimize, for example, by attending to stimulation (i.e., novelty). This can improve task performance when focused on relevant detail.

**Training in specific skills.**

Using direct/explicit instruction to teach specific skills such as note taking or test performance strategies is an effective way to boost academic performance in students with ADHD. Training in strategies such as “time management, prioritization, organization, problem solving, motivation, and emotional regulation” improve one’s ability to overcome the behavioral and cognitive effects of ADHD (Volkow & Swanson, 2013, p. 1941) and help students overcome poor academic tendencies (VanSciver & Conover, 2009). Disruptive behavior decreases when students are cognitively engaged in an activity such as note-taking (Evans et al., 1994). In piano study, specific skills that are important to teach include how to plan practicing, how to practice, and avoiding distractions.

**Computer-assisted instruction, peer tutoring, and daily report cards.**

Other research has shown the effectiveness of computer-assisted instruction to improve on-task behavior and academic performance in math and reading, while class-wide peer-tutoring improves task engagement and academic performance in math, reading, and spelling. In piano study, numerous apps are available to provide tutoring to
students during and outside of lessons. Daily report cards are another intervention used to provide feedback to students and their parents, and encourage academic improvement by informing the student of their progress, and reporting it to their parents. In music study, teachers can communicate this feedback orally to parents or write it in the student’s assignment book.

**Combinations of interventions.**

Lienemann and Reid (2008) and Jacobson and Reid (2010) used a combination of self-regulation, explicit instruction and training in strategies to improve the writing of students. Studying the effect of the Self-Regulated Strategy Development (SRSD) on essay length, number of essay elements, and holistic quality of student essays, Lienemann and Reid found that SRSD improved performance and maintenance of these skills. In Jacobsen and Reid’s study, one subject excelled, one had average success, and one struggled. Even though results varied for each subject, there is evidence that SRSD is highly successful at combining the interventions of Self-Regulation, explicit instructions, and training in specific strategies, all of which have been found to be effective in the research. SRSD should be investigated for its use in piano instruction. In writing, students need to develop a basic ability to put words together coherently, make sense out of them, and construct an essay. This is similar to music. We teach notes, technique, and artistry with the goal of creating a sensitive and artistic final product that makes sense, allows phrases and sections to meld together in a musically coherent manner, and intelligently express emotion or feelings, much like writing.
**Self-regulation.**

Self-regulating interventions include self-monitoring (SM), self-management (SMGT), self-reinforcement (SR), and self-monitoring plus reinforcement (SM+R). According to Barry and Messer (2003), self-management involves teaching people to recognize their behaviors, set goals for which behaviors to increase or decrease, record, and reinforce their behaviors. The student is responsible for the entire process of behavior change, whereas when self-monitoring they are observing their behaviors and recording them (Martella et al., 1993). Management helps students develop the ability to monitor themselves with only minimal oversight from teachers. Self-management has proven effective in numerous academic settings, and is effective in increasing completion rates of homework assignments, (Olympia et al., 1994). Students who set their own performance goals make more improvement than those who do not. These findings have potential applicability to piano students with ADHD.

Both homework and piano practice require the following steps:

1. Understand the end goal and what is needed to accomplish the assignment.
2. Organize materials and time, and lay out a plan for accomplishing the task.
3. Meaningful practice/work.
4. Stay on task.
5. Finish accurately and completely.

During this process, the student must evaluate if their behaviors are on-task and monitor for accuracy, recognizing mistakes as they happen. Homework and piano practicing are different because piano requires building psychomotor pathways and coordination during the assignment, repetitions of passages (homework usually does not
include doing the same problem multiple times, although it can include doing similar problems in quantity to build neural pathways and understanding of the concept being taught), and piano assignments might need a longer time to complete.

Self-monitoring increases on-task behavior, academic performance, accuracy, and productivity while proving to be efficient in terms of time use and cost (Reid et al., 2005; Trammel et al., 1994; Wolfe et al., 2000; Wood et al., 1998). Goal setting and self-graphing of data are two ways students can self-monitor progress. In a review of literature, Reid (1996) showed self-monitoring of on-task behaviors to be particularly effective at increasing on-task behaviors, and self-monitoring of performance to increase academic productivity in students with learning disabilities. Students can be successfully engaged and frustration can be reduced through sufficiently instructing, allowing enough opportunities to practice, instilling a positive attitude, and teaching students to self-monitor progress (Johnson & Reid, 2011).

**Group/class size.**

Though not an intervention, it is important to mention class size. Class size affects the ability of students with ADHD to maintain on-task behavior and productivity. Hart, Massetti, Fabiano, Pariseau, and Pelham (2011), found that during instruction, participation in a small-group was most effective for remaining on task. Vaughn et al., (2003) used multiple strategies to improve phonological awareness, word patterns, fluency, and comprehension in students and found that a student teacher ratio of 1:1 or 3:1 was more effective on all measures than a 10:1 ratio, although the 1:1 was not necessarily better than the 3:1 group size. Kim, Linan-Thompson, & Misquitta also found
that individual or pair-size instructional groups were a critical part of successfully teaching reading comprehension (2012).

Music and ADHD

Research on Music and ADHD

The existing body of research on music and students with special needs falls into two main categories: research on teaching music to students with special needs and research on using music as a form of therapy for students with special needs. The non-musical benefits of music study are often mentioned, although these results are often secondary findings in research from the other areas. These two categories are vastly different from each other. Research in music therapy has shown that music can be used in non-instructional ways. Studies have been done on the effects of music therapy on impulsivity and restlessness (Rickson, 2006), using music therapy to promote pro-social behaviors (Gooding, 2011; Watkins & Rickson, 2003), using music therapy to improve the speaking and storytelling skills of English as a Second Language (ESL) students (Kennedy & Scott, 2005), and using music therapy to treat ADHD (Carrer, 2015; Jackson, 2003). Music therapy has helped students learn to speak, discover learning strategies, gain self-confidence (Ouellet & Poliquin, 2012), and when used in individual and small-group settings it allows students to exercise self-expression, and gain a sense of control (McFerran, 2009). Greenop and Kann (2007) found that listening to music helped some students improve accuracy on math performance. Music has also helped reduce the physiological differences in the brains of students with ADHD, and improve sound and speech processing, as well as complex auditory pattern recognition (Seither-Preisler et al., 2014; Serrallach et al., 2016).
In consideration of findings like these, it is plausible that students with any disability may experience secondary therapeutic benefits during the course of their music study even though music study is not being used as a form of therapy. Teachers can also use music to bring about desired behaviors or changes in their students as well (i.e. improved social interactions, improved motor skills, increased confidence, or increased flexibility in decision making). Typically, students with disabilities receive physical, occupational, speech, or other therapy services as part of their IEP, and it is hard to know where the benefits of one service stop and another begins. It is therefore conceivable that these therapies may provide benefit to music study and music study may, in return, help students in their other therapies.

Some music-related articles apply to music students with disabilities and deserve mention. Though not written with students with disabilities in mind, Litterst (2006), McAllister (2010), and Pike (2014) address the need for music lessons to be fun, suggest repertoire and teaching interventions that can help students experience greater enjoyment in music study, and encourage teachers to find ways to make music an enjoyable experience for all involved. The authors also address the need for teachers to incorporate current technologies in their lessons to enhance student learning and enjoyment. It is conceivable that students with ADHD may require teachers to implement technology or spend extra time planning a variety of activities and experiences into their lessons to maintain attention and help students have a fun experience while learning. It is unknown to what level piano teachers currently integrate these considerations when teaching students with ADHD.
Many authors have taken great efforts to help teachers understand disabilities and specific interventions or accommodations that may be effective. Though these interventions have not been researched in a private lesson setting, they have been researched in academic classroom settings and they provide a starting point for teachers looking for help. McDowell (2010) created a tool kit for music teachers that mentioned many interventions and accommodations that have proven effective in classroom settings.

Darrow, a prolific researcher and author on teaching music to students with special needs, has published a wealth of information on this topic. According to Darrow, inclusion is a concept that many agree with, yet are uncertain as to how it should be implemented (2010a). Drawing on years of experience and research, Darrow and others recommend a variety of strategies and accommodations to enhance the learning process for students with ADHD. Although these recommendations are for the music classroom, they may also have benefit in private lessons as well.

To effectively teach students with special needs, Darrow (2007; 2008) recommends the following:

- Vary the level of participation expected of the students.
- Utilize a multi-modal approach that incorporates visual, tactile, active participation, and group learning communities.
- Allow alternative methods of student response including verbal, written, movement, or assistive communication devices.
- Adapt the skill level, type of problem, or rules for a given task.
- Adapt the time allotted for completing a task, test, or skill acquisition.
- Adapt how much the student is expected to learn or complete.
• Adapt outcome expectations or goals while still using the same materials for all students.

• Provide different curriculum or materials to meet the student’s goals.

• Alter the environment by removing stimulating or distracting items.

• Incorporate adaptive instruments based on a student’s abilities.

• Use age-appropriate activities. If someone with disabilities is 14, they should participate in activities or songs that are appropriate for 14 year olds.

• Increase peer support for completion of tasks.

• Provide consistent, predictable, and clear communication and consequences.

• Provide frequent feedback.

• Collaborate with other professionals in music education, therapy, special educators, parents, teachers, etc.

• Understand the function of task analysis. Task Analyses provide step-by-step instructions for students and are beneficial to the accurate completion of tasks.

• Have a positive attitude.

In addition, arrangement of the environment, consistent parental communication, and understanding how ADHD affects learning can help instrumental teachers effectively teach students with ADD or ADHD (Melago, 2014). Students with disabilities are quite capable. As a result, teachers should never underestimate students but, rather, they should maintain high expectations. If teachers are flexible, develop relationships with students, and have positive attitudes, they are more likely to be successful in teaching this population (Darrow, 2008).
Barriers to Instruction

Difficulties in teaching students with special needs are often caused by organizational, attitudinal, and knowledge barriers such as poor organization or planning, a lack of understanding, and lack of knowledge about people with disabilities and how to teach them (Darrow, 2009).

Organizational.

To overcome organizational barriers, teachers should focus on the needs of one or two children at a time or set up the music room in a way that provides structure (Darrow, 2009). It is not uncommon for disruptive behaviors to occur as a result of the environment. In general, students with problem behaviors will perform better when sitting close to the teacher, next to peer role models, or when engaged in a desirably activity (Darrow, 2006).

Attitudinal.

Over the years, researchers have found many biases that prevent inclusion from being seamless. Wilson and McCrary (1996) found that while training increased music educators’ professional competence in working with students with disabilities, it also decreased their willingness to work with the same population. Yet, music education students with field experience teaching students with disabilities gained confidence in their abilities to teach these populations, were more willing to work with them in the future, and became more comfortable in inclusive music settings (Hourigan, 2009; Van Weelden & Whipple, 2005). One possible explanation of the differences could be the use of field experience versus training, and the experience level of the educators. Another explanation centers on the plausibility that student teachers might not understand the
amount of work required to make lesson plans, accommodations, and modifications for students with disabilities, whereas their counterparts did and were less likely to work with this population because they knew what effort level would be required.

Most music teachers are generally positive towards inclusion, access to support, and outcomes for their students with disabilities (Scott, Jellison, Chappell, and Standridge, 2007). Students’ attitudes on inclusion are more positive when appropriate modeling occurs (Johnson and Darrow, 1997). Teachers can impact the integration of disabled students through small group experiences and reinforcing positive interactions among students (Jellison, Brooks, & Huck, 1984). Recognizing similarities among people is important in helping teachers and nondisabled students accept those with disabilities (Stainback & Stainback, 1981). Helping others see benefits brought by those with disabilities and understanding a disability better can also help overcome attitudinal barriers (Darrow, 2009).

**Knowledge-based.**

Finally, education, age-appropriate activities, and communication with other professionals can aid teachers in overcoming knowledge barriers (Darrow, 2009). It is not uncommon for teachers to feel inadequately trained or prepared to teach students with special needs (Hammel, 2001; Hansen, 2012). It is imperative that music educators have competencies if they are to include students with disabilities into their classrooms. McCord and Watts (2010) found that music educators had a low level of involvement in the educational planning of students with disabilities, and were aware of the importance of assistive technology, but needed better training and preparation to teach students with
special needs. Additionally, they found that music teachers sought better collaboration among the other teachers involved in a given student’s IEP.

Scruggs and Mastropieri (1994) found teachers including students with disabilities in their classroom needed strong administrative support, special education personnel support, an appropriate curriculum, and peer assistance among other things. Although this applies to general education classrooms, the implications carry over into music classrooms as well. Frisque, Niebur, and Humphreys (1994) found that few music educators had access to special education personnel support or had enough time for planning for individuals with disabilities. This support is critical to the successful inclusion of students with disabilities. Although private piano teachers are not typically part of the school education process, they still need adequate support from professionals and parents, as well as adequate time to plan activities and lessons for each individual. In piano study, teachers are directly involved in the planning of every aspect of a lesson. They must determine the environment, curriculum, strategies or accommodations, and any other pertinent elements of the education.

According to Martiros and Hanley-Maxwell (2013), teachers often feel insecure about teaching students with disabilities due to a lack of education, training, and experience. Teachers were often willing to seek out training for teaching students with new disabilities they had not before encountered, but wanted current reference lists of resources on teaching students with disabilities.

Due to the training required, many teachers did not actively advertise for students with disabilities. Fears were either of a disability or of teaching children with disabilities in general. These fears often developed from bad experiences. Successfully teaching
students with disabilities requires teachers develop new teaching tools. Teaching students with disabilities requires large amounts of planning, so much so that teachers were found to be less likely to include these types of students in the future (Martiros & Hanley-Maxwell, 2013).

Colwell and Thompson examined the catalogs for 171 colleges and universities and found that 74% of them offered at least one special education course to their music education majors. Of the 140 courses offered, only 30 were music content specific, and only 43% of those were required courses for music education majors (2000). Mastropieri and Scruggs found that effective general teaching skills and disability-specific teaching skills were key parts of successfully including students with disabilities in a mainstreamed classroom (1994).

**Music Study and Learning**

Some research has produced findings similar to studies on students with ADHD in academic settings. Soltani, Roslan, Abdullah, and Jan (2011) researched optimal stimulation in a music intervention setting and found it to be essential to promoting intrinsic motivation among music students with intellectual disabilities. Although the subjects did not have ADHD, it is important to note the crossover between academic and music settings that this research provides.

While McCord and Fitzgerald (2006) do not offer suggestions for teaching piano, they discuss music reading. Their suggestions for helping students with special needs read music include simplifying rhythms, highlighting spaces with markers, using a viewer to show students only the part they need to read, using alternate staffs, and using graphic notation. In a study on teaching composition, McCord (2002) found that music
students with special needs composed best when experiencing music in a multi-sensory environment because their stronger learning modes often compensated for their weaker ones. Bell (2008) taught a student with Down Syndrome to compose music and found that focusing on the student’s abilities, providing positive support, allowing opportunities for students to make choices and explore, as well as accompanying them on the piano were important for success.

Jellison and Flowers (1991) found that few students with disabilities took music lessons outside of the music classroom. In examining students with and without disabilities, they found common musical interests and preferences between the two groups such as both enjoyed singing, and both enjoyed dancing while listening to music. Additionally, students without disabilities gave a higher frequency and greater variety of verbal responses than those with disabilities. Their suggestions included teachers incorporating “functional music conversation” into their lessons (p. 329). Knowledge of these preferences and abilities can aid in proper lesson development and positive student interaction during classes.

**Practicing.**

Mindful practicing is how musicians improve at reading, playing, and all other aspects of music. It is an essential element of music study and is similar to homework that is given in academic settings. Many articles have been written about the art and science of practicing. Duke, Simmons, and Cash (2009) researched what practice strategies were most commonly employed by highly successful pianists. Their findings indicated that the top practicers’ success was more likely to stem from strategies
employed in a practice session than the quantity of material or length of time spent in rehearsal.

In contrast to the recommendations of many pedagogues, Duke et al., found that playing hands-together early on was more effective than delaying it for extra hands-separate practice. Other top practice strategies included thoughtful and focused practice where the pianist caught and fixed errors immediately. The three most effective strategies included accurately identified, rehearsed, and corrected errors; systematically varied tempi of each trial; and repeated target passages until errors were corrected and the passage was stabilized and error-free. These strategies, while crucial to effective practicing, could be difficult for students with ADHD if their executive function impairments prevented them from implementing practice strategies effectively, staying on task, recognizing errors, or completing their assignment.

In addition to practice strategies, Duke, Cash and Allen (2011) determined attention was important in accurate performance. Not only was it important, but also where a pianist directed their focus impacted their motor control. Pianists who directed their attention on the effects of their movements (sound production, hammers, etc.) had greater accuracy than those who focused on the movements themselves. If a student with ADHD was unable to properly focus their attention, their accuracy could be impacted.

Jutras (2009) pointed out that piano students were often required to work without supervision and must practice independently throughout the week between lessons. Jutras estimated that upwards of 80-90% of students’ learning time was spent working on their own without supervision or guidance. While students with ADHD benefit from the intervention of being taught specific skills or strategies, many typically developing
students also need to be taught how to practice (Beaumont, 2011; Hayghe, 2009; Jutras, 2009).

Hayghe recommended several skills critical to effective practicing: scheduling practice time, setting clear goals, using tools and tricks, drilling passages, practicing under tempo, practicing with a metronome, fixing passagework, practicing musical concepts, and planning and documenting one’s practice. Some of these skills are difficult for neurotypical pianists to develop, but could also be key points that pianists with ADHD struggle with. Executive function deficits make planning, scheduling, goal setting, and paying close attention to details nearly impossible without interventions. But Hayghe emphasized that teaching students “how to practice is as important as teaching them what to practice” and “shorter sessions with specific goals and the right methods to achieve these goals are key elements of productive practicing” (2009, p. 58). It seems likely that this would hold especially true for students with ADHD.

Sikes (2013) studied four specific practice strategies of free practice, slow practice with gradual speed up, repetition of small sections, and repeating larger sections multiple times. In string players, it was found that each strategy improved their performance significantly, though the players’ ability levels may have affected the results. These strategies may require any number of executive functions, including temporal processing (tempo and rhythm), processing speed (visual, aural, kinesthetic), inhibition (avoiding errors), planning (how and what to practice), and an ability to perform new tasks (learning new music or trying new practice techniques). More research on students with ADHD using these practice techniques would provide greater insight into how well these strategies will work for this particular population.
Beaumont (2011) mentioned that deficiencies in organizational skills might be common to all piano students, especially those not taught this particular skill set. Her recommendations included selecting manageable amounts of music for the student to practice, having the student take notes during lessons, and dividing assignments into three components of passages, problems/goals, and practice suggestions. Beaumont also advocated using a hierarchy in helping students know what to practice. By establishing this order of importance, students would know which items to focus on most. Finally, she encouraged teachers to carefully describe what steps should be taken during each practice session as well as what technical or musical elements students should work to improve. By providing this structure, students would be equipped with tools to accomplish their assignments each week.

However, not every teacher realizes the struggles that students, especially those with ADHD, have in planning, organizing, and accomplishing their practice goals and assignments. It has been suggested that determination to keep practicing and willpower to avoid distractions are all we need for successful practicing (Jancewicz, 2013). If only it was this easy for pianists with ADHD.

Although not part of the literature on music and ADHD, research on goal setting offered potential insights into how students with ADHD might approach practicing. According to Barron, Evans, Baranik, Serpell, and Buvinger (2006), people generally set two types of goals: mastery goals, wherein they develop competence through new knowledge and skills; and performance goals, wherein they demonstrate competence in relation to others. Mastery goals are measured through a criterion referencing, or a set
standard. Either they are or are not accomplished. Performance goals, however are measured through norm referencing, or by comparing one’s self to others.

Early research findings indicated that students with ADHD tended to quit working on academic tasks more often than their neuro-typical peers, even though they had the necessary skills to complete the task. In a 2006 study, it was confirmed that students with ADHD are more likely to view schoolwork through a mastery goal mindset. Researchers also found higher than normal rates of performance-avoidance goals in students with ADHD, meaning they set less optimal goals than their neuro-typical peers (Barron, et al., 2006).

**Hansen case study.**

Hansen offered one of the more in-depth case studies of music students with ADHD. Since her study involved middle school-aged music students (the same age group of this study), it seems particularly pertinent to mention her findings. In 2012, Hansen observed three middle school band students with ADHD in case studies to see what academic, interpersonal, and behavioral challenges they faced in band class. She found that while some students felt isolated from peers, others felt a sense of belonging, viewing their classmates as family. Their motivations to study music included their own music learning, achievement, personal development, enjoyment, and intrinsic motivation. The students exhibited a variety of behaviors in class such as hyper-focusing (the research is uncertain on its efficacy) although Hansen concedes the students may not have been aware they were doing it, self-monitoring, self-entertainment through fidgeting, disorganization, hyperactivity, and listening.
Hansen did not specify how she verified the subjects’ diagnoses of ADHD, what testing they went through to receive their diagnoses, or with which subtype of ADHD they were diagnosed. Based on descriptions of the subjects, one in particular had symptoms more similar to non-ADHD disorders than ADHD. He was diagnosed by a medical practitioner, which, in light of the points presented in the previous section on diagnoses, suggests there is a good chance the student was not tested adequately and may not have had ADHD. Overall, Hansen found that despite experiencing behavioral challenges that affected their success in social, occupational, and academic settings, students with ADHD valued the musical, non-musical, and social aspects of band in the same ways as their neuro-typical peers.

Band directors in the study said they were, “uninformed or unprepared to use accommodation strategies that support students with ADHD,” yet they seemed to implement them well when needed (p. 155). In particular, they successfully redirected attention, structured their classrooms to support learning by minimizing distractions, gave clear instructions, and developed personal cues to remind students to stay on task. All of the directors spoke positively of their students, focusing on their abilities and strengths. Positive interactions between band directors and students with ADHD were a finding particular to this study and not others, as were the positive peer relationships. Inappropriate interactions (i.e.: monitoring peers, correcting peers, and talking out of turn) initiated by the students were not specific to this study alone. While it did not have an impact on their overall participation in band, ADHD did have a negative effect on the music learning, achievement, and relationships of the band students in Hansen’s study (2012, p. 163).
Learning in Academic and Musical Domains

Learning in academic and musical domains share many commonalities. After a concept is taught, an assignment is given to reinforce the students’ understanding of that skill. In academic settings this is manifest in homework, class assignments, and tests. In musical domains this takes the form of weekly assignments. Much like homework problems develop a student’s mastery of an academic topic, music teachers assign pieces that help a student develop mastery of a musical skill or concept. Music, however, is different from academics in several ways.

In 1956, Benjamin Bloom identified three domains of learning; cognitive, affective, and psychomotor (Bloom, 1986; Clark, 2015; Krathwohl, Bloom, & Masia, 1964). Cognitive learning involves mental skills such as comprehension, application, and analysis. The affective domain includes emotional areas like attending, response, and valuation. The psychomotor domain includes physical skills such as perception, imitation, proficiency, and adaptation.

Learning in academic areas largely involves the cognitive domain, with students learning, comprehending, and applying their knowledge through homework, class assignments, and tests. The cognitive domain engages as students learn new music concepts and skills, apply them to the pieces they are playing, and analyze or evaluate their performance. But music learning requires more than just a cognitive involvement. Unlike academic learning, music also engages the affective and psychomotor domains.

When students listen to a piece of music and have an emotional response to it, they are engaging the affective learning domain. When they make a musical decision about how to play a passage or perform a piece, students are using their affective domain.
Music demands an affective response from listeners and performers alike. Whether that response is to like, dislike, or remain neutral, these responses show what one values, and how those values are projected on the music (Price, 1986). The psychomotor domain is equally important to the others. A pianist’s ability to play the piano relies heavily on psychomotor abilities. Pianists need the ability to perceive where their fingers and hands must move (visuo-spatial abilities), imitate others, and have proficiency as they play. Clearly, music learning is more complex and involves more learning domains than academic learning. Music learning is notably different than other experiences (Abril, 2012). Because of this, students with ADHD may have even greater difficulties learning music.

Private piano students often attend one lesson per week, leaving with an assignment to work on specific pieces or passages within those pieces, technical exercises, and various workbook activities. Their practicing conceivably includes assignments of varying length and intensity. Some pieces may be in the final stages of learning while others may have just been assigned. Having an assignment to complete requires piano students to utilize executive functions to plan out their practice, complete their assignments, accurately play the notes while including all musical elements dictated in the music (i.e., dynamics, articulation, phrasing, etc.), and maintain motivation to finish the assignment within the timeframe between lessons, much like they do with school homework.

In the field of piano pedagogy, there is a paucity of studies on teaching piano to students with ADHD. Polischuk (2010) discussed teaching a student with Asperger’s Syndrome, a high-functioning form of Autism. He outlined his teaching efforts, the
student’s struggles, and that he learned best by experiencing concepts before understanding them.

Martiros and Hanley-Maxwell (2013) interviewed piano teachers of students with disabilities and wrote about their inclusion practices, philosophies on disabilities and inclusion, training, experiences with teaching students with disabilities, and whether they modified their teaching for these students. This study was limited to a small area in one Midwest state. The current study, though similar, differs from this one: a larger geographic area will be studied; and it focuses mainly on students with ADHD rather than multiple disabilities.

Following up the work of Gfeller, Darrow, and Hedden from 1990, Vanweelden and Whipple (2014) found teacher responses indicated a greater level of successful integration, meeting musical needs, and teachers appeared more comfortable adapting/modifying curriculum as needed. Furthermore, teachers were more likely to grade students with special needs with the same standards as other students in their classes.

In 2013, Gerrity, Hourigan, and Horton examined what conditions facilitated music learning for students with disabilities. The results helped the researchers develop a model for teaching students with disabilities in music classes, but since their conditions were designed to be similar to school classes, it is unknown how they will apply to private music instruction.
Chapter 3. Research Method and Design

Purpose for the Study

It is very clear that students with ADHD experience executive function deficits. These deficits affect students’ on-task behavior, productivity levels, accuracy on assignments, planning, organization, preparation, and motivation. Researchers have repeatedly found evidence that these deficits translate into academic difficulties for students with ADHD. Students struggle to complete their assignments, complete assignments accurately, maintain on-task behaviors, plan out projects, and maintain the motivation to finish them. This is made even more evident by the abundance of research on self-maintenance interventions aimed specifically at overcoming these effects of executive function deficits in students with ADHD. What researchers have not explored in depth is whether these executive function deficits in students with ADHD have a similar impact in certain non-academic settings like private piano instruction, what interventions may be necessary to successfully teach these students, and what teacher training may be needed to accomplish this.

The need for this study has grown from a gap in the research literature. The major purposes of this study were:

1. To explore the teacher training and professional development of piano teachers who teach students with ADHD.
2. To explore potential best practices in teaching piano students with ADHD as reported by piano teachers of students with disabilities.

The research was guided by the following research questions:

1. What background, teacher training, and/or professional development do the piano teachers think are most helpful for teaching students with ADHD?
2. How are the behaviors of students with ADHD perceived by the teachers and what impact do the teachers feel the behaviors have on a student’s lessons and practicing?
3. What strategies, interventions, or teaching approaches do piano teachers find most useful or effective when teaching students with ADHD?
4. How might other factors (i.e. use of interventions, lesson setting (private, group, semi-private), teachers’ attitudes towards students with disabilities, parents’ level of involvement in practicing, etc.) inform our understanding of successfully teaching piano students with ADHD?

**Method**

**Research Design**

This study was a survey of piano teachers who currently have or previously had students with ADHD. This researcher sought to describe the experiences of piano students with ADHD, including the background and training of their teachers, and how a variety of factors may help teachers successfully instruct piano students with ADHD. Piano teachers responded to a questionnaire about their training, experiences teaching students with ADHD, and their students’ behaviors, among other topics (see Appendix F).
Participants

Participants were private piano teachers teaching in the Mid-Atlantic region of the United States for two main reasons: population density, which meant a greater chance of finding a larger number of piano teachers and students with ADHD, and the researcher’s knowledge of qualified subjects residing in the region. To account for as many teaching styles and teacher types as possible, piano teacher recruitment occurred within professional music teacher organizations. Lists of teachers and music schools affiliated with the following professional organizations formed a pool of potential respondents.

1. Music Teachers National Association (MTNA)
2. American College of Musicians (Piano Guild)
3. Royal Conservatory of Music
4. National Federation of Music Clubs
5. Suzuki Association of the Americas
6. National Association for Music Education (NAfME)
7. American Music Therapy Association

While some teachers may have had more advanced training than others, or even held various certifications, those differences among teachers allowed for a broader spectrum of experiences in teaching piano students with ADHD. Because there is no professional organization devoted specifically to the interests of piano teachers or music teachers working with students who have ADHD, a random sample was not possible.

Measurement / Instrumentation

The questionnaire drew on the following topics, which have been explored by researchers working with a more-generalized population of teachers: teacher training
attitudes on inclusion (Hourigan, 2009; VanWeelden & Whipple, 2005; Wilson & McCray, 1996), teaching strategies and accommodations (Beaumont, 2011; Bell, 2008; Darrow, 2007, 2008; Duke et al., 2009; Duke et al., 2011; Hayghe, 2009; Jutras, 2009), and their perceptions of how ADHD affects their students’ piano study (Melago, 2014). Consideration was given to specific strategies or accommodations perceived to be applicable to piano study, and questions were developed to help the researcher better understand best practices among the participants, the effectiveness and implementation of accommodations, and what additional factors might contribute to successfully teaching piano students with ADHD. Teachers reported on their own pre-service and in-service experiences, providing data for this descriptive study.

Some drawbacks to survey research include the inability to ask follow-up questions to clarify responses, observe students in multiple environments, or verify medical diagnoses of ADHD. To counter this drawback, the questionnaire was crafted in a way in which follow-up questions which would have been asked in a personal interview were anticipated and included in the survey. While the data relies on self-reported experiences and analyses, the findings of the study may prove valuable for current and future practitioners who have similar interests.

**Detailed Study Procedures**

Teachers received a link to an online website with the questionnaire. The estimated time for completion was 10-15 minutes, but may have taken longer in some cases. The questions included information about demographics and professional
qualifications. Teachers were asked to disclose demographical information about their students including age ranges of students, number of students, types of disabilities their students have, and behaviors those students exhibit. The questionnaire did not ask respondents to provide diagnoses of disabilities or the severity of impairments. The researcher attempted to ensure the anonymity of the respondents and their students. The only other personal information collected was email addresses. Teachers had an option to disclose their email address if they wanted to know the study results or be included in a directory of piano teachers of students with disabilities to be made in the future.
Chapter 4: Results

Participant responses

Demographics

In addition to posting on the Facebook group, invitations to participate were sent to 29 music schools that potentially offered piano lessons for students with disabilities, the presidents of the seven state MTNA chapters, the presidents of the seven state federation chapters, and 11 additional private teachers who were known to teach or advertised teaching piano students with ADHD. Additionally, the national offices previously mentioned in Chapter 3 were contacted. Follow-up emails and/or phone calls were sent to those who did not respond to the initial contacts. A small group of teachers (n = 7) responded to the questionnaire, and only one of the seven declined to participate.

The six participants in this study were all female, half having taught piano lessons for 11-15 years, and half having taught for over 20 years (see Figure 1). All had taught students with disabilities for at least 10 years, with the average length of time being 22 years and the median length being 24.5 years. These teachers lived in different states within the Mid-Atlantic region of the United States, in suburban areas (population under 50,000), with most living within 20 miles of larger cities (populations over 100,000). Participants’ membership in professional organizations included five of the seven options, with the National Guild of Piano Teachers and National Federation of Music
Clubs not being represented. Two of the teachers belonged to more than one professional organization, while one did not belong to any of these organizations (see Table 9).

![Number of Years Teaching Piano](image)

*Figure 1. Number of Years Teaching Piano*

<table>
<thead>
<tr>
<th>Professional Organization</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music Teachers National Assoc. (MTNA)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Royal Conservatory of Music (Music Development Program)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Guild of Piano Teachers (Piano Guild)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Federation of Music Clubs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suzuki Association of the Americas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>National Association for Music Education (NAfME)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>American Music Therapy Association</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Studio Description

The average studio size of these teachers was 33 students, with four teachers having more than 36 students, and two having studios containing 15 or fewer students. Teachers were most likely to teach students with disabilities individually in a private lesson setting, although one teacher provided online lessons to special learners as well. Out of those studios, one had between six and ten current students with ADHD, two had between 11-15, and three studios had 5 or fewer current students with ADHD. The population of current students with ADHD in these studios ranges from 28 to 55 students between the ages of 5 and 22. Of the six participants in this study, five also taught students with other disabilities, including Autism Spectrum Disorder (ASD), Learning Disability, Multiple Disabilities (Blindness and ASD), Physical Disabilities (Blindness, Deafness), Intellectual Disabilities (Down Syndrome), Traumatic Brain Injuries (TBI), Oppositional Defiant Disorder (ODD), and Anxiety.

The responses indicated that students with ADHD or other disabilities studied piano with their teachers between three and ten years. Lessons were most often administered in 30 -minute sessions. Though every teacher had attrition in their studio, the reasons for this were varied and included moving, affordability, aging out, lack of practice, and frustration on either the parents’ or student’s part.

Education

Five of the six teachers who participated in this study held advanced degrees, four with Masters degrees and one who was ABD for their PhD (see Table 10). Certifications held or recently held by the teachers included music therapy, Kodaly, state music
educator association, teacher’s license, supervisor credentials, and certification through a state division of developmental disabilities.

Table 10. *Level of Participants' Education*

<table>
<thead>
<tr>
<th>Subject</th>
<th>Degrees Obtained</th>
<th>Fields of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bachelors, Masters</td>
<td>General Music, Music Education, Special Education</td>
</tr>
<tr>
<td>2</td>
<td>Bachelors</td>
<td>Non-musically oriented degree</td>
</tr>
<tr>
<td>3</td>
<td>Bachelors, Masters</td>
<td>Music Therapy</td>
</tr>
<tr>
<td>4</td>
<td>Bachelors, Masters</td>
<td>Music Performance, Music Pedagogy</td>
</tr>
<tr>
<td>5</td>
<td>Bachelors, Masters, ABD for Ph.D.</td>
<td>Music Education, Music Pedagogy, Other Music Degree</td>
</tr>
<tr>
<td>6</td>
<td>Bachelors, Masters</td>
<td>General Music, Special Education</td>
</tr>
</tbody>
</table>

Participants utilized professional development activities in many forms including reading research studies/findings, attending workshops, participating in conferences, and summer pedagogy institutes, but not training sessions, college courses, or local chapter meetings of professional organizations (see *Figure 2*). Of these activities, only four of the six teachers found these to adequately address their needs in teaching students with disabilities. Instead, they cited costs, inconvenient schedules, or information that was overly general and lacked sufficient specifics to be useful as reasons these professional development offerings did not meet their needs.
The teachers in this study began teaching students with disabilities either as a natural extension of their work, or at the encouragement or invitation of others. When asked how they learned to teach students with disabilities, the majority of participants cited formal training (67%), self-education (83%), and trial and error (67%) as the main ways they learned. Other avenues mentioned included professional development (50%), consulting with other professionals (50%) and/or piano teachers (33%), but not through observation of other teachers (see Figure 3).
Student Success

When asked how important specific elements of piano study were to their students’ success, the majority of teachers listed repertoire selection (83%), using interventions (83%), and performance opportunities (83%) as being important or essential to the success of piano students with ADHD (see Figure 4.). Technique was ranked as more likely to “moderately contribute” to student success than to be “important” for their success, and the importance of group activities, making music away from the piano, and technology were not ranked as high (see Figures 5-10). When teaching students with ADHD how to read music, teachers 1 and 6 use a Middle C approach; teachers 2 and 5 utilize mnemonic devices (sayings to remember note names, such as Every Good Boy Does Fine for the names of the lines in the treble clef), with teacher 2 also using rote and the Piano Pronto piano method; teacher 3 uses lead sheets of simplified songs the students like, and teacher 4 uses a combination of whatever works.
Figure 4. Importance of developing technique to the success of piano students with ADHD.

Figure 5. Importance of repertoire selection to the success of piano students with ADHD.
Figure 6. Importance of making music away from the piano to the success of students with ADHD.

Figure 7. Importance of using interventions to the success of piano students with ADHD.
Figure 8. Importance of performance opportunities to the success of piano students with ADHD.

Figure 9. Importance of group activities to the success of piano students with ADHD.
Figure 10. Importance of using technology to the success of piano students with ADHD.

Strategies and Accommodations

Multiple strategies and accommodations that are described in Chapter 2 of this study were identified in various teacher responses. When asked which specific strategies or accommodations were used to help their students in lessons or at home, several were utilized quite regularly (see Table 11). Monitoring understanding, cueing/refocusing, and giving praise for desirable behaviors were the most commonly used accommodations (100%); using shorter tasks, reinforcing behaviors with a reward, and allowing students to choose which pieces to play were second (83%); training in specific skills or strategies and giving complete and thorough directions were next (66%); and goal setting and taking short breaks were utilized by 50% of the respondents.
Table 11. *Accommodations Used by Participating Teachers*

<table>
<thead>
<tr>
<th>Accommodation/Strategy</th>
<th>Teacher 1</th>
<th>Teacher 2</th>
<th>Teacher 3</th>
<th>Teacher 4</th>
<th>Teacher 5</th>
<th>Teacher 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cueing/Refocusing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Training</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report Card</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Computer Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Peer Tutoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete/Thorough Directions</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Monitor Understanding</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Goal Setting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Shorter Tasks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mnemonic Devices</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Self-grading</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Rewards</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Loss of reward</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Time-out</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Allowing choices</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Short breaks</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Praise</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In describing their own pre-service education and training, the teachers learned about these interventions in a variety of ways, some of which overlap. Teacher 1 learned through schooling, teaching experience, and workshops; Teacher 2 was largely self-
taught; Teacher 3 learned through school, research, and trial and error; Teacher 4, who had a piano degree, learned through the students’ school teachers and parents, as well as in pedagogy class; Teacher 5 cited training and experience as their main source of knowledge on the topic; Teacher 6 developed knowledge as a school teacher. Regardless of degree or job type, it appears that experience was a main factor in the acquisition of knowledge in this area.

When asked what impacts the accommodations and strategies had on the students during lessons, teachers validated that these accommodations worked in private lesson settings, with positive results. Teacher 1 responded that, “Understanding how my students learn and then structuring my teaching appropriately is what keeps my students coming to lessons for over six years. It also builds their self-confidence enough to want to learn how to perform.” Others replied that they saw, “Better behavior” (Teacher 4), “Less frustration and more progress” (Teacher 6), or that, “learning is fun and safe and often self-motivated” (Teacher 3). It is worth noting that, according to their teachers, students had less frustration and more progress, improved behavior, higher levels of enjoyment, increased self-motivation and self-confidence, and they appeared to stick with piano study longer as a result of successful accommodations and strategies.

When asked what impacts those same strategies and accommodations had on their students when practicing at home, their responses were mixed. While Teacher 3 was hopeful their strategies worked at home, Teacher 2 was, “not sure” of the impact, and Teacher 3 stated, “Little. Very hard to transfer learning skills outside of lesson…”. Contrasting these experiences, were statements such as, “Less frustration, more progress” (Teacher 6), “Very helpful in self-directing of learning and improvement” (Teacher 5),
“Giving a student a practicing guide that works for them and allows them to actually enjoy practicing allows them to learn more with less frustration and more joy” (Teacher 1). These answers demonstrate that not all accommodations work the same way on each student.

**Barriers**

When asked about barriers students with ADHD face when studying piano, teachers’ responses centered around those that were related to the student or ones that revolved around non-students. Student-related responses included their being easily distracted or not on time to lesson (Teacher 2), “Lack of focus, motor skills difficulty, or low self-esteem” (Teacher 3), or, “Impatience with remaining on the same piece until it is learned” (Teacher 5). Responses focusing on non-student barriers included, “Teachers who have little understanding of how ADHD affects learning to play the piano” (Teacher 1), “Teachers who don’t understand how ADHD impacts learning except for the pre-conceived notion that children with ADHD can’t sit still and can’t stop talking (Teacher 6), and, “the wrong teacher” (Teacher 4). Any of these barriers can lead to frustration on the parts of the teacher, student, or parent (Teacher 4).

Of the solutions offered to overcome these barriers, most seemed to be teacher-oriented in nature. Teacher education (Teachers 1 & 6), publicizing their work with students with special needs (Teacher 4), minimizing distractions in the teaching environment and knowing what works best for each individual student (Teacher 2) were all mentioned. Additionally, parental support and explanations were deemed helpful (Teacher 5), as were successful experiences and realistic expectations (Teacher 3), both of which could affect students, parents, or teachers.
Enjoyment

In terms of enjoyment, 83% of respondents ranked their students’ enjoyment of piano lessons at the highest level. These high levels of enjoyment could be related to their teachers’ repertoire selections. When asked about what styles of music or composers their students enjoy, an overarching theme of personalizing based on student interests was noticed among the respondents’ answers. Although just about every type of music was mentioned (pop, jazz, classical, musicals, 80’s music, holiday music, Disney, Harry Potter, Star Wars, Beatles, Elvis, Adele, etc.), three teachers specifically mentioned using music in which their students are interested. Statements such as, “If the student is interested, I do my best to find the music at their level” (Teacher 6), “I always give him a piece that [they] know…” (Teacher 4), and “I learn what they enjoy…and incorporate it right from the beginning…If it’s out there I do my best to find it at their level” (Teacher 1), appeared to indicate the importance of engaging students through repertoire selection.

Student/Parent Involvement

While it is unknown just how many piano students have ADHD, or how involved they are in festivals or competitions, four of the participants reported that their students participate in events such as state Music Teacher Association festivals, a national-level festival and competition, recitals, and in-house assessments by external teachers. Since preparing for festivals takes considerable practice, this raises a question about quality and quantity of at-home practicing, including the level and intensity of parental involvement.

Two respondents noted that parents of their students were involved in their children’s practicing “at different levels” (Teacher 4), or by giving “reminders” and “encouragement” (Teacher 3). While Teacher 5 stated, “Most are too busy”, Teacher 2
was frustrated by the lack of involvement, even after repeated efforts on the teacher’s part to involve the parents. “In my case, the parents and grandparents are not too involved; it is frustrating and I even go over with them the importance of helping” (Teacher 2). The final two teachers actually worked to remove the parents from helping with practicing, training, and encouraging the student to practice on their own. “I actually work towards making the students as independent as possible while practicing, so parent involvement is as minimal as possible to begin with and is faded with time”, wrote Teacher 6. For Teacher 1, it is “individual to each student because my students may need anything from hand over hand to just making sure the student practices what is in the notebook. Older students that I’ve been teaching for more than 6 years may not need any parental involvement.”

**Assignment Accuracy and Completion**

When asked about assignment completion, Teachers 1, 4, and 6 indicated their students completed 76-100% of their assignments (see Table 12), Teacher 5 ranked their students’ completion rates at 51-75%, while Teachers 2 and 3 indicated their students completed between 26-50% of their assignments. When asked how accurately those assignments were completed, Teachers 1, 3, 4, and 6 ranked their students at 76-100% accuracy, Teacher 5 estimated their students’ accuracy at 51-75%, and Teacher 2 ranked their students at 0-25% accuracy on their assignments. It is difficult to definitively ascertain the quality of at-home practice. Individual reports on accuracy and completion vary with each teacher, and are subjective since individual standards are subjective.
Table 12. *Rates of Accuracy and Completion on Assignments*

<table>
<thead>
<tr>
<th></th>
<th>Teacher 1</th>
<th>Teacher 2</th>
<th>Teacher 3</th>
<th>Teacher 4</th>
<th>Teacher 5</th>
<th>Teacher 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion</td>
<td>76-100%</td>
<td>26-50%</td>
<td>26-50%</td>
<td>76-100%</td>
<td>51-75%</td>
<td>76-100%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>76-100%</td>
<td>0-25%</td>
<td>76-100%</td>
<td>76-100%</td>
<td>51-75%</td>
<td>76-100%</td>
</tr>
</tbody>
</table>

**Participant Perceptions**

**Teacher Training**

The responses to questions about teacher training shed light on the teachers’ opinions of the current state of teacher training programs as well as professional development within the United States (see *Appendix G*). When asked what training prepared them for teaching students with disabilities, five of the six teachers’ responses included an element of experience. Teacher 1 was a “…piano teacher of typical students and both a special [education] aide and special education music teacher in the public-school system”, while Teacher 3 gained her experience through “School, internships, and years of teaching.” In addition to reaching out to other teachers, Teacher 4 learned “through [their] own trials.” Teacher 5 learned through training in “college, but mostly experience”, and Teacher 6 gained experience through both “education and teaching as a special education music teacher in the public-school system.”

When asked what aspects of teaching piano to special learners had to be learned through experience, the teachers gave specific examples, several of which overlapped. Teacher 1 related,
My experiences being an aide and teaching in the school system were where I learned how to use IEPs effectively, how to work with students with disabilities one to one (as an aide), [and] how to work with parents. It was also where I was able to work with students with many disabilities. I think it would have been very difficult to understand the nuances of how disabilities affect learning without first having had these experiences. I’m also a parent of an adult with ADHD – those life experiences are invaluable to a) gaining trust of both parent and student and b) understanding exactly how this disability affects learning to play the piano.

For Teacher 2, experience helped them develop an understanding of “other ways of learning than the normal method books: visuals, games, slower pace, and unique ideas not found in books.” Teachers 4 and 6 both related how experience allowed them to develop a sense of being comfortable with students who have disabilities. For Teacher 4, this included “Teaching note reading, technique, learning LH from RH, the speed in which I teach, expectations, allowing them to be themselves…”. Additional skills developed through experience included “Redirection, patience, sense of humor” (Teacher 3), and “Patience, persistence, consistency, concrete examples in their lives not abstractions” (Teacher 5).

**Professional Development Efficacy**

When discussing training and professional development, the question of effectiveness and applicability must be addressed. Several questions addressed this. First, what skills and training from their schooling were most applicable to teaching their students; second, what skills and training teachers wish they had received; and lastly, how can teacher training be improved to better prepare teachers to instruct special
learners. Though there did not appear to be any correlation between types of degree, the answers provide important insight into the perceived benefits of teacher training (See Appendix G).

As shown in Figure 2, the teachers in this study participated in a number of professional development activities, including reading research studies and findings (83%), attending workshops (66.7%), and reading journals about piano teaching or attending regional, national, or international conferences such as Music Teachers National Association or National Conference on Keyboard Pedagogy (50%). The two teachers who replied “other” also attended workshops specifically for teaching students with disabilities or online clinics by Wendy Stevens, a pianist/composer whose sessions focus on pedagogy and business practices.

Two-thirds of the participants found their professional development to be adequate, while the two who did not, gave specific recommendations as to what they feel is lacking. “I want to hear SPECIFICS of what works”, wrote Teacher 4, who attends conference and summer pedagogy institutes, and reads research and journals about piano teaching. Teacher 2 mentioned frustrations about “actually finding an affordable course online/convenient to schedule…about ADHD and what best methods to use or create in your studio.

**Barriers**

When addressing the barriers faced by teachers of students with disabilities, five of the elements mentioned in responses could be perceived as being teacher-caused, or associated with the teacher. The one barrier not related to the teacher was the parents (Teacher 5) and their “unrealistic expectations” (Teacher 3). Those related to the teacher
included: “Lack of awareness of how this disability affects all aspects of a person’s life, not just issues with sitting still and focusing.” (Teacher 1); “Their lack of knowledge about the disability, the misconception that it takes patience to teach a student with ADHD, and the misconception that students with ADHD cannot work at the piano for more than ten minutes without constant change in activities.” (Teacher 6); “Time management, understanding their needs.” (Teacher 2); “Having a conducive environment for teaching (few distractions/safe space).” (Teacher 3); and “My student with ADHD he loves technology. So, I use a lot of games with him as well as all of my other students on IPAD and on my big screen TV. Maybe some teachers are not tech-savvy.” (Teacher 4).

These responses demonstrate the pervasive effects of ADHD.

When asked how these barriers could be overcome, the participants offered suggestions that often focused on either a student’s parents or teacher. “Parents need to be educated about expectations,” wrote Teacher 5, with Teacher 3 in agreement. Teacher 4 stated that the parents need to see that a teacher’s strategies work. But teachers also need to be educated through “research and education” (Teacher 6), or “getting information by way of article, book, or online course” (Teacher 2). Perhaps Teacher 1 explained it best. Teachers need, “Education about the disability. The willingness to take the time to learn more and then spend more time learning how people with ADHD are taught – what works, what doesn’t. And then applying it to piano lessons.”
Chapter 5: Discussion

Participant Responses

Study Limitations

While the descriptions offered by this small group of teachers offers some valuable insights for current and future teachers, we can draw limited conclusions or generalizations from the descriptive data they provide. The results of this study must be viewed in relation to several limitations. First, a low number of participants, which was likely caused by multiple factors. To start with, the cost was prohibitive because some professional organizations (AMTA, MTNA) required large amounts of money to email the study link to their members. This was an unanticipated expense that could not feasibly be covered. Second, some professional organizations (Suzuki, NAfME, Guild, and Federation) did not provide membership lists. To bypass the costs associated with purchasing membership lists from the national office, emails were sent to the presidents of state affiliates of MTNA, with the request that they be forwarded to state membership. It is unknown how many of those emails were forwarded. The Royal Conservatory Music Development Program had membership searches available on its website. Music Schools associated with this group were contacted and asked to forward the survey link to their piano teachers. Some did. The researcher also personally contacted teachers he knew could participate in the study and invited them to complete the questionnaire. Finally, a
post inviting teachers to participate was posted on the Facebook page Piano Teachers for Special Needs. The response rate was disappointing.

Some design factors also limited the ways in which results can be interpreted. This questionnaire relied on each respondent’s interpretation in answering certain questions that were not operationalized in definitions (ie: percentage of assignment completed or accurate, etc.). The researcher also trusted the teachers’ knowledge of students’ ADHD diagnoses were correct, rather than requiring medical verification. This study utilized a questionnaire instead of observations to obtain data, so responses could be skewed based on teacher perceptions. Lastly, data may not necessarily be applicable to others because a randomized sample was not utilized since there was not a known population of potential participants.

The results of this study presented several interesting findings about teaching piano students with ADHD, including information on how ADHD might impact students’ piano study, as well as the potential strengths and weaknesses of teacher training and professional development. Overall, it appears that there is no single way to teach students with disabilities. ADHD is exhibited in a spectrum of ways among different people, and even in the same person over time. Teachers need to be ready with a variety of teaching tools. Participants responding to this questionnaire emphasized the importance of teacher training, professional development, and experience.

Training, Education, and Experience

Teachers in this study felt training, education, and experience helped to remove insecurities about teaching students with disabilities. This is in line with previous research on teaching students with disabilities (Hourigan 2009; Martiros & Hanley-
Maxwell, 2013; VanWeelden & Whipple, 2005). Even though responses varied among participants, some consistencies could be viewed as important to teacher training. First, experience. The importance of experience in preparing piano teachers to teach students with disabilities cannot be understated. According to the teachers’ responses, professional development and teacher training do not always provide every answer; there is much to be learned through experience. Five of the six participants agreed that their prior experience was crucial to their success.

Second, being able to focus on the individuals was viewed as important: learning how to relate to students individually, including modifying instruction; knowing how their disability affects learning, and teaching to their strengths; understanding childhood development and what is appropriate at each age; and designing lesson plans and curriculum. Third, training does not give teachers every skill they need. Several teachers mentioned additional skills they desired, including business knowledge, parental interaction solutions, and a better understanding of what is best for teaching students with ADHD. While every teacher training program designs a curriculum they feel is best, it is feasible to suggest that no program will cover every skill necessary for teacher success. Teachers’ responses also varied based on their type of training and whether or not that focused on teaching students with disabilities. Although one teacher had no formal music degree, their experiences in teaching students with ADHD seemed to align closely to the other teachers in the study.

A common suggestion was an increased amount of field experience, including teaching observations and discussion/feedback. Additionally, teachers recommended that getting to know people with disabilities, understanding the differences between
disabilities and how they affect learning, and gaining exposure to teaching students with disabilities could be beneficial, much like previous research has found (Darrow, 2009; Melago, 2014). Field experience is important enough that education majors are required to student-teach as part of their training to be certified as school teachers, yet no certification requirement like this exists for piano teaching programs. Could that be why teachers desire more field experience during their training? If field experience activities such as supervised teaching and observations are necessary for teachers of school subjects, should they also be required of piano teachers? One can certainly see the potential benefits, especially when teaching students with disabilities. Additionally, many school-teachers are required to certify and pass tests as part of becoming a teacher, thus ensuring that a standard of quality is maintained. The difficulty in all of this lies in the difference between training independent music teachers and licensed school teachers. Licensed teachers are regulated and training is standardized. The same cannot be said for independent music teachers. Because it takes time and training to get experience teaching those with disabilities, independent music teachers often rely on professional development opportunities such as courses, conferences, and symposiums.

These findings suggest that there is a need for greater access to training and information through other, more flexible, formats and venues. The questionnaire did not as teachers if they exchanged information through groups on social media, nor did they suggest alternative modes for delivery of training and information. Perhaps professional development conferences, in piano especially, would benefit from training that is more applicable to teachers’ situations, which is difficult due to the diversity of their teaching situations.
It may, however, be possible to offer new types of training, training on topics that have not been presented before, or training of a higher quality. A cursory search showed national conferences for Music Teachers National Association (MTNA) and The National Center for Keyboard Pedagogy (NCKP), two large piano teacher organizations, recently had or will have sessions on these topics involving students with special needs: teaching creativity, inclusion, dyslexia, hearing loss, developing music programs for this population, using technology, and behavior. Additionally, in 2013, MTNA devoted an entire Saturday to various types of disabilities at their national conference. Topics covered included developmental disabilities, Autism, Down Syndrome, general disabilities, and Dyslexia, but not ADHD. The Collegiate Piano Pedagogy Symposium, part of MTNA, has also had presentations and posters on teaching students with disabilities.

Yet, in all of this, the focus has mainly been presenting information, and has lacked teaching demonstrations. Naturally, live teaching demonstrations are difficult to coordinate or control, especially when disabilities are involved. But videos of teaching examples could be equally effective in these situations. In the opinions of the participants, current professional development activities are mostly sufficient, but it depends on who you ask. Differences in training, teaching situations, and other variables likely caused this answer to not be definitive. However, it is a question worth constant reconsideration.

It gives the impression that, to these teachers, keeping up to date on research findings is extremely important. Perhaps this is to remain informed about interventions, disabilities, and other aspects that could help them in teaching students with ADHD. It
should also be noted that, based on their degrees, several of the teachers are in professional positions that likely require, for certification purposes, or strongly urge attending workshops and staying informed of new research findings (teachers, music therapist, etc.), which could be another explanation as to why they utilize research and workshops so heavily. As far as could be known, teachers 2 and 4 did not have degrees in special education, music therapy, or music education, so their frustration with professional development conferences may not only be understandably justified, but also speak to the training they received in their degrees. It could also speak to the type of professional development workshops they have attended. For instance, teachers 1, 3, and 6 had degrees in music therapy, music education, or special education and regularly work with students who have disabilities. It is conceivable the workshops they have attended were applicable to their work more so than a piano conference, and that their training transferred over into their piano teaching. There is potential with using emerging platforms and internet resources for informal and formal training purposes, including blogs, social media groups, and videos.

**Behaviors Perceived and Impact**

It appears that ADHD has impacted the experience of piano students, as seen in teacher comments about at-home practicing and behaviors in lessons, completion and accuracy rates, number and types of strategies used, and comments made about barriers that students may face while studying. Specifically, these behaviors seemed to manifest themselves similarly to what might be seen in an academic classroom setting, showing that these behaviors have also occurred in private piano study. These behaviors included difficulty maintaining attention during the lesson and with assignments away from
lessons, including all skills associated with maintaining attention, planning, organization, perseverance and persistence, error recognition and correction, etc., all of which are executive functions, the impairments of which are central to ADHD. These teacher-reported issues verified what has been seen in other research involving music students with ADHD, and suggested they were not limited to non-private settings (Darrow, 2007, 2008; Melago, 2014).

**Strategies and Interventions**

At first glance, it appears that the three teachers with special education/therapy training (Teachers 1, 3, 6) used interventions more efficiently than the other participants. This could be due to training, experience, or that interventions were second nature to them since they used them so frequently. It seems that many of the strategies that worked in academic classroom settings were also necessary, and even effective, in private piano lesson settings.

The interventions utilized by teachers in this study have all been recommended in other literature focused on non-private music or academic settings. Those mentioned in music-based literature included training in specific skills (Beaumont, 2011; Hayghe, 2009; Jutras, 2009), allowing student choices (Bell, 2008; Darrow, 2006), parental communication through report cards (Melago, 2014), and several others. Several other interventions were used by most or all of the teachers. These included cueing/refocusing, giving complete and thorough directions, monitoring understanding, giving shorter tasks, rewards, and giving praise.

Most teachers had difficulty implementing strategies and accommodations outside of lessons, but found success during their lessons. Many students had difficulty
completing assignments outside of lessons. In ADHD, a student’s ability to break a task into manageable parts and complete it is impaired by executive function deficits. Additionally, when practicing, students had to maintain focus for extended periods of time and implement good practice strategies (Duke et al., 2009; Duke et al., 2011). For these students, practicing outside of lessons was a challenge magnified by this deficit. Teachers also mentioned the importance of maintaining an environment free of distractions (Darrow, 2007, 2008; Melago, 2014).

Also worthy to note, two of the three accommodations used by all six teachers (cueing/refocusing, monitoring understanding, and giving praise) were designed to help students pay better attention and stay on task. With several comments written about ADHD involving more than just poor attention, it was interesting that the teachers consistently focused on interventions that would help students stay focused both in and out of lessons. Perhaps this was because several difficulties associated with ADHD revolved around attention in some way: inattentiveness, hyperactivity, poor planning, inability to finish a task, forgetting the correct materials, etc. This appears to be indicative of certain traits of ADHD being demonstrated consistently across settings and more likely to be demonstrated among students regardless of age or diagnosis.

Darrow (2006) encouraged the use of desirable activities when working with students with disabilities. It seems that a teacher’s willingness to use repertoire that students liked, including non-classical repertoire, was necessary when working with students who have ADHD. For this question, teachers responded with names of genres and artists, and some of them made specific arrangements of those songs for their students. The impression was given that familiarity played a role in what pieces or genres
students enjoyed. Students enjoyed playing pieces they were familiar with. For example, even though some students do not enjoy classical music, many enjoyed playing *Fur Elise*, perhaps because they were familiar with it. Likewise, teachers’ responses suggested the same for piano students with ADHD; they enjoyed playing pieces with which they were familiar.

**Other Factors**

Multiple factors seemed to work together to contribute to the overall success of students in this study. The necessity of ongoing teacher training and experience was evident. The teachers all had positive opinions about including students with disabilities in their studios. Each participant implemented interventions as deemed necessary, including taking time to find pieces the students enjoyed. And, they personally knew how to work with the individual needs of each student. To extract one variable and claim it worked better than the others would be impossible. In sum, these consistencies between participants gave the impression that all are part of the best practices these teachers used in their teaching, and that they contributed to our understanding of successfully teaching piano students with ADHD.

**Future Research**

Numerous paths could be pursued in furthering research on teaching students with ADHD: teachers’ options of professional development options; why teachers choose specific training; researching the use of each intervention on an individual basis; the list could go on. Perhaps the most immediate need would be for a case study that examines this topic from the students’ view: an in-depth case study where students are observed in multiple environments (i.e., at home, in lessons, and at school) to observe what and how
interventions are implemented and the effectiveness of said interventions. Information that is drawn from observations as well as interviews would allow researchers to more completely understand how to best teach piano students with ADHD.
References


Arehart-Treichel J. (2006). Gene testing could help predict drug response. Available at: http://pn.psychiatryonline.org/cgi/content/full/40/10/33


Effective instructional strategies for exceptional children (pp. 319-334). Denver, CO: Love.


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. doi: 10.1375/ajse.33.1.72


Appendix A: ADHD Diagnostic Criteria from DSM-5

A. A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by (1) and/or (2):

   1. **Inattention:** Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

      - **Note:** The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.

      a. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate).

      b. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate).

      c. Often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).

      d. Often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).
e. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., starts tasks but quickly loses focus and is easily sidetracked).

f. Often has difficulty organizing tasks and activities (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines).

g. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers).

h. Often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).

i. Is often easily distracted by extraneous stimuli (for older adolescents and adults, may include unrelated thoughts).

j. Is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).

Hyperactivity and impulsivity: Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

- Note: The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or a failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.
a. Often fidgets with or taps hands or feet or squirms in seat.

b. Often leaves seat in situations when remaining seated is expected (e.g., leaves his or her place in the classroom, in the office or other workplace, or in other situations that require remaining in place).

c. Often runs about or climbs in situations where it is inappropriate. (Note: In adolescents or adults, may be limited to feeling restless.)

d. Often unable to play or engage in leisure activities quietly.

e. Is often “on the go,” acting as if “driven by a motor” (e.g., is unable to be or uncomfortable being still for extended time, as in restaurants, meetings; may be experienced by others as being restless or difficult to keep up with).

f. Often talks excessively.

g. Often blurts out an answer before a question has been completed (e.g., completes people’s sentences; cannot wait for turn in conversation).

h. Often has difficulty waiting his or her turn (e.g., while waiting in line).

i. Often interrupts or intrudes on others (e.g., butts into conversations, games, or activities; may start using other people’s things without asking or receiving permission; for adolescents and adults, may intrude into or take over what others are doing).

Several inattentive or hyperactive-impulsive symptoms were present prior to age 12 years.

Several inattentive or hyperactive-impulsive symptoms are present in two or more settings (e.g., at home, school, or work; with friends or relatives; in other activities).
There is clear evidence that the symptoms interfere with, or reduce the quality of, social, academic, or occupational functioning.

The symptoms do not occur exclusively during the course of schizophrenia or another psychotic disorder and are not better explained by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder, personality disorder, substance intoxication or withdrawal) (APA, 2013, p. 59-60).
Appendix B: Website Recruitment Posting

Website posting - for posting on Facebook groups for piano teachers and piano teachers of students with special needs. One of the researchers, Bill Mullins, is a member of these groups.

I am doing my doctoral research on piano students with ADHD. It is hoped that this research will help us better understand what experiences students with ADHD have during their piano study, best practices for teaching students with ADHD, and how to improve teacher training and/or professional development to better support teachers of special learners. I am looking for teachers who teach piano students with ADHD to complete a questionnaire about their experiences in teaching these students. Specifically, I am recruiting in the Mid-Atlantic region (West Virginia, Maryland, Washington DC, Virginia, Delaware, Pennsylvania, New Jersey, or New York). If you live in one of these states, teach at least one student with ADHD, and are willing to participate, please contact me and I will email you a link to the survey. Thank you for your help. I can be contacted at mullins.335@osu.edu or (405) 532-3848.
Appendix C: Recruitment Email

Recruitment email to be sent to piano teachers

Subject line: Survey about teaching piano students with ADHD

Dear Fellow Piano Teacher,

By way of introduction, my name is Bill Mullins and I am a doctoral student at The Ohio State University. As part of my dissertation research, I am looking for volunteer participants who are willing to complete a questionnaire examining the experiences of piano students with ADHD.

As part of this study, researchers will seek to better understand the experiences of teachers and their students with ADHD as they study piano. It is hoped that this research will increase our understanding of how to better teach piano students with ADHD by understanding their experiences in piano study, including lessons and practice sessions. It is also hoped that this research will shed light on appropriate practices for teacher training and professional development as they relate to teaching students with disabilities.

If you are willing to complete this questionnaire, your participation would be greatly appreciated. You may complete the questionnaire online at (web link to be inserted). If you have further questions or would like to participate in this study, you can contact:
Bill Mullins

mullins.335@osu.edu

(405) 532-3848

Sincerely,

William Mullins, M.M.Ed.
Appendix D: Original The Ohio State University Consent to Participate in Research

Study Title: An Investigation of the Existence and Effects of Executive Function Deficits in Private Piano Study for Students with Attention Deficit Hyperactivity Disorder.

Researcher: Bill Mullins and Dr. Kenneth Williams

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary. Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. The purpose of this study is to better understand what effects ADHD has on piano study. We want to learn more about the experiences of piano students with ADHD and their teachers’ experiences teaching them.

If you participate in this study, you will be asked to complete a questionnaire about your piano students, your background and training, and your experiences teaching students with ADHD. Your participation in the study should take between 10-15 minutes of your time.

You may stop taking the questionnaire at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:

There are no known risks from participating in this study. It is hoped that what we learn from the study may help piano students with ADHD and their teachers in the future.

Confidentiality:

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.
We will work to make sure that no one sees your survey responses without approval. But, because we are using the Internet, there is a chance that someone could access your online responses without permission. In some cases, this information could be used to identify you.

**Incentives:**
Compensation will not be provided for participating in this study.

**Participant Rights:**
If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

**Contacts and Questions:**
For questions, concerns, or complaints about the study, or you feel you have been harmed as a result of study participation, you may contact:

**Bill Mullins**
(405) 532-3848
mullins.335@osu.edu

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

By clicking to begin the survey, you consent to participating in this study.
Appendix E: Consent Form Used For the Online Survey

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Your participation is voluntary. Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate.

The purpose of this study is to better understand what effects ADHD has on piano study. We want to learn more about the experiences of piano students with ADHD and their teachers’ experiences teaching them. If you participate in this study, you will be asked to complete a questionnaire about your piano students, your background and training, and your experiences teaching students with ADHD. Your participation in the study should take between 10-15 minutes of your time. You may stop taking the questionnaire at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits: There are no known risks from participating in this study. It is hoped that what we learn from the study may help piano students with ADHD and their teachers in the future.

Confidentiality: Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be
released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

We will work to make sure that no one sees your survey responses without approval. But, because we are using the Internet, there is a chance that someone could access your online responses without permission. In some cases, this information could be used to identify you.

Incentives: Compensation will not be provided for participating in this study.

Participant Rights: If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions: For questions, concerns, or complaints about the study, or if you feel you have been harmed as a result of study participation, you may contact: Bill Mullins (405) 532-3848, mullins.335@osu.edu.
For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

By clicking to begin the survey, you consent to participating in this study.
Appendix F: Online Teacher Survey

Demographic Information

1. What is your zip code?

2. What is your gender?

3. To which professional organizations do you belong? (check all that apply):

   Music Teachers National Association (MTNA)
   Royal Conservatory (Music Development Program)
   National Guild of Piano Teachers (Piano Guild)
   National Federation of Music Clubs
   Suzuki Association of the Americas
   National Association for Music Education (NAfME)
   American Music Therapy Association
   Other__________

4. For how many years have you taught piano lessons?

5. How many piano students (with and without disabilities) do you currently teach?

6. What is your opinion about including students with ADHD in your piano studio?

7. How many of your current piano students have ADHD?

8. What ages are your students with ADHD?

9. Do you teach any students with other disabilities?
10. According to your understanding, which disabilities do your students have: Please indicate a number for each type of disability.

   Autism Spectrum Disorder
   Learning Disability
   Multiple Disabilities (please specify which)
   Physical disabilities (loss of digits or limb, physical impairments, physical limitations, blindness, deafness)
   Intellectual Disability (Downs Syndrome)
   Other (please specify)

**Teacher Training Information**

1. What is your highest degree obtained?

2. What were your field(s) of study? Check all that apply:

   General Music
   Music Performance
   Music Education
   Music Pedagogy
   Music Therapy
   Special Education
   Other (Musically Oriented Degree)
   Other (Non-musically Oriented Degree)

3. What certifications do you hold? *(examples could include: Suzuki (indicate levels), NCTM, Royal Conservatory teacher (indicate levels), Piano Guild Teacher Certification, Musikgarten, Kindermusik, others, none, etc.)*
4. What training or experiences do you feel have prepared you for teaching piano students with disabilities?

5. In your teaching, what aspects of teaching piano to special learners had to be learned through experience?

6. What skills/training from your schooling do you find most applicable to teaching your students?

7. What skills/training do you wish you had received during your schooling?

8. How do you think piano teacher training can be improved to better prepare teachers to instruct special learners?

9. What professional development activities do you utilize? Check all that apply:
   - None
   - Local professional chapter meetings
   - Regional/National/International conferences (MTNA, NCKP, NAfME, etc.)
   - Workshops
   - Summer pedagogy institutes/courses
   - Training sessions (Suzuki, Royal Conservatory, etc.)
   - College Courses/Massive Open Online Courses (MOOCs)
   - Reading research studies/findings
   - Reading journals about piano teaching (Keyboard Companion, Clavier, American Music Teacher, etc.)
   - Other

10. Do these professional development activities adequately address your needs in teaching special learners?
11. If not, what do you think could be improved?

12. In your opinion, what barriers do the teachers of students with ADHD face?

13. In your opinion, how can those barriers be overcome?

**Teaching Information**

1. On average, how long do students with ADHD study piano with you?

2. Have you previously taught any students with ADHD who are no longer studying piano with you?

3. For what reason(s) were the lessons were discontinued?

4a. In which settings do you teach your student(s) (*students with and without disabilities*)? Check all that apply:
   - Individual/Private lesson
   - Semi-private lesson (2-3 students)
   - Group class (6 or more students)
   - On the internet (on a regular basis)

4b. If you teach lessons on the internet, do any of your “online” piano students have disabilities?

5. How long is each piano lesson?

6. How long have you been teaching students with ADHD or other disabilities?

7. How did you start teaching students with disabilities?

8. How did you learn to teach students with disabilities? Check all that apply:
   - Observing other teachers
   - Formal training/education
Self-education

Trial and error

Consulting with other piano teachers

Consulting with professionals (i.e. psychologists, teachers, special educators, speech pathologists, etc.?)

Professional development (conference/professional meetings, college course/Massive Open Online Course (MOOC), summer pedagogy institute, other.)

9. On a scale of 1-5, please indicate how important each of the following elements are to the success of your piano students with ADHD: (1 = Does not contribute to student success; 2 = contributes somewhat to student success; 3 = contributes moderately to their success; 4 = is important for student success; 5 = is absolutely essential for student success)

   Developing their technique

   Repertoire selection

   Making music away from the piano

   Using interventions to help with behaviors, attention, etc.

   Opportunities for students to perform

   Group activities with other students

   Technology (apps, computer games, etc.)

   Other (please specify)
10. What music reading approach do you find most effective for students with ADHD? 
(Answers could include rote, middle C approach, intervallic approach, mnemonic devices, a combination of these, or other)

11. Which, if any, of the following strategies or accommodations do you use to help your student(s) in lessons or to complete assignments at home? Please check all that apply.

1. Cueing or re-focusing their attention.

2. Training them in specific skills or strategies, such as how to practice or monitor the accuracy of their playing.


4. Computer-assisted instruction (including computer/tablet/phone apps, games, etc.).

5. Peer tutoring/instruction.


7. Monitoring understanding through asking questions or having the student demonstrate their understanding of a skill.


10. Mnemonic Devices (Ex: All Cows Eat Grass for bass clef space names).

11. Having the student monitor their on-task behaviors or assignment progress.
12. Materials that allow students to grade their own work.

13. Reinforcing behaviors with a reward.


15. Time-out for undesired behaviors.

16. Allowing students to make choices about which pieces they play.

17. Taking short breaks during the lesson.

18. Giving praise for good behaviors.

19. None

12. How did you learn about these strategies or accommodations?

13. What, if any, impacts do you perceive the strategies/accommodations have on your student(s) during lessons?

14. What, if any, impacts do you perceive the strategies/accommodations have on your student(s) while practicing at home?

**Student Information**

1. In your opinion, what barrier(s) to piano study do student(s) with ADHD face?

2. In your opinion, how can those barrier(s) be overcome?
3. On a scale of 1-5, how much do you think your student(s) with ADHD enjoy playing the piano for fun? (1 = Dislikes it very much. 2 = Dislikes it somewhat. 3 = neutral (neither hates nor likes). 4 = Likes it somewhat. 5 = Likes it very much)

4. On a scale of 1-5, how much do you think your student(s) with ADHD enjoy taking piano lessons? (1 = Dislikes it very much. 2 = Dislikes it somewhat. 3 = neutral (neither hates nor likes). 4 = Likes it somewhat. 5 = Likes it very much)

5. In general, what styles of music/composers do your student(s) with ADHD enjoy playing the most?

6a. Do your student(s) participate in any piano festivals or competitions?

6b. If so, which festivals or competitions?

7. Based on your perceptions and understanding, how are the parents of your student(s) involved with at-home practicing? (Answers could include but are not limited to giving reminders, helping organize practice sessions, listening to practicing, giving feedback, practicing with student, etc.)

8. On average, what percentage of the assignment do your student(s) complete each week?

- 0-25%
- 26-50%
- 51-75%
- 75-100%
9. On average, how accurately do your student(s) complete their assignments?

0-25%

26-50%

51-75%

76-100%.

10. What, if any, difficulties do your student(s) have focusing/paying attention during lessons?

*Please enter your email address if you would like to be contacted with the results of this study.

*Please enter your email address if you would like information on joining a nationwide database of piano teachers of students with disabilities/special needs.
Appendix G: Perceptions on Teacher Training
<table>
<thead>
<tr>
<th>Question</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What skills/training from your schooling do you find most applicable to teaching your students?</strong></td>
<td>It was all applicable (the MA in Sp. Ed.). The music education – most has to be modified for my students.</td>
<td>How to relate to students on an individual basis and their interests.</td>
<td>Understanding of childhood development.</td>
<td>“There is music in every child” Frances Clark. Thoroughness, persistence, teaching to their strengths.</td>
<td>Curriculum, lesson planning.</td>
<td>Knowing what the disabilities are beyond the stereotypes. Understanding how each disability affects learning. Knowing how to develop learning programs for exceptional learners.</td>
</tr>
<tr>
<td><strong>What skills/training do you wish you had received during your schooling?</strong></td>
<td>I was fortunate to have received a lot of training. If I had not taught in the school system, then I would have volunteered to get experience. I think all music teachers who want to work with children with disabilities need to spend a lot of time in some volunteer capacity and need some education before teaching children with exceptionalities.</td>
<td>Knowledge of what best fits to ADHD students.</td>
<td>Business skills.</td>
<td>Honestly, I think I had wonderful training. I was honored to study with Frances Clark and Louise Goss. No regrets!</td>
<td>How to deal with unrealistic parents.</td>
<td>-blank-</td>
</tr>
</tbody>
</table>

Table 13. *Participants' Perceptions on Teacher Training*
| **How do you think piano teacher training can be improved to better prepare teachers to instruct special learners?** | **Time spent outside of the lesson room with people who have the disability the teacher is intending to teach. Knowing one kid with ADHD does not prepare anyone adequately to teach them appropriately.** | **Online courses and knowledge of what best method book is out there.** | **Live and videotaped observation and discussion.** | **Great question! I did a presentation on this recently. I find that off-staff notation is not concrete enough for many students with special learning needs: use landmarks to start. I think that a teacher needs a bag of tricks and determination because more often than not, what you are doing will not work. Know your students’ diagnosis: A student with Down’s is VERY different than a student with Autism. I find that using a drum or bells is a great way to just have fun with music when the piano is getting frustrating!** | **More field experience.** | **They need to take courses in special education – learn about the disabilities and learn how to teach students with disabilities.** |