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Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education

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the Faculty of the School of Music

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by

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Abstract

There are still limited studies in music education with published documentation for autism, despite growth over the last ten years in educational research on autism spectrum disorder (ASD). Teachers have received limited preparation and training for students with special needs, including those with autism. Many teachers ask which specific teaching strategies produce positive learning outcomes in instrumental music that align with the curriculum's educational goals, standards, and objectives for students with ASD. The qualitative instrumental case study documents educational outcomes resulting from intervention strategies for students with autism spectrum disorder (ASD) in music classrooms through video modeling and computer-assisted learning. The study includes students with ASD in a focus group format. The study compares musical reading abilities in ASD using a pre-assessment followed by a post-test, with intervention strategies implemented during the post-test. The intervention goal is the ASD student's demonstrable improvement in note and rhythm accuracy. The intervention employed evidence-based strategies to improve educational outcomes in music instruction for students with ASD. The post-test results will demonstrate the intervention’s efficacy in improving instructional effectiveness, learning rhythm, and note accuracy for students with ASD. The zygonic theory is applied to the sound-of-intent content in music engagement. The study’s implications make music accessible, inclusive, and equitable among students with ASD. The analysis enables future research on interventions and modifications to music education for ASD.

Keywords: autism, music education, interventions, developmental delays, executive function.

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Over the past three years, this academic journey has provided invaluable knowledge, contributing to both my personal and professional growth. Although this has been the most challenging document I have ever written, I hope that the knowledge and experiences gained through this journey will encourage continued professional growth among music educators and inspire them to support, include, and provide meaningful musical experiences for every student. Fostering an environment where every student is valued, supported, and given the opportunity to flourish, while finding a sense of belonging.

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For Ashton and Emilia

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Abbreviations

ABA	Applied Behavior Analysis
ABC	Antecedent, Behavior, and Consequence Chart
ADA:	The Americans with Disabilities Act
ADDM	Autism and Developmental Disabilities Monitoring
ADHD	Attention Deficit Hyperactivity Disorder
ADI – R	Autism Diagnosis Interview – Revised
ADOS	Autism Diagnostic Observation Schedule
ADOS-G	Autism Diagnostic Observation Schedule - Generic
AIMS	Achieving Independence and Mastery in Schools
APA	American Psychiatric Association
ARD	The Admission Reviews and Dismissal Committee
ASD	Autism Spectrum Disorder
AYP	Annual Yearly Progress
BC	Backward Chaining
BIP	Behavior Intervention Plan
BX	Behavior
CAI	Computer-Assisted Instruction
CDC	Centers for Disease Control and Prevention
CARES	The Autism Collaboration, Accountability, Research, Education, and Support Act
CARS	Childhood Autism Rating Scale
CRE	Culturally Responsive Education
DSE	Disability Studies in Education

DSM-III	Diagnostic and Statistical Manual of Mental Disorders, 3rd Edition
DSM-4	Diagnostic and Statistical Manual of Mental Disorders, 4th Edition
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, 5th Edition
DTT	Discrete Trial Training
EAS	Educational Assistants
EBI	Evidence-Based Interventions
EBP	Evidence-Based Practices
EF	Executive Function
EI	Explicit Instruction
ESEA	Elementary and Secondary Education Act of 1965 (Educational Reform Act)
ESSA	Every Student Succeeds Act of 2015 (Educational Reform Act)
EXT	Extinction
FAPE	Free Appropriate Public Education
FA	Functional Analysis
FBA	Functional Behavior Assessment
FC	Forward Chaining
FCMT	Family-Centered Music Therapy
GAR-S	Gilliam Autism Rating Scale, 2nd Edition
GP	Gesture Prompt
ICD-10	International Classification of Diseases, 10th Edition
IDD	Intellectual and Developmental Disabilities
IDEA	Individuals with Disabilities Education Act (Educational Reform Act)
IEP	Individualized Education Program

IMT	Improvised Music Therapy
IQ	Intelligence Quotient
JA	Joint Attention
LRE	Least Restricted Environment
MCA	Model Cornerstone Assessment
MI	Music-Based Interventions
MP	Model Prompt
MT	Music Therapy
MTSS	Multi-Tiered System of Supports
NAfME	National Association for Music Education
NCLB:	The No Child Left Behind Act of 2001 (Education Reform Act)
NCSE	National Council of Special Education, Ireland
NET	Natural Environment Teaching
NPDC	National Professional Development Control
OCD	Obsessive Compulsive Disorder
PECS	Picture Exchange Systems
PLOP	Present Levels of Performance
PMLD	Profound and Multiple Learning Difficulties
PP	Physical Prompt
PRT	Pivotal Response Training
RJA	Responding to Joint Attention
RRB	Restricted, Repetitive Behaviors
SBI	Schema-Based Instruction

SLD	Severe Learning Difficulties
SR+	Positive Reinforcement
SR-	Negative Reinforcement
TCDD	The Texas Council for Developmental Disabilities
TD	Typically Developing
TEACCH	Treatment and Education of Autistic and Related Communication – Handicapped Children
ToM	Theory of Mind
UDL	Universal Design for Learning
VP	Verbal Prompt
XR	Extended Reality

Chapter One: Introduction

Background

Autism Spectrum Disorder (ASD) appears in children as a neurological and developmental condition that influences interaction with others, altering their communication skills, producing difficulties in learning behavior, and adversely affecting emotions and behaviors. According to the American Psychiatric Association (APA), "Autism Spectrum Disorder is characterized by persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships."[1] Individuals diagnosed with ASD may demonstrate restricted or repetitive patterns of behavior, highly focused interests, differences in sensory processing, varying levels of language and communication abilities, preferences for predictable routines, and challenges with social interaction. These characteristics may influence how students respond to teacher directions, transition between activities, engage with peers, and participate in classroom instruction. When these characteristics interact with instructional demands or environmental expectations, they may create barriers to learning and participation. Understanding the defining characteristics provides a foundation for examining how ASD influences learning, highlighting the need for instructional approaches that address diverse educational needs.

Educators with ASD students need solid educational support systems in place to instruct them. According to Erika Knapp, Assistant Professor of Music Education at Texas Women's University, "teachers expressed challenges related to planning and implementing instruction,

[1] *American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders,* 5th ed. (Arlington, VA: American Psychiatric Association, 2013), 32.

including uncertainty about musical planning, how to set goals with measured growth, and addressing varied special education needs within the same class."[2] Amanda Draper, Assistant Professor of Music Education at Indiana University states that "it is widely accepted that music instruction is beneficial for children with disabilities, and much scholarly attention has been paid to increasing teachers' preparedness about working with this population."[3] The empirical evidence for interventions for students with ASD comes from general education courses and is applied to music classes, rather than from music education itself. Chapter One discusses the background, theoretical framework, the problem, the purpose, the significance of the study, and the constraints on the core concepts.

Statement of the Problem

According to the Autism and Developmental Disabilities Monitoring (ADDM) network, a collaborative program funded by the Centers for Disease Control and Prevention (CDC), "The overall ASD prevalence per 1,000 children aged eight years was 27.6 (1 in 36)" in 2020.[4] Compared to a rate of one in 150 having autism in 1994. According to the most recent information, 32.2 (1 in 31) of students are diagnosed with ASD; see Table 1 below. The growth in diagnosed ASD cases is alarming, increasing by 384% since 2000. The substantial increase in identification and prevalence of ASD among school-aged children highlights the growing need for effective educational interventions and inclusive instructional practices.

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[2] Erika J. Knapp, "Teaching Students with Disabilities in Self-Contained and Mainstreamed Elementary Music Settings: A Collective Case Study" (paper presented at the Texas Music Educators Association Conference, San Antonio, TX, February 9, 2020).

[3] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, 2020), 16, ProQuest Dissertations & Theses.

[4] Matthew Maenner et al., "Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years—Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2020," *MMWR Surveillance Summaries* 72, no. 2 (March 24, 2023): 1, https://pubmed.ncbi.nlm.nih.gov/36952288/.

Table 1. Identified ASD Prevalence

Surveillance Year	Birth Year	ADDM Sites	Prevalence per 1,000 Children	Ratio
2022	2014	16	32.2 (9.7-53.1)	1 in 31
2020	2012	11	27.6 (23.1-44.9)	1 in 36
2018	2010	11	23.0 (16.5-38.9)	1 in 44
2016	2008	11	18.5 (18.0-19.1)	1 in 54
2014	2006	11	16.8 (13.1-29.3)	1 in 59
2012	2004	11	14.5 (8.2-24.6)	1 in 69
2010	2002	11	14.7 (5.7-21.9)	1 in 68
2008	2000	14	11.3 (4.8-21.2)	1 in 88
2006	1998	11	9.0 (4.2-12.1)	1 in 110
2004	1996	8	8.0 (4.6-9.8)	1 in 125
2002	1994	14	6.6 (3.3-10.6)	1 in 150
2000	1992	6	6.7 (4.5-9.9)	1 in 150

Source: Centers for Disease Control and Prevention, "Data and Statistics on Autism Spectrum Disorder," (CDC, 2025). https://www.cdc.gov/autism/data-research/index.html.

Music educators will, as a result, have more students with ASD in their classrooms. They will need to develop practical educational solutions through pedagogical interventions to adapt instruction to legal requirements. There is an evident lack of documented cases of the use of intervention strategies in instrumental music. Brianna Applewhite, a researcher affiliated with King's College of London, along with her colleagues in a systematic review of existing studies, notes the following:

> Among the identified and screened articles, 81 out of 621 qualified as scientific studies involving 43,353 participants. These studies investigated the peculiarities of music perception in people with ASD and the effects of music and MT [Music Therapy] in this patient group. Most of the music-based interventions were beneficial in improving social, emotional, and behavioral problems.[5]

The literature typically discusses the positive effects of music therapy on social, emotional, and behavioral outcomes.

These studies generally measured perception in ASD students, advocating for music for the treatment of ASD symptoms. Music therapy has documented cases of improvement in behaviors in the treatment of ASD. These studies provide evidence through exploration and

[5] Briana Applewhite et al., "A Systematic Review of Scientific Studies on the Effects of Music in People with or at Risk for Autism Spectrum Disorder," *International Journal of Environmental Research and Public Health* 19, no. 9 (April 22, 2022): 5150, https://doi.org/10.3390/ijerph19095150.

discovery regarding the treatment of ASD. The discoveries improve the lives of students with ASD by helping them function within society's established norms.

There seem to be only a few researchers who examine the scope of ASD in Music Education. Draper is one of the few researchers who have investigated ASD in depth within the field of music education. She summarizes the contributions of others in music education and is showcased below:

> Due to the prevalence of this neurodevelopmental disorder, most educators will likely have students with autism in their classrooms. While the music classroom is often one of the first inclusion placements for students with disabilities,[6] preservice music teacher education programs may not adequately prepare teachers to work with this population adequately. [7] Scholars have contributed practitioner literature,[8] offering suggestions and strategies for teaching students with ASD. However, empirical evidence of what music educators actually do in practice is largely absent from the literature.[9] Furthermore, their book Music in Special Education suggests that the purpose of students with ASD and other diagnoses participating in music classes may be social or musical. However, there is a lack of research that illuminates the beliefs of critical stakeholders about this.[10]

Draper highlights Alice-Ann Darrow, Professor at Florida State University, and Mary Adamek, Professor at the University of Iowa, as adding to the difficulties of implementing inclusion practices within music education for students with ASD, due to the scope of the spectrum. The lack of knowledge to implement these inclusion practices is confirmed by Karen Salvador,

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[6] Alice-Ann Darrow and Mary Adamek, "Instructional Strategies for the Inclusive Music Classroom," *General Music Today* 31, no. 3 (April 2018): 61, https://research.ebsco.com/c/r3w5i4/viewer/pdf/ce44cbqzkv?route=details.

[7] Kimberly VanWeelden and Jennifer Whipple, "Music Educators' Perceived Effectiveness of Inclusion," *Journal of Research in Music Education* 62, no. 2 (July 2014): 158, http://www.jstor.org/stable/43900241.

[8] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 1–243.

[9] Karen Salvador, "Music Instruction for Elementary Students with Moderate to Severe Cognitive Impairments: A Case Study," *Research Studies in Music Education* 37, no. 2 (December 2015): 172, https://doi.org/10.1177/1321103X15613645.

[10] Amanda R. Draper, "Music Education for Students with Autism Spectrum Disorder in a Full-Inclusion Context," *Journal of Research in Music Education* 70, no. 2 (July 2022): 133.

Associate Professor of Music Education at Michigan State University, as noted by Draper. The findings show that only 29.6% of respondents (music teachers) were required by their institution to take a course on teaching special populations in educators' degree programs. As mentioned above, Salvador's study highlighted that music instructors felt uncomfortable teaching in inclusive settings and mainstreaming their students because they were inadequately prepared to instruct this population. Draper also notes a study by Kimberly VanWeelden, Professor of Music Education at Florida State University, and Jennifer Whipple, Professor of Music Therapy at Charleston Southern University, that compared teachers' perceptions of inclusion over twenty years, with results showing improved views on meeting students' needs. Regarding empirical evidence from music educators, VanWeelden and Whipple contend that the field experiences in music programs nationwide remain largely unknown due to the lack of research in the field. To expand on what was previously indicated above, Alice Hammel, Professor at James Madison University, and Ryan Hourigan, Professor at Ball State University, assist by providing literature grounded in practical teaching suggestions, classroom experiences, and best practices, with direct and relational applications to music. Still today, empirical data from research or experimental studies, remain largely lacking with data points on intervention strategies towards ASD. As referred to above, Salvador affirms that research is also needed to disseminate information about instruction for inclusive practices within music education.

The music education literature is limited in its coverage of ASD students compared to the music therapy literature. Intervention strategies and their effectiveness in supporting secondary students with ASD in instrumental music should be documented. Autism Spectrum Disorder is not considered a learning disorder; however, it is a neurological disorder affecting communication, social interaction, and executive function, causing developmental obstacles to

learning. In addition, ASD may also be accompanied by other learning disabilities. The problem is that the literature has not fully addressed how instrumental music can implement interventions and apply modification strategies to help students with ASD improve their music learning while meeting the educational goals of their Individual Education Program. Empirical data that supports and validates evidence-based instruction for individuals with ASD is needed in music education. The gap in the literature does not link data with these evidence-based strategies in music education. Because there is little data linking that information to instructional strategies, it is difficult to connect the effectiveness of those approaches to consistently reinforcing positive educational and musical outcomes. According to Amanda Draper:

> There are many resources describing best practices for working with students with disabilities in music, as well as those specific to students with ASD.[11] However, with a few notable exceptions,[12] there is a paucity of empirical investigations in music education research that relate more broadly to musical development and special education, and no identifiable research specific to ASD. [13]

The block quote above refers to Hammel and Hourigan's literature, which primarily focuses on general music classes, offering broad, adaptable guidance for classroom practice that can be applied to secondary settings. The empirical investigation Draper refers to is Kevin Gerrity, Coordinator of Music Education at Ball State University, along with his colleagues, who conducted a mixed-methods study using a pre-post test design to track musical growth and provide empirical data. Draper also refers to Judith Jellison, Professor Emerita at the University

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[11] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2013), 1–243.

[12] Kevin Gerrity, Ryan Hourigan, and Patrick Horton, "Conditions That Facilitate Music Learning Among Students with Special Needs: A Mixed-Methods Inquiry," *Journal of Research in Music Education* 61, no. 2 (July 2013): 153, https://doi.org/10.1177/0022429413485428.

[13] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, 2020), 16, ProQuest Dissertations & Theses.

of Texas at Austin, and Ellary Draper, Associate Professor at the University of Alabama, who maintain that, due to federal mandates, students with disabilities are in inclusive educational settings, such as music classes. Nevertheless, little is known about these classrooms, the instruction provided, and the level of participation. A research-to-practice gap is the disconnect between research knowledge and real-world practice. Educators may unintentionally focus their efforts on unfounded educational trends, promoting ineffective instructional practices that lack empirical validation, or avoid them entirely. Jean Crockett, Professor of Special Education at the University of Florida, and Sharon Malley, special education specialist, note, "For example, teacher praise, a seemingly straightforward practice with sound research support, is implemented at low rates. However, instructional approaches, such as designing instruction to match students' learning styles, are commonly implemented, despite a lack of empirical support."[14] This disconnect underscores the importance of examining evidence-based practices that have demonstrated effectiveness in other academic subjects and how they may apply to music education settings.

This study provides evidence by applying those specific intervention strategies for students with ASD in instrumental music courses. The evidence produced in the study fills gaps in the literature. The data in this study focus on improving instrumental music skills among students with ASD in specific areas including musical accuracy, technical skills, rhythmic and tempo fluency, engagement, independence, self-regulation, and responsiveness to instruction.

[14] Jean Crockett and Sharon Malley, eds., *Handbook of Arts Education and Special Education: Policy, Research, and Practices* (Oxford: Taylor & Francis Group, 2017), ProQuest Ebook Central.

Statement of the Purpose

This qualitative instrumental case study aims to identify potential intervention strategies for students with ASD who participate in instrumental music classes. Furthermore, the study achieves this purpose by investigating established evidence-based interventions from general education research for students with ASD and applying them to instrumental music instruction. Draper believes, "The field of music education would benefit from a more robust body of empirical research examining best practices for teaching music to students with disabilities."[15] Therefore, the literature review will examine the dynamics of ASD within students' lives and explore interventions in general education subject content to achieve desired outcomes in music education for students with ASD.

Significance of the Study

The section underscores the study's theoretical, empirical, and practical significance for developing practical interventions appropriate for students with ASD in instrumental music. Although studies on ASD intervention strategies for use in general education and music classes exist, few studies have examined such strategies in instrumental music classes. There is a gap in the literature demonstrating the effectiveness of ASD intervention strategies in instrumental music.

The instrumental case study emphasizes the use of interventions to achieve positive educational outcomes for students with ASD in instrumental music. The study focuses on ASD. The discovery of interventions prompts the instructor to incorporate teaching strategies for students with ASD. These strategies are refined as we develop a more robust instructional

[15] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, 2020), 16, ProQuest Dissertations & Theses.

pedagogy of instrumental music for students with ASD. The findings from this study are discussed with other music educators to support their professional growth and enable them to assist students with ASD in instrumental music.

The study aims to expand the knowledge base and empirical data by examining the complexities of autism spectrum disorder, demonstrating the effectiveness of applicable intervention strategies in instrumental music. Many educators recognize the impact of music on achieving positive educational outcomes, which are observable and measurable changes that indicate improvement in individual musical growth. Positive educational outcomes represent meaningful improvement or progress relative to an individual's performance rather than solely the achievement of a predetermined level of musical proficiency. Because students have different musical abilities and respond differently to instruction, educators must consider individual learning needs. Derek Polischuk, Professor of Piano at Michigan State University, notes, "It is essential that music teachers understand what high-functioning autism is. Additionally, teachers should take the time to educate themselves on teaching strategies for these students."[16] Music educators must have a working knowledge of the concerns and issues associated with ASD as they relate to the learning process. By compiling a list of evidence-based interventions for students with ASD, this study will help close a gap in the literature by demonstrating the implementation and documentation of these discovered strategies in instrumental music. Finally, educators need to understand how engagement with music benefits students with ASD. Adam Ockelford, music psychologist, theorist, and Professor of Music at the University of Roehampton, details how the empirical significance of the sound of intent demonstrates musical

[16] Derek Polischuk, "Autism Research and Its Implications for Music Educators," *American Music Teacher* (August/September 2016), https://www.mtna.org/downloads/DEI/Inclusive/2016_AS_Autism.pdf.

engagement and its frequency.[17] Finally, empirically grounded inclusive practices for students with ASD will enhance instrumental music educators' instructional methods.

Practical information on students with ASD in instrumental music education remains limited. There is a lack of documented sources on applying intervention strategies for ASD students in instrumental music classes. This study aims to identify and incorporate effective strategies into music pedagogy for teaching students with ASD. The position of the National Association for Music Education (NAfME), an advocacy group for music education, is expressed in the following words:

> A well-rounded and comprehensive music education program, as envisioned in the 2014 National Music Standards, should exist in every American school; it should be built on a curricular framework that promotes awareness of, respect for, and responsiveness to the variety and diversity of cultures; and should be delivered by teachers whose culturally responsive pedagogy enables them to design and implement such an inclusive curricular framework successfully.[18]

This instrumental case study, conducted in a middle school setting, summarizes recognized strategies for students with ASD in instrumental music classes. By reviewing intervention strategies for ASD in other general education subject areas, music educators' pedagogy improves, allowing for the potential application of inclusion practices to enhance educators' professional development.

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[17] Adam Ockelford, "The Sounds of Intent Project: Modeling Musical Development in Children with Learning Difficulties," *Tizard Learning Disability Review* 20, no. 4 (October 2015): 192, https://soundsofintent.org/outputs/Output%2096%20-%20The%20Sounds%20of%20Intent%20Project,%20Tizard%20Learning%20Disability%20Review,%202015.pdf.

[18] "Inclusivity and Diversity in Music Education," *National Association for Music Education*, accessed February 25, 2024, https://nafme.org/resource/inclusivity-and-diversity-in-music-education-2/

Research Questions

1.) Central Research Question: What specific teaching strategies can be implemented to produce positive learning outcomes in instrumental music, as outlined in educational goals, standards, and objectives for the ASD student?

2.) Sub Research Question 1: How do the educational outcomes of the autistic student determine future lesson planning by their educational plan as prescribed by state and federal law?

3.) Sub Research Question 2: How can instrumental music educators execute teaching approaches toward ASD students that allow them to be fully included in the classroom?

Hypotheses

Hypothesis 1: An intervention of thirty minutes will produce positive learning outcomes in instrumental music for ASD students, as outlined in educational goals in the curriculum by standards and objectives consistent with recent research.

Hypothesis 2: By applying accommodations and modifications in the instrumental music curriculum, ASD students are fully included in the class, and there is compliance with federal and state law towards the advancements in the music educators' methods and pedagogy.

Hypothesis 3: The teaching strategies implemented for improving educational outcomes are evidence-based interventions (EBIs), as shown in general education classes for application in instrumental music classes.

Theoretical Framework

The sound-of-intent design aims to maximize educational outcomes for students with ASD in instrumental music. Educational psychology researcher Novika Sari and colleagues authored a study on ASD academic achievement which states, “We conclude that autistic

symptoms associate with lower academic achievement, but by carefully matching on background variables and potential confounders, the academic achievement of children with clinical ASD might not differ from that of their typically developing peers."[19] Evidence points to the fact that ASD students may have similar educational outcomes with slight changes in instruction. The National Autistic Society states, "There is a huge range of interventions for autistic people, including some that are communication-based, behavioral, educational, or medical."[20] Through the incorporation of the "sound of intent," a metric to gauge musical engagement was established. Interventions were implemented, and instructional adjustments were made as needed to meet the modifications or accommodations outlined in IEP and 504 plans for students with ASD.

This study applies the theoretical concept derived from zygonic theory. As Adam Ockelford notes, "If the zygonic conjecture is correct, then the capacity to hear musical structure through perceived sonic imitation must develop as a feature of human maturation."[21] The 'zygonic' theory, which holds in all domains of perceived sound and at all levels, is the ultimate organizing force in music in the sound of intent. These domains include reactive participation, proactive music involvement, and interactive music contribution. Completed surveys with study participants help the researcher evaluate participants' perceptions of the musical domains. If correct, zygonic theory supports musical engagement among students with ASD.

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[19] Novika Sari et al., "Academic Achievement of Children with Autistic Symptoms Compared to Typically Developing Children," *European Journal of Psychology of Education* 39, no. 4 (November 2023): 1979, https://doi.org/10.1007/s10212023-00758-6.

[20] "Strategies and Interventions," *National Autism Society*, accessed March 15, 2026, https://www.autism.org.uk/advice-and-guidance/strategies-and-interventions.

[21] Adam Ockelford, *Applied Musicology: Using Zygonic Theory to Inform Music Education, Therapy and Psychology Research* (Oxford: Oxford University Press, 2013), 127, https://doi.org/10.1093/acprof:oso/9780199607631.003.0005.

Theoretically, this case study will extend Adam Ockelford's zygonic theory into the context of teaching intervention strategies to students with ASD in instrumental music.[22] This study expands on Kagari Shibazaki, Adam Ockelford, and Nigel Marshall's work, which examined how children influence one another musically during group tasks, focusing on individual growth through the support of educational interventions. Empirically, it adds to the literature by providing data demonstrating the practical application of intervention strategies in instrumental music for students with ASD.

Definition of Terms

Accommodations and Modifications: "referring to adaptations of the educational environment, the presentation of educational material, the method of response, or the educational content."[23] "Modifications are changes to practices in schools that alter, lower, or reduce expectations to compensate for a disability."[24] Whereas, "Accommodations are changes to practices in schools that hold a student to the same standard without disabilities but provide a differential boost to mediate the impact of the disability on access to the general education curriculum."[25]

The Americans with Disabilities Act (ADA): is a federal civil rights law enacted in 1990 that prohibits discrimination against individuals with disabilities and ensures equal access,

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[22] Kagari Shibazaki, Adam Ockelford, and Nigel A. Marshall, "Extending Zygonic Theory to Analyse Patterns of Musical Influence between Children Creating Pieces of Music in Groups in England and Japan," *Musicae Scientiae* 17, no. 4 (October 2013): 429, https://doi.org/10.1177/1029864913493109.

[23] Judith Harrison et al., "Educational Accommodations for Students with Behavior Challenges: A Systematic Review of the Literature," *Review of Educational Research* 83, no. 4 (December 2013): 555.

[24] Harrison et al., "Educational Accommodations," 556.

[25] Ibid., 556.

guaranteeing they have the same opportunities and protections as those individuals without disabilities.[26]

The Admission, Review, and Dismissal Committee (ARD): includes parents, guardians, students when appropriate, general and special education teachers, diagnosticians, school district representatives (usually administration), visual and/or auditory impairment teachers, language/speech assessment representatives, and other non-academic teachers or coaches.

Annual Goals: Measurable objectives intended to focus on students' specific needs and challenges; devised and aimed for one year and guide the educational process.

Assistive Technology (AT): Devices, tools, or equipment supporting a student's participation in educational activities; could include speech-to-text software, adaptive keyboards, or communication devices.

Autism Spectrum Disorder (ASD): "Characterized by persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships."[27]

Behavior Intervention Plan (BIP): Developed if a student's behavior interferes with their learning or the learning of others; includes strategies, goals, and supports to address and modify behavior.

Disability: The Americans with Disabilities Act (ADA) Sec. 12102 defines the term disability as "with respect to an individual. (A) a physical or mental impairment that substantially limits one

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[26] "Introduction to the Americans with Disabilities Act," United States Department of Justice. Civil Rights Division, Accessed June 20, 2026, https://www.ada.gov/topics/intro-to-ada/.

[27] *American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (Arlington, VA: American Psychiatric Association, 2013), 32.

or more life activities of such individual; (B) a record of such an impairment; or (C) being regarded as having such an impairment."[28]

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5): The "2013 update to the *Diagnostic and Statistical Manual of Mental Disorders*, the taxonomic and diagnostic tool published by the American Psychiatric Association (APA)."[29]

Established Interventions: "In the context of the general call for evidence-based practices and the increase in the number of interventions for children and adolescents with autism spectrum disorders (ASD), the need to critically evaluate intervention effectiveness becomes more important than ever."[30]

Evidence-Based Practice (EBP): "The practices that are effective based on multiple, high-quality studies that use experimental research designs and demonstrate robust effects on student outcomes (with ASD)."[31]

Executive Function (EF): "Cognitive control processes for regulating attention and behavior and are of enormous importance for child development."[32]

Individualized Education Program (IEP): "A document that is created for each student in the United States public school system who qualifies for special education services. The IEP

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[28] "Americans with Disabilities Act of 1990, as Amended," United States Department of Justice, Civil Rights Division, accessed February 24, 2024, https://www.ada.gov/law-and-regs/ada/#:~:text=(1)%20Disability.

[29] American Psychiatric Association, *Diagnostic and Statistical Manual*, 32.

[30] Anastasia Konina and Lee Kern, "Social Story Interventions for Students with Autism Spectrum Disorders: A Meta-Analysis," *Journal of Autism and Developmental Disorders* 40, no. 7 (July 2010): 812.

[31] Selena Layden et al., "Discovering Practitioners' Knowledge and Use of Evidence-Based Practices for Autism Early Childhood Interventions," *Topics in Early Childhood Special Education* 44, no. 1 (January 2024): 58, https://doi.org/10.1177/02711214231219281.

[32] Franziska Degé and Ulrike Frischen, "The Impact of Music Training on Executive Function in Childhood: A Systematic Review," *Journal of Educational Research (ZfE)* 25, no. 3 (2022): 581.

document is created through the IEP process, an ongoing process that involves repeated assessment, goal setting, progress monitoring, and parent-school collaboration required by the Individuals with Disabilities Education Act."[33]

Individuals with Disability Education Act (IDEA): "The purpose of the Act is to assure that all handicapped children have available to them, within the time periods specified . . . a free appropriate public education which emphasizes special education and related services designed to meet their unique needs, to assure that the rights of handicapped children and their parents or guardians are protected, to assist States and localities to provide for the education of all handicapped children."[34]

Intellectual Disabilities: Involves problems with general mental abilities that "affect functioning in two areas: cognitive functioning, such as learning, problem solving, judgment…. [and] adaptive functioning, activities of daily life such as communication skills and social participation."[35]

Least Restrictive Environment (LRE): is a foundational principle of the Individuals with Disabilities Education Act requiring that students with disabilities be educated alongside their nondisabled peers to the maximum extent appropriate.[36]

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[33] Kelli Sanderson and Amanda J. Rojas, "Parent Perspectives on Student IEP Involvement," *Journal of Research in Special Educational Needs* 23, no. 2 (April 2023): 91.

[34] Jane West et al. "The Americans with Disabilities Act and the Individuals with Disabilities Education Act: Intersection, Divergence, and the Path Forward," *Journal of Disability Policy Studies* 34, no. 3 (December 2023): 225.

[35] "What Is Intellectual Disability?" *American Psychiatric Association*, accessed February 24, 2024, https://www.psychiatry.org/patients-families/intellectual-disability/what-is-intellectual-disability.

[36] "About IDEA," United States Department of Education, Office of Special Education Programs, accessed June 20, 2026, https://sites.ed.gov/idea/about-idea/.

Neurodiversity: "A concept that recognizes and celebrates the diversity of neurological differences across humanity."[37]

Objectives: Measurable checkpoints that trace progress toward accomplishing the annual goals.

Present Levels of Performance (PLOP): The student's current academic functional abilities; serves as a starting point to establish goals, accommodations, and services for the student.

Procedural Safeguards: Outlines the legal rights of parents and students in the special education process; includes the right to be informed, to participate in decision-making, and, if necessary, to resolve disputes through due process.

Related Services: Essential to help students with special education needs; related services include transportation, speech therapy, occupational therapy, and counseling.

Special Education Services: Specialized instruction and support services students receive, which include but are not limited to, one-on-one instruction, small group instruction, instruction sessions, or specialized teaching methods.

Transition Plan: Outlines services and activities to support students with disabilities in transitioning from school to postsecondary education, employment, and independent living.

504 Plan: "There are two main mechanisms through which school-based services are formally provided: Section 504 of the Rehabilitation Act of 1973 and the Individuals with Disabilities Education Improvement Act (IDEA, 2016). The first, Section 504 of the Rehabilitation Act of 1973, is a civil rights law that requires schools to provide students with disabilities an education analogous to that provided to students without disabilities. These efforts are documented in 504 Plans. Students with 504 Plans are typically provided

[37] Jessica Dark, "Eight Principles of Neuro-Inclusion: An Autistic Perspective on Innovating Inclusive Research Methods," *Frontiers in Psychology* 15 (February 2024): 2, https://doi.org/10.3389/fpsyg.2024.1326536.

extra supports or classroom modifications within the general education environment."[38]

Summary

The instrumental case study investigates interventions for ASD in instrumental music. It explicitly focuses on developing instructional strategies and pedagogies used in other academic settings, with modifications and accommodations as needed. These are empirically supported and evidence-based, being appropriate in an instrumental music setting. The purpose of the study is to illuminate the phenomenon of ASD in music education and improve instructional delivery by applying intervention strategies for music educators, thereby enhancing the educational process for students with ASD. A deep contextual understanding of ASD within social, historical, cultural, and institutional contexts enriches a broader comprehension of ASD. The study may be reproduced in other areas, regions, or states for future study. In this study, participants will be instrumental music students with ASD in a secondary school setting, yielding documented data to inform the development of instructional strategies. The sound of intent provides a metric for music engagement, measured by outcomes against state and district standards and objectives. This case study provides insight into ASD and intellectual disabilities within instrumental music to advance music educators' practices.

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[38] Chelsea Hustus et al., "An Evaluation of 504 and Individualized Education Programs for High School Students with Attention Deficit Hyperactivity Disorder," *School Psychology Review* 49, no. 3 (September 2020): 334, https://www.proquest.com/scholarly-journals/evaluation-504-individualized-education-programs/docview/2503471103.

Chapter Two: Literature Review

Introduction

Music educators must identify challenges and areas of concern to focus their efforts on developing solutions and promoting student learning to enhance students' educational experiences. When addressing these issues, music educators should reference the National Association for Music Education (NAfME). NAfME's position states, "All students deserve access to and equity in the delivery of music education, one of the subjects deemed necessary in federal law for a well-rounded education."[39] This commitment to equitable access underscores the importance of developing instructional practices that address diverse learning needs.

Music educators must have an instructional foundation for equitable participation to improve musical outcomes for all students. NAfME's companion statement "promotes awareness of, respect for, and responsiveness to the variety and diversity of cultures; and should be delivered by teachers whose culturally responsive pedagogy enables them to design and implement such an inclusive curricular framework successfully."[40] NAfME frames and emphasizes music educators' ethical obligation to promote equitable instruction and learning environments that foster positive educational opportunities for all students. Through ongoing research, the development of innovative educational approaches, applying data-driven practices, instructional methods will continue to evolve to better support students with ASD. Due to the scope of ASD, society's understanding of the condition is ever evolving.

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[39] "Equity and Access in Music Education," *National Association for Music Education*, 2017, accessed June 30, 2024, https://nafme.org/resource/equity-and-access-in-music-education-2/.

[40] "Inclusivity and Diversity in Music Education," *National Association for Music Education*, 2017, accessed June 30, 2024, https://nafme.org/resource/inclusivity-and-diversity-in-music-education-2/.

History of Autism Spectrum Disorder in Children

Swiss psychiatrist Eugen Bleuler coined the term autism in 1911, describing symptoms of schizophrenia. Bonnie Evans, a lecturer in History of Medicine and Health at the University of Manchester, notes that, "According to Bleuler, autistic thinking was characterized by infantile wishes to avoid unsatisfying realities and replace them with fantasies and hallucinations."[41] Such accounts appear as a defensive retreat against those dissatisfactions with reality, being a psychotic experience compared to a cognitive one. Noah Sasson, a Professor of Psychology at the University of Texas at Dallas, along with his colleagues, cite Bleuler stating, "Schizophrenics, who have no more contact with the outside world, live in a world of their own. They have encased themselves with their desires and wishes...they have cut themselves off as much as possible from any contact with the external world. This detachment from reality and the relative and absolute predominance of the inner life, we term autism."[42] This passage frames the individual with schizophrenia withdrawing into detachment from external reality in opposition to their driven personal internal fantasy. Highlighting the subjective experience of schizophrenia, however, is void of the meaningful ways in which those individuals engage in their environments. During this period, a diagnosis of child schizophrenia was used, as autism was not yet fully understood in the medical field.

Later, in 1926, Grunya Efimovna Sukhareva, a child psychiatrist in the Soviet Union, referred to six boys presenting clinical criteria for today's ASD as high functioning. Annio Posar and Paolo Visconti, prominent Italian child neurologists and psychiatrists who collaborate

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[41] Bonnie Evans, "How Autism Became Autism," *History of the Human Sciences* 26, no. 3 (May 2013): 4, https://doi.org/10.1177/0952695113484320.

[42] Noah Sasson et al., "The Benefit of Directly Comparing Autism and Schizophrenia for Revealing Mechanisms of Social Cognitive Impairment," *Journal of Neurodevelopmental Disorders* 3, no. 2 (December 2010): 88, https://doi.org/10.1007/s11689-010-9068-x.

extensively on ASD, note that "the description of these cases is of an amazing precision and modernity: just think of the fact, for example, that Grunya Efimovna Sukhareva emphasized the importance of the presence of sensory abnormalities, which only recently regained their proper weight in the description of ASD in the DSM-5."[43] Sukhareva's observations anticipated contemporary criteria for ASD, shaped by shifts in emphasis of symptoms of the condition, instead of straightforward linear knowledge accumulation, as autism was not yet distinguished in terms of the spectrum. Sukhareva's work is acknowledged for the presence of sensory abnormality studies within broader descriptive psychiatry, with her clinical texts being viewed, reinterpreted, and validated for their historical content and contemporary relevance.

Despite these early observations, the absence of standardized diagnostic criteria led to psychiatric diagnoses. This is seen in the 1930s, when Louise Despert, a French-American child psychiatrist, documented that "schizophrenia in children is probably not so rare as it has long been thought…. To our way of thinking, studies of child schizophrenia should be limited to individuals of less than thirteen years."[44] The report states that twenty-nine children were admitted to New York's State Psychiatric Institute from 1930 to 1937. Despert frames the tendency and frequency while giving clear boundaries of age, attempting to distinguish the diagnosis of child schizophrenia as not so rare. Most likely, today, children diagnosed with child schizophrenia would be diagnosed with autism spectrum disorder (ASD) as traits parallel modern classifications and criteria for diagnosis.

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[43] Annio Posar and Paola Visconti, "Tribute to Grunya Efimovna Sukhareva, the Woman Who First Described Infantile Autism," *Journal of Pediatric Neurosciences* 12, no. 3 (July–September 2017): 300, https://doi.org/10.4103/jpn.JPN_46_17.

[44] Louise Despert, "Schizophrenia in Children," *Psychiatric Quarterly* 12, no. 2 (April 1938): 366.

In the spring of 1943, Leo Kanner, an Austrian-American psychiatrist, published "Autistic Disturbances of Affective Contact," introducing a new disorder in child psychiatry. Researchers and authors Christopher Sterwald and Jeffrey Baker cite Kanner's work outlining a new syndrome, "inborn autistic disturbances of affective contact."[45] His observations identified unique patterns of social interaction and behavior. Noah Sasson and colleagues mention Kanner's work, studying eleven children who shared "a powerful desire for aloneness and sameness," laying the foundation for future research.[46]

While Kanner's publication is often credited with introducing autism as a clinical diagnosis, similar observations were being made independently in Europe. Herwig Czech, a medical historian at the Medical University of Vienna, notes that "Hans Asperger… first designated a group of children with distinct psychological characteristics as 'autistic psychopaths' in 1938, several years before Leo Kanner's famous 1943 paper on autism."[47] Asperger's work documented characteristics that differed from Kanner's original descriptions. Noah Sasson and colleagues note that in 1944, Asperger described several children who displayed "a lack of empathy, little ability to form friendships, one-sided conversations [and] intense absorption in a special interest."[48] Both Kanner and Asperger employed the term

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[45] Christopher Sterwald and Jeffrey Baker, "Frosted Intellectuals: How Dr. Leo Kanner Constructed the Autistic Family," *Perspectives in Biology and Medicine* 62, no. 4 (Autumn 2019): 691, https://go.openathens.net/redirector/liberty.edu?url=https://proquest.com/schoraly-journals/frosted-intelleturals-how-dr-leo-kanner/docview/2321166360/se-2.

[46] Noah Sasson et al., "The Benefit of Directly Comparing Autism and Schizophrenia for Revealing Mechanisms of Social Cognitive Impairment," *Journal of Neurodevelopmental Disorders* 3, no. 2 (December 2010): 88, https://doi.org/10.1007/s11689-010-9068-x.

[47] Herwig Czech, "Hans Asperger, "National Socialism and 'Race Hygiene' in Nazi-Era Vienna," *Molecular Autism* 9, no. 29 (April 2018): 1, https://doi.org/10.1186/s13229-018-0208-6.

[48] Noah Sasson et al., "The Benefit of Directly Comparing Autism and Schizophrenia for Revealing Mechanisms of Social Cognitive Impairment," *Journal of Neurodevelopmental Disorders* 3, no. 2 (December 2010): 88, https://doi.org/10.1007/s11689-010-9068-x.

“autism,” derived from the Greek word “autos,” meaning “self.” It is believed that Kanner and Asperger were unaware of each other’s work; however, the term "autism" was first used by Bleuler in 1911. Asperger's argued that autism shared negative symptoms of schizophrenia, whereas Kanner argued for a different stance of derived development for the new syndrome, not sharing those traits. These researchers document historical moments leading up to the differentiation of diagnostic categories within a single framework. The significance of their work lies in the prevalence of ASD and the evolving views in twentieth-century psychiatry between psychosis and neurodevelopment. Asperger aligns autism with the negative symptoms of schizophrenia, such as social withdrawal and reduced communication in reciprocity; however, Kanner concentrates his efforts on the formulation of autism as a distinct developmental condition with early onset and a specific trajectory.

This pioneering research led to the recognition of developmental characteristics that existing psychiatric diagnostic criteria of the past could not fully explain. Today, according to the American Psychiatric Association, “Autism Spectrum Disorder is characterized by persistent deficits in social communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships.”[49] ASD affects children differently, manifesting itself in emotional and behavioral responses. Those deficiencies, however, establish a standardized clinical threshold, enabling reliability for both practitioners and researchers, allowing analysis of behaviors to be observed and measured for diagnosis.

[49] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (Arlington, VA: American Psychiatric Association, 2013), 32.

Below is the current criteria for ASD as presented in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders:

> Consolidation of autistic disorder, Asperger's disorder, and pervasive developmental disorder into autism spectrum disorder. Symptoms of these disorders represent a single continuum of mild to severe impairments in the two domains of social communication and restrictive repetitive behaviors/interests rather than being distinct disorders. This change is designed to improve the sensitivity and specificity of the criteria for diagnosing autism spectrum disorder and to identify more focused treatment targets for the specific impairments.[50]

The four subcategories stated above were combined into a single diagnosis of ASD. In 2020, the Centers for Disease Control (CDC) in the United States estimated that one in every thirty-six children is affected by ASD, compared to one in every 150 children in 1994. An international commission on autism recently established the definition of profound autism as being someone who has an IQ of fifty or less and cannot communicate. Mike Stobbe, an award-winning medical and science writer for the Associated Press, reports that "Under that definition, about a quarter of U.S. children identified as having autism by age 8 fall into the profound category, the new study found."[51] It is estimated that 110,000 students in the U.S. have profound autism, with cases increasing. Due to the large number of profound cases of ASD, educational systems will need to be prepared with high-support systems, resources, staffing, and accessibility. In addition, schools must adapt learning environments and curricula to accommodate the complex needs of individuals with ASD. Stobbe also states that "Experts cite improved screening, services, increased awareness, and advocacy."[52] Careful interpretation of the increasing prevalence,

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[50] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, xliii.

[51] Mike Stobbe, "Study: Milder Autism Far Outpacing 'Profound' Diagnoses," *Associated Press News*, April 19, 2023, https://apnews.com/article/profound-autism-rate-us-bc21057fabe11774843d4ac2197956a4.

[52] Stobbe, "Study: Milder Autism Far Outpacing 'Profound' Diagnoses," 2023.

however, is warranted as those numbers may reflect expanded diagnostic criteria and improved identification. It is significant as those figures define the issues schools will encounter, both as an educational and medical phenomenon, requiring support and resources to assist the profoundly autistic student. Evaluating ASD prevalence, music educators are likely to have multiple students with ASD in their classes and must know the best way to accommodate their educational needs.

Educational Legislation for Disabilities

Over the past 50 years, numerous legislative acts have been enacted to improve the lives of individuals with ASD. The Education for All Handicapped Children Act (EHA), Public Law 94-142, was passed by Congress in 1975. Its function was "protecting the rights of, meeting the individual needs of, and improving the results for infants, toddlers, children, and youth with disabilities and their families."[53] Before EHA, children were denied equal access to educational rights and privileges. Since the implementation of the EHA in 1975, significant progress has been made toward achieving national goals of developing programs that provide services such as early intervention, special education, and related services to meet the individual needs of students. Instead of excluding 1.8 million children with disabilities, the passage of the EHA of 1975 assisted more than 8 million children with disabilities with special education. The legal obligations of learning institutions are to protect the rights of students with disabilities, to provide individualized support through appropriate services that enable measurable outcomes within the educational process, and to shift from the medicalized model to a rights-based framework. Policy language reflects the need for flexibility in meeting the needs of individuals

[53] "A History of the Individuals with Disabilities Education Act," *United States Department of Education*, accessed February 25, 2024, https://sites.ed.gov/idea/IDEA-History.

with disabilities while balancing legal protections and personal care. It holds the institution responsible for meaningful educational practices that have proven effective for those individuals.

Individuals with Disabilities Education Act (IDEA)

Alice M. Hammel and Alice-Ann Darrow provide a brief history of educational law reform, noting that Congress reauthorized the EHA Act in 1990 as Public Law 110-476, renaming it the Individuals with Disabilities Education Act (IDEA).[54] There is a shift in terminology, such as from "disabled children" to "individuals with disabilities," emphasizing identity over disability or impairment, aligning focused inclusion practices and rights-based frameworks, and reconceptualizing how individuals engage, interact, and participate with peers within educational institutions. Hammel and Darrow detail how music educators acknowledge their apprehensions about their limited knowledge in response to effectively accommodating students' needs. IDEA mandates that all eligible students have access to a free and appropriate public school education (FAPE), including music classes.

In addition, IDEA sets parameters for identifying individual disabilities that could adversely affect academic performance and establishes eligibility for special education and related services. The Americans with Disabilities Act (ADA) of 1990 was also passed, prohibiting discrimination against individuals with disabilities, which included school settings. Jane West, a federal education policy expert, along with her colleagues, note that Congress found a million children with disabilities were entirely excluded from the public school system, and that many other students with disabilities were not identified, thus not being appropriately served

[54] Alice M. Hammel and Alice-Ann Darrow, "Introduction: Maintaining Our Proud History of Teaching Music to Students with Disabilities," *Music Educators Journal* 104, no. 2 (December 2017): 13, https://doi.org/10.1177/0027432117734170.

even when they were in school.[55] The next few decades saw additional updates to the IDEA Act, which Congress reauthorized. In 1997, additions were made to transition plans in post-secondary life.

Data collection monitors IDEA compliance. In 2010-2011, the number of students receiving IDEA services in the United States increased from 6.4 million to 7.3 million in 2021-2022. The Department of Education reports that "taken as a percentage of total public school enrollment, this equates to an increase from 13 to 15 percent of students" who are served under IDEA.[56] This report underscores the need for compliance monitoring, data collection, making student disability visible through statistics, documentation, and accountability within our educational institutions. Data indicates an increase in the number of students served with disabilities, as improved screening, broader diagnostic criteria, along with stronger enforcement of eligibility have assisted educational institutions' capacity to recognize individual needs as populations change. Data collection and analysis enable educational institutions to evaluate whether identified students receive appropriate services while ensuring that current practices align with federal requirements. Such documentation also provides a basis for identifying areas in which instructional practices, accommodations, and supports may need to be strengthened to address the changing needs of students with disabilities. The statistics illustrate the increasing role of the federal government in disability law in public education, as seen in Figure 1 below.

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[55] Jane West et al., "The Americans with Disabilities Act and the Individuals with Disabilities Education Act: Intersection, Divergence, and the Path Forward," *Journal of Disability Policy Studies* 34, no. 3 (December 2023): 224.

[56] "Students with Disabilities," *Condition of Education*, National Center for Education Statistics, U.S. Department of Education, Institute of Education Sciences, last updated May 2024, accessed March 13, 2026, https://nces.ed.gov/programs/coe/indicator/cgg

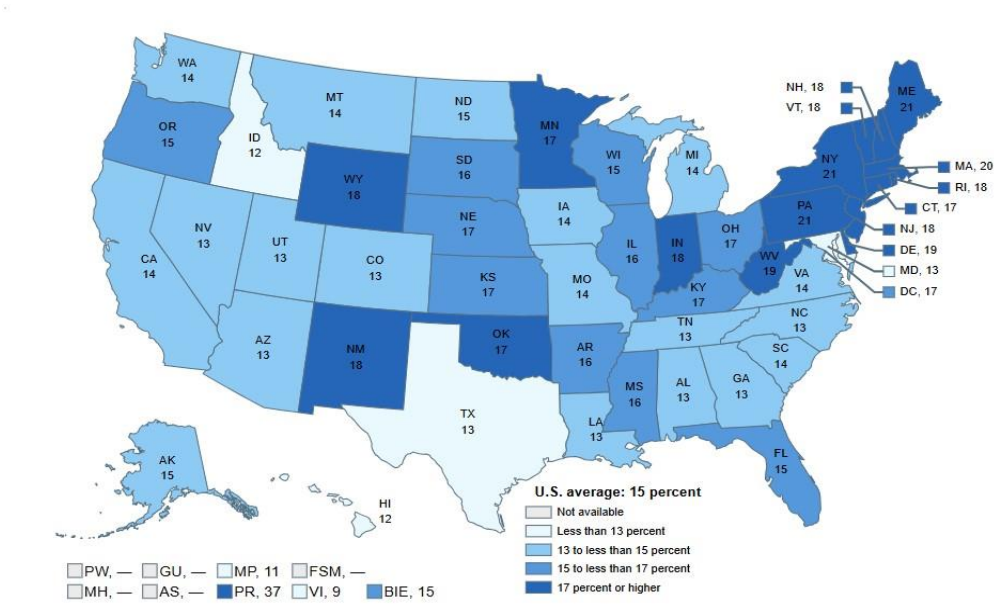


Figure 1. Percentage of Students Served Under IDEA by State in 2023.

Source: United States Department of Education, Office of Special Education Programs, Individuals with Disabilities Education Act (IDEA) database, retrieved October 13, 2023, https://data.ed.gov/dataset/idea-section-618-state-part-b-child-count-and-educational-environments/resources. National Center for Education Statistics, Common Core of Data (CCD).

According to the National Institute on Disability and Rehabilitation Research in 2012, approximately 6.5 percent of students received services under established criteria for autism disorders, as presented in Table 2 below. This compares to the percentage of students ages 3-21 served under the IDEA by selected disability type for the 2022-2023 school year, as seen in Table 3 below. The autism disability type has almost doubled since 2010-2011. Significant changes in the DSM-5 in 2013 consolidated the four previous distinct diagnoses of Autistic Disorder, Asperger's Disorder, PDD-NOS, and Childhood Disintegrative Disorder into an umbrella term of Autism Spectrum Disorder (ASD). The significance lies in music educators understanding the general characteristics of autism and other learning impairments, which enables them to make informed decisions about lesson planning, resources, learning environments, pacing, and participation to enhance the educational process.

Table 2. Categories and Prevalence of Disabilities under IDEA

Disability	Percent
Specific learning disability	41.2
Speech or language impairment	18.7
Other health impairments	12.2
Intellectual disability	7.6
Emotional disturbance	6.8
Autism	6.5
Multiple disabilities	2.1
Developmental delay	1.9
Hearing impairments	1.2
Orthopedic impairments	1.0
Visual impairments	0.4
Traumatic brain injury	0.4
Deaf-blindness	0.02

Source: National Arts Standards, Sharon M. Malley, "Students with Disabilities and the Core Arts Standards: Guiding Principles for Teachers Acknowledgments and Credits." (2014), https://www.nationalartsstandards.org/sites/default/files/Guiding%20Principles%20for%20Inclusion.pdf.

Table 3. Students with Disabilities in 2022-2023 in the United States

Disability type	Percent
Specific learning disability	32
Speech or language impairment	19
Other health impairment	15
Autism	13
Developmental delay	7
Intellectual disability	6
Emotional disturbance	4
Multiple disabilities	2
Hearing impairments	1

Source: United States Department of Education, Office of Special Education Programs, Individuals with Disabilities Education Act (IDEA) database, retrieved October 13, 2023, from https://data.ed.gov/dataset/idea-section-618-data-products. National Center for Education Statistics, Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 2022–23. See Digest of Education Statistics 2023, table 204.30.

No Child Left Behind (NCLB)

The No Child Left Behind (NCLB) educational reform, introduced in 2001, required all students, even those covered under IDEA with IEPs and 504 plans, to participate in standardized testing, making accessibility a reality for all students, even those with disabilities. Additionally,

disaggregated data made autistic students more visible, as testing must be reported separately in subgroups such as students with disabilities. Adequate yearly progress (AYP), introduced by NCLB, requires schools to show academic improvement by subgroups, including students with disabilities. NCLB also shifted from life-skills or functional-based models of instruction to focusing on academic standards and/or grade-level content for students with impairments or disabilities. Making AYP requires data-driven instruction that applies evidence-based practices and sets measurable goals while providing students with ASD access to the general curriculum in public education. Later, in 2004, early child intervention services and accountability measures were added to NCLB.

Congress passed the Combating Autism Act in 2006, which frames autism through a medical and public health lens as an urgent health concern. The language in this law focuses on early identification of autism, funding research, and ultimately finding a cure. There is evidence that increased awareness can lead to early intervention, expand access to services, and improve developmental outcomes. The quotes below reflect the thoughts of President George W. Bush and the passage of the Combating Autism Act of 2006:

> For the millions of Americans whose lives are affected by autism, today is a day of hope. The Combating Autism Act of 2006 will increase public awareness about this disorder and provide enhanced federal support for autism research and treatment. By creating a national education program for doctors and the public about autism, this legislation will help more people recognize the symptoms of autism. This will lead to early identification and intervention, which is critical for children with autism. I (President George W. Bush) am proud to sign this bill into law and confident that it will serve as an important foundation for our Nation's efforts to find a cure for autism.[57]

This was a relief to Americans who had a relative or loved one who had ASD, as funds were made available for research, treatment, and support. The Autism Collaboration, Accountability,

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[57] "President's Statement on Combating Autism Act of 2006," *National Archives*, December 19, 2006, https://georgewbush-whitehouse.archives.gov/news/releases/2006/12/20061219-1.html

Research, Education, and Support (CARES) Act of 2014 was reauthorized and expanded to become the Combating Autism Act of 2014.

Every Student Succeeds Act (ESSA)

The Every Student Succeeds Act (ESSA) was enacted by Congress in 2015 as the primary legislation governing K-12 public education, replacing the No Child Left Behind Act (NCLB). In addition, ESSA continues the lasting commitment to providing equitable access to quality public education by reauthorizing the Elementary and Secondary Education Act of 1965 (ESEA). Education policy and political science scholars Jeffrey Henig, David Houston, and Melissa Arnold Lyon frame ESSA as educational law reform that promotes state and local flexibility for accountability through student and parental engagement while improving school climate and culture.[58] These authors in *The Every Student Succeeds Act: What It Means for Schools, Systems, and States* assert ESSA maintains and even strengthens NCLB transparency, providing states with control of accountability while avoiding teacher evaluation mandates. ESSA continues to require annual state assessment tests and reporting results by subgroups, giving states more flexibility than NCLB in how schools may identify criteria for low-performing students and how to improve them.

ESSA supports well-rounded curricula that extend beyond math and reading, thereby supporting all future career and technical pathways, including music. The National Association for Music Education points to ESSA as revising the previous education bill (NCLB) by supporting music education, recognizing music as a core subject, and emphasizing its inclusion

[58] Jeffrey Henig, David Houston, and Melissa Arnold Lyon, "From NCLB to ESSA," in *The Every Student Succeeds Act: What It Means for Schools, Systems, and States*, ed. Frederick Hess and Max Eden (Cambridge: Harvard Education Press, 2017), 37.

in a well-rounded education, thereby providing exceptional opportunities and experiences for students.[59] This shift in stance between NCLB and ESSA justifies music as a core academic subject rather than merely an enrichment-based one.

ESSA strengthens protections and supports for students with disabilities by working with the Individuals with Disabilities Education Act (IDEA), broadening the scope of inclusion, access, and accountability to general education. Education policy experts Erin Lomax and Ann Lordemann note that ESSA also emphasizes participation in general education classes; when appropriate for students with ASD, participation should occur in the least restrictive environment, be taught at the highest academic standard, and provide access to grade-level content to foster meaningful inclusion.[60] Additionally, ESSA requires that all students, even those with ASD, must be included and participate in statewide standardized testing, with accommodations as needed, with their disability as a subgroup. Author and disability advocate Lauren Agoratus explains in her writing that all students, except the top 1% of students with severe cognitive disabilities, must use the state's academic standards and statewide standardized tests, as results from all subgroups must be transparent, as they cannot be hidden or averaged.[61] ESSA also supports social-emotional and behavioral development, directly addressing the learning barriers these students face. ESSA promotes the individualized, multi-tiered systems of

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[59] "The Every Student Succeeds Act: What It Is, What It Means, and What's Next," accessed November 30, 2025, https://nafme.org/wp-content/uploads/2023/04/ESSA-In-Plain-EnglishFINAL-2-2016.pdf.

[60] Erin Lomax and Ann Lordeman, Congressional Research Service, *Education of Students with Disabilities: Alignment between the Elementary and Secondary Education Act and the Individuals with Disabilities Education Act*, October 31, 2011, 2, https://www2.law.umaryland.edu/marshall/crsreports/crsdocuments/R42070_10312011.pdf.

[61] Lauren Agoratus, "The Effects of the ESSA (Every Student Succeeds Act) for Children with Disabilities," *The Exceptional Parent* 46, no. 9 (September 2016): 26, https://www.proquest.com/magazines/effects-essa-every-student-succeeds-act-children/docview/1865412441.

support (MTSS) that utilize technology assistance and early interventions for students with ASD. Continued professional development for teachers on ASD may be funded through ESSA for autism awareness, which supports evidence-based practices, behavioral supports, communication supports, and Universal Design for Learning (UDL). By linking ESSA accountability to the least restrictive environment of IDEA, public education policy shifts the placement of inclusion to engage students in the educational process through learning-conducive environments, with responsibility for instruction shared among all stakeholders within the educational institution.

Least Restrictive Environment

The Least Restrictive Environment (LRE) has significant implications for participation in secondary music education by promoting meaningful inclusion alongside nondisabled peers whenever appropriate. Erin McCloskey, Professor at Vassar College known for her least restrictive environment work, notes that "In 1975, the United States Congress passed the Education for All Handicapped Children Act (Public Law 94-142), requiring that all institutions that receive federal funds implement policies to ensure that children with disabilities receive a free and appropriate public education in the least restrictive environment."[62] Through the Individualized Education Program (IEP) process, the educational team determines the level of participation and support that best meets each student's unique strengths, needs, preferences, towards their educational goals. This individualized planning may include accommodations or modifications such as assistive technology, adapted instructional methods, adjusted activity formats, or additional adult support to ensure equitable access to music instruction and

[62] Erin McCloskey, "To the Maximum Extent Appropriate: Determining Success and the Least Restrictive Environment for a Student with Autism Spectrum Disorder," *International Journal of Inclusive Education* 20, no. 11 (2016): 1205.

performance opportunities. Parents are encouraged to attend meetings, provide input, and collaborate with educators to ensure the plan meets their child's needs. Because the level of support may vary depending on the instructional or performance setting, LRE allows flexibility in placement while maintaining the goal of maximizing participation in the general education music experience. Inclusive participation in music ensemble courses fosters social integration, peer relationships, independence, along with a sense of belonging, while providing students with disabilities opportunities to develop musical, social, and self-advocacy skills within the broader school community.

Clinical Diagnosis

Autism and schizophrenia have a mutually blurred diagnostic past, which was not resolved until 1980 with the publication of the DSM-III. Noah Sasson and colleagues note that "though now recognized as heterogeneous disorders with distinct developmental trajectories and dissociative features,… confusion stemmed from apparent overlap in certain areas of social dysfunction."[63] Extensive research in the medical field has been accumulated for autism and schizophrenia, establishing the abnormalities for both disorders. Before this, the distinction between the two disorders had overlapping symptoms, such as atypical communication and social withdrawal, contributing to frequent misclassification. With contemporary diagnosis criteria, however, both autism and schizophrenia are fundamentally different in terms of developmental onset and progression. Autism is a neurodevelopmental condition with early onset, and schizophrenia is a psychotic disorder emerging in late adolescence or early adulthood.

[63] Noah Sasson et al., "The Benefit of Directly Comparing Autism and Schizophrenia for Revealing Mechanisms of Social Cognitive Impairment," *Journal of Neurodevelopmental Disorders* 3, no. 2 (December 2010): 88, https://doi.org/10.1007/s11689-010-9068-x.

Sasson states that social cognitive impairment may have different mechanisms: besides onset, individuals with autism demonstrate impairments in facial perception, persisting throughout their lives. Furthermore, individuals with schizophrenia may outperform ASD individuals in basic social perception but perform similarly in inferring intent and belief at higher levels of social cognitive skill. These impairments in social perceptual mechanisms may cause social cognitive dysfunction for individuals with autism, while individuals with schizophrenia may show higher-order abnormalities in social cognitive processes. Overall, the distinctions between ASD and schizophrenia highlight the social difficulties associated with each condition while demonstrating the diverse neurodevelopmental and cognitive pathways experienced by affected individuals.

As the understanding of Autism Spectrum Disorder has evolved, emphasis has also shifted. From defining the characteristics to developing methods of identification. Kris Evers, a clinical psychologist, along with his colleagues, states, "The diagnostic assessment of Autism Spectrum Disorder (ASD) in children is a complex process, in which information is gathered from parents (or caregivers) about the child's developmental history and current level of functioning, together with first-hand observations by an experienced clinician."[64] According to the team of authors in "How Well are DSM-5 Diagnostic Criteria for ASD Represented in Standardized Diagnostic Instruments?" diagnostic decisions should not be based on one instrument for assessment. Still, integration of diverse sources of information through a multimethod, multidisciplinary approach by an experienced multidisciplinary team, with review of caregiver reports alongside clinicians' direct observations. Parental input is necessary because clinicians may not fully observe emerging behavioral and communication challenges during their sessions. In addition, parental

[64] Kris Evers et al., "How Well Are DSM-5 Diagnostic Criteria for ASD Represented in Standardized Diagnostic Instruments?" *European Child & Adolescent Psychiatry* 30, no. 1 (January 2021): 75.

input can establish developmental history, assisting clinicians in identifying issues with joint attention, sensory challenges, atypical play, and other possible symptoms of ASD.

Schools may conduct a diagnostic assessment, along with an Admission, Review, and Dismissal (ARD) committee hearing to determine special education placement and to ensure that students receive services protected under federal law. Screening tools include the Autism Diagnostic Interview-Revised (ADI-R), Autism Diagnostic Observation Schedule-Generic (ADOS-G), Childhood Autism Rating Scale (CARS), and Gilliam Autism Rating Scale-Second Edition (GAR-S). Special education placement requires a flexible, individualized planning approach that supports appropriate inclusion for social integration while promoting independence.

Delayed Autism Detection

From 1996 to 2020, public knowledge and understanding of ASD have increased, improving the identification of those children who show symptoms; however, the COVID-19 pandemic impacted screening, evaluations, and diagnosis of children suspected of having ASD. The rate of assessments declined dramatically and did not return to pre-pandemic levels until safety guidelines were lifted, thereby delaying access to treatment. Hammel and Hourigan note that "if the diagnosis of autism has been delayed, and many behaviors that are completely appropriate for a student with autism have been mislabeled as bad by teachers or parents, having this negative label will… affect the overall self-esteem and sense of worth of the child."[65] More damage occurs to the child's sense of self when there is a late diagnosis of autism. For music educators, it is important to be aware and sensitive to issues of self-esteem. Hammel and

[65] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 72.

Hourigan indicate that music educators must consider individual challenges, such as discipline, self-control, and decision-making skills. By assisting students in developing those abilities, educators accommodate their needs, enabling students with ASD to interact with their peers and have positive musical experiences.

Early Detection

ASD cannot be cured, but there are different means to manage symptoms. The Autism and Developmental Disabilities Monitoring Network (ADDM), funded by the Centers for Disease Control and Prevention (CDC), notes that "Moving forward, it …[is] important to identify ways to support children who have experienced delays in early ASD identification and to improve equitable and timely access to early identification."[66] CDC findings indicate that early detection of ASD can improve quality of life by promoting social interaction and communication skills, reducing behavioral difficulties, supporting brain plasticity for adaptation to new situations, while connecting families with essential support networks and resources.

Medical vs Social

Social movements, such as the autism rights movement, emphasize acceptance by adopting the neurodiversity paradigm, which views cognitive differences as the norm rather than as pathology. Craig Goodall, Associate Lecturer in Autism at St. Mary's University College in Belfast, notes, "The social model locates the problem within the person-environment relationship: it is the failure of society (and schools) to recognize and accommodate a person's needs by removing environmental and attitudinal barriers."[67] The medical model, as perceived by

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[66] "Key Findings from the ADDM Network," *Centers for Disease Control and Prevention*, October 2, 2020, https://www.cdc.gov/ncbddd/autism/addm-community-report/key-findings.html.

[67] Craig Goodall, *Understanding the Voices and Education Experiences of Autistic Young People: From Research to Practice* (New York: Routledge, 2020), 37.

the community, views disabilities and disorders as conditions needing correction, focusing on a diagnosis with the possibility of fixing the impairment. The medical model then focuses on changing the person to conform to societal standards of normality and advocates extensive intervention and treatment. Goodall notes, "This can perpetuate deterministic notions that a child's ability is static and non-transformable."[68] Nevertheless, contemporary social models and educational reforms have shifted the understanding of ASD from an individual deficit toward environmental disparities that create learning barriers. The social model emphasizing the need to reduce exclusion, promoting full participation, fostering inclusion and belonging to address those learning barriers. For therapeutic purposes, there are numerous approaches in the study of ASD and how to treat it from a medical model. In education, symptoms of ASD receive treatment to reduce unwanted behaviors by applying both models. In educational settings, there is a shift from "fixing" the individual with ASD to removing barriers in redesigning classrooms, curricula, and attitudes toward ASD students, witnessed in sensory-friendly surroundings, visual supports, predictable routines, flexible communication methods, and social expectations that permit ASD students to be themselves while not masking or changing their neurology.

Currently, there is no clear evidence or understanding of what causes ASD. Dennis Thompson reports that new data suggests "Severe forms of autism could be linked to overgrowth of the brain's outer layer that starts while a baby is in the womb."[69] This statement focuses on the biological-neurodevelopmental aspects as a possible explanation for autism. The research indicates that large brain size may produce excess neurons that disrupt connectivity during key

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[68] Goodall, *Understanding the Voices and Education Experiences of Autistic Young People*, 37.

[69] Dennis Thompson, "Could Brain Overgrowth Contribute to Autism?," *HealthDay*, June 7, 2024, https://www.usnews.com/news/health-news/articles/2024-06-07/could-brain-overgrowth-contribute-to-autism.

developmental stages in individuals with ASD, supporting the theory of differences in early neural development. Strong evidence of prenatal cortical overgrowth may correlate with severe autism; it is only one pathway and cannot serve as a universal explanation for autism, as there are other biological and environmental contexts to consider.

The University of California, Los Angeles (UCLA) published a study linking genetics to ASD. David Sampson, a media relations representative for the University of California, Los Angeles (UCLA) Health, reports findings with genetic clues. Sampson quotes Dr. Daniel Geschwind stating that, "Most genetic studies of autism have focused on families with one child affected by the neurodevelopmental disorder, sometimes excluding families with multiple affected children. Study design is critical, and insufficient attention has been paid to studying families with more than one affected child."[70] Sampson continues by highlighting Geschwind's argument about the importance of uncovering connections of inherited de novo genetic mutations within multiplex families, with multiple autistic children, instead of concentrating on simplex families, with one autistic child, detailing a gap in study methodology. By including multiplex families, results from the studies provide a clearer picture of possible heritable risk factors. It is acknowledged that autism is heritable, but it is cost-prohibitive to get genetic testing. Genetics may not be the only contributing factor to ASD diagnosis, framing it only as a biomedical condition, overshadowing the educational and social approaches, which focus on inclusion and accommodation.

Another report states that parents have claimed that their child's ASD symptoms improve when there is an infection that causes a fever. David Orenstein, a science writer and

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[70] David Sampson, "New Genetic Clues Uncovered in Largest Study of Families with Multiple Children with Autism," *UCLA Health*, accessed July 7, 2024, https://www.uclahealth.org/news/release/new-genetic-clues-uncovered-largest-study-families-with.

communications professional for MIT's Picower Institute for Learning and Memory, reports that Autistic symptoms may improve during times of fever. Orenstein notes Neuroscientist Gloria Choi, who explains that, "To the best of ..[her] knowledge, the 'fever effect' is perhaps the only natural phenomenon in which developmentally determined autism symptoms improve significantly, albeit temporarily."[71] Currently, the Marcus Foundation has given a grant to scientists from MIT and Harvard to study this "fever effect." While not a treatment pathway for ASD, as a biological medical model, the claim details short-term improvements in ASD symptoms, challenging assumptions that ASD-related traits become fixed once development occurs, highlighting neural plasticity over permanence. Plasticity is a vital bridge towards the educational social model of disability for ASD, as outcomes can be shaped by instructional design, social context, and environmental supports, and not neurobiology alone.

Music therapy (MT) has been used as an intervention to improve deficits in social communication and repetitive, restrictive behaviors in students with ASD. Other therapies for ASD include improvised music therapy (IMT), family-centered music therapy (FCMT), and group-based improvisational music therapy. Typically, parents use the Autism Diagnostic Observation Schedule (ADOS) and Childhood Autism Rating Scale (CARS) to self-report behaviors they observe at home. These data are compared with observations made by other professionals to diagnose ASD. In a recent study, neuroimaging tools were suggested to document how MT affects functional and behavioral outputs in ASD. Amparo Márquez-Garcia, a clinical neuropsychologist and researcher specializing in neurodevelopmental disorders, along with her colleagues, note that "given the heterogeneity within the autism spectrum, it is

[71] David Orenstein, "Understanding Why Autism Symptoms Sometimes Improve Amid Fever," *MIT News*, Massachusetts Institute of Technology, May 23, 2024, https://news.mit.edu/2024/understanding-why-autism-symptoms-sometimes-improve-amid-fever-0523.

necessary to develop a range of assistive devices, tools, and therapies that can be selectively utilized to address the diverse support needs of individuals with ASD."[72] This is true for all supplemental aids to assist students with ASD. Garcia highlights the importance of differentiated intervention, which combines the biological and social models of disability and recognizes supports as individualized rather than standardized. The biological view focuses on neural plasticity, as individuals respond differently to music; the experience can improve social engagement, emotional regulation, and joint attention. The social model of disability suggests individuals become disabled due to societal barriers, rather than their inherent differences. Lastly, adults with ASD may need continued support systems beyond school settings and past post-graduation.

Learning Barriers

Individuals with Autism Spectrum Disorder and their families may face complex barriers, encountering obstacles to obtaining services to cope with daily challenges. Natasha Malik-Soli, a health care policy researcher, along with her colleagues, identifies structural barriers that document gaps and disparities in accessing healthcare. Families who have children with "ASD …[may] not have access to the care required to address their diverse health needs."[73] Those issues include a shortage of specialized physicians in non-metropolitan areas. Additionally, the cost of services can be prohibitive for families on a limited income; services may not be available in an immediate area, health insurance may not be approved for the condition, there is a

[72] Amparo Márquez-García et al., "Music Therapy in Autism Spectrum Disorder: A Systematic Review," *Review Journal of Autism and Developmental Disorders* 9, no. 1 (March 2022): 91.

[73] Natasha Malik-Soni et al., "Tackling Healthcare Access Barriers for Individuals with Autism from Diagnosis to Adulthood," *Pediatric Research* 91, no. 5 (March 2021): 1028, https://doi.org/10.1038/s41390-021-01465-y.

lack of awareness among general family physicians, and there is a need for transition services from childhood to adulthood for medical needs. Additionally, symptoms of ASD include receptive and expressive language difficulties; limited vocabulary; challenges in perceiving information from gestures, body language, and facial expressions; executive function difficulties; sensory sensitivities; emotional dysregulation; processing speed difficulties; low tolerance for transitions; restricted interests; and motor skill difficulties. Furthermore, environmental and instructional barriers may include unstructured environments at schools, a lack of visual aids, and limited routines, which discourage engagement, as students with ASD may not learn through traditional methods. Students may be labeled, encounter ableism, or develop learned helplessness as a coping mechanism.

Ableism

As music educators may lack training, expertise, or confidence in teaching diverse learners, they must be cautioned against unknowingly advancing ableist ideology. Note that the Individuals with Disabilities Education Act provides access to free and appropriate public education in the least restrictive environment, thereby ensuring rights for all families and students with diverse learning needs. Susan Balglieri and Priya Lalvani, Associate Professors at Montclair State University, outline ableism as a structural force that lowers expectations and restricts access for students with disabilities like ASD. Ableists consider those with disabilities unable to participate or excel in life's activities as a permissible prejudice in society due to cognitive, physical, emotional, or behavioral barriers, which appear subconsciously or consciously at different levels of acceptance.[74] Students with ASD may encounter assumptions, that all autistic people are the same, or stereotypes, such as the assumption of incompetence due

[74] Susan Baglieri and Priya Lalvani, *Undoing Ableism: Teaching about Disability in K–12*

to communication or social issues, both of which are untrue. Individuals in society may pathologize normal autistic traits, viewing behaviors as psychologically abnormal, trying to suppress actions of stimming, hand flapping, rocking, or fidgeting instead of understanding their coping function in self-regulation. In addition, those with ASD mask to make others feel comfortable. Baglieri's and Lavani's work highlights disability as a form of human diversity, promotes peer acceptance, challenges ableist views to reduce social isolation for students, and aligns with inclusive education practices that emphasize belonging and high standards.

According to Kristen Bottema-Beutel, Professor of Special Education at Boston College, educators must be aware of historical reflections on language regarding autism and the lack of consensus and accuracy in terminology, which creates social exclusion of students with ASD due to misunderstanding.[75] Fostering learning-conducive environments that provide quiet spaces, flexible scheduling, and autonomous learning in the least restrictive environment enhances educational opportunities; educators must use neutral language that does not marginalize students with ASD. Words such as "special needs" or "special interest" might be patronizing to the community and should be replaced with "focused interests." Furthermore, compliance culture in the instrumental music classroom advances ableism towards students with ASD. Autistic students need time to process information, be allowed to make decisions independently, and engage in behaviors that may differ from those of others. Bottema-Beutel and colleagues note that "language is a powerful means for shaping how people view autism. If researchers take steps to avoid ableist language, researchers, service providers, and society at large may become more

Classrooms (New York: Routledge, 2020), 13–15.

[75] Kristen Bottema-Beutel et al., "Avoiding Ableist Language: Suggestions for Autism Researchers," *Autism in Adulthood: Challenges and Management* 3, no. 1 (2021): 19, https://doi.org/10.1089/aut.2020.0014.

accepting and accommodating of autistic people."[76] Barriers to educational success may not be influenced by characteristics of ASD but by environments and societal attitudes that unintentionally perpetuate ableism. Individuals with ASD not only require increased access to services, as appropriately needed, but also educational practices that recognize and challenge abelist attitudes and assumptions.

David Connor, Professor Emeritus of Special Education/Learning Disabilities at Hunter College, along with his colleagues, suggests that to prevent ableism, one should examine the guiding tenets of Disability Studies in Education (DSE), which foster inclusivity and equity in educational opportunities, provide access, and reject deficit models of disability.[77] Anti-ableist practices toward students with ASD can occur through respecting neurodiversity, supporting preferences, accepting all forms of communication, honoring sensory needs, avoiding neurotypical norms, and including the autistic voice. A concrete method within the DSE framework, Connor rejects deficit models that perpetuate ableism and has the potential to transform the educational experience. Music education as an access-oriented framework, rather than a performance-based one, by moving away from the development of highly focused musical skills towards musical enjoyment through experience for all. As ASD students may learn sound, rhythm, and sensory input differently, music pedagogy should provide multiple pathways for participation in music classes. Amanda Draper states, "In reality, students labeled with a disability or other exceptional learning style are often marginalized due to inaccessible classroom environments, one-size-fits-all curriculum, and instructional approaches that serve a select few

[76] Bottema-Beutel et al., "Avoiding Ableist Language: Suggestions for Autism Researchers," 19.

[77] David Connor et al., "Disability Studies and Inclusive Education, Implications for Theory, Research, and Practice," *International Journal of Inclusive Education* 12, no. 5–6 (September 2008): 442, https://doi.org/10.1080/13603110802377482.

musicians. It is these barriers that may be disabling to a student, not the students themselves."[78] Alternative notation, technology-assisted learning, sensory-regulated rehearsal spaces, and flexible tempo expectations can broaden musical competence without lowering standards. Through flexible pedagogy, multimodal engagement supports communication and regulation for ASD students in music classes, redefining musical success as a part of the social model of disability.

Learned Helplessness

Although learned helplessness is not an official diagnostic term for ASD, it is a recognized behavioral phenomenon that may develop when individuals repeatedly experience constraints to being independent in their environments regarding autonomy, communication, and opportunity. Lynn Kern Koegel, Clinical Professor of Psychiatry and Behavioral Sciences at Stanford University School of Medicine, notes that "When children get their needs met without having to be communicative, their efforts accomplish the end goal, and they may cease to engage in these important behaviors. In other words, under such conditions, children behave as if they are helpless because they are unable to escape controlled events or negative situations."[79] This underscores the importance of creating environments that promote ASD communication rather than preempt it. Educators must be aware of the need to consistently anticipate needs without providing opportunities for expressive communication or support, as the ASD student may not initiate communication when there is no need. In addition, music educators should be aware of

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[78] Amanda R. Draper, "Disrupting Ableism in Music Education through Preservice Preparation," in *Points of Disruption in the Music Education Curriculum*, vol. 1, ed. Marshall Haning, Jocelyn A. Stevens, and Brian N. Weidner (New York: Routledge, 2024), 51, https://doi.org/10.4324/9781003410645-4.

[79] Lynn Kern Koegel, "Pivotal Response Treatment (PRT): Research Findings Over 30 Years," in *Handbook of Applied Behavior Analysis Interventions for Autism: Integrating Research into Practice*, ed. Justin Leaf et al. (Cham, Switzerland: Springer, 2022), 210, https://doi.org/10.1007/978-3-030-96478-8.

highly structured settings that limit choice, autonomy, and self-advocacy, as these settings can limit communicative behavior. Additional processing time or wait time should be incorporated into teacher-student interactions as alternative modalities and opportunities for agency.

Social Isolation

There may be barriers in social community settings due to the nature of ASD, as students may be limited in their communication means. One stigma includes the significant challenges surrounding ASD, with limited understanding and misconceptions leading to social exclusion, stereotypes, and discrimination, hindering opportunities to develop meaningful social connections. Social perception, compared with neurology, appears to be the primary barrier to participation in this instance. Within the social model of disability, stigma operates as a social and environmental barrier restricting learning in social contexts. Social interaction is crucial for promoting learning, boosting self-esteem, and enhancing physical and mental well-being, as stigma, along with isolation, can contribute to anxiety, reducing participation, lowing academic performance. Educators are encouraged to promote neurodiversity awareness by designing cooperative activities that use multiple forms of interaction, increasing social engagement for all.

Students with ASD may also experience differing degrees of social isolation, such as physical isolation, emotional isolation, and academic isolation. Teaching practices or approaches may also contribute to additional isolation, including physical and academic isolation. Educators should be mindful to show empathy and consider students' perceptions of being unsupported or misunderstood. In addition, the negative impact on school enjoyment may manifest as despair, dread, stress, and anxiety stemming from the unpredictability of sensory information in the social environment or routine at the learning institution, leading to increased social isolation.

Students with ASD can be socially isolated, leading to bullying or contributing to mental health issues. Tatiani Gkatsa and Irene Antoniou, researchers at the University of Ioannina, Greece, found that inclusion needs to be supported by cultural and structural measures, which may limit their exposure to bullying, as autistic children have a higher risk of being prone to victimization compared to typically developing children.[80] The social model of inclusion focuses on the intentional education of peers with the design of educational settings to enhance learning for students with disabilities. Craig Goodall explains that autistic children may unknowingly mistake attempts by peers to tease or humiliate as friendly interactions, finding subtle social interaction nuances ambiguous in body language, voice intonation, and unwritten rules of social engagement.[81] Inclusion should foster genuine social belonging while providing and promoting safe educational settings for all students, eliminating bullying with the associated mental health effects of heightened anxiety, depression, and school avoidance, which negatively impact academic engagement.

The Label

A person's first language should be used, rather than an identity-first language, for example, when referring to an "individual with ASD." First-person language is socially acceptable: by definition, it emphasizes the person as an individual before the disability. This contrasts with identity-first language, which refers to the disability first, before the individual, such as "autistic individual." A person's first language is always in line with the law. Less

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[80] Tatiani Gkatsa and Irene Antoniou, "Bullying and Autism Spectrum Disorder: Correlating the Victimization of High-Functioning Autism Students with Educational Practices in the Context of Inclusion in Primary Education," *International Journal of Bullying Prevention* 6 (January 2024): 342, https://doi.org/10.1007/s42380-023-00208-3.

[81] Craig Goodall, *Understanding the Voices and Educational Experiences of Autistic Young People: From Research to Practice* (New York: Routledge, 2020), 68.

emphasis must be placed on the disability label and more on the person. Additionally, terms and language must be used correctly. Terms such as attention deficit disorder (ADD), Asperger's, "R" word, or handicapped are not used in today's setting. Finally, the label of ASD may be a barrier, as people may have preconceived ideas or misconceptions about what the disorder is.

Symptoms

The multitude of symptoms, acting as barriers, associated with ASD have to be overcome. Sensory processing may be hypersensitive or hyposensitive, and this sensitivity can vary depending on the circumstances or setting. They experience difficulties with sensory integration, as information from multiple senses and sources can become overwhelming, leading to overstimulation. Some ASD students who are hypersensitive may seek out other senses to compensate for the lack of stimuli. Amy Yacoub, a Pediatric Speech-Language Pathologist, suggests this may be perceived as constant movement, which can affect the attention required for learning in an academic environment.[82] Yacoub views sensory processing differences not as deficits to overcome but as a function to influence how ASD students interact and engage in their learning environments. Educators can reduce overstimulation in their learning environments, support regulation, and improve access by removing barriers and making classrooms sensory-responsive.

Additionally, students with ASD may have deficits in executive function that impact cognitive skill sets, manifesting in a lack of organization, impaired memory, or lack of attention. Language and communication symptoms of ASD also contribute to learning barriers. These students may exhibit delayed expressive and receptive language, as well as difficulty with the

[82] Amy Yacoub, "How Does Autism Affect Learning," *Forbrain*, September 4, 2023, https://www.forbrain.com/autism-learning/.

social use of language. Students with ASD process information differently, with some having enhanced visual processing skills; however, written or verbal information processing may be challenging for these students. Generalization and figurative language on concepts may be complex for students with ASD, as they may not understand metaphors or analogies. Transferring knowledge from multiple sources toward a general theme or idea is also challenging for students with ASD. Generally, students with ASD prefer structured environments with predictable routines. Restrictive and repetitive behaviors (RRB) of ASD can also interfere with learning as students become hyperfocused on an object or topic.

Comorbidities

Psychiatric, neurodevelopmental, or medical comorbidities may accompany ASD. Psychiatric comorbidities include: attention deficit hyperactivity disorder (ADHD), anxiety disorders, depression, and obsessive-compulsive disorder (OCD). Neurodevelopmental comorbidities include intellectual and developmental disability (IDD), language disorders, and specific learning disorders. Medical comorbidities may manifest as epilepsy, gastrointestinal issues, and sleep disturbances. These comorbidities may complicate interventions, necessitating individualized, holistic support approaches for educational practices to optimize effective, functional outcomes.

Joint Attention

The development of language and communication skills requires consideration of others' interests through shared attention to objects and activities. The key components of joint attention include coordinated attention through looking, social awareness, and communication skills. Joint attention is a difficult concept for those with ASD, as they may not be interested in people, events, objects, or situations compared to their peers. In addition, students with ASD may find it

challenging to engage with others. Students with ASD may be unable to receive informational input that engages joint attention on a particular interest that is meaningful to them. Facial expressions, tone of voice, and gestures may not have contextual meaning regarding the interest.

Joint attention is important because it is linked to language development, social communication, and theory of mind. Hammel and Hourigan note, "the lack of joint attention by students with autism leaves them at a disadvantage in the area of cognition. They fail to be interested in the shared earnings from a group activity or project. The struggle to pick up on imitation cues or the modeling that happens in their learning groups."[83] Therefore, music educators must examine the social aspect of learning as an accommodation for students with ASD. It is only through repeated, direct task behaviors that shared joint attention to an interest, as it relates to them, can be taught to them from another person through cues and information. Hammel and Hourigan demonstrate that the primary barrier to joint attention is instructional design rather than the ASD student's cognition. At the same time, the music educator needs to provide multimodal instruction with structured supports to fully engage all students, rather than relying on unspoken social cues and implicit modeling, which can rapidly shift students' attention. Visual models, step-by-step demonstrations, and written or graphic supports with predictable structures assist with neurodiversity teaching and joint attention.

Social Attention

Social attention differs from joint attention. Components of social attention include eye contact, social referencing, recognition of facial expressions, responses to social cues, and the initiation of social interactions. Social attention fosters growth in language development, social

[83] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 63.

communication, learning through observation, emotional understanding of others, self-regulation, and friendship development. Both social attention and joint attention focus on an object of interest; social attention relies on social interaction, noticing and interpreting cues such as voice inflection, body gestures, or facial responses from other individuals. According to Hammel and Hourigan, these cues provide individuals with meaningful social interaction; however, "Children with ASD often compartmentalize these interactions and become confused."[84] This explanation focuses on a model of processing differences, in which information may be sequential through sound, then movement, then visual detail, rather than being holistic. The cognitive load may lead to delayed or atypical responses, as evidenced by reduced eye contact and/or gaze, contributing to challenges in social attention and interaction with others.

Levels of Autism

Measurement of Severity

According to the American Psychiatric Association, ASD is assessed at three severity levels by a practicing licensed clinician using the Clinician-Related Severity of Autism Spectrum and Social Communication Disorders Form.[85] The measurement of levels of interference, or autistic traits that interfere with daily tasks or functioning, determines the support required for a) social communication problems and b) restricted interests and repetitive behaviors for the

[84] Hammel and Hourigan, *Teaching Music to Students with Autism*, 59

[85] "Clinician-Rated Severity of Autism Spectrum and Social Communication Disorder," *American Psychiatric Association*, accessed October 19, 2025, https://www.psychiatry.org/File%20Library/Psychiatrists/Practice/DSM/APA_DSM5_Clinician-Rated-Severity-of-Autism-Spectrum-and-Social-Communication-Disorders.pdf.

individual diagnosed with ASD and receiving care. The assessment assists in treatment planning and prognostic decision-making.

Scoring of Assessment

The scoring for the assessment of severity falls on a four-point scale (Level Zero=None; Level One=Mild/Requiring support; Level Two=Moderate/Requiring Substantial support; and Level Three=Severe/Requiring Very Substantial support). The clinician's scoring is intended to accurately assess the individual based on available information and professional judgment. Severity levels are reported separately for each domain and should not be combined into a single score.

Autism is a multidimensional condition that involves two distinct core domains. Domain one includes social communication and social interaction. Domain two includes restricted, repetitive patterns of behavior, interests, and activities. For students with ASD, difficulties in one domain may not correspond to difficulties in another. For example, a student may have severe social communication difficulties but mild repetitive behaviors. Another student may have severe sensory issues and restrictive behaviors but have moderate social communication difficulties. A single combined score would obscure the results of observations and undermine the importance of those differences.

In addition, the separate severity rating assists in understanding individuals with ASD difficulties, helping tailor interventions to their specific needs. Clear communication across multidisciplinary teams, including music education, supports planning for students with ASD, promotes the least restrictive environment, applies universal learning design, and develops interventions and educational strategies to support students' learning. Continued tracking of the process across all domains for students with ASD fosters ongoing feedback to adapt instruction

to their needs. With a combined score in the severity rating, it would be challenging to know areas of improvement with intervention and what is driving impairment for the ASD student.

The two domains have different underlying issues with neurocognitive and genetic components. Severity in one domain does not predict the severity in the other. Autism spectrum disorder, then, is not one-dimensional and not in a single continuum. Using the severity rating form may reveal the individual's strengths and weaknesses.

Frequency

Over time, an individual's severity of ASD symptoms may be tracked. The severity form may be completed at regular intervals, as clinically indicated, based on the individual's symptoms, stability, and treatment status. Specifically, high scores in domain areas may indicate problematic areas that warrant further examination, treatment, and follow-up.

Level One

Individuals with ASD typically fall within this diagnosis level. Individuals at level one have some difficulty communicating, understanding social cues, and receiving and producing expressive and receptive language. These individuals may exhibit limited interests and restricted, repetitive behaviors (RRB). The American Psychological Association (DSM-5) states the following:

> Without supports in place, deficits in social communication cause noticeable impairments, Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to others' social overtures. May appear to have decreased interest in social interactions. For example, a person who can speak in full sentences and engage in communication but whose to-and-from conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful. Behavioral inflexibility significantly interferes with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.[86]

[86] "Clinician-Rated Severity," *American Psychiatric Association*, accessed October 19, 2025.

ASD translates to more than social differences in symptoms, but is an obvious impairment, apparent without appropriate supports to assist in coping with these deficiencies. Individuals with levels of ASD may not understand body language, say the wrong thing at the wrong time, have difficulty initiating conversation, and find relationships difficult to establish and maintain compared to peers. Individuals may find it challenging to switch from one activity to another, especially when an item, object, or topic grabs their attention. There may be cognitive developmental delays that affect their thinking and problem-solving, which may manifest as a lack of interest in certain classroom activities or experiences. The DSM-5 establishes criteria for ASD; however, educational practice assesses individuals' abilities against these criteria to determine learning limitations and eligibility for the least restrictive environment to support inclusion in the learning process.

Level Two

Individuals with level two ASD have more difficulty communicating, using simple language to express their wants and needs. Typically, students with level two ASD receive services from a multidisciplinary team, including a behavior analyst, speech-language pathologist, and occupational therapist, to address their needs. The American Psychological Association (DSM-5) states the following:

> Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interactions are limited to narrow special interests, and who has markedly odd nonverbal communication. Inflexibility of behavior, difficulty coping with change, or other restricted/repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action.[87]

[87] "Clinician-Rated Severity," *American Psychiatric Association*, accessed October 19, 2025.

The wording of "marked deficits" indicates intensifying severity compared to milder manifestations of behaviors, as stressing accommodations may benefit students with ASD, but not eliminate the noticeable behavioral and social communication differences between neurodivergent individuals and the neurotypical. Additionally, individuals with level three ASD engage in echolalia, repeating phrases they have heard before, which may or may not be meaningful. Additionally, an augmentative and alternative communication (AAC) system that uses one- or two-word phrases communicates needs or wants. RRB becomes more evident to others as vocal scripting, repetitive motor movements, or fixations on environmental objects. These individuals may struggle with changes that result in challenging behaviors.

Level Three

Individuals with level three ASD have severe difficulty expressing themselves non-verbally and verbally. They do not initiate interaction and may not speak or engage in conversation. If they do engage, it is solely to have needs met. The American Psychological Association (DSM-5) states the following:

> Severe deficits in verbal and nonverbal social communication skills result in severe impairments in functioning, limited social initiation, and minimal response to others' social overtures. For example, a person with few words of intelligible speech who rarely initiates interaction and, when they do, makes unusual approaches to me needs only to respond to very direct social approaches. Inflexibility of behavior, extreme difficulty coping with change, or other restricted/repetitive behaviors markedly interfere with functioning in all spheres. Great distress/difficulty changing focus or action.[88]

Some individuals will be completely non-verbal; however, they may communicate through an AAC device, such as a speech-generating device, pictures, and/or signs. Intensive support is

[88] "Clinician-Rated Severity," *American Psychiatric Association*, accessed October 19, 2025.

required to enable the individual to achieve their full potential. Here, inclusion requires a multi-tier system of supports with deliberate planning and collaboration of all stakeholders; the terminology for this level of ASD centers on impairment. However, educational practice can reframe behaviors and traits through a strengths-based, access-oriented lens, shifting individual deficits into needs for support. The language does not minimize the significant challenges of ASD. Still, it holds the educational system responsible for finding a way to provide access, rather than being defined by labels or individual limitations.

Intelligence

To further understand intelligence within an educational context, it is important to consider the cognitive abilities that enable individuals to respond to daily challenges. According to Ulric Neisser, intelligence encompasses an individual's "ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by thought."[89] Within the Wechsler model of cognitive ability, intelligence is evaluated across five primary domains: verbal comprehension, visual-spatial processing, fluid reasoning, working memory, and processing speed, providing information about different aspects of an individual's cognitive functioning, assisting professionals to understand how students process information for learning tasks.[90] Advocates for music programs, using a utilitarian approach, would argue that music makes students smarter; however, without establishing a baseline for intelligence (IQ) and a recognized method for obtaining valid

[89] Neisser, Ulric, Gwyneth Boodoo, Thomas J Bouchard, A Wade Boykin, Nathan Brody, Stephen J Ceci, Diane F Halpern, et al. "Intelligence: Knowns and Unknowns." *American Psychologist.* 51, no. 2 (February 1996): 77.

[90] Gary Groth-Marnat and A. Jordan Wright, *Handbook of Psychological Assessment*, 6th ed. (Hoboken, NJ: Wiley, 2016), 180.

results demonstrating increased IQ growth with music, the argument becomes less compelling. Daniel Levitin, Professor Emeritus of Psychology and Neuroscience at McGill University, notes that "musical activity involves nearly every region of the brain that we know about and nearly every neural subsystem."[91] Additionally, Harold Abeles, Professor Emeritus of Music Education at Teachers College and Columbia University, states, "The multisensory nature of the musical activity is seemingly mapped in the multiple locations for music,"[92] which includes the hippocampus, amygdala, corpus callosum, cerebellum, prefrontal cortex, auditory cortex, sensory cortex, and motor cortex. Since neural areas in the brain activate simultaneously during aural stimulation, music may serve as a pathway to supporting social communication deficits in individuals with ASD, enhancing individual expression, regulation, and connection. Researcher and musicologist Laura Navarro, along with her colleagues, suggest that music-based interventions (MI) may not yield uniformly large or statistically robust effects across all developmental domains in autism; they show meaningful promise when applied in a targeted, individualized, and context-sensitive manner.[93] Music interventions in the educational process should be tailored to students' needs to produce measurable positive outcomes, as they can be a flexible pedagogical tool to support learning in educational settings. Navarro's study underscores the non-invasive potential of music, within the context of sensitivity and domain-specific strengths, as a therapeutic approach that benefits social, emotional, and cognitive responses for

[91] Daniel Levitin, *This Is Your Brain on Music: The Science of a Human Obsession* (New York: Dutton, 2008), 299.

[92] Harold Abeles, *Critical Issues in Music Education* (New York: Oxford University Press, 2010), 66.

[93] Laura Navarro et al., "The Effect of Music Interventions in Autism Spectrum Disorder: A Systematic Review and Meta-Analysis," *Frontiers in Integrative Neuroscience* 27 (October 2025): 2, https://doi.org/10.3389/fnint.2025.1673618.

individuals on the spectrum by engaging multiple areas of the cerebral cortex that enhances brain function.

Music offers numerous benefits for students in music education programs within our school systems. *The Benefits of Music* details research that shows students trained in music exhibit a high degree of precision in auditory processing, enabling them to distinguish subtle details in speech and reading, thereby increasing comprehension and enhancing their ability to interpret others.[94] Students' verbal comprehension also improves through participation in school music programs. Beyond literacy development, one benefit of music education is improved social understanding, as individuals must recognize and interpret the visual and vocal cues which emphasize emotional inflection when performing music. Additionally, cognitive psychologists Anaya Esperanze, David Pisoni, and William Kronenberger indicate that music training can strengthen the connection between visuospatial sequential learning and sensorimotor abilities.[95] Furthermore, music students process information, interpreting it in connection to musical development while applying it in a performance setting that is ever-changing in musical growth. Research shows that students' fluid reasoning increases in music participation. Psychologists and researchers Jim Meyer, Pinar Oguz, and Katherine Moore note that "the global finding that musicians scored better than non-musicians on fluid intelligence is consistent with prior literature showing superior cognition in trained musicians."[96] In addition, they found that musicians scored

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[94] "The Benefits of Music Education," *An Overview of Current Neuroscience Research*, The Royal Conservatory, accessed November 30, 2024, https://www.rcmusic.com/about-us/rcm-neuroscience/why-study-music.

[95] Esperanza Anaya, David Pisoni, and William G. Kronenberger, "Visual-Spatial Sequence Learning and Memory in Trained Musicians," *Psychology of Music* 45, no. 1 (July 2016): 19, https://doi.org/10.1177/0305735616638942.

[96] Jim Meyer, Pinar Oguz, and Katherine Moore, "Superior Fluid Cognition in Trained Musicians," *Psychology of Music* 48, no. 3 (May 2020): 434, https://doi.org/10.1177/0305735618808089.

higher on several cognitive components. Likewise, working memory improves with musical participation. It allows one to retain information while engaged in other activities or tasks. The ability to reason, recognize patterns, and solve problems relies on previously learned knowledge. Cognitive neuroscientists and researchers Nutley Bergman, Sissela Darki, and Torkel Klingberg note that "music practice positively affects working memory and supports the importance of practice for the development of working memory during childhood and adolescence."[97] Only through consistent, regular, structured engagement can music instruction provide repeated opportunities to develop memory, attention, and sequenced skills, enhancing the capacity for cognitive growth.

Lastly, processing speed is a controversial component of intelligence, as it might not be a reliable indicator of IQ. Engagement in music reading and listening may increase the brain's ability to receive, process, and respond to information; however, disorders such as ASD may be associated with slower processing speeds that do not reflect the individual's IQ.

Research suggests moving away from terms such as high and low functioning as categorical descriptors for ASD. Gail Alvares, Research Fellow at CliniKids within The Kids Research Institute Australia, along with colleagues, suggests applying meaning "towards a greater understanding of the variety of functioning and cognitive profiles that manifest across the autism spectrum and the specific support needs required to maximize an individual's opportunities and potential."[98] Intelligence may be an imprecise metric of ability. Alvares and colleagues found that IQ was a weak indicator of adaptive functioning, as cognitive scores might

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[97] Nutley Bergman, Sissela Fahimeh Darki, and Torkel Klingberg, "Music Practice Is Associated with Development of Working Memory during Childhood and Adolescence," *Frontiers in Human Neuroscience* 7 (2014): 1662, https://doi.org/10.3389/fnhum.2013.00926.

[98] Gail A. Alvares et al., "The Misnomer of 'High Functioning Autism': Intelligence Is an Imprecise Predictor of Functional Abilities at Diagnosis," *Autism* 24, no. 1 (January 2020): 230, https://doi.org/10.1177/1362361319852831.

not reflect how individuals with ASD manage their daily tasks, interactions, and communication. Their research suggests a gap between intellectual potential and task performance. Instead of relying on IQ labels, assessments should have a wide range of skills to determine their support needs.

Biological, Cognitive, and Behavioral

The biological aspects of ASD refer to underlying conditions in brain development, including genetics, brain structure and function, neurological development, prenatal and perinatal factors, and environmental conditions. Cognitive aspects relate to how individuals with ASD process information, including their thinking, reasoning, and understanding over time. Environment, education, nutrition, and social interaction influence both intelligence and cognition. Key theories explain social and communication differences for individuals with ASD, which include theory of mind, executive function, and weak central coherence. Lastly, the behavioral models focus on observable behavior. Key concepts include the following: behavior is influenced by the environment; the learning process differs from that of neurotypical children; behavior serves a function; methods such as Applied Behavior Analysis (ABA) teach new skills through evidence-based practices; and behavior is a form of communication.

Cognitive Theories

Mind-Blindness

Cognitive issues for an ASD individual include thoughts, feelings, and perspectives of others, occurring as mind-blindness. Mind-blindness is a cognitive disorder in which a person is unable to attribute mental states to themselves and others. As a result, the person is unaware of other mental states. Mind-blindness is closely related but not the same as autism. The individual

is incapable of attributing beliefs and desires to others, a capacity known as theory of mind. However, individuals with ASD still care and have empathy towards others but process it differently.

Theory of Mind (ToM)

It is theorized that the theory of mind is delayed in development for individuals with ASD, causing gaps in conceptualizing, understanding, and predicting emotional states in others. The theory of mind in ASD labels students with deficiencies in central coherence, executive function, cognitive processing, and engagement. Autistic students struggle with the ability to discern personal yearnings or perspectives from other people's beliefs or desires. Hammel and Hourigan note that "for example, if you ask a child with autism what a friend might want as a birthday present, the individual might answer by telling you what he or she wants instead."[99] The child interprets the world from their individual viewpoint, not intentionally disregarding others, since that skill has yet to develop. Hourigan and Hammel describe the challenge as the difficulty of shifting from one's unique perspective to considering others' thoughts or preferences outside one's own. In educational settings, the theory of mind explains why students' responses and behaviors appear to be driven by social information. When educators understand this mental state and recognize these differences, they can provide model responses, prompts, and musical stories to clarify expectations, offer guidance, and provide structured opportunities to consider others' viewpoints.

[99] Ryan M. Hourigan and Alice M. Hammel, "Understanding the Mind of a Student with Autism in Music Class," *Music Educators Journal* 104, no. 2 (2017): 22.

Executive Function (EF)

Additionally, executive function (EF) issues may affect planning, organization, and self-control. Leanne Tamm, Professor of Pediatrics at the University of Cincinnati College of Medicine, along with her colleagues, note that "academic challenges such as losing/not turning in assignments, misplacing materials, and inefficient studying are common in middle-school students with autism spectrum disorder (ASD) without intellectual disability."[100] Tamm conveys that ASD students may be successful when they set goals and develop strategies to achieve, using those skills to structure tasks and apply resources. Their success reduces anxiety and increases their capacity to control and manage their emotions. These steps lay the foundation to achieve educational milestones. Behavioral and social success are reinforced, which is key to maintaining positive conduct and interactions which builds sustaining relationships. Tamm's research highlights the need for targeted supports to enhance executive function.

Weak Central Coherence

Limitations in deficit-based explanations have prompted the development of alternate theories which provide a comprehensive understanding of information processing for individuals with ASD. Uta Frith, Emeritus Professor at University College London, and Francesca Happe, Professor of Cognitive Neuroscience at King's College London, are credited with the development and expansion of Weak Central Coherence Theory. Weak central coherence may explain problems in interpreting or understanding language, communication challenges, along with difficulties in social understanding. Francesca Happé, Judy Briskman, and Uta Frith state:

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[100] Leanne Tamm et al., "Improving Academic Performance through a School-Based Intervention Targeting Academic Executive Functions – A Pilot Study," *International Journal of Developmental Disabilities* 70, no. 3 (July 2024): 549, https://doi.org/10.1080/20473869.2022.2095690.

> Both the theory of mind account and the executive function theory of autism are deficit accounts. As such, they have difficulty explaining why some cognitive functions are not only spared but also, on occasion, superior in people with autism. In response to this challenge, an alternative account of the nonsocial aspects of autism has been proposed: weak central coherence.[101]

Individuals with ASD may hyperfocus on small details instead of seeing the bigger picture. ASD also affects individuals' intellectual profiles, with difficulty integrating information and thinking abstractly.

Behavioral Models

Individuals with ASD may have noticeable mannerisms, such as repetitive and restricted behaviors. Additionally, individuals may have sensory and communication challenges, as well as difficulty controlling emotions. It is important to understand the function of behavior, as individuals with ASD often attempt to communicate or achieve something through their actions. All behaviors have a purpose, being expressions of need. If one knows why a behavior occurs, a response can be provided to help teach a more appropriate behavior. Responses may inadvertently reinforce undesired behavior. Furthermore, one must reflect on their responses to reinforce positive behaviors. Knowing the function of the behavior may also help identify an alternative response that better meets the individual's needs. When behavior is understood as a function of communication rather than misbehavior, one can remain calm, reducing frustration and enabling better choices in the moment. Ignoring or reprimanding behavior without understanding its purpose might work temporarily, but it does not address the root cause.

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[101] Francesca Happé, Judy Briskman, and Uta Frith, "Exploring the Cognitive Phenotype of Autism: Weak 'Central Coherence' in Parents and Siblings of Children with Autism: I. Experimental Tests," *Journal of Child Psychology & Psychiatry* 42, no. 3 (2001): 300, https://doi.org/10.1017/s0021963001006916.

Four Functions of Behavior

Understanding the function of behavior can build lasting skills that an individual can use in life. Functional analysis (FA), developed by Brian Iwata, is a systematic method that identifies the components of a specific behavior, including its purpose, reinforcement, and frequency.[102] Functional analysis provides individualized treatment with humane, evidence-based, functionally driven interventions. Before the development of FA, challenging behaviors, such as self-injury, were treated negatively because clinicians did not understand their causes. Crystal Slanzi, a behavioral scientist and Assistant Professor of Psychology at California State University of Los Angeles, along with her colleagues expand on functional analysis by identifying the four functions of behavior, which are (a) attention-gaining social attention from others, (b) escape/avoidance- to avoid a task, situation, or demand, (c) tangible-accessing a preferred item or activity, and (d) sensory-receiving internal or sensory stimulation.[103] All behavior has a purpose. Jennifer Fritz, Professor in the Department of Clinical Health and Applied Sciences at the University of Houston-Clear Lake, along with her colleagues, note: "since the development of functional analysis methodology for identifying the reinforcers that maintain problem behavior, researchers have been able to develop interventions that effectively decrease the behavior more precisely."[104] It is crucial for educators to understand the reasons and needs behind individual behavior to develop interventions to address those needs before attempting to

[102] Brian Iwata et al., "Toward a Functional Analysis of Self-Injury," *Journal of Applied Behavior Analysis* 27, no. 2 (Summer 1994): 207, https://doi.org/10.1901/jaba.1994.27-197.

[103] Crystal Slanzi et al., "Further Evaluation of Functional Analysis Screening Methods in Early Autism Intervention," *Journal of Applied Behavior Analysis* 55, no. 3 (June 2022): 856, https://doi.org/10.1002/jaba.925.

[104] Jennifer Fritz et al., "Noncontingent Reinforcement without Extinction plus Differential Reinforcement of Alternative Behavior during Treatment of Problem Behavior," *Journal of Applied Behavior Analysis* 50, no. 3 (Summer 2017): 591, https://doi.org/10.1002/jaba.395.

eliminate the behavior. By analyzing the function of behavior, educators can respond by modifying instructional strategies, communication methods, or environmental demands, thereby supporting positive student outcomes.

Child Behavior Development for ASD Students

Students with ASD typically display social and behavioral development delays compared to neurotypical peers, encountering a more complex demanding environment socially and academically. Hammel and Hourigan acknowledge that students with autism may also have challenges with "routines, eating, toilet training, social skills, basic decision-making skills, self-control, and a fundamental sense of autonomy."[105] Examination of the ASD student's IEP, along with discussions with special education staff, will include methods for achieving academic and behavioral goals that exist to benefit their needs.

Disruptions

Meltdowns, outbursts, or other disruptions appear in the form of fear or anxiety for the ASD student in the classroom and school settings. These students try to identify, avoid, and cope with persistent strong feelings associated with triggers to anxiety. Students with ASD find managing anxiety frustrating, challenging, and uncomfortable, as they have a limited ability to communicate their feelings or to process their emotions with others around them. Educators should reflect on these classroom disruptions in a positive light, as they are a signal (need) to express themselves. The behavior is not intended to disrupt but to convey a need, express fear, anxiety, or frustration, as these may indicate a need for assistance in adjusting to the learning environment. When disruptive outbursts occur, they are not intentional. The disruptive behavior

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[105] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 89.

communicates that the students with ASD have a need, are missing something, or lack processing ability and/or understanding in their learning environment; however, for the student's protection, a behavior intervention plan (BIP) may be included in the IEP to guide the management of behavior issues.

Educators can support students with ASD by establishing clearly structured routines and predictable classroom environments. Hammel and Hourigan note that "Interruptions in a schedule or routine often cause disruptive behaviors in students with autism. Many teachers misinterpret behaviors associated with these disruptions. Students with autism experience high anxiety regarding events in their lives they cannot control."[106] Hammel and Hourigan also discuss that clearly defined schedules assist students in understanding and anticipating what will occur that day. The use of visual schedules can also reduce anxiety, helping them cope with daily scheduled expectations.

Reflecting on Behavior (BX)

First, when reflecting on behavior, educators should refrain from labeling it "bad" until they understand its intent. When students repeatedly hear that their behavior is bad, it can negatively affect their self-esteem. Second, educators should not assume students with ASD comprehend social expectations and procedures in the music classroom. Those procedures and expectations must be clear and use multimodal methods so that all students can understand; however, specific behavior plans may not align with rules, procedures, and expectations, needing to be adapted for the student with ASD when appropriate to meet their needs. Lastly, the

[106] Hammel and Hourigan, *Teaching Music to Students with Autism*, 96.

intervention should not occur until the educator understands why the student is engaging in the behavior, unless it poses a danger to the class or to the educator.

Positive Reinforcement (SR+)

Positive reinforcement is used to reward good behavior and to encourage repetition. Reinforcing appropriate behaviors in behavioral conditioning moves a person toward a learning goal. Examples of positive reinforcement include verbal praise, such as compliments and acknowledgment of effort; physical affection, such as high-fives, pats on the back, and side hugs; and tangible rewards, such as stickers, tokens, and extra playtime. The benefits of positive reinforcement include improved behavior, strengthened relationships, and continued development towards educational goals. As a precaution, overusing a reward system for students may diminish its effectiveness.

Shaping Behavior

Shaping occurs when praise reinforces behavior in small steps toward a larger goal, thereby creating a new skill within the environment. The purpose of shaping is to teach students skills or behaviors that are not yet in their skill repertoire. Psychologists and behavioral scientists Megan Callahan, Jill Fodstad, and James Moore note that shaping is the process of applying "differential reinforcement of successive approximations to a terminal response."[107] To paraphrase, it is the rewarding of individuals for the performance of successive approximations towards a target or response. Beyond learning content, this method can also achieve social and behavioral goals. Olumuyiwa Fagbohun, founder of ABA-Seniade, which provides culturally

[107] Megan Callahan, Jill Fodstad, and James Moore, "History of Applied Behavioral Analysis," in *Handbook of Applied Behavior Analysis Interventions for Autism: Integrating Research into Practice*, ed. Johnny Matson (Cham, Switzerland: Springer, 2023), 11, https://doi.org/10.1007/978-3-031-19964-6.

responsive interventions for individuals with autism, suggests that identified barriers should be considered to enhance the effectiveness of shaping when meeting the needs and preferences of students with ASD. Integrating technology-based tools can complement traditional shaping techniques to improve behavioral outcomes that supports self-regulation in the learning process.[108]

Prompting

Prompting is a form of verbal instruction (VP), gestures (GP), modeling/demonstrating (MP), and physical touch (PP). Soonhwa Seok notes that prompts assist in supporting an individual to make correct/errorless responses during learning and performance.[109] The purpose is to ensure success when support is gradually removed during the teaching of a new skill. Prompting creates predictability, reduces frustration during skill acquisition, and builds the individual's confidence and independence. All forms of prompting support learners in reducing errors and minimizing confusion toward successful task completion. Prompts fade out once the learner can perform the behavior, skill, or task independently.

Chaining Behavior

Chaining behavior is a teaching method in which a complex behavior is broken down into smaller, sequential steps, with each step serving as a cue for the next through reinforcement. This technique helps individuals learn new skills by reinforcing the connections among the steps in

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[108] Olumuyiwa Fagbohun, "Barriers to Prompting and Shaping Techniques in Behavior Intervention for People with Autism" (PhD diss., Walden University, Minneapolis, 2024), 119, ProQuest Dissertations & Theses Global, https://www.proquest.com/dissertations-theses/barriers-prompting-shaping-techniques-behavior/docview/3142752624/se-2.

[109] Soonhwa Seok, "A Systematic Review of the Use of Prompting for Preschoolers With Developmental Delay," *Handbook of Research on Critical Issues in Special Education for School Rehabilitation Practices*. Edited by Ajay Singh, Chia Jung Yeh, Sheresa Blanchard, and Luis Anunciação, (Hershey, Pennsylvania: Information Science Reference, 2021), 79, doi:10.4018/978-1-7998-7630-4.

the chain. Examples of chaining include backward (BC) and forward chaining (FC). Backward chaining involves teaching the last step first, then progressively adding the preceding steps in reverse order. Forward chaining begins by teaching the first step and progressively adding subsequent steps until the sequence is mastered. Hammel and Hourigan suggest that "Tasks, information, skills, and sequences can be taught by creating small steps (discrete trials) or pieces from a larger set of behaviors."[110] This is similar to other task management strategies for learning.

Chaining should not be confused with scaffolding, which is a temporary support system used as a teaching strategy to help students learn something they cannot do independently. Scaffolding supports include visual aids, prompts, modeling, chunking information, guided practice, breaking down instructions into small segments, and graphic organizers. Over time, scaffolding support fades, enabling students to perform tasks independently. Chaining is taught as a multi-step process for behaviors, focusing on actions, whereas scaffolding emphasizes temporary supports to develop the new skill. The tasks in chaining follow clear, orderly, almost rigid steps structured as events. In contrast, scaffolding applications for conceptual and academic topics are less structured, being more flexible, tailored to students' needs. Finally, Eric Burkholder and Martha Pelaez make the connection, stating, "Scaffolding is very similar to the behavioral process of shaping. By successively changing the criterion for reinforcement, the behavior being shaped more closely resembles the targeted terminal behavior."[111] The

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[110] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 14.

[111] Eric Burkholder and Martha Peláez, "A Behavioral Interpretation of Vygotsky's Theory of Thought, Language, and Culture," *Behavioral Development Bulletin* 9, no. 1 (Spring 2000): 7, https://doi.org/10.1037/h0100530.

comparison of the two strategies demonstrates that both rely on an incremental learning process, with gradual progression toward mastery of the learned skill.

Extinction (EXT)

Extinction removes or interrupts the reinforcement cycle that maintains a behavior. When behavior decreases, the individual becomes receptive to learning new skills, allowing them to use more appropriate means to address their needs. In short, behavior analysts Hannah MacNaul and Leslie Neeley detail the ethical implications in various instances where target behaviors may have increased but were replaced by undesired or negative behaviors.[112] In some cases, this would be an extinction burst, in which the unwanted behavior becomes more intense or frequent when the reinforcer is removed. In addition, anxiety, frustration, and emotional distress may escalate during the EXT process with the sudden removal of the reinforcer. Furthermore, it is important to be consistent in implementation, as unintentional reinforcement makes it harder to eliminate the behavior. Educators typically combine extinction with reinforcement of an appropriate replacement behavior.

Generalization

Generalization is the process by which teaching behavior occurs across individuals and settings, using and applying different materials. The purpose of generalization is to provide skills that are functional in real-life settings. Generalization provides individuals with independence and the flexibility to adapt to different settings and circumstances.

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[112] Hannah MacNaul and Leslie Neely, "Systematic Review of Differential Reinforcement of Alternative Behavior Without Extinction for Individuals with Autism," *Behavior Modification* 42, no. 3 (May 2018): 400, https://doi.org/10.1177/0145445517740321.

Behavioral Adaptations within the Music Classroom

The music educator should establish and teach classroom rules, define those expectations, and be consistent in administering consequences and positive reinforcement within the class. Carol McDowell's text, *An Adaptation Tool Kit for Teaching Music*, offers suggestions for addressing behavioral, motivational, and organizational needs to adapt the music classroom to individual students' needs. Clear, uncomplicated directions that reinforce desired behaviors, using peer role models, visual schedules, signals, and proximity, assist the instructor in monitoring behavior, which allows for appropriate feedback.[113] Suggestions include instructional approaches to modifications and accommodations, as well as curricular, environmental, organizational, and presentation considerations.

Motivational Adaptations within the Music Classroom

Motivation towards an object provides direction, as it affects the amount of effort, intensity, and persistence expended in the process. In addition, motivation can manifest internally or externally. Intrinsic motivation, such as enjoyment of personal interests, helps maintain or satisfy consistent long-term behaviors that fulfill purpose and individual needs. Extrinsic motivation can quickly change behavior, but it relies on external factors, such as rewards or praise, and may lack the lasting effects of intrinsic motivation. When the external incentive decreases, the motivation driving behavior decreases as well. In autism, both intrinsic and extrinsic factors may be present; however, sensory overload or executive function difficulties can affect motivation, influencing behavior.

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[113] Carol McDowell, "An Adaption Tool Kit for Teaching Music," *Teaching Exceptional Children Plus* 6, no. 3 (February 2010): 5–6, https://files.eric.ed.gov/fulltext/EJ879595.pdf.

For the music educator, discover what students do well, offer them leadership opportunities, and harness their motivation. Personal interests in music are great drivers of enjoyment. Allowing students to select songs, conduct, play, or lead a music game can enhance learning opportunities, enhancing their personal motivation and interest in music.

Applied Behavior Analysis (ABA)

Applied Behavior Analysis (ABA) is based on learning theory, focusing on how environments influence behavior and on supporting appropriate behavior through positive reinforcement. Thomas Leeder, a coaching researcher, mentions B.F. Skinner's theory of operant conditioning in their article, emphasizing the role of reinforcement in modifying behavior.[114] Even though the article discusses operant conditioning in sports and athletics, implemented by coaches, the theory still has direct application to influencing desired behaviors in ASD students, as these behaviors are learned through interactions with the environment. What happens before (antecedent) and after (consequence) the behavior affects its reoccurrence. The Antecedent, Behavior, and Consequence (ABC) Chart provides a valuable tool for assessing and collecting data on behaviors that disrupt learning. The theory of operant conditioning can implement positive or negative reinforcers (SR-), as both types aim to strengthen desired behavior. Positive reinforcers are preferred as they create a pleasant experience compared to negative reinforcers, strengthening the desired behavior for recurrence. This technique is relevant through the systematic reinforcement of desired behaviors, such as communication, task completion, and social interaction, especially for ASD students as they develop new academic and adaptive skills.

[114] Thomas Leeder, "Behaviorism, Skinner, and Operant Conditioning: Considerations for Sport Coaching Practice," *Strategies* 35, no. 3 (2022): 28, https://doi.org/10.1080/08924562.2022.2052776.

The principles of ABA are evidence-based methods, including positive reinforcement, extinction, prompting, shaping, chaining, and generalization. Documenting precursors to behavior may help inform adaptations to the learning environment. The learning process in ABA increases the volume of content, the complexity of tasks, the duration of instruction, and the processing of sequences, while decreasing the reliance on rewards over time. In addition, behavior programs must be consistent across all school settings, and when implemented correctly, ABA can be effective across all content areas, including music.

Discrete Trial Training Method (DTT)

In ABA therapy, Discrete Trial Training (DTT) is a method in which children learn by breaking complex skills into manageable steps and receiving a reward for each step. Callahan, Fodstad, and Moore highlight how DTT promotes engagement, assisting in the development of communication skills, social interaction, and cognitive abilities. Each trial has a cue, a prompt, a response, a consequence, and an intertrial interval. The cue is the initial instruction or question. The educator guides the student to the correct response by applying a prompt. The student's response follows the prompt. The instructor provides a consequence for the correct response, with the student receiving positive reinforcement, and for incorrect responses, with a prompt or correction to the behavior.[115] DTT pedagogy remains effective in teaching new skills, building foundational academic skills, and increasing student attention with overall compliance. The DTT method functions on a one-to-one, highly structured, repetitive, data-driven process that tracks attempts and success rates. In music class, applying DTT pedagogy can develop skills, with

[115] Megan Callahan, Jill Fodstad, and James Moore, "History of Applied Behavioral Analysis," in *Handbook of Applied Behavior Analysis Interventions for Autism: Integrating Research into Practice*, ed. Johnny Matson (Cham, Switzerland: Springer, 2023), 11, https://doi.org/10.1007/978-3-031-19964-6.

success measured by assessing students with ASD's abilities in appropriate contexts for those discrete behaviors. Hammel and Hourigan's viewpoint on DTT as an effective pedagogy in music education is noted, as they state, "A music educator can work with students this way in a classroom environment; however, it is more effective to use ABA when there is an aide or another adult in the classroom to provide prompts and rewards."[116] DTT helps students understand that, as they grow older, their behavior has both positive and negative outcomes.

Natural Environment Teaching (NET)

Another ABA teaching approach is Natural Environment Teaching (NET), which uses everyday activities, interests, and natural surroundings to teach meaningful skills in a fun way. Videsha Marya, Board Certified Behavior Analyst and ASD researcher, along with colleagues, discusses NET characteristics, including student-led learning (students choose the activity); natural reinforcers (students are interested in the activity); flexibility (teaching movements arise in natural play); and generalized focus (skills are taught in the same environment where the object or activity occurs).[117] Applying NET is highly motivating, increasing student engagement while promoting independence and fostering functional communication in social and language development, skills that can be transferred beyond therapeutic environments for the individual with ASD.

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[116] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 15.

[117] Videsha Marya, Victoria Suarez, and David Cox, "Ethical Decision-Making and Evidence-Based Practice," in *Handbook of Applied Behavior Analysis Interventions for Autism: Integrating Research into Practice*, ed. Justin Leaf, Joseph Cihon, Julia Ferguson, and Mary Jane Weiss (Cham, Switzerland: Springer, 2022), 63, https://doi.org/10.1007/978-3-030-96478-8.

Pivotal Response Training (PRT)

The application of Pivotal Response Training by ABA therapists, speech pathologists, special educators, and teachers targets areas for improvement in social interaction, communication skills, along with learning by using individuals' interests. PRT is play-based, child-led therapy that focuses on natural interests and uses specific toys or activities to support the development of core pivotal areas towards acquiring associated skill sets. Callahan, Fodstad, and Moore highlight five pivotal areas: motivation, responding to multiple cues, self-management, self-initiation, and empathy.[118] First, reinforcers for learning when applying PRT are derived from the child's personal interests. Second, children learn to respond to multiple environmental cues, thereby encouraging varied responses rather than a single one and allowing flexibility in applying responses across different settings and social interactions. Third, self-management teaches children to monitor and control their behavior. Children may notice and evaluate their own behavior, tracking the behavior through recording it, reward themselves when they meet a goal, build autonomy, while reducing their dependence on adults. Lastly, PTR encourages individuals to initiate spontaneous communication and ask questions.

Functional Behavior Assessment (FBA)

A Functional Behavior Assessment (FBA) identifies the target behavior and assesses its function by collecting antecedent-behavior-consequence (ABC) data. Co-authors Yara Farah, an educational psychologist and special education researcher, and Susan Johnsen, Professor Emerita of Educational Psychology at Baylor University, give clear examples of antecedent-behavior-

[118] Megan Callahan, Jill Fodstad, and James Moore, "History of Applied Behavioral Analysis," in *Handbook of Applied Behavior Analysis Interventions for Autism: Integrating Research into Practice*, ed. Johnny Matson (Cham, Switzerland: Springer, 2023), 12, https://doi.org/10.1007/978-3-031-19964-6.

consequence in their text, as well as how to understand the relationships between environmental events associated with behavior. Using the ABC data, the individual performing the FBA hypothesizes the function of the behavior and develops an intervention plan to help establish new behaviors.[119] Educators can use ABC data and chart information to identify triggers and consequences that influence behavior, coordinating with support staff to implement strategies to achieve desired outcomes. From behavior function to intervention, one can teach replacement behaviors that serve the same function as the existing behavior by modifying the environment to reinforce a desired behavior.

In addition, rapport and relationships drive motivation for behavior intervention. Knowing students helps better understand their typical behavior and responses, while alleviating anxiety and stress. Building trust through consistency, interest, and strengths-based language can establish rapport and support the desired educational behavior toward academic goals. Adapting to educational settings through flexibility and classroom design is crucial for students with ASD. One cannot control students' behavior; one can only influence it through environmental changes. Constant monitoring of progress, using simple charts and ABC logs to track data. Using the ABC data, strategies can be developed and adjusted based on their needs.

Within the Music Classroom

When educators understand cognitive and behavioral characteristics associated with ASD, they may be able to implement instructional strategies that promote success in the classroom. Hammel and Hourigan state, “A modified ABA or DTT model can be used

[119] Yara N. Farah and Susan K. Johnsen, *Classroom Management for Gifted and Twice-Exceptional Students Using Functional Behavior Assessment: A Step-by-Step Professional Learning Program for Teachers* (London: Routledge, 2021), 75, https://doi.org/10.4324/9781003233640.

successfully in the music classroom. Any behavior can be taught, and with time, repetition, and patience, students with autism can be shown the skills and behaviors used in music."[120] ABA techniques, when applied in the music classroom, can positively reinforce the individual through rewards and recognition of appropriate behaviors. Hammel and Hourigan suggest being open to how the needs of ASD students are communicated, as "behavior is one major challenge that emerges when teaching music to students with autism…. Before we suggest strategies for successful management of behavior, it is appropriate to consider the typical behavioral development of a child and how it may differ for those with autism."[121] Additionally, special education teachers are trained to use one or more behavioral intervention methods and can assist with implementing behavioral management plans to ensure consistency across all-inclusive classrooms on the ASD student's particular campus. Music educators should consider the complex needs of students with ASD when developing lesson plans, as these students may not be accustomed to addressing these needs. When students are unable to master personal discipline, self-control, and decision-making skills, they may be unable to participate in classroom or rehearsal settings without assistance in learning music. It may be detrimental to the learning process if students with ASD cannot interact with peers and the teacher socially and behaviorally. Hourigan and Hammel state, "when ABA strategies are used correctly, they work."[122] However, music educators should be familiar with all available methods for promoting positive behavior among students with ASD in their classrooms.

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[120] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 15.

[121] Hammel and Hourigan, *Teaching Music to Students with Autism*, 71.

[122] Ibid., 91.

Treatment and Education of Autistic and Related Communication –Handicapped Children

The Treatment and Education of Autistic and Related Communication–Handicapped Children (TEACCH) is an evidence-based educational system and approach developed by Dr. Eric Schopler at the University of North Carolina at Chapel Hill. As Gary Mesibov, Professor Emeritus at the University of North Carolina at Chapel Hill, who served as the director of Division TEACCH under Schopler along with colleagues, notes, "the program was initially funded by the Federal Government in 1966. At that point, ASD was viewed as an emotional disorder, and parents were seen as the main cause."[123] The core idea is to adapt the environment to the individual's accessibility needs. In contrast, Hammel and Hourigan encourage, "Teachers and professionals develop classrooms that specifically complement the strengths, preferences, and interests of students with autism."[124] The key principles include structured teaching, clear, organized activities, predictable routines, and visual supports. These structured educational settings provide opportunities to perform daily tasks and develop these skills. Pictures or schedules are always available, which visually assist students in completing their responsibilities throughout the day. The system emphasizes independence over compliance, allowing individuals to self-direct off-task behaviors rather than relying on an ABA prompt.

Visual supports provide students with ASD additional tools to understand classroom routines and expectations. Lauren Turner-Brown, clinical psychologist, and Kara Hume, Special Education Professor at the University of North Carolina at Chapel Hill, note that, "Modifying the

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[123] Gary Mesibov et al., *Accessing the Curriculum for Learners with Autism Spectrum Disorders: Using the TEACCH Programme to Help Inclusion* (New York: Routledge, 2015), 5, http://ebookcentral.proquest.com/lib/liberty/detail.action?docID=3570141.

[124] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 10.

environment often entails adding visual cues and supports to help answer the following six questions that often lead young children with ASD to be confused or frustrated:

1. Where am I supposed to be?
2. What am I supposed to do?
3. How should I do it?
4. How long will I do this, or how many should I do?
5. How will I know that I am making progress and when I am finished?
6. What will happen next?[125]

Hammel and Hourigan suggest, "The use of PECS [Picture Exchange Communication Systems], a picture schedule, a very well-known and often repeated set of activities and songs, and a consistent schedule are all excellent strategies to use when teaching music to students with autism."[126] Pictures provide the individual with visual clarity, structure, and organization within the task's visual instructions. Pictures taken of the individual engaging in the musical learning activity may be laminated and placed in a binder, with scheduled times for the learning lesson sequence, which allows them to self-direct through prompts, as needed, answering the questions listed above.

TEACCH works well in a self-contained music classroom. In the instrumental music classroom, parts of the method include choosing music and activities based on the students' interests. For music educators, relationship development begins with familiarity with students' interests. The implementation of visuals can also strengthen the connection between the student

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[125] Lauren Turner-Brown and Kara Hume, "The TEACCH Approach and Other Visually Based Approaches for Children with Autism," in *Clinical Guide to Early Interventions with Autism*, ed. Giacomo Vivanti, Kristen Bottema-Beutel, and Lauren Turner-Brown (Cham, Switzerland: Springer Nature, 2020), 133–134.

[126] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism* (New York: Oxford University Press, 2020), 11.

and the educational content. Pictures or videos of the desired method of engagement and learning content may support the student's desired behaviors towards educational goals.

TEACCH is not ABA-based. Additionally, TEACCH does not focus on changing personality, forcing normalcy. Furthermore, TEACCH is individualized to the individual's needs, with its application tailored to their success in the classroom. Nevertheless, TEACCH employs effective strategies in the self-contained classroom that can be applied in inclusive music classrooms.

Sound of Intent: Theoretical Framework for Teaching ASD Students Music

Adam Ockelford developed the "Sounds of Intent" framework to support children with ASD in engaging with music. The following is said about it: "The Sound of Intent project was set up in 2001 to investigate the musical development of children and young people with severe learning difficulties (SLD) or Profound and multiple learning difficulties (PMLD)."[127] Rather than assume these individuals had limited music engagement capacity, the framework aimed to map out stages of musical development and understanding. There are six levels of "neurotypical occurrence" typical to age-onset, with associated levels of disability, seen in Table 4 below. The framework establishes a metric for gauging music engagement in the following words:

> The Sounds of Intent project began in 2001, when Adam Ockelford, Graham Welch, and Sally Zimmermann, based in London at the University of Roehampton, UCL Institute of Education, and Royal National Institute for Blind People, set out to discover how children with learning difficulties develop musically. Their initial focus was on those with the most profound and complex needs, as this group of children and young people had previously been neglected by academics researching the developmental psychology of music and music education. This was because the prevailing research paradigms in

[127] Adam Ockelford, "Sounds of Intent," *SEN Magazine*, October 28, 2011, accessed February 25, 2024, https://senmagazine.co.uk/content/activities/music-arts/116/sounds-of-intent-musical-development-in-children-with-complex-needs/.

> these fields identified 'typical' abilities as a first step, and then – very rarely – attempted to use these to account for exceptionalities in the context of norm-driven models.[128]

Instead of focusing on neurotypical development, Sound of Intent begins with neurodiverse children who have the most complex needs. This approach promotes music development based on the continuum of human experience, not just neurotypical development. The shift supports inclusive approaches for both music education and autism-related research that do not exclude or minimize learners with profound disabilities.

Table 4. Sound of Intent, Six Levels of Musical Engagement

Level	Name	Description	Age of 'neurotypical' occurrence	Associated level of disability
1	Learning to hear.	Before the hearing gets going.	Three months before birth.	Coma or unresponsive state; the most profound learning difficulties.
2	Sounds interesting.	Sound is heard or made as a purely sensory experience.	From three months before birth to around nine months	Profound learning difficulties.
3	Copy me, copy you.	Recognizing simple patterns: anticipating and copying.	From around nine months to around 15 months.	Severe or profound learning difficulties; may include autism.
4	Bits of pieces.	Hearing and creating groups of sounds as meaningful units of musical information, such as ringtones, motifs, and riffs.	From around 15 months to around 33 months.	Moderate or severe learning difficulties; may include autism.
5	Whole Songs	Intuitively understanding simple musical structures, singing short songs in time and in tune, and playing relatively simple pieces.	From around 33 months onwards.	Moderate or severe learning difficulties; may include autism.
6	The wider world of music.	Appreciating music in an amateur way as a language of the emotions; performing persuasively with a familiar culture, potentially at an advanced level.	In the teenage years.	Moderate or severe learning difficulties; may include autism.

Source: The Sound of Intent, "Levels - Sounds of Intent Framework." Accessed March 15, 2026. Soundsofintent.org. https://soundsofintent.org/en/sounds-of-intent-framework/levels/index.

Ockelford Sound of Intent framework comprises three domains of music engagement, seen in Table 5 below. Domain One focuses on reactive participation through music; Domain Two on proactive involvement; Domain Three on interactive music contributions.

[128] Ockelford, "Sounds of Intent," 1.

Table 5. Musical Domains of Sound of Intent.

Domain	Abbreviation	Description
Reactive	R	Listening and responding to sounds and music.
Proactive	P	Making sounds, singing, and playing alone.
Interactive	I	Making sounds and music with other people.

Source: The Sound of Intent, "Domains - Sounds of Intent Framework."Accessed on March 15, 2026. Soundsofintent.org. https://soundsofintent.org/en/sounds-of-intent-framework/domains/index.

There are four segments at each level, corresponding to the respective domains. According to Ockelford, individuals reach milestones as detailed in his framework of the sound of intent of musical development. Descriptions of the criteria within the elements of each domain are provided for each developmental age level. An example of the teenage years, level six, within the Sounds of Intent framework details these elements; see Table 6 below.

At level six in Sound of Intent, the zygonic theory explains musical understanding in terms of hierarchical relationships among musical events within the framework of musical development. The zygonic theory gives insight into how children/students with ASD perceive, understand, and learn music through pattern recognition. The zygonic relationship exists through musical engagement, with active imitation and repetition shaping expectations, connecting the musical foundations of understanding how sound relates to future musical events. Individuals at level six consider music in a system, understanding how pieces are built, how ideas connect, and how music is designed.

Sound of Intent levels are not limited by age or typical cognitive development. The model allows for flexibility for individuals with autism or complex needs, as individuals can be on different levels of musical development regardless of age, diagnosis, or development. The framework is non-age-based and non-linear, independent of fixed timelines. The sound of intent

focuses on what the person can do musically currently. In practice, a young child and an adult can be on the same level of music engagement. In addition, an autistic learner with complex needs may show advanced musical understanding in one area and more basic skills in another. Sound of Intent model separates musical ability from chronological age, language ability, and cognitive levels, evaluating observable behaviors and relationships in sound.

Table 6. The Expanded Sounds of Intent Framework of Music Development

Ability	Reactive	Proactive	Interactive
Segment	(R.6) Has a mature, shared understanding and appreciation of the music of a particular culture, in a given style or styles.	(P.6) Perform and/or improvise solos of increasing sophistication persuasively within a given style and/or compose stylistically coherent pieces that are intended to convey particular effects.	(I.6) Performs and/or improvises solos of increasing sophistication expressively with other people.
Pure Sound and Music	(R.6.A) Develops a mature response to music, engaging with pieces as abstract 'narratives in sound.'	(P.6.A) Plays or sings expressively using familiar performance conventions at the highest level, producing original interpretations.	(I.6.A) Is aware of, and emulates, the expressivity of others' playing or singing in ensemble performance.
	(R.6.B) Becomes familiar with an increasing number of styles and genres and develops preferences.	(P.6.B) Improvises on music in a familiar style or styles to convey desired effects, at the highest level producing original versions of existing pieces (as in 'jazz standards')	(I.6.B) Contributes one's own expressiveness to others' playing or singing in ensemble performance
	(R.6.C) Becomes familiar with different performances of pieces and styles of performance, and develops preferences	(P.6.C) Composes pieces in a familiar style to convey desired effects, at the highest level producing original material judged to be of intrinsic musical value within a given culture	(I.6.C) Improvises with others with stylistic coherence, sharing and developing materials in increasingly sophisticated ways
Sound and Music Related to Other Things	(R.6.D) Becomes aware of how music as an abstract narrative in sound relates to other media (words, movement, etc.) to create multi-modal meaning)		
Technical Elements		(P.6.D) Technical proficiency develops to meet the demands of a widening repertoire.	(I.6.) Develops increasingly advanced ensemble skills, managing material of growing technical and musical complexity as part of a group.

Source: The Sound of Intent "Elements and Strategies - Sounds of Intent Framework." Accessed March 15, 2026. Soundsofintent.org. https://soundsofintent.org/en/sounds-of-intent-framework/elements-and-strategies/elements-matrix.

Ockelford views music instruction as developing alongside children's musical growth, as "Sounds of Intent is a model of musical development that sets out how we all engage with music, from children in the early years to older people with dementia, from those with profound learning difficulties who are still learning to process sound, to others who are regarded as

advanced musicians in their culture.[129] Ockelford's research focuses on a model of musical capacities and strategies that are fully inclusive to enhance educational outcomes for students with ASD in music; however, before this, there were limited systems of engagement or methods for addressing ASD. Ockelford noted that "Given the almost total lack of research in the field, we decided to take a step back and have a fresh look at the children themselves, both through systematic observation by members of the research team and by utilizing the expertise of a group of practitioners, importantly, both specialists and non-specialists in music."[130] Over the 24 months, Ockelford studied children to observe how they engaged with music. "Researchers noted the children's actions, responses, and interactions, and sought to gauge which of these were representative, exceptional, or in any way indicative of musical attainment or progress. As ideas emerged, they were used to inform a new developmental model, which went through several iterations."[131] Results led Ockelford to establish clear intentions for students with learning difficulties towards music.

Ockelford's core idea is that musicality is universal, as everyone has musical potential, even if it does not appear typical. Musical behaviors at all stages are meaningful for development and are not random, according to the philosophy of The Sounds of Intent. Neurodiverse individuals may not reach level six during the teenage years, as all forms of musicality are valid. However, reaching level six may provide additional social and musical opportunities to neurodiverse individuals in the future.

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[129] Ockelford, "Sounds of Intent," 1.

[130] Ibid.

[131] Ibid.

Curriculum

The curriculum encompasses the entire student experience throughout the educational process. State and district guidelines, standards, and objectives outline performance skills. This knowledge and these performance skills comprise students' collective experiences in instrumental music education classes. Sound of Intent was a new concept for students with ASD, allowing them to learn through multiple modalities, including tactile, visual, auditory, and kinesthetic. Because there is no single curriculum for students with ASD, lesson design is adapted when preparing music lessons. To identify intervention strategies for students with ASD in instrumental music that yield positive educational outcomes, it is essential to consider students' learning needs when preparing music lessons.

Documentation

Documentation involves Individualized Education Programs (IEPs) and 504 Plans, which should be in a reviewable format, such as a spreadsheet that is easily updated and maintained. This documentation allows parents to receive feedback on their child's progress, which is tracked, and provides data and information to support students' future academic performance. Involvement with special education teachers and staff provides diverse perspectives on students' strengths and needs, offering suggestions on how students can improve with support. Together, systematic documentation and collaboration among educators provide a foundation for developing individualized instructional strategies that address students’ specific learning needs and promote meaningful academic and musical progress.

Sound of Intent Model in Exploratory and Qualitative Analysis

One such framework that has influenced inclusive music education is *Sounds of Intent,* which provides a developmental model of understanding musical engagement among students with learning difficulties. Ockelford's theoretical development of Sounds of Intent:

> Sounds of Intent has been through two main phases: first, exploratory, qualitative analysis was used to inform the development of a model setting out how musical abilities and engagement are thought to develop in children and young people with learning difficulties; and second, the framework's efficacy has been evaluated through gathering data from several practitioners in the field that has been analyzed principally through quantitative means.[132]

According to Ockelford, the practical use of sound of intent, in the findings of the study, shows "virtually all children…(even ASD children) can engage with music, whether reactively, proactively or interactively."[133] Students' engagement in musical development can be achieved over time. This is the first study focusing on the musical development of children with learning difficulties.

Music Educator Training

Music educators often lack training in teaching students with special needs. Typically, music education majors have only one course that provides a brief overview of special education issues. Hourigan and Hammel state, "Through our national and international travel, … many music teachers have been assigned to teach students in self-contained autism classrooms for the first time, many without necessary training or guidance."[134] This creates a gap in educators'

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[132] Adam Ockelford, "The Sounds of Intent Project: Modeling Musical Development in Children with Learning Difficulties," *Tizard Learning Disability Review* 20, no. 4 (October 2015): 179, https://doi.org/10.1108/TLDR-02-2015-0007.

[133] Ockelford, "Sounds of Intent," 179.

[134] Ryan M. Hourigan and Alice M. Hammel, "Understanding the Mind of a Student with Autism in Music Class," *Music Educators Journal* 104, no. 2 (December 2017): 22.

knowledge of how to address students' needs through instruction. Karen Salvador's study confirmed insights into music education in the following words:

> Required coursework in special education is taught by the department/school/college of education, (b) this topic is difficult to integrate into the already credit-heavy load of music education students, (c) our faculty lack the expertise to teach a course in this topic or to intergrate this topic across our curriculum, and (d) our faculty believe that this topic should be intentionally integrated throughout music education coursework.[135]

It appears, largely, that only colleges or universities with researchers in special education for music education offer extensive special-needs content in their curricula for future music educators. In contrast, most schools briefly touch on those topics. The lack of training for music educators creates a barrier that hinders students and teachers from connecting in the learning process. Music educators must understand the complexities of teaching students with ASD and develop learning strategies that promote equitable participation in education.

Music educators can feel frustrated with their lack of knowledge about teaching students with ASD. Ellary Draper, Laura Brown, and Judith Jellison created a survey study for elementary music teachers reviewing their perceptions of teaching students with ASD. The focus was "to identify elements necessary for creating a culture of inclusion and implementing the inclusion of students with ASD."[136] Their in-class observations confirmed the teacher perceptions, as it "suggested elements that could impede or facilitate elementary music teachers in their efforts to create a classroom culture of inclusion and implement inclusion using best

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[135] Karen Salvador, "Who Isn't a Special Learner? A Survey of How Music Teacher Education Programs Prepare Future Educators to Work with Exceptional Populations," *Journal of Music Teacher Education* 20, no. 1 (October 2010): 32, https://doi.org/10.1177/1057083710362462.

[136] Ellary Draper, Laura S. Brown, and Judith A. Jellison, "Identifying Elements of Inclusion: Interviews with Elementary Music Teachers about Their Students with Autism Spectrum Disorder," *Update: Applications of Research in Music Education* 43, no. 2 (March 2024): 41, https://doi.org/10.1177/87551233241237498.

practices from music education and special education."[137] This could also be considered a social injustice, as teachers are not fully prepared to teach those with exceptional needs.

Gaps in Music Education Research for ASD

In general, research on ASD in music education is limited, and the study's scope should be expanded to address these gaps. Draper says the following:

> The field has benefited from a large body of literature in music education that suggests best practices for teaching students with ASD. (Adamek & Darrow, 2018) However, recent literature reviews have elucidated the limited empirical research in the field.[138] To date, no research in music education has been identified that explicitly examines how best to support the musical development of students with ASD.[139]

Draper refers to Adamek and Darrow's text, explaining how education and music therapy can effectively support students with disabilities in inclusive and specialized learning environments. Their text outlines the historic, legal, and instructional foundation of special education, along with appropriate instructional adaptations in music-based strategies. In addition, Draper refers to Hammel and Hourigan's book, which outlines the diagnosis of ASD; the team approach to teaching music to students with ASD; and challenges in communication, cognitive abilities, socialization, sensory difficulties, and possible behavior issues within the classroom. Hammel and Hourigan also highlight the perspectives of students with ASD, advocating for the needs of music education within a well-rounded curriculum. The strategies are not in question. However, there is limited empirical research and data through the music education lens and scope, with

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[137] Draper, "Identifying Elements of Inclusion," 41.

[138] Judith A. Jellison and Ellary Draper, "Music Research in Inclusive School Settings: 1975 to 2013," *Journal of Research in Music Education* 62, no. 4 (January 2015): 325.

[139] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, Evanston, 2020), 96, ProQuest Dissertations & Theses Global.

much of the research stemming from music therapy sources or curriculum areas outside music education. Judith Jellison and Ellary Draper state the following:

> No systematic reviews have been conducted on music research involving children with disabilities and their typically developing peers in inclusive school settings. A review of inclusion music education research takes on particular importance, given the federal mandate that, to the extent appropriate, children with disabilities be educated in regular classrooms with children without disabilities and have access to the regular curriculum.[140]

The lack of systematic reviews underscores the need to evaluate the validity and practical effectiveness of inclusive music education strategies and approaches. The review process can strengthen the evidence and empirical data created in administering those inclusion approaches in the educational process for all students. Lastly, the review process can ensure that inclusive music education meets federal mandates and truly benefits students with disabilities, such as those with ASD.

Literature Review

This section identifies the major positions, topics, and content of research within ASD. The literature review provides an overview of ASD in historical context and details the challenges music educators face in teaching students with ASD. This review draws on prior publications to provide context for teaching music students with ASD. The review will examine publications primarily from 2020 to 2025, but not limited to them, reflecting the current diagnostic criteria. The Jerry Falwell Library search engines are primarily used to access resources in a centralized system, querying multiple academic databases, the physical catalog, and e-books simultaneously, employing the "and/or" Boolean operators. For inclusion, studies

[140] Judith A. Jellison and Ellary Draper, "Music Research in Inclusive School Settings: 1975 to 2013," *Journal of Research in Music Education* 62, no. 4 (January 2015): 326.

published in English, applying to school-aged individuals with ASD, taking place in an appropriate school setting, and presenting empirical findings, either qualitative or quantitative, related to ASD. Sarah Parsons, Professor at the University of Southampton, along with colleagues, was referenced using the "search terms developed with the National Council for Special Education (NCSE), Ireland, advisory group, built upon those used by Parsons et al. (2009)," and later expanded by educational psychologist Caroline Bond, with application to this literature review. [141] Material outside the years of 2020-2025 was applied if relevant to the literature review through an appropriate discovery of information about ASD in relation to music education. Many of the terms, but not all, were implemented when corresponding words were used, usually including the term "music education" within the search.

The three main research topics at the intersection of music include psychology, cognition, and music therapy. Researchers such as Adam Ockelford and Darold Treffert constitute the bulk of the information in psychology. An example is Ockelford's claim that "music sessions offer a unique and secure framework through which many of the skills and disciplines of social interaction can be experienced and developed."[142] Ockelford's zygonic theory framework encompasses cognition, emotion, behavior, development, and social interaction, drawing on psychology. Treffert explores savant syndrome from a psychological perspective, noting possible explanations for extraordinary musical abilities.[143] Treffert and Rebedew report that the most

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[141] Caroline Bond et al., "Educational Interventions for Children with ASD: A Systematic Literature Review 2008–2013," *School Psychology International* 37, no. 3 (June 2016): 307, https://doi.org/10.1177/0143034316639638.

[142] Adam Ockelford, *Music, Language and Autism: Exceptional Strategies for Exceptional Minds* (Philadelphia: Jessica Kingsley Publishers, 2013), 138, https://ebookcentral.proquest.com/lib/liberty/detail.action?docID=1249368.

[143] Darold A. Treffert, "The Savant Syndrome: An Extraordinary Condition—A Synopsis: Past, Present, Future," *Philosophical Transactions of the Royal Society B: Biological Sciences* 364, no. 1522 (2009): 1351, http://www.jstor.org/stable/40485906.

common underlying disability was autistic spectrum disorder at approximately 75%, with music being the most frequent principal skill.[144]

Developmental psychologist Pamela Heaton and music psychologist and neuroscientist Liila Taruffi have primarily contributed to music cognitive literature. Heaton highlights, "High-functioning children with autism and age- and intelligence-matched controls participated in experiments testing perception of pitch intervals and musical contours. The finding from the interval study showed superior detection of pitch direction over small pitch distances in the autism group."[145] In addition, empirical data show that autistic children possess musical potential that can be developed.[146] Heaton and her colleagues discovered that children with ASD have exceptional sensitivity to changes in pitch contour across different auditory stimuli.[147] In addition, Heaton states that children with ASD showed no deficits in processing affect in musical stimuli.[148] Taruffi's study review examined alexithymia, a personality trait characterized by a reduced ability to translate internal emotional experiences into precise, explicit verbal form,

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[144] Darold Treffert and David L. Rebedew, "The Savant Syndrome Registry: A Preliminary Report," *WMJ: Official Publication of the State Medical Society of Wisconsin* 114, no. 4 (August 2015): 158–62.

[145] Pamela Heaton, "Interval and Contour Processing in Autism," *Journal of Autism and Developmental Disorders* 35, no. 6 (December 2005): 787, https://www.proquest.com/scholarly-journals/interval-contour-processing-autism/docview/2226001628.

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[146] Pamela Heaton, "Assessing Musical Skills in Autistic Children Who Are Not Savants," *Philosophical Transactions of the Royal Society B: Biological Sciences* 364, no. 1522 (May 2009): 1443.

[147] Pamela Heaton et al., "Superior Discrimination of Speech Pitch and Its Relationship to Verbal Ability in Autism Spectrum Disorders," *Cognitive Neuropsychology* 25, no. 6 (September 2008): 778.

[148] Pamela Heaton et al., "Can Children with Autistic Spectrum Disorders Perceive Affect in Music? An Experimental Investigation," *Psychological Medicine* 29, no. 6 (November 1999): 1405, https://doi.org/10.1017/S0033291799001221.

common to autism spectrum disorder.[149] These findings suggest musical potential in individuals with ASD, providing rationale and implications for designing inclusive music classrooms.

Lucja Bieleninik, Monika Geretsegger, Susan Sze and Sanna Yu appear to be the main contributors to music therapy. Bieleninik's study showed no significant difference between standard care and music therapy.[150] However, Geretsegger's study found, "This updated review provides evidence that music therapy may help children with ASD to improve their skills in primary outcome areas that constitute the core of the condition, including social interaction, verbal communication, initiating behavior, and social-emotional reciprocity."[151] Sze's and Yu's study highlights literature documenting the effects of music therapy for children with disabilities.[152]

Lastly, within the literature review, major contributors to music education research, in a pedagogical framework, regarding ASD include Alice Hammel, Ryan Hourigan, Amanda Draper, Alice-Ann Darrow, Mary Adamek, Ellary Draper, Sheila Scott, and Judith Jellison. Their work highlights instructional strategies, classroom adaptations, teacher preparations, inclusive teaching methods, accessibility, interdisciplinary approaches, and student equity.

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[149] Liila Taruffi et al., "Individual Differences in Music-Perceived Emotions," *Music Perception* 34, no. 3 (2017): 254.

[150] Lucja Bieleninik et al., "Effects of Improvisational Music Therapy vs Enhanced Standard Care on Symptoms Among Children with Autism Spectrum Disorder," *JAMA* 318, no. 6 (2017): 528, https://doi.org/10.1001/jama.2017.9478.

[151] Monika Geretsegger et al., "Music Therapy for People with Autism Spectrum Disorder," *Cochrane Database of Systematic Reviews* 2014, no. 3: 2.

[152] Susan Sze and Sanna Yu, "Educational Benefits of Music in an Inclusive Classroom" (2004), 1, https://files.eric.ed.gov/fulltext/ED490348.pdf.

Related Music Research Towards ASD

In 2022, a study presented how music benefits people with ASD, detailing music-based interventions to improve social, emotional, and behavioral skills. Psychologist Roy Allen and colleagues' study found that individuals with ASD use music for numerous reasons, such as emotional, cognitive, and social needs towards personal development, social inclusion, and mood management.[153] The study also revealed differences in the conceptualization and verbalization of emotional states involving music, compared to neurotypical individuals.

Applewhite and colleagues conducted a systematic review of scientific literature examining the use and effectiveness of music-based interventions for individuals with ASD. Their findings concluded that most music-based interventions produce positive effects and meaningful outcomes across various areas of development. In particular, music-based interventions were associated with improvements in engagement, communication, and interaction for individuals with ASD.[154] The findings suggest that music can support learning and participation when instruction is intentionally structured to address individual needs. The benefits of music-based interventions further support the use of individualized and evidence-based instructional strategies within instrumental music settings.

The quote below covers a wide range of research and topics:

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[153] Roy Allen, Elizabeth Hill, and Pam Heaton, "'Hath Charms to Soothe …': An Exploratory Study of How High-Functioning Adults with ASD Experience Music," *Autism: The International Journal of Research and Practice* 13 (2009): 21–41, https://doi.org/10.1177/1362361307098511.

[154] Briana Applewhite et al., "A Systematic Review of Scientific Studies on the Effects of Music in People with or at Risk for Autism Spectrum Disorder," *International Journal of Environmental Research and Public Health* 19, no. 9 (April 22, 2022): 5150, https://doi.org/10.3390/ijerph19095150.

They were reported to have a strong preference for music over verbal material[155], superior pitch memory, recognition of changes in pitch[156, 157, 158, 159], and to enjoy dissonant music more than controls with typical development (TD).[160] It has been shown that people with ASD were physiologically more responsive to their preferred music than those in the comparison group.[161] In a peer-assisted learning study by Johnson and LaGasse (2021), music appeared to increase pro-social skills in children with ASD who were paired with neurotypical children.[162] People with ASD appeared to prefer more predictable[163] and upbeat music.[164] The latter may be related to increased activity in dorsolateral prefrontal regions in response to happy music.[165]

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[155] Jaclyn Barnes et al., "Child-Robot Interaction in a Musical Dance Game: An Exploratory Comparison Study between Typically Developing Children and Children with Autism," *International Journal of Human-Computer Interaction* 37 (2021): 249–66, https://doi.org/10.1080/10447318.2020.1819667.

[156] Anne Marie DePape et al., "Auditory Processing in High-Functioning Adolescents with Autism Spectrum Disorder," *PLoS ONE* 7 (September 2012): 1–17, https://doi.org/10.1371/journal.pone.0044084.

[157] Ashleigh Hillier et al., "Increased Physiological Responsiveness to Preferred Music Among Young Adults with Autism Spectrum Disorders," *Psychology of Music* 44, no. 3 (March 2016): 481–92, https://doi.org/10.1177/0305735615576264.

[158] Erik Johnson and A. Blythe LaGasse, "Musical Creativity in Autism: Exploring Growth through Collaborative Peer Interaction," *International Journal of Disability, Development and Education* 69 (2021): 139–53, https://doi.org/10.1080/1034912X.2021.1940883.

[159] Nobuo Masataka, "Neurodiversity, Giftedness, and Aesthetic Perceptual Judgment of Music in Children with Autism," *Frontiers in Psychology* 8 (September 2017): 1–7, https://doi.org/10.3389/fpsyg.2017.01595.

[160] Christina Whipple et al., "Do Communication Disorders Extend to Musical Messages? An Answer from Children with Hearing Loss or Autism Spectrum Disorders," *Journal of Music Therapy* 52, no. 1 (Spring 2015): 78–116, https://doi.org/10.1093/jmt/thu039.

[161] Ashleigh Hillier et al., "Increased Physiological Responsiveness to Preferred Music Among Young Adults with Autism Spectrum Disorders," *Psychology of Music* 44, no. 3 (March 2016): 481–92, https://doi.org/10.1177/0305735615576264.

[162] Erik Johnson and A. Blythe LaGasse, "Musical Creativity in Autism: Exploring Growth through Collaborative Peer Interaction," *International Journal of Disability, Development and Education* 69 (July 2021): 139–53, https://doi.org/10.1080/1034912X.2021.1940883.

[163] Judith Goris et al., "The Relation Between Preference for Predictability and Autistic Traits," *Autism Research: The Official Journal of the International Society for Autism Research* 13 (July 2020): 1144–54, https://doi.org/10.1002/aur.2244.

[164] Jaclyn Barnes et al., "Child-Robot Interaction in a Musical Dance Game: An Exploratory Comparison Study between Typically Developing Children and Children with Autism," *International Journal of Human-Computer Interaction* 37 (2021): 249–66, https://doi.org/10.1080/10447318.2020.1819667.

[165] Line Gebauer et al., "Intact Brain Processing of Musical Emotions in Autism Spectrum Disorder, but More Cognitive Load and Arousal in Happy vs. Sad Music," *Frontiers in Neuroscience* 8 (July 2014): 1–10, https://doi.org/10.3389/fnins.2014.00192

As referenced by Applewhite and colleagues, the use of robots in therapy for children with ASD may be of interest to the research community. Results from computer science researcher Jaclyn Barnes and colleagues' study revealed significant differences between typically developing (TD) children aalong with those with ASD, as TD children had greater attention to the researcher. In contrast, children with ASD focused more attention while dancing with the robot. Along with upbeat music, which encouraged greater movement than calm music, suggesting that individual music preferences may affect engagement and outcomes.

As mentioned, psychologist and cognitive neuroscience researcher Anne Marie DePape along with her Colleagues, studied the measurement of perception across speech and music. According to DePape, results show that the ASD group performs more poorly at filtering, exhibits less audio-visual integration, shows less specialization for native phonemic and metrical categories, having a higher rate of absolute pitch than the control group. Furthermore, Ashleigh Hillier, a clinical/developmental psychologist at the University of Massachusetts Lowell, as mentioned, along with her colleagues, showed that ASD participants were more physiologically responsive to their preferred music than the comparison group, suggesting that music may be a potential tool for self-regulation. In addition, music educator Erik Johnson and A. Blythe LasGasse, Associate Professor at Colorado State University, found that grouped ASD children spent more time making creative products than neurotypical (NT) children. Researchers noticed that NT children would initiate talking before beginning their process, whereas ASD children would talk less and move into active music playing. The study also detailed initial evidence that peer-assisted learning (PAL) benefits both neurotypical and neurodiverse individuals in collaborative music experiences. As mentioned above, developmental psychologist Nobuo Masakata conducted a study showing that children with ASD had a greater preference for the

aesthetic quality of highly dissonant music compared to the TD children, hinting that children with ASD might have different perspectives and inclinations. Whereas music therapist Christina Whipple and colleagues' study confirmed there was no significant difference between ASD and TD with normal hearing (NH) in the identification of musical emotions or movements. Psychologist Judith Goris and colleagues observed positive correlations between individuals' autistic traits and their preference for predictability, both in music and the perceptual fluency task. These findings show that autistic traits and a preference for predictability can be observed in a standardized lab environment. Little research on the preference for predictability to create empirical data has been done. Moreover, Line Gebauer, a cognitive neuroscientist, along with colleagues, applied functional magnetic resonance imaging and tracked brain activity in response to happy versus sad music, which was observed in the ASD group in the dorsolateral prefrontal regions and the Rolandic operculum/insula. They propose that the increase might reflect cognitive processing and physiological responses to emotion through musical stimuli.

Three studies found music increases emotional recognition and comprehension in people with ASD. Music therapist June Katagiri's research suggests that background music may be an effective tool for improving emotional comprehension in children with ASD, increasing the likelihood of social interaction.[166] In addition, music therapist Laura Brown's study investigated the influence of music's strong emotional valence on children with ASD's ability to label emotions depicted in facial photographs. Brown notes that "music appears to affect perceptions of emotion in children with ASD, and perceptions of sad facial expressions seem to be more affected by emotionally congruent background music than are perceptions of happy or neutral

[166] June Katagiri, "The Effect of Background Music and Song Texts on the Emotional Understanding of Children with Autism," *Journal of Music Therapy* 46, no. 1 (Spring 2009): 15–31, https://doi.org/10.1093/jmt/46.1.15.

faces."[167] Furthermore, psychologist Gary Wagener and his colleagues' research found that "Emotion congruent music may support emotion recognition in children with ASD, and thus may improve their social skills."[168]

Three studies found music increases emotional recognition and comprehension in people with ASD. Music therapy and psychology researcher Evelyn Buday's study explored the use of music as a strategy to improve memory for manual signs in children with autism. Buday noted that "in each case, correct imitation favored music condition training over rhythm condition training."[169] Behavioral scientist Michael Weiss and his colleagues' research findings show that individuals with ASD and Williams Syndrome (WS) show enhanced processing of auditory signals in the context of music using varied folk songs.[170] Grace Anne Thompson, an Associate Professor of Music Therapy at the University of Melbourne, and Larry Allen Abel, a neuroscientist, found that children with ASD looked more at a person when the person was singing and telling/reading a familiar story.[171]

Lastly, one study reports motivation towards physical exercise. Researcher Ashley Woodman and her colleagues found that slow music may motivate students with ASD to engage

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[167] Laura Brown, "The Influence of Music on Facial Emotion Recognition in Children with Autism Spectrum Disorder and Neurotypical Children," *Journal of Music Therapy* 54, no. 1 (March 2017): 55, https://doi.org/10.1093/jmt/thw017.

[168] Gary Wagener et al., "Effects of Emotional Music on Facial Emotion Recognition in Children with Autism Spectrum Disorder (ASD)," *Journal of Autism and Developmental Disorders* 51 (November 2020): 3256, https://doi.org/10.1007/s10803-020-04781-0.

[169] Evelyn Buday, "The Effects of Signed and Spoken Words Taught with Music on Sign and Speech Imitation by Children with Autism," *Journal of Music Therapy* 32, no. 3 (Fall 1995): 189–202, https://doi.org/10.1093/jmt/32.3.189.

[170] Michael Weiss et al., "Enhanced Memory for Vocal Melodies in Autism Spectrum Disorder and Williams Syndrome," *Autism Research* 14 (June 2021): 1127–33, https://doi.org/10.1002/aur.2462.

[171] Grace Anne Thompson and Larry Allen Abel, "Fostering Spontaneous Visual Attention in Children on the Autism Spectrum: A Proof-of-Concept Study Comparing Singing and Speech," *Autism Research* 11 (May 2018): 732–37, https://doi.org/10.1002/aur.1930.

in vigorous exercise, helping prevent childhood obesity and other health problems.[172] The study also noted higher adaptive behaviors with increased intensity during fast tempos.

Instructional Approaches

Meeting the needs of students with ASD requires music educators to refine their instructional practices continually. Darrow and Adamek state that "music educators often work with students who are along the continuum of abilities, ranging from gifted to those with the most severe disabilities. Music educators can prepare themselves by engaging in continuous education, collaborating with other school personnel, and staying current on appropriate readings in professional journals."[173] Considerable research on music focuses on students with disabilities; however, it often appears to exclude ASD from studies aimed to establish a standard profile in general. The successful implementation of inclusive music education ultimately depends on the knowledge, preparation, and continued professional development of music educators.

Inclusive Classrooms

The principles of inclusive education extend beyond advocating for students with ASD. Darrow and Adameck suggest that "Inclusive classrooms, which include students with disabilities, should now be considered the norm; therefore, students with disabilities should be included in music education research, regardless of their sensory, cognitive, or physical disabilities."[174] There are some unique challenges for music educators in creating inclusive

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[172] Ashley Woodman et al., "The Effect of Music on Exercise Intensity among Children with Autism Spectrum Disorder: A Pilot Study," *Journal of Clinical Medicine* 7, no. 3 (February 2018): 38, https://doi.org/10.3390/jcm7030038.

[173] Alice-Ann Darrow and Mary S. Adamek, "Preparing for the Future: Music Students with Special Education Needs in School and Community Life," in *The Oxford Handbook of Music Education*, vol. 2, ed. Gary E. McPherson and Graham F. Welch (New York: Oxford University Press, 2019), 82.

[174] Darrow and Adamek, "Preparing for the Future," 90.

music classrooms. According to McDowell, students should be made aware of the classroom's room arrangements.[175] Additionally, the Model Cornerstone Assessments (MCA) should be used, as they are standard, objective-based. "The Model Cornerstone Assessments depend on instructional products and outcomes; the following guidelines are designed for instruction and assessment of students with disabilities within the Core Arts Standards framework."[176] This is seen in Table 7 below. According to Malley, the Model Cornerstone Assessment serves as an inclusive framework for assessment in special education and music education, particularly for students with complex learning needs, such as those with ASD, focusing on student-centered learning that promotes meaningful engagement and progression.

Extensive modifications may be necessary for students with disabilities, as they may be unable to access information or keep up with instruction. Teachers will need to plan and adapt instructional methods to meet their needs. The lack of confidence and sense of unpreparedness to teach these diverse learners may stem from insufficient expertise and training.

Table 7. Guidelines for Teachers of the Arts, Instructing Students with Disabilities

Steps	Guidelines
1.	Maintain high expectations
2.	Promote communicative competence
3.	Use the principles of Universal Design for Learning.
4.	Know how to select and use appropriate accommodations for individual students.
5.	Make use of evidence-based practices.
6.	Target instruction and use formative indicators of student performance

Source: National Arts Standards, Shannon Malley. 2014. "Students with Disabilities and the Core Arts Standards Guiding Principles for Teachers." https://www.nationalartsstandards.org/sites/default/files/Guiding%20Principles%20for%20Inclusion.pdf. Compiled from Kleinert, et al., 2013; Thompson, Morse, Sharpe, & Hall, 2005; Thurlow, 2012; Thurlow, 2011.

[175] Carol McDowell, "An Adaption Tool Kit for Teaching Music," *Teaching Exceptional Children Plus* 6, no. 3 (February 2010): 6–7, https://files.eric.ed.gov/fulltext/EJ879595.pdf.

[176] Sharron Malley, "Students with Disabilities and the Core Arts Standards: Guiding Principles for Teachers," *The International Organization on Arts and Disability* (Washington, DC: Kennedy Center, 2014), 8, https://www.nationalartsstandards.org/sites/default/files/Guiding%20Principles%20for%20Inclusion.pdf.

Universal Design (UDL)

Universal design for Learning (UDL) can be applied to educational research and is recommended in the planning and delivery of instruction. The principles of universal design incorporate inclusive practices that accommodate learning differences, ensuring every student is included without compromising curriculum standards. Designing accessible instruction and assessment for all students alleviates the need for individual accommodations. UDL does not lower musical standards, simplify repertoire, reduce challenge, or replace technique, discipline, or expectations.

Educators still need to comply with and document modifications and accommodations to instruction and assessment as required by law. Rather than changing the standard, weakening the curriculum, or lowering expectations, administering appropriate accommodations preserves the instructional and assessment content for the student, simply changing how the student interacts with it. Nevertheless, UDL ensures equitable use by making materials easy to understand and flexible enough to accommodate students' diverse abilities and needs. This is best summed up in the position statement by the National Association for Music Education (NAfME) in the following words:

> A well-rounded and comprehensive music education program, as envisioned in the 2014 National Music Standards, [It] should exist in every American school; [It] should be built on a curricular framework that promotes awareness of, respect for, and responsiveness to the variet and diversity of culture; and should be delivered by teachers whose culturally responsive pedagogy enable(s) them to successful design and implement such an inclusive curricular framework.[177]

UDL anticipates learner variability, removes unnecessary barriers, preserves musical goals and targets in the learning process, and expands access to learning. Traditional instruction equates a

[177] "Inclusivity and Diversity in Music Education," *National Association for Music Education*, last modified 2017, https://nafme.org/resource/inclusivity-and-diversity-in-music-education-2/.

uniform learning process with musical rigor; UDL challenges that premise without compromising excellence. CAST identifies "The goal of UDL is learner agency that is purposeful and reflective, resourceful and authentic, strategic, and action-oriented,"[178] as showcased in the learning guidelines for UDL, as seen in Table 8 below.

Amanda Draper expresses that "Teachers may find UDL useful in planning to effectively meet the musical learning needs of all students in their classes. The pillars of UDL encourage teachers to consider providing multiple means of (a) engagement, (b) representation, and (c) action and expression, which allows students to approach educational experiences in the ways they best learn."[179] One must question, "Why am I learning this?" Engagement through UDL addresses that question from the perspectives of motivation, persistence, and relevance to learning. Second, how does one understand the learning? In UDL, it is information represented as it is perceived, processed, and encoded by the learner.

Music educators should know how their students will demonstrate what they know. All while enabling all students to progress under the same standards, rather than alternative curricula or standards. In musical classroom settings, it is appropriate to engage, explain, and demonstrate in different ways. Designing for learning should have meaning, purpose, and ownership, not merely for compliance. Examples of engaging all learners include culturally relevant teaching, peer-assisted teaching, autonomous learning, and appropriate classroom roles. Additionally, UDL engagements within the music classroom may include tuning roles or student-led warm-ups, choice of feedback or assessment, targeted individual aims aligned with ensemble goals,

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[178] "The Universal Design for Learning Guidelines," *CAST*, 2014, https://udlguidelines.cast.org/static/udlg3-graphicorganizer-digital-numbers-a11y.pdf.

[179] Amanda R. Draper, "Music Education for Students with Autism Spectrum Disorder in a Full-Inclusion Context," *Journal of Research in Music Education* 70, no. 2 (2022): 149, https://doi.org/10.1177/00224294211042833.

peer coaching within sections, and musical sharing through their culture. In UDL, as individual meaning increases, so does engagement towards learning.

Table 8. CAST Universal Design for Learning Guidelines

Design Options	Design Multiple Means of Engagement	Design Multiple Means of Representation	Design Multiple Means of Action and Expression
Access	Welcoming Interests and Identities *Optimize choice and autonomy *Optimize relevance, value, and authenticity *Address biases, threats, and distractions	Perception *Support opportunities to customize the display of information *Support multiple ways to perceive information *Represent a diversity of perspectives and identities in authentic ways	Interaction *Vary and honor the methods for response, navigation, and movement *Optimize access to accessible materials and assistive and accessible technology
Support	Sustaining Effort and Persistence *Clarify the meaning and purpose of goals *Optimize challenge and support *Foster collaboration, interdependence, and collective *Foster belonging and community *Offer action-oriented feedback	Language and Symbols *Clarify vocabulary, symbols, and language structures *Support decoding of text, mathematical notation, and symbols *Cultivate understanding and respect across languages and dialects *Address biases in the use of language and symbols *Illustrate through multiple media	Expression and Communication *Use multiple media for communication *Use multiple tools for construction, composition, and creativity *Build fluency with graduate support for practice and performance *Address biases related to modes of expression and communication
Executive Function	Emotional Capacity *Recognize expectations, beliefs, and motivation * Develop awareness of self and others *Promote individual and collective reflection *Cultivate empathy and restorative practices	Building Knowledge *Connect prior knowledge to new learning * Highlight and explore patterns, critical features, big ideas, and relationships *Cultivate multiple ways of knowing and making meaning *Maximize transfer and generalization	Strategy Development *Set meaningful goals *Anticipate and plan for challenges *Organize information and resources *Enhance capacity for monitoring progress *Challenge exclusionary practices

Source: CAST. 2024. “The Universal Design for Learning Guidelines.” https://udlguidelines.cast.org/static/udlg3-graphicorganizer-digital-numbers-a11y.pdf.

UDL representation in music classes focuses on expanding access to understanding. Music notation and literacy remain central; however, they are not neutral, as they rely on visual processing, working memory, and decoding. Music instruction within UDL may be delivered through physical, aural, and visual modeling; chunking information; paired visual and verbal cues with multiple examples; and technology that strategically enhances learning. Examples within music class may be color-coded phrasing, chunked musical excerpts, conducting gestures to visually assist in musical shape and rhythm, listening to professional models, and the use of computer-assisted instruction.

The concept of action and expression in UDL emphasizes long-term growth within music, not the final product of a concert. Expression expands evidence of individual growth. UDL promotes multiple ways to display progress, supports physical and cognitive differences, focuses on the process rather than the product, allows structured feedback from multiple sources or models, and includes checkpoints or benchmarks throughout the educational process. Examples within the musical classroom may include audio or video demonstrations, individual or section recordings with self- and/or peer-assessment, coaching students to give meaningful feedback, individual reflection using musical evidence, and adaptive equipment to provide flexible physical positioning. Additionally, assistive technologies and teaching methods will be readily available with inclusion by design. When designing UDL, educators should assume a continuum of learning differences, with individual strengths and weaknesses below, at, and above grade level. Multiple formats and media, action pathways, and several ways to engage students in their personal interests when applying UDL.

There is a teacher-centered approach within the traditional ensemble model of teaching: one method or performance as instruction and assessment. UDL provides multiple artifacts and

multiple pathways to master musical concepts. For educators, this is not a loss of control but a means of gaining clarity for learners who learn differently. UDL deepens thought. Instead of one method, it expands musical thinking through flexible pathways, supports, demonstrations, and reflection methods to reach the same educational targets or goals. Nevertheless, musical concepts such as tone, pitch, rhythm, style, and musical excellence remain firm in UDL.

Hammel and Hourigan, along with Adamek and Darrow, have advocated applying the UDL framework to support students with disabilities in their music learning.[180] UDL promotes musical evidence for musical growth, fostering students' fluency in their musical development and encouraging them to think beyond the notes. According to Dr. Amanda Draper, research on the efficacy of UDL in practice has not been conducted.[181] Exploring UDL in music education would contribute to the body of research and inform other fields that support UDL in learning environments and contexts. In 2014, however, Yvel Crevecoeur, Associate Professor of Special Education at City College of New York, along with colleagues, stated that UDL has merit but urged caution, as there was no empirical evidence to validate its educational utility in the learning environment.[182] Since then, more information has been produced about UDL. The CAST website states that UDL is research-based and improves academic achievement, learner engagement, educator learning, and development within subject areas of education. UDL has merit; future research can test its principles with students with disabilities, substantiating its

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[180] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism*, 2nd ed. (New York: Oxford University Press, 2020), 92, https://ebookcentral.proquest.com/lib/liberty/detail.action?docID=6273033.

[181] Amanda R. Draper, "Music Education for Students With Autism Spectrum Disorder in a Full-Inclusion Context," *Journal of Research in Music Education* 70, no. 2 (2022): 149, https://doi.org/10.1177/00224294211042833.

[182] Yvel Crevecoeur et al., "Universal Design for Learning in K–12 Educational Settings: A Review of Group Comparison and Single-Subject Intervention Studies," *Journal of Special Education Apprenticeship* 3, no. 2 (2014): 2.

relevance to proactively removing learning barriers while accommodating the diverse needs of all learners. Educational leaders, consultants, and authors Mirko Chardin and Katie Novak maintain in their book that "When teachers align the design of learning experiences to the three UDL principles, all learners personalize their journey to the same destination, and this celebrates every student as they drive the learning that is taking place."[183] UDL provides students with a choice and voice in their learning environment.

Evidence-Based Intervention (EBI)

Amanda Draper's findings identify teacher-directed approaches that might have direct application to music instruction in general education settings. These approaches, explicit instruction and schema-based instruction, are considered evidence-based interventions (EBIs). EBIs are empirically supported by peer-reviewed, systematic evaluations that demonstrate replicability, theoretical foundations, and a proven ability to achieve specific educational outcomes. According to The National Professional Development Center on Autism Spectrum Disorder, Evidence-Based Practices (EBP) "is an instructional/intervention procedure or set of procedures for which researchers have provided an acceptable level of research that shows the practice produces positive outcomes for autistic children, youth, and/or adults."[184] These strategies assess students' current skill sets and are followed by interventions to improve performance. The intervention strategies must be ongoing and collect data to monitor student progress. They must be implemented in accordance with established protocols to maintain effectiveness and ensure that the intervention's benefits outweigh its limitations. Sara Rieth,

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[183] Mirko Chardin and Katie Novak, *Equity by Design: Delivering on the Power and Promise of UDL* (Thousand Oaks, CA: Corwin Press, 2022), 25.

[184] The National Professional Development Center on Autism Spectrum Disorder, "Evidence-Based Practices," *Autism PDC*, 2020, https://autismpdc.fpg.unc.edu/ebps/.

Associate Professor at San Diego State University, along with her colleagues, state that "Recent reviews have identified evidence-based educational and psychological interventions for individuals with autism spectrum disorder (ASD) through extensive literature review and careful classification of outcome data."[185] No single intervention, however, has emerged as effective for all children. There is agreement on evidence-based interventions consistently supported by well-designed research. Both explicit instruction and schema-based instruction, which is in the next section, occur as EBIs by providing direct instruction or scaffolding support to help the learner acquire the skill or task.

Explicit Instruction

Explicit Instruction (EI) is a structured, systematic methodology in which content is logically selected, sequenced, and broken down into manageable units for instruction based on the students' cognitive abilities. Co-Authors Anita Archer, an educator best known for developing and promoting evidence-based explicit instruction, along with Charles Hughes, Professor Emeritus of Special Education at Pennsylvania State University say, "Explicit instruction is characterized by a series of supports or scaffolds, whereby students are guided through the learning process with clear statements about the purpose and rationale for learning the new skill, clear explanations and demonstrations of the instructional target, and supported practice with feedback until independent mastery has been achieved."[186] EI has great potential as an educational process, as it has clear target goals regarding what to learn and why it is important. When content is presented in context, it provides the purpose for learning. In EI, the

[185] Sara Rieth et al., "Identifying Critical Elements of Treatment: Examining the Use of Turn Taking in Autism Intervention," *Focus on Autism and Other Developmental Disabilities* 29, no. 3 (September 2014): 168, https://doi.org/10.1177/1088357613513792.

[186] Anita L. Archer and Charles A. Hughes, *Explicit Instruction: Effective and Efficient Teaching* (New York: Guilford Press, 2011), 17.

teacher models or demonstrates the process for developing the skill. Through guided practice, teachers provide students with feedback and scaffolded support to develop the desired skill. Teachers use the EI check for understanding to correct students' errors and adjust instruction to meet students' needs best. EI fosters students' competence in the skills through independent practice. Finally, in EI, teachers review and reinforce these skills to promote long-term retention.

Video Modeling

Video modeling is an evidence-based instructional strategy that provides learners with a tool to observe and imitate to achieve a targeted behavior or skill, aligning with their strengths in visual learning. The application of video modeling extends across numerous learning and skill domains, improving social interaction, vocational tasks, and daily living activities in real-life settings. Implementing video modeling alongside other ABA techniques, such as Discrete Trial Training (DTT), may enhance effectiveness by creating an engaging, interactive learning environment.

Proper implementation of video modeling requires a distraction-free environment and access to all necessary materials, both of which are vital to its application. The video model can be stored on a digital device for repeated viewing, providing consistent, clear visual information to support the learning objective. Videos, in full or in segments, promote practical pauses that encourage individual guided practice. Integration of video modeling into the routines of individuals with ASD fosters self-reliance and greater independence by enhancing skill acquisition.

One study by Hedieh Piraneh, who is affiliated with Tabriz University of Medical Sciences in Iran, concludes that video modeling, which applies modern technologies, dramatically improves oral hygiene compared with traditional social stories in standard

education for individuals with ASD. The key findings demonstrated that video modeling was significantly more effective with dental care, as children with ASD responded better to technology-driven audiovisual media.[187] Piraneh and colleagues assert that video modeling may confer benefits similar to those of learning by enhancing the visual learning strengths of students with ASD. Students may also record themselves attempting to complete a learning objective, then compare and contrast their recording with the video model. This benefits students with ASD by enabling observational learning, imitation of behaviors, and skill development. Educators may tailor video modeling demonstrations to individual needs, allowing for flexibility and access in the learning process.

Computer-Assisted Instruction (CAI)

The integration of technology as an instructional strategy provides tools supporting students with ASD in music education. Researcher Christine Williams finds that on-task behavior and improved word recognition occur when implementing computer-assisted instruction. Williams notes that, "Computer-assisted instruction (CAI), increasingly used in special education, has been suggested as a means of enabling new ways of learning and teaching in children with autism where traditional methods may not always be appropriate or productive."[188] In her literature review, Amanda Draper's points to the potential of computer-assisted instruction in music education. Draper note that "the prevalence of computers in

[187] Hedieh Piraneh et al., "Social Story-Based Toothbrushing Education Versus Video-Modeling Based Toothbrushing Training on Oral Hygiene Status Among Male Students Aged 7–15 Years Old with Autism Spectrum Disorders in Tehran, Iran: A Quasi-Randomized Controlled Trial," *Journal of Autism and Developmental Disorders* 53 (October 2023): 3822, https://doi.org/10.1007/s10803-022-05679-9.

[188] Christine Williams et al., "Do Children with Autism Learn to Read More Readily by Computer-Assisted Instruction or Traditional Book Methods?" *Autism* 6, no. 1 (March 2002): 72, https://doi.org/10.1177/1362361302006001006.

classrooms makes them a valuable tool for instruction with students with ASD. Computer-assisted instruction (CAI) uses computers or other handheld devices to support students' learning."[189] As e-learning programs rapidly increased, creating a blend of overlapping vocabulary, Researcher Alla Anohina at Riga Technical University analyzed technology terminology in her study, providing a structural taxonomy for the fields of education, instruction, learning, teaching, and tutoring.[190] Computer-assisted instruction presents material and manages the student learning process through practice, assessment, and feedback. The benefits of using CAI include high student engagement, autonomous learning enabled by its self-paced nature, individualized instruction, immediate, real-time feedback, and multisensory methods to enhance content instruction.

Schema-Based Instruction (SBI)

Schema-based instruction applies explicit instruction to solve problem types. The schema will evolve over the course of instruction, requiring students to adapt and refine their thinking and understanding as they solve the problem. Typically, visual representations, such as diagrams, charts, graphic organizers, manipulatives, and pictures, provide a structure or model to help solve the problem. Additionally, SBI focuses on vocabulary development to help students interpret language and solve problems. Schema-based instruction also emphasizes step-by-step strategies to help students develop problem-solving skills. Systematic practice, along with teacher feedback, helps students identify solutions to their problems.

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[189] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, 2020), 104, ProQuest Dissertations & Theses Global.

[190] Alla Anohina, "Analysis of the Terminology Used in the Field of Virtual Learning," *Educational Technology & Society* 8, no. 3 (2005): 91.

Graphic Organizers

Amanda Draper's literature review shows that Baker and Darch/Eaves have similar views. These relate to "graphic organizers, …. [being] procedural facilitators that use visual and spatial displays, diagrams, or outlines to help students organize key concepts and vocabulary for comprehension of text."[191] Craig Darch and Ronald Eaves, Professors of Special Education at Auburn University (1986), briefly state that graphic organizers facilitate the initial teaching of contextual information.[192] Key findings of Darch and Eaves' study demonstrate how presenting information through visual-spatial displays significantly enhances comprehension. Compared to solely relying on standard textbooks. Furthermore, Co-Authors Scott Baker, Professor at Southern Methodist University, Russell Gersten, Professor Emeritus of Education at the University of Oregon, and David Scanlon, Associate Professor of Special Education at Boston College, discuss how "results showed that students with learning disabilities made large gains in their knowledge of the strategy steps and in the quality of the graphic organizers they developed."[193] Graphic organizers help students understand complex concepts and improve their comprehension. Additionally, they provide a means of organizing thoughts, enabling students to connect ideas and concepts. Graphic organizers are beneficial for students with learning disabilities and for visual learners.

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[191] Amanda R. Draper, "Music Education for Students with Disabilities" (PhD diss., Northwestern University, 2020), 102, ProQuest Dissertations & Theses Global.

[192] Craig Darch and Ronald Eaves, "Visual Displays to Increase Comprehension of High School Learning-Disabled Students," *The Journal of Special Education* 20, no. 3 (October 1986): 309.

[193] Scott Baker, Russell Gersten, and David Scanlon, "Procedural Facilitators and Cognitive Strategies: Tools for Unraveling the Mysteries of Comprehension and the Writing Process, and for Providing Meaningful Access to the General Curriculum," *Learning Disabilities Research & Practice* 17, no. 1 (2002): 68, https://doi.org/10.1111/1540-5826.00032.

Manipulatives

For this study, manipulatives were defined as physical or virtual objects that students can touch, move, and explore to understand abstract concepts. Manipulatives provide physical models and visual representations that allow students to interact with them. Manipulatives promote active learning, support critical thinking, engage multiple learning styles, and improve understanding for students with learning disabilities.

Visual Mapping

A core component in Hammel and Hourigan's research, visual mapping, such as mind maps or visual schedules, assists students with ASD in organizing information and understanding concepts, thereby supporting their daily functioning. Visual mapping can help convey the musical story and is suitable for all students. Additionally, students with ASD require time to decode and process information, utilizing their executive functions.[194] This can affect physical body coordination during music classes, influencing musical nuances. Communication cards, lists, or visual cues can help students recall terms or phrases. Music educators need to engage socially with students with ASD, fostering positive interactions that reinforce cognitive-emotional behaviors through music. Support for each student who has ASD may look different. Researchers Valentin Bauer, Tifanie Bouchara, and Patrick Bourdot highlight that students with ASD may prefer visual learning and technology that helps connect concepts. Their study titled "Extended Reality Guidelines for Supporting Autism Interventions Based on Stakeholders' Needs" introduced extended reality (XR) to students with ASD, focusing on the socioemotional learning skills of students with ASD and on the support systems that may be needed in

[194] Ryan M. Hourigan and Alice M. Hammel, "Understanding the Mind of a Student with Autism in Music Class," *Music Educators Journal* 104, no. 2 (December 2017): 24, https://doi.org/10.1177/0027432117732386.

educational settings. The findings suggest that XR and other technological educational supplemental aids can be beneficial to students with ASD. [195]

Educational Assistants

Educational assistants (EAS) can support students in classroom settings. This enables them to receive meaningful, fulfilling instruction tailored to their educational needs. EAS should understand their roles and responsibilities for students with special needs through mutual respect and collaboration. Their aim should be to help students reach the class's educational goals. Also known as paraprofessionals or teacher's aides, these EAS can provide support and services tailored to their individual needs. Through ongoing dialogue, EAS and the teacher can collaborate to foster growth in music classes. According to educator and researcher Melissa Cole, using models of inclusion, both EAS and teachers can create learning environments with a system of approaches that best suit the student's learning process. EAS should be used to demonstrate, guide, and participate, thereby enabling students with ASD to enhance their learning domains and reach their full potential.[196]

Reverse-Inclusion Instruction

There are many benefits to developing inclusive music classrooms. First, students can serve as positive role models in peer-mediated settings. Amanda Draper describes the

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[195] Valentin Bauer, Tifanie Bouchara, and Patrick Bourdot, "Extended Reality Guidelines for Supporting Autism Interventions Based on Stakeholders' Need," *Journal of Autism and Developmental Disorders* 53, no. 5 (May 2023): 2078, https://www.proquest.com/scholarly-journals/extended-reality-guidelines-supporting-autism/docview/2804805203/se-2.

[196] Melissa Cole, "Incorporating Educational Assistants into Inclusive Music Classrooms," *The Canadian Music Educator* 59, no. 3 (Spring 2018): 30, https://go.openathens.net/redirector/liberty.edu?url=https://www.proquest.com/scholarly-journals/incorporating-educational-assistants-into/docview/2189488666/se-2.

implementation process of reverse inclusion instruction by having peers act as mentors to support students with disabilities in the classroom and by forming buddy pairs.[197] Second, Darrow and Amadek assert that "students with disabilities have increased opportunities for normalized peer interactions."[198] Third, the demonstration of a skill, no matter the level, that would otherwise go undetected is now apparent due to equitable educational opportunities.

Joint Attention (JA) Strategies

An important concept of concern for educators is joint attention. Kai Zhang and the team of researchers affiliated with Central China Normal University note that "Joint attention (JA) refers to the process by which two individuals share their attention and interest in an object or event, typically manifested through eye gaze, pointing, or other verbal or non-verbal cues."[199] It is a foundational skill supporting communication, social interaction, and learning. One study using virtual reality technology to track eye movements examined social and non-social stimulus conditions to determine whether joint attention improves under these conditions. Zhang's study articulates, "Under social stimulus conditions alone, the joint attention abilities of children with ASD are significantly influenced by the environment, while typically developing abilities remain unaffected; the additional non-social stimuli significantly enhanced the joint attention scores for

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[197] Amanda R. Draper, "Music Education for Students with Autism Spectrum Disorder in a Full-Inclusion Context," *Journal of Research in Music Education* 70, no. 2 (July 2022): 136, https://doi.org/10.1177/00224294211042833.

[198] Alice-Ann Darrow and Mary S. Adamek, "Preparing for the Future: Music Students with Special Education Needs in School and Community Life," in *The Oxford Handbook of Music Education*, vol. 2, ed. Gary E. McPherson and Graham F. Welch (New York: Oxford University Press, 2019), 91.

[199] Kai Zhang et al., "Investigating Joint Attention in Children with Autism Spectrum Disorder through Virtual Reality and Eye-Tracking: A Comparative Study," *Education and Information Technologies* 30 (2025): 18780, https://doi.org/10.1007/s10639-025-13554-0.

both groups."[200] These findings suggest that, with thoughtful instructional design, appropriate learning environments, and emerging technologies, joint attention may be enhanced.

The environment can influence joint attention, thereby enhancing the learning process and knowledge acquisition. Holding attention improves learning. "The longer a music educator can hold a student's interest, the more that student will learn. Hammel and Hourigan defend that children learn by engaging with the world, and the more these activities are practiced, the stronger they become. Extending joint attention is a primary goal for many students with ASD.[201] Instructional strategies promoting sustained joint attention should be considered an essential evidence-based component in music instruction.

By seeking to extend joint attention in music education whenever possible, one may enhance learning for students with ASD. Hammel and Hourigan suggest applying pattern-echo exercises or expanded musical conversation, which ASD students engage in to increase focus on musical interest and to develop trackable skill sets. The use of eye contact, body gestures, and vocal inflection in repeated tasks in a learning-conducive environment fosters joint attention. It increases opportunities in our music classes that provide meaning for students with ASD.

The end goal for students with ASD is to develop joint attention. ASD students responding to joint attention (RJA) begin to notice when someone points to or looks at an object or point of interest, shifting their attention to the same focal point. Students with ASD begin to develop their understanding through shared experiences and joint attention. Furthermore,

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[200] Zhang et al., "Investigating Joint Attention," 18779.

[201] Alice M. Hammel and Ryan M. Hourigan, *Teaching Music to Students with Autism*, 2nd ed. (New York: Oxford University Press, 2020), 45.

students with ASD will initiate joint attention by pointing, showing, shifting gaze to the object of interest, discussing it, and inviting others to share the interest.

Executive Function Strategies

Research indicates that executive function in students with ASD can improve. Tamm notes that the study applied Achieving Independence and Mastery in School (AIMS), which involves "teaching academic EF [executive function] skills using evidence-based strategies for students with ASD (e.g., behavior agreement, visual supports, video modeling, technology, behavioral techniques such as reinforcement) to promote increased independence related to academics."[202] Parents report improvements in the study children's organizational skills in task planning, organized actions, material management, and memory. The study also documented improvements reported by parents in academic executive function skills and in disruptive behaviors. Teachers also reported similar improvements in executive function in the study.

Summary of Core Concepts Towards ASD in Music Education

Students with special needs must have specially trained educators who can provide quality instruction that meets their needs. Hammel and Hourigan clarify, "Through our national and international travel, … many music teachers have been assigned to teach students in self-contained autism classrooms for the first time, many without necessary training or guidance."[203] The phenomena of Autism Spectrum Disorder identify areas of weakness in social deficits, sensory dysfunction, communication, developmental delays, complications in processing

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[202] Leanne Tamm et al., "Improving Academic Performance through a School-Based Intervention Targeting Academic Executive Functions: A Pilot Study," *International Journal of Developmental Disabilities* 70, no. 3 (2024): 552, https://doi.org/10.1080/20473869.2022.2095690.

[203] Ryan M. Hourigan and Alice M. Hammel, "Understanding the Mind of a Student with Autism in Music Class," *Music Educators Journal* 104, no. 2 (December 2017): 22.

information, repetitive behaviors, and executive function. Music educators need to understand the complexities of autism to implement effective educational strategies and create equitable music classroom settings for students with ASD. Intervention strategies have been researched in music therapy, general education, and general music. Those intervention strategies have been shared by special education teachers with other professionals regarding ASD students.

First, before designing an inclusive music classroom, one must understand the students' needs. Amy Clements-Cortes, Associate Professor of Music at the University of Toronto, says, "Children diagnosed with autism or ASD suffer qualitative impairments in communication and social skills, resulting in students having difficulty with expressive and receptive language interactions with others, and the ability to understand that others' thoughts, feelings, and perspectives might be different from their own."[204] Second, Sheila Scott, Associate Professor of Music Education at Brandon University, highlights the need for flexibility in the education process. Scott notes that "Children on the autism spectrum display various behaviors, cognitive abilities, and social skills. For this reason, no single educational program meets the needs of all individuals in this diverse population."[205] Third, children with special needs, such as those with ASD, who have behavioral, psychomotor, or cognitive disabilities, learn in inclusive ways, trying to reach the same goals as their peers in class. Numerous environmental conditions can trigger overstimulation, leading to disruptive classroom behavior. Scott notes that "autism is a life-long condition with no known cure or cause."[206] There are treatments for the disorder.

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[204] Amy Clements-Cortes, "Designing an Inclusive Music Classroom for Students with Autism and Autism Spectrum Disorders," *The Canadian Music Educator* 53, no. 3 (Spring 2012): 35.

[205] Sheila Scott, "Autism and Music Education," in *Music Education for Children with Autism Spectrum Disorder: A Resource for Teachers* (New York: Oxford University Press, 2017), 3.

[206] Scott, "Autism and Music Education," 4.

Appropriate educational practices can help address cognitive delays to improve learning. Co-authors Matthew Bennett, Emma Goodall, and Jane Nugent skillfully account for the emotional distress caused by receiving the ASD diagnosis as a parent for their child, below:

> When a parent learns that their child is autistic, it is often perceived as a life-changing event, or at the very least a momentous occasion, with many parents worrying that their child will not be able to thrive. In response to this diagnosis, families often seek strategies or programs that can help their autistic child reach their potential. Although families have the best intentions, the chance of finding an effective strategy or program is hampered by the plethora of strategies marketed as evidence-based supports and therapeutic programs.[207]

Carefully designed instructional strategies, beyond supportive environmental adaptations, provided meaningful learning opportunities for students with ASD. Scott tells how "Teachers develop instructional strategies for working with children on the autism spectrum, choosing activities that are challenging but, at the same time, not so difficult that the child is not able to experience success. The resulting learning environment is built on safety and trust so that students are willing to approach new challenges without undue anxiety or withdrawal."[208] According to Hourigan, "The challenge for music teachers is discovering how to tap into this responsiveness in the midst of all of the other distractions that arise for the child."[209] The purpose of appropriate educational modification practices is to address cognitive delays and improve learning. Examples include discipline support, transitional support, invention responses, emphasis on self-determination, differentiated instruction, universal design for learning, peer mediation or peer mentoring, joint attention, intersubjectivity, and technology assistance. Music Educator Mary Scholtens notes that

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[207] Matthew Bennett, Emma Goodall, and Jane Nugent, *Choosing Effective Support for on the Autism Spectrum: A Guide Based on Academic Perspectives and Lived Experience* (London: Routledge, 2021), 18.

[208] Scott, "Autism and Music Education," 12.

[209] Ryan M. Hourigan and Alice M. Hammel, "Teaching Music to Children with Autism: Understandings and Perspectives," *Music Educators Journal* 96, no. 1 (September 2009): 40.

"according to music therapy pioneer Rolando Benenzon, music can serve as a bridge between the nonverbal world of these children and what is to many of them the threatening domain of words."[210] Music acts as a non-threatening channel for students with ASD. These instructional approaches support individualized learning, which reduces barriers in the educational process through fostering communication, engagement, and meaningful participation in music education.

Approaches Supporting Educational Practices for Students with ASD.

Clear, concise language, along with verbal instruction and visual aids, helps the student with ASD understand directives. Students will use language and speech literally, so educators should avoid idioms, double meanings, sarcasm, and avoid verb overload. Students should have sufficient processing time to comprehend information, along with the educator checking for understanding, as individuals with ASD may struggle with abstract and conceptual thinking.

Educators should support social interaction that develops communication skills through joint activities, modeling, role-playing, and joint attentionalong with incorporating special interests. Author and education consultant Barbara Blackburn contends that educators need to "remember that facial expressions and other social cues may not work. Most individuals with autism have difficulty reading facial expressions and interpreting body language."[211]Educators should focus on explicit forms of communication, adapting their communication practices to reduce ambiguity and providing clear, consistent verbal instruction that supports successful student participation in all learning activities.

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[210] Mary Scholtens, "Using Music to Encourage Joint Attention for Students with Autism Spectrum Disorder: Attention as a Reciprocal Relationship," *Music Educators Journal* 105, no. 4 (June 2019): 46.

[211] Barbara Blackburn, *Motivating Struggling Learners: 10 Ways to Build Student Success* (New York: Routledge, 2016), 130, https://ebookcentral.proquest.com/lib/liberty/detail.action?docID=3569638.

Executive function may be applied by breaking tasks into smaller steps, using checklists or timers, and employing problem-solving strategies. Students with ASD have difficulty with organizational skills,rehearsing tasks until they become routine. Educators should always remember to praise students when they recall something they had forgotten.

Educators should be aware of sensory barriers that apply to students with ASD, such as sensory triggers. The learning environment should be calm and provide low sensory input for students with ASD. Educators should prepare students with ASD for environmental changes through written and visual schedules. Students with ASD thrive when they have a clear, predictable structure, visual schedules/routines with specific start and stop points, and warnings for transitions.

Praising students for their independence encourages them to self-advocate. Educators should have emotional awareness of issues associated with ASD. Blackburn notes that "behavior management works, but if incorrectly used, it can encourage robot-like behavior, provide only short-term behavior change, or result in some form of aggression. Use positive and chronologically age-appropriate behavior procedures."[212] When students with ASD use repetitive verbal arguments or questions, one needs to interrupt the continuation of the behavior, as responding logically or arguing back may not work. Request that they respond in writing to the question or argumentative statement. This usually calms them and discontinues the repetitive activity. Then the educator should record their response.

Positive behavior support should always be in place, with clear expectations, a strengths-based approach, and high levels of reinforcement. Instruction should be flexible, visual, and

[212] Blackburn, *Motivating Struggling Learners*, 130.

language-rich, providing concrete learning experiences. Consistency in expectations and treatment is vital.

Educators should provide students with choices, when possible, which improves engagement through autonomy while reducing the stress and anxiety that students with ASD encounter. Strategies can include scaffolding or chunking (breaking material into smaller, shorter tasks), predictable patterns, and guided practice to develop organizational skills for task performance. "If the student does not seem to be learning a task, break it down into smaller steps or present the task in several ways (e.g., visually, verbally, physically)."[213] Educators should adapt instruction to students' needs rather than expecting students to adapt to instructional methods.

Misbehavior should not be taken personally. Blackburn notes, "An increase in unusual or difficult behaviors probably indicates an increase in stress. A sense of loss of control can cause stress. Many times, the stress will only be alleviated when the student physically removes himself from the stressful event or situation."[214] The behavior typically represents efforts to cope with confusion, disorientation, or anxiety while processing new information or experiences.

Autism Stigma

Students with ASD experience stigma displayed through ignorance, prejudice, and discrimination. Researchers and authors Alice Turnock, Kate Langley, and Catherine Jones emphasize how "autism stigma is affected by people's understanding of autism and by visible autistic traits. A poor understanding of autism means that visible autistic traits may be viewed

[213] Blackburn, *Motivating Struggling Learners*, 130.

[214] Ibid.

negatively."[215] Several factors affect the stigma of ASD, which include the quality or quantity of contact, cultural differences in beliefs towards autism, sex, gender, education and age. "Autism stigma hurts well-being. This includes poor mental and physical health, as well as reduced social connections. Autism stigma also leads to increased 'camouflaging' of autistic traits."[216] Reducing autism stigma is important. Music educators need to create more autism-friendly classroom spaces, enhance their public and professional understanding of ASD, while supporting neurodiversity.

The Autistic Voice

The autistic voice refers to direct lived experiences and perspectives of individuals with ASD. Valuing the autistic individuals' point of view, recognizing their authentic perspective of the world, along with acknowledging their experiences may be minimized or misinterpreted by non-autistic individuals, including advocates, parents, health care providers, and researchers, unintentionally. Chandra Lebenhagen, researcher and founder of Including Autism, proclaims that ethical listening is crucial for understanding the autistic perspective rather than imposing an external interpretation. Lebenhagen notes that "ethical listening improves the inclusion of autistic voice in research because it values nonspoken forms of communication and demonstrates to autistic people that they and their perspectives are important."[217] At the same time, researcher Valerie Courchesne and her colleagues state that the authentic voice calls on all forms of

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[215] Alice Turnock, Kate Langley, and Catherine Jones, "Understanding Stigma in Autism: A Narrative Review and Theoretical Model," *Autism in Adulthood* 4, no. 1 (March 2022): 76, https://doi.org/10.1089/aut.2021.000.

[216] Turnock, "Understanding Stigma in Autism," 77.

[217] Chandra Lebenhagen, "Including Speaking and Nonspeaking Autistic Voice in Research," *Autism in Adulthood* 2, no. 2 (September 2019): 128, https://doi.org/10.1089/aut.2019.0002.

communication, not just conventional speech, for a meaningful purpose.[218] Both are important as communication takes many forms, not just verbal ones, and the autistic voice still deserves inclusion.[219]

Historically, the autistic voice has been excluded from many forums. Their perspectives and viewpoints, however, should be considered within society, not viewing neurotypical behavior as superior, which distorts the understanding of autistic experiences. Co-authors and researchers Aino-Mari Uisma, Tujia Virkki, and Minna Ylilahti from the University of Jyväskylä claim, "We acknowledge how neuronormativity – the hegemonic assumptions, norms and practices that place certain social, communicative and cognitive styles as better than others – creates additional hierarchies where autistic people are considered deviant or disordered in their diverging from these neuronormative ideals."[220] This creates a prejudiced system with physical, social, and attitudinal barriers forcing conformity. Adoption of views or language is harmful to individuals with ASD, neglecting the need for accessibility and services. There has been a social paradigm shift in the view of individuals' disabilities. James Charlton, disability rights activist and author, avows, "This shift poses a fundamental challenge to the ideological oppression of people with disabilities. For it sees disability as normal, not inferior, and demands self-determination over the resources people with disabilities need."[221] Educators should recognize

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[218] Valerie Courchesne et al., "Autism Voices: A Novel Method to Access First-Person Perspective of Autistic Youth," *Autism* 26, no. 5 (September 2021): 1123, https://doi.org/10.1177/13623613211042128.

[219] Chandra Lebenhagen, "Including Speaking and Nonspeaking Autistic Voice in Research," *Autism in Adulthood* 2, no. 2 (September 2019): 129, https://doi.org/10.1089/aut.2019.0002.

[220] Aino-Maru Uisma, Tuija Virkki, and Minna Ylilahti, "Misunderstood, Minimised, Misrepresented: Autistic Young Adults' Experiences of Epistemic Injustices in Healthcare Interactions around Autism," *Sociology of Health & Illness* 48, no. 1 (January 2026): 2, https://doi.org/10.1111/1467-9566.70124.

[221] James Charlton, *Nothing about Us without Us: Disability Oppression and Empowerment* (Berkeley: University of California Press, 1998), 22.

neurodiverse learners from a social concept rather than a deficit-based framework that allows the acknowledgment of their unique perspectives.

Centering autistic voices must be an ethical imperative, shifting from a philosophical-medical/deficit approach to a neurodiversity approach, which views neurodiversity as a natural variation in the human genome rather than as an inadequacy that needs to be cured. Kathy Leadbitter, along with the interdisciplinary team of researchers from the University of Manchester, states, "A central premise of the neurodiversity movement is that variations in neurological development and functioning across humans are a natural and valuable part of human variation and therefore not necessarily pathological."[222] The autistic rights movement, along with traditional disability rights groups, rejects the idea that others speak for individuals with ASD, as it marginalizes them. Individuals with ASD should be the primary interpreters, speaking on their own behalf, through self-advocacy.[223] A key point, "Nothing about us (ASD) without us (ASD)," serves as a broader context, focusing not just on inclusion but on advancing ethical matters.

The voices of people with autism express their worldviews directly. According to Lebenhagen, including the autism voice captures their subjective interpretations and meaningful insights rather than distorting them.[224] Courchesne and colleagues note that acknowledging interpretations with compassion improves the relevance of scholarly research, as their perspectives can and should direct it. At the same time, Teal Benevides, a professor and

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[222] Kathy Leadbitter et al., "Autistic Self-Advocacy and the Neurodiversity Movement: Implications for Autism Early Intervention Research and Practice," *Frontiers in Psychology* 12 (April 2021): 2, https://doi.org/10.3389/fpsyg.2021.635690.

[223] Leadbitter et al., "Autistic Self-Advocacy," 2.

[224] Chandra Lebenhagen, "Including Speaking and Nonspeaking Autistic Voice in Research," *Autism in Adulthood* 2, no. 2 (September 2019): 128, https://doi.org/10.1089/aut.2019.0002.

researcher in occupational therapy from Augusta University, along with a team of colleagues, argue that autistic individuals should be co-producers of knowledge in research.[225] Lastly, James Charlton states, "When people with disabilities come to the conclusion that they have the right to be in the community, to have a say in how that community treats them, they are beginning to develop a consciousness about taking control of their lives and resisting all attempts to give others that control."[226] Individuals with ASD are experts in their own experiences, and their unique perspectives may help shape future practices, policies, and research.

Culture Influences ASD Perception

Cultural factors can influence individuals' perceptions of those with ASD, affecting acceptance, understanding, and interpretations in social interactions. Myths about ASD can exist in cultural and community settings, preventing people from seeking assistance. Even when information is received about ASD, it may be confusing to one ethnic group while helping another. Mattina Davenport, Assistant Professor of Pediatrics at The Ohio State University, along with her colleagues, declare, "Given the dynamic relationship between culture and social behavior, the effectiveness of social skills interventions may be particularly influenced by the degree to which they are culturally appropriate."[227] According to Michael DuBay, Assistant Professor of Speech Communication Disorders at the University of Virgina, Linda Watson,

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[225] Teal Benevides et al., "Listening to the Autistic Voice: Mental Health Priorities to Guide Research and Practice in Autism from a Stakeholder-Driven Project," *Autism* 24, no. 4 (May 2020): 823, https://doi.org/10.1177/1362361320908410.

[226] James Charlton, *Nothing about Us without Us: Disability Oppression and Empowerment* (Berkeley: University of California Press, 1998), 15.

[227] Mattina Davenport et al., "A Systematic Review of Cultural Considerations and Adaptation of Social Skills Interventions for Individuals with Autism Spectrum Disorder," *Research in Autism Spectrum Disorders* 52 (August 2018): 23, https://doi.org/10.1016/j.rasd.2018.05.003.

Professor Emerita in Speech and Hearing Sciences at the University of North Carolina (UNC), and Wanqing Zhang, Associate Professor and Lead Reearch Methodologist in Health Sciences at UNC, in Hispanic culture, "Many caregivers still face criticism and judgment from their communities within the US for having caused their child's ASD or not doing the right things to treat it. This criticism … was a great source of stress for caregivers."[228] Our cultural factors influence how we experience autism. Understanding family backgrounds, including language, geographic location, religion, nationality, economic status, gender, beliefs, and values, provides insight into how families approach disability. These cultural factors influence decisions regarding care and services. As educators, we need to learn to be culturally sensitive, taking time to listen, reducing those barriers for ASD students and families.

Cultural Community Collaboration

Educators can implement evidence-based instructional strategies upon culturally responsive relationships that support diverse learning profiles. Kate Fitzpatrick, Associate Dean for Undergraduate Academic Affairs and Professor of Music at the University of Michigan, asserts that "embracing the cultures of our students successfully in the music classroom requires attention to both the content of our curriculum and the process of our pedagogy. Without such actions, teachers may unintentionally propagate dissonance between students' personal and school identification."[229] Building relationships with families and students helps us acknowledge and understand students' diverse cultural identities, improve music curricula, and enhance

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[228] Michael DuBay, Linda R. Watson, and Wanqing Zhang, "In Search of Culturally Appropriate Autism Interventions: Perspectives of Latino Caregivers," *Journal of Autism and Developmental Disorders* 48, no. 5 (May 2018): 1628, https://doi.org/10.1007/s10803-017-3394-8.

[229] Kate R. Fitzpatrick, "Cultural Diversity and the Formation of Identity: Our Role as Music Teachers," *Music Educators Journal* 98, no. 4 (June 2012): 59, http://www.jstor.org/stable/41692639.

instruction. Fitzpatrick notes that "knowing your students' cultural backgrounds, as well as recognizing your own, can foster greater respect, clear understanding, and better connections in the music classroom."[230] Fitzpatrick concludes with the following:

> By carefully and critically considering the rich cultural backgrounds that our students and we bring to the learning experience, and by thoughtfully planning the incorporation of culturally relevant music and pedagogy into our curricula, music teachers and their programs can more effectively serve the needs of their deserving students.[231]

Community members foster cultural competence by building educational partnerships. Support networks foster trust through open communication, generating open dialogue that enhances culturally relevant teaching. Cultural competence, understanding the diverse intersections of culture and autism, requires ongoing professional development with continuous learning, adaptation, and reflective practice that evolves our educational practices to incorporate every student's needs within the cultural dynamic.

ASD within Culturally Responsive Education Setting

Music educators should establish a culture of excellence by creating a welcoming, positive, and inclusive learning environment as they build their music program. According to Mark Holster, Associate Professor of Music Production Studies at Clemson University, "cultural environments are often unique to specific organizations, and most cultures can be categorized as either positive—contributing to the mission of the organization—or negative—holding back from achieving its ultimate purpose."[232] Furthermore, schools, programs, families, and students each have their own cultures, which together form the local community. Education journalists

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[230] Fitzpatrick, "Cultural Diversity and the Formation of Identity," 53.

[231] Ibid., 59.

[232] Mark Holster, "Shaping the Culture in High School Bands," *The Instrumentalist* (May 4, 2015), https://theinstrumentalist.com/may-2015/shaping-the-culture-in-high-school-bands/.

Madeline Will and Ileana Najarro report that educators should draw on students' perspectives, experiences, and customs to develop a more effective culturally responsive education (CRE) process.[233] Nevertheless, inclusion is a part of CRE, as it is "a pedagogy used to validate students' varied experiences and to teach to and through their strengths. Vanessa Bond, Professor and Coordinator of Graduate Music Education at Rowan University, highlights CRE as emphasizing high expectations, the formation of cultural competence, and the development of a critical consciousness."[234] It is essential to build a community and culture in the music program that is inclusive of all students. Using culturally responsive teaching, particularly for students with autism spectrum disorder (ASD), can enrich the overall music program by drawing on their unique perspectives and experiences.

Social Justice

There is an ongoing pursuit of equality and social justice for students with ASD; however, learning barriers still exist, which include health needs, social interactions due to diagnosis stigma, and ASD symptoms themselves. With the removal of educational barriers, all students gain access to instruction, and, more importantly, they feel they belong. Hammel affirms, "Inclusion has a huge effect on music educators. We now see more special learners in our classrooms and often find ourselves teaching students with far greater needs and more severe disabilities than in years past."[235] For these students, the music classroom should be a safe,

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[233] Madeline Will and Ileana Najarro, "What Is Culturally Responsive Teaching?" *Education Week* (April 18, 2022), https://www.edweek.org/teaching-learning/culturally-responsive-teaching-culturally-responsive-pedagogy/2022/04.

[234] Vanessa L. Bond, "Culturally Responsive Education in Music Education: A Literature Review," *Contributions to Music Education* 42 (January 2017): 153, https://www.jstor.org/stable/26367441.

[235] Alice M. Hammel, "Inclusion Strategies That Work," *Music Educators Journal* 90, no. 5 (May 2004): 35, https://go.openathens.net/redirector/liberty.edu?url=https://www.proquest.com/scholarly-journals/inclusion-strategies-that-work/docview/197194160/se-2.

welcoming, and healthy environment that provides unparalleled experiences with a profound impact on their lives. Hammel states, "To me, it is more important that we integrate a culture of belonging among our music classes and ensembles. When our philosophy is inclusive, determining the strategies becomes easier. Once our inclusive philosophy of belonging is in place, we can create adaptations that fit a universal learning design (UDL) framework."[236] Embracing a culture of belonging as an inclusive philosophy serves as a basis for implementing universal design by applying instructional practices that create a foundation for equitable music education, which removes barriers while helping each student thrive.

Music educators should diversify their teaching methods by incorporating visual, kinesthetic, and aural approaches to foster educational growth. This can be achieved by considering different learning domains, such as cognition, communication, and sensory input, as well as physical and medical issues, when teaching students. Special consideration and thought are required before selecting the number and size of musical pieces for performance and instruction. What modifications or accommodations should be included for students with ASD? Accommodations for instruction include highlighting, color-coding, enlarging text, slowing down with appropriate instructional pacing, adapting the part, and playing only the notes they know. Examples of instructional modifications may include playing the first note of each measure, simplifying the rhythm, or creating a separate part, as appropriate for the lesson or musical event. Both modifications and accommodations should be used to meet the needs of students with ASD and to support them in the music classroom.

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[236] Alice M. Hammel, "Teaching Students with Differences and Disabilities in Music Classrooms and Ensembles," *School Band & Orchestra* (April 2024): 18, https://go.openathens.net/redirector/liberty.edu?url=https://www.proquest.com/magazines/teaching-students-with-differences-disabilities/docview/3041763173/se-2.

Relevance in Music Educators/Professional Development

As the world changes, music educators must find new ways to stay relevant in the classroom. Through professional development, music educators can find new methods and approaches for teaching students with ASD. One example is shown in "Effects of Three Music Therapy Interventions on the Verbal Expressions of Children with Autism Spectrum Disorder: A Combined Single-Subject Design," a study focused on three-year-olds diagnosed with ASD, by researchers Nayla Attar, Anies Al-Hroub, and Farah El Zein, comparing the effects of using musical interventions, including interactive music-playing therapy, interactive singing therapy, and receptive impact learning.[237] The findings concluded that the lowest transfer of knowledge skills was observed when singing therapy was used alone; however, incorporating the other two musical interventions, which provided multiple methods for integrating learning domains, increased participants' knowledge retention.

Autism Relationship in Biblical Text

Grant Macaskill, Lightfoot Professor of Divinity at Durham University, argues that biblical writers had no reference to the condition itself, as it was unknown in the ancient world; therefore, one cannot find texts or passages in Scripture to inform thinking from this perspective.[238] The phenomena of autism being labeled differently, suggesting specific characteristics had ASD traits, or even equating to demon possession, become problematic; however, Christ's teaching stresses the importance of loving one another. The carryover for

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[237] Nayla Attar, Anies Al-Hroub, and Farah El Zein, "Effects of Three Music Therapy Interventions on the Verbal Expressions of Children with Autism Spectrum Disorder: A Combined Single-Subject Design," *Frontiers in Psychology* 13 (March 2022): 1, https://doi.org/10.3389/fpsyg.2022.819473.

[238] Grant Macaskill, *Autism and the Church: Bible, Theology, and Community* (Waco: Baylor University Press, 2020), 2.

music educators, then, becomes to care for all students, especially those with ASD. Likewise, music performance opportunities for individuals most likely occur weekly during a religious service, which promotes structured social interaction, fosters communication, enhances cognition, and engages sensory information through participation.

Autism in the Church Community

Besides educational environments, faith-based communities represent another important setting for individuals with ASD. It is at these faith-based community sites that individuals will most likely interact with music performance in a worship setting. Community life plays a vital role in development and social interaction. Andrew Whitehead, Professor of Sociology at Indiana University, notes, "In a nationally representative survey of children, those with autism spectrum disorders, developmental delays, learning disabilities, depression, anxiety, speech problems, and conduct disorders are consistently more likely never to attend religious services. Religious organizations are yet another sector of social life … [these] families struggle to integrate."[239] God provides music to connect, which children with ASD utilize. In turn, music helps alleviate the challenges associated with the condition. Mary Beth Walsh, parent advocate, who holds a doctorate in theology, and long-term board member of the Association for Science in Autism Treatment, stresses that "answers not found in theory might be found in church, but only if churches commit themselves to seeing beyond the surface and listening for the voices that are the hardest to hear. Our sacred spaces can and must become our safe places."[240] Over time, society's

[239] Andrew Whitehead, "Religion and Disability: Variation in Religious Service Attendance Rates for Children with Chronic Health Conditions," *Journal for the Scientific Study of Religion* 57, no. 2 (June 2018): 391, http://www.jstor.org/stable/26652131.

[240] Mary Beth Walsh, "Autism, Culture, Church: From Disruption to Hope," *Journal of Disability & Religion* 20 (December 2016): 350, https://doi.org/10.1080/23312521.2016.1239916.

understanding, acceptance, comprehension, and perception of ASD have changed. Academic researchers Eilidh Galbraith and Stewart Rapley, who specialize in the emerging field of autism theology, state, "Our theological thinking about autism has undergone numerous evolutions and transformations since it began to emerge as a subject of inquiry."[241] The shift in theological thinking affirms that individuals are not defined by their deficits, as they are part of the diversity of human creation, and that the disclosure encourages all communities to engage in faith, supporting autistic individuals by valuing their unique perspectives and contributions.

Higher Education

Higher education instructors require a range of skills beyond instructional delivery to foster a learning environment that welcomes students from diverse backgrounds. Educators must provide meaningful instruction that connects students' experiences and backgrounds to new information. As student populations become increasingly diverse, college educators must incorporate inclusive teaching practices for all students. Adult learners with disabilities, including those with ASD, will be in the classroom, where educators must adhere to providing appropriate accommodations that enhance learning.

Higher Education Population-Specific Considerations

The Postsecondary National Policy Institute Students with Disabilities in Higher Education reported various learning barriers associated with accessibility and inclusion in higher education.[242] First, students were unaware of the services the resource office provides for

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[241] Eilidh Galbraith and Stewart Rapley, "Autism Theology 'from the Outside In': Mapping the Journey of Autism Theology from the Margins to the Centre," *Practical Theology* (November 2023): 57, https://doi.org/10.1080/1756073X.2023.2270810.

[242] Postsecondary National Policy Institute, *Students with Disabilities in Higher Education* (Washington, DC: Postsecondary National Policy Institute, April 2025), accessed September 5, 2024, https://pnpi.org/wp-content/uploads/2025/04/StudentswithDisabilities_FactSheet_Apr25.pdf.

students with disabilities. Because students were unaware of the services provided by the resource office, they did not register for them, thereby hindering their ability to navigate the educational process with necessary accommodations. College educators may not be familiar with students' learning barriers or with the appropriate use of accommodations, as these have not been established. Additionally, educators may resist or object to proper educational accommodations or requests from the institution's disability office. College educators must be aware of their obligations and responsibilities under the educational reform law to ensure the rights of students with disabilities in higher education settings.

Higher Education Planning for Students with Disability

Higher education institutions across the United States are seeing an increase in student enrollment among individuals with disabilities. According to the Texas Council for Developmental Disabilities (TCDD), "Higher Education Resource Guide for Students with Disabilities," about 19.4% of college undergraduates are considered individuals with disabilities (about 3,755,000 students nationwide).[243] With increased support, schools are better equipped to address issues faced by students with disabilities, providing an equitable learning environment. Students should find schools that fit their specific physical, intellectual, and developmental needs, which assists them in planning for higher education. These resources include a list of tasks to help you register for and attend college, a process to determine your learning style, a system to identify challenges in the educational process, and guidance in establishing goals while exploring your personal interests.

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[243] Texas Council for Developmental Disabilities, *Higher Education Resource Guide for Students with Disabilities* (Austin, TX: Texas Council for Developmental Disabilities, 2020), accessed September 7, 2025, https://tcdd.texas.gov/wp-content/uploads/2020/03/2020-Higher-Ed-Guide-Remediated-EN.pdf.

TCDD provides parents with resources on college and career readiness, financial aid, support and services, educational choices, and information to help them navigate the transition period after high school. Additional resources include guidance through the college application process aalong with a toolkit for planning high school graduation and post-secondary education. Educators play a crucial role in inspiring students with disabilities to continue their education. Additionally, students need a fine arts credit, such as a music appreciation course, to complete their degree program, meaning they will take the appropriate courses to fulfill the requirement.

Disability, Activity, and Accommodations in Higher Education

Higher education instructors are responsible for understanding students' disabilities and their impact on class participation. Students must disclose their disabilities and request accommodations through the appropriate disability service office at their educational institution. A disability and inclusion statement should be included in every educator's syllabus. For example, if you have a documented disability and wish to discuss academic accommodations, please get in touch with me as soon as possible. Colleen Conway, Professor of Music Education at the University of Michigan, suggests providing a written notice of expectations that fulfills instructors' requirements for educational rights.[244]

Communication between the instructor and students is vital in implementing accommodations and engaging them in their learning. According to Alfred Schabmann, Professor at the University of Cologne, along with colleagues from Germany, notes, “Instructors are informed about…. [disability] to some extent; they lack basic information about certain

[244] Colleen M. Conway, *Teaching Music in Higher Education* (New York: Oxford University Press, 2020), 65.

aspects, particularly diagnostics and appropriately dealing with …[it].”[245] Educators are still responsible for providing a range of instructional methods, strategies, and options to address disability-related gaps, applying accommodations to mitigate learning barriers.

Educators, given the range of disabilities, should consult their disability office for guidance on how best to serve students. A variety of accommodations may include extended time, tutors, teacher-provided notes, reduced class load, smaller class sizes, preferential seating, recorded lectures, written directions, enlarged print, closed captioning, flexible attendance, sound amplification devices, interpreters, alternative test arrangements, recorded class sessions, and electronically formatted materials. Educators must apply all accommodations across all instructional settings, including computer labs, distance learning, group work, discussions, lectures, assignments, test-taking, technology, and fieldwork.

As students with ASD transition into higher education, they often encounter new barriers. Ursula Faure-Martinez and Javier Cifuente-Faura, Spanish academic researchers based at the University of Murcia, say, “Despite the strong commitment to remove barriers to participation and learning, the number of students with disabilities or special needs who undertake studies is low.”[246] Similar issues occur in postsecondary education settings both in Europe and the United States. Greater responsibility is placed on students to request accommodations, advocate for their needs, and manage complex academic expectations. Additionally, the United States Department of Education provides guidance on new accommodations guidelines in postsecondary education settings. Nevertheless, educators in higher education settings should develop strategic

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[245] Alfred Schabmann et al., “Knowledge, Awareness of Problems, and Support: University Instructors’ Perspectives on Dyslexia in Higher Education,” *European Journal of Special Needs Education* 35, no. 2 (March 2020): 273.

[246] Ursula Faure-Martinez and Javier Cifuentes-Faura, “Building a Dynamic Indicator on Inclusive Education in Higher Education,” *European Journal of Special Needs Education* 37, no. 4 (May 2021): 694.

professional development plans in instructional delivery for students with disabilities, aiming to advance their understanding and foster an equitable learning environment for all students.

Parents of Children with ASD

The diagnosis of ASD often brings substantial changes that influence the well-being and functioning of the entire family. Prominent special education experts Emerita Professors from San Francisco State University Pamela Le Page and Susan Courey state, "When talking with parents, the first thing we noticed was that all of the parents we interviewed said they were willing to give up almost anything to help their children….After their children were diagnosed with autism, most parents had to make changes in the way their families functioned to give their children (those with and without autism) what they needed."[247] Academic researchers and psychologists Amanda Ludlow, Charlotte Skelly, and Poul Rohleder highlight five areas of concern for parents with children with ASD, including challenging behavior, dealing with judgments from others, lack of support, impact on the family, and coping with difficulties.[248] The challenges not only highlight the effects on children with ASD but also the emotional and social well-being of family members.

Summary

All students within our educational system require a process of appreciating diversity while understanding and eliminating oppression, causing marginalization and inequality in the treatment of students with special needs in academic settings. All students should have access to

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[247] Pamela Le Page and Susan Courey, *Teaching Children with High-Level Autism* (New York: Routledge, 2013), 92.

[248] Amanda Ludlow, Charlotte Skelly, and Poul Rohleder, "Challenges Faced by Parents of Children Diagnosed with Autism Spectrum Disorder," *Journal of Health Psychology* 17, no. 5 (July 2012): 702, https://doi.org/10.1177/1359105311422955.

educational opportunities and be fully included in those settings. When barriers to learning are eliminated in the educational process, learning opportunities for students with special needs will provide equitable access for all. Harold Abeles and Lori Custodero, Associate Professor of Music Education at Teachers College at Columbia University, state, "Like other civil rights movements, disability rights advocates suggest that disabled persons face oppression and discrimination and that, rather than conforming to ideals of normality, society should accept and accommodate disabilities without stigma."[249] Students with autism spectrum disorder (ASD) should be allowed to participate in inclusive learning environments within the classroom setting that foster their development to the fullest potential. Autism Speaks, a nonprofit autism awareness and research organization, states that "Inclusion is about offering the same activities to everyone, while providing support and services to accommodate people's differences. Ensuring access for everyone, inclusive organizations actively reach out to people with disabilities and seek to understand and appreciate their differences, while fostering a sense of belonging."[250] Music educators must identify challenges in their field to advance positive learning experiences. According to National Association for Music Education (NAfME), "All students deserve access to and equity in the delivery of music education, one of the subjects deemed necessary in federal law for a well-rounded education."[251] NAfME "promotes awareness of, respect for, and responsiveness to the variety and diversity of cultures; and should be delivered by teachers whose culturally responsive pedagogy enables them to design and

[249] Harold F. Abeles and Lori A. Custodero, *Critical Issues in Music Education* (New York: Oxford University Press, 2021), 35.

[250] Autism Speaks, "Inclusion: Ensuring Access for Everyone," accessed July 19, 2024, https://www.autismspeaks.org/tool-kit-excerpt/inclusion-ensuring-access-everyone.

[251] National Association for Music Education, "Equity and Access in Music Education," 2017, accessed June 30, 2024, https://nafme.org/resource/equity-and-access-in-music-education-2/.

implement such an inclusive curricular framework successfully."[252] The ethical obligation of music educators is to provide educational opportunities that promote equitable instruction for all students.

Even though public awareness of Autism Spectrum Disorder continues to grow, there are still barriers students struggle with and have to overcome for equality in our public school system. Although education laws were established to protect rights by making appropriate public education available, students with ASD still struggle with these learning barriers. Harold Abeles and Lori Custodero contend that the issue of social justice is critical for educators to address in the following words:

> However, the assumption that there are no differences and all the students, all the teachers, all the families, and all the neighbors within a school community come from similar backgrounds and belief systems and support the same educational goals does not create cohesion. In contrast, focusing totally on difference and presupposing no similarities within or among groups presents another extreme that does not encourage community.[253]

Inclusive school communities require the balance of both commonality and diversity. Educators should not ignore the unique cultural, social, and personal perspectives of individuals but recognize those differences to collaborate towards a shared purpose among their members. In addition, Randall Allsup, Associate Professor of Music at Teachers College at Columbia University, and Eric Sheih, a founding music educator at the Metropolitan Expeditionary Learning School, maintain that these music classes must incorporate equal and equitable practices for students with special needs, enabling them to provide fair access to be more

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[252] National Association for Music Education, "Inclusivity and Diversity in Music Education," 2017, accessed June 30, 2024, https://nafme.org/resource/inclusivity-and-diversity-in-music-education-2/.

[253] Harold F. Abeles and Lori A. Custodero, *Critical Issues in Music Education* (New York: Oxford University Press, 2021), 29.

effective.[254] Acknowledging the learning barriers faced by students with autism spectrum disorder in music education courses and identifying the contributing factors helps music educators increase their awareness.

[254] Randall Allsup and Eric Shieh, "Social Justice and Music Education: The Call for a Public Pedagogy," *Music Educators Journal* 98, no. 4 (June 2012): 48, http://www.jstor.org/stable/41692638.

Chapter Three: Methodology

Introduction

The purpose of the qualitative instrumental case study was to explore potential intervention strategies for students with ASD participating in instrumental music classes to improve the educational process. This chapter outlines the research design, participants and their setting, methods of data collection, study procedures, the researcher's positionality, study validity, data analysis, and summary. The study's documented results provide evidence-based data to inform instruction for students with ASD, thereby supporting the development of solutions to educational challenges in real-world contexts.

Research Design

The study focused on autism and examined how intervention strategies improved students' understanding while eliminating educational barriers in a music classroom. The researcher applied intervention strategies documented in other subject areas to generate specific data to inform future instruction. By employing a qualitative, instrumental case study design to investigate autism in music education, the researcher gained insight into the complexities of strategic educational interventions and their impact on students' musicianship with ASD. Music instruction may be more beneficial when music educators understand how and why strategic interventions work with students with ASD. The instrumental case study design offered flexibility for studying the specific issues of strategic intervention for students with ASD in music education classes.

Participants and Setting

Upon receiving approval from the institutional review boards for research involving human participants from both the school district and the university, a total of ten participants,

seven males and three females, will be given pseudonyms for the study. The participants must have been diagnosed with ASD. A designated school official will be used to contact students' parents and individuals with ASD due to FERPA concerns. With verbal consent, the researcher contacted potential participants. Their parents will provide written consent for their participation in the study.

After the thesis defense (Appendix A) and the Institutional Review Board (IRB) approval (Appendix B), the researcher ensured the research study met ethical standards by complying with human-subjects requirements. To do so, a third-party official contacted potential participants. A letter requesting site approval (Appendix C) was submitted, and their approved response was received (Appendix D). The IRB was notified of the organization's site approval response.

To be eligible, participants had to meet several criteria. First, they had to be enrolled in school. Second, they had to have a disability based on eligibility requirements for ASD. Third, they needed to have existing interventions, accommodations, or modifications identified for instruction in IEP goals. Fourth, participants could not have hearing or vision impairments that might impede instruction or interventions. Fifth, they were required to demonstrate adequate visual discrimination skills to respond to stimuli, music notation, and visual cues. Sixth, they had to have adequate auditory discrimination skills to respond to stimuli in the computer-assisted instruction and video modeling. Seventh, they had to demonstrate sufficient motor skills to use the computer software and video modeling independently. Eighth, they were required to have a history of independent computer use. Ninth, they needed to be active in playing and receiving instrumental music instruction at school. Finally, Participants had to be between the ages of 10 and 19 years of age. Parents of students with ASD received a recruitment letter (Appendix E), verbal recruitment (Appendix F), and/or follow-up letters (Appendix G) to participate in the

study. Students who were 18 or older also received a recruitment letter (Appendix H), verbal recruitment (Appendix I), and/or a follow-up recruitment letter (Appendix J).

Characteristics that made an individual ineligible included one or more of the following. The viewing or performance through instrumental playing of one of the five selections in the learning management system using computer-assisted instruction. Prior study, playing, or viewing of the musical selections by the participant invalidated the study's findings on ASD interventions in music education, making the individual ineligible for this study. Participants were asked before the weekly session whether they had encountered, viewed, or played any of the selections in the learning management system. Prior viewing and study of the video modeling of the music selections, which corresponds with the learning management system, could invalidate the results, making the individual ineligible for the study. Characteristics or traits of an ASD diagnosis have the potential to invalidate results, including limited communication or understanding of the instructions. Failure to follow study directions would make a participant ineligible.

The author served as the primary researcher, interventionist, and data collector. He was a doctoral student with a valid teaching certificate and twenty-seven years of experience in instrumental music. All sessions took place in a middle school instrumental music classroom and used a one-to-one instructional format. During these sessions, participants worked individually at a computer, using headphones with a learning management system designed for computer-assisted instruction in instrumental music.

All intervention sessions occurred outside of school. The middle school instrumental classroom included an ample rehearsal space, an office, a music library, and three practice rooms. Each practice room was equipped with a computer, headphones, and access to the

learning management system. Materials for each session included (a) one laptop computer, (b) headphones, (c) five different music selections, (d) a video camera to record the intervention sessions for data collection, (e) a learning management system for computer-assisted instruction for music selections, and (f) a video modeling system for music selections.

The probe session included one musical selection for each of the five study sessions for each participant. The researcher selected musical tasks based on rhythm, range, meter, key, dynamics, and style, foundational musical parameters that could be applied to other selections for future performances. The musical selection was available within the established video-modeling and learning-management system.

The computer-assisted instruction intervention and video modeling both utilized explicit instruction. The explicit instruction in the computer-assisted intervention, delivered via the learning management system, displayed time and pulse in the musical selection using a cursor that participants could follow. Participants could record, play along, and listen to the musical selection in the learning management system. The participant could slow the tempo and/or loop sections to improve their musical performance. The learning management system also provided note names, fingering, and pitch reference for the participant. Video modeling provided a visual and aural representation of the musical selection. A total of five videos will be available for each musical selection in the study's intervention section. These videos demonstrated proper playing, providing participants with a model to imitate.

Measurement and Data Collection Plan

Data collection was from multiple sources. Observational studies, analyses of observations, analyses of applied intervention strategies, and documentation provided quantitative data for interpretation and a comprehensive understanding of instructional practices

for students with Autism Spectrum Disorder (ASD) in instrumental music settings. Primary data includes observations regarding student engagement, documents of participant work, documentation of participant work implementing instructional interventions, and participant perceptions. Analysis of these diverse data sources identifies patterns, themes, and insights to inform effective instructional strategies for students with ASD in instrumental music.

Documentation included artifacts from the recordings, along with scoring of the probe and intervention segments for each participant for the five sessions. Musical selections occurred within an educational unit in a method book, which is autonomous and logically sequenced for learning. The researcher evaluated the effects of two independent variables: (a) computer-assisted instruction (CAI) through a learning management system and (b) video modeling on a dependent variable of the musical selections. To assess the effectiveness of the musical performance, an initial probe session with the participant was conducted, during which they could draw on their personal knowledge to interpret the selection's notation. The probe session was scheduled for the last five minutes, during which the participant could play their instrument to learn the selection. After five minutes, the participant submitted their recorded performance. The intervention session took place after the five-minute probe session. The intervention session incorporated video modeling and computer-assisted instruction into the learning process. The intervention session lasted for ten minutes. Upon completing the intervention-timed session, the participant recorded and submitted it in the learning management system to measure the effectiveness of the combined interventions of computer-assisted instruction and video modeling. The participant submitted only one recording during the intervention session. Upon completion of each study session, the participant completed a perception survey on the probe and intervention sections.

Since musical ability also occurs on a spectrum, the researcher carefully selected musical tasks for each session appropriate to the student's ability based on age and experience. Since participants will range from eleven to eighteen, with some having less than one year of playing experience compared to others who had played for seven years, skill levels will vary. It was crucial to select tasks that would not invalidate results or findings because they are too hard for the participant to play and/or learn within a reasonable time during the probe and intervention periods for the particular weekly session. Participants played music in groups based on their age, experience, and ability, with beginner (11 years old), intermediate (12-13 years old), and advanced (14-18 years old) groups, to obtain credible and valid results.

The researcher structured a systematic approach to observations, focusing on key domains of student participation, engagement, musical evaluation, and the implementation of instructional interventions, using video modeling and computer-assisted instructional learning strategies. Detailed field notes captured the implementation of instructions during the study sessions, including the participants' behaviors and responses towards task completion. Observational data included the frequency and quality of student participation, the accuracy of performance (notes, rhythm, articulation, tone, and tempo), and students' responses to specific instructional strategies. The researcher also documented environmental factors. These observations were conducted across multiple sessions to provide a reference point for performance during the probe session and to capture changes following the intervention session, allowing for comparison of student engagement and performance over time.

Each weekly study session included structured observation, performance, intervention, and reflection, totaling thirty minutes. Sessions included a five-minute probe session in which the participants were observed performing a selected music piece. Once the probe session had

concluded, the first recorded performance was documented as a reference point for musical skill. The probe session was followed by a ten-minute intervention session in which participants engaged in video modeling and computer-assisted instruction to improve performance. After the intervention session, participants submitted a second recording of their performance. Finally, participants completed a music perception survey to reflect on their experiences with the interventions, self-reporting on observations of tone, technique, and musical understanding. Each week, the study followed the same repeated sequence for systematic observation, documentation, and analysis of instructional strategies and student outcomes.

Lastly, participant perceptions were collected using a structured Music Perception Survey administered at the end of each session. The survey assessed participants' self-reported performance in tone, technique, music understanding, and other musical nuances, with those categories rated on a five-point Likert scale. The Music Perception Survey also captured participants' perceptions of the effectiveness of the video modeling and computer-assisted instruction learning interventions, with yes/no responses for each musical category. This provided insight into the participants' perspectives on how the interventions influenced the musical performance.

The researcher presented the musical selection for each session on a music stand, providing an initial instructional cue. (e.g., “Whenever you are ready, you can start to study, read, and play the musical selection in the probe section for five minutes. Timing starts when you first start playing. Upon completion of the five-minute probe session, you will play the musical selection to the best of your ability.) The researcher provided no instruction, error correction, prompting, or feedback during the probe or intervention periods. Without notification, the probe period was terminated if the participant demonstrated a lack of engagement for more than a

minute, as indicated by not participating in studying, reading, or playing the musical selection; the participant then advanced to the intervention period. The intervention period occurred in all sessions; however, if comprehension and/or engagement appeared to decline, the intervention period could be applied before the five-minute probe period was completed.

Procedures

The procedures for the instrumental case study appear below.

General Information:

- Each session includes a probe period to establish a baseline of five minutes. Each The session includes a ten-minute intervention.
- The study takes place within a music classroom.
- Study duration is 30 minutes weekly.

Set-Up (Weekly Study)

- The study utilizes the following materials and equipment.
  - Video recorder
  - Musical selections from Habits for a Successful Beginner Band Musician
  - Music stand
  - Chair
  - Computer with a microphone
  - MakeMusic learning management system/computer-assisted instruction.
  - Participant's music instrument
  - Music perception survey
  - Pencil
  - Instructions for each session

Probe Session

- Only the following items were used during the probe session.
  - -Chair
  - -Music stand
  - -Musical selection from Habits for a Successful Beginner Band Musician
  - -Participant's Musical Instrument
  - -Video recorder
  - -Participant instructions for probe session

First Submission Session

- Only the following were used during the First Submission Session
  -Chair
  -Music stand
  -Musical section
  -Participant musical instrument
  -Video recorder
  -Participant instructions for First Submission Session

Intervention Session

- Only the following were used during the intervention, immediately after the prone session.
  -Chair
  -Music stand
  -Musical selections from Habits for a Successful Beginner Band Musician
  -Participants music instrument
  -Computer with a microphone
  -Computer with the MakeMusic learning management system/computer-assisted instruction.
  -Video recorder
  -Instructions for Intervention Session

Probe Session (Five Minutes)

1.) The participant would get their instrument, remove it from its case, and put it together as appropriate.

2.) The participant warms up in the designated area for a minute before entering the study session area inside the music classroom. Participants may decline to warm up and enter the study session area.

3.) Participants enter the study session area in the music classroom.

4.) Participants sit down and adjust the music stand accordingly, based on personal preference.

5.) The researcher starts the video recorders, focused on the participant.

6.) The musical selection/task is placed on the music stand.

7.) The five-probe session starts after the researcher says, “Whenever you are ready, you can start to study, read, and play the musical selection in the probe section for five minutes. Timing starts when you first start playing. Upon completion of the five-minute probe session, you will play the musical selection to the best of your ability.”)

8.) The participant engages in study, reading, and playing of the musical section.

Special Instructions during the Probe Session

9.) The probe period did not use any external sources for assistance to the participant.

10.) The researcher presented the musical selection for each session on a music stand, providing an initial instructional cue. (e.g., "Whenever you are ready, you can start to study, read, and play the musical selection in the probe section for five minutes. Timing starts when you first start playing. Upon completion of the five-minute probe session, you will play the musical selection to the best of your ability.")

11.) The researcher provided no instructional, error correction, prompting, or feedback during the probe or intervention periods.

Establishment of Baseline: (Within the Probe Session)

12.) Without notification, the probe period could be terminated if the participant demonstrates a lack of engagement for more than a minute, as indicated by not participating in studying, reading, or playing the musical selection, and the participant will advance to the intervention period.

13.) The intervention period occurred in all sessions; however, if comprehension and/or engagement appears to decline, the intervention period may be applied before the five-minute probe period is combined.

First Submission Period:

14.) Once the five-minute probe session expires in time, the participant submits an initial recorded performance of the musical selection.

Intervention Session:

15.) The researcher opened the MakeMusic learning management system/computer Assisted learning was logged onto the participant's account with the appropriate instrument and music section that matches the musical piece in the probe session.

16.) The researcher opened the video modeling of habits universally, which corresponds with the musical sections from Habits for Successful Beginner Band Musicians.

17.) The participants were instructed that they have ten minutes to use the video modeling resource and/or MakeMusic learning management system/computer-assisted instruction in any combination. Presenting those resources to the participant for their use in learning the musical section.

18.) Participants started the intervention session of ten minutes (e.g., “Whenever you are ready, you can start to study, read, and play the musical selection in the intervention section for ten minutes. Upon completion of the ten-minute intervention session, play the musical selection to the best of your ability. You may now begin.”)

19.) The participants were engaged in study, reading, and playing of the musical section.

Special Instructions for the Intervention Session:

20.) Immediately after completion of the Probe Session and First Submission Period, the participant moved into the Intervention Session.

21.) This session used the computer to access video modeling and computer assisted learning. Utilizing the mentioned websites above.

22.) Participants could use any features on the makemusic system, such as the metronome, tuner, play feature, recording feature, and self-analysis to improve their playing.

23.) Participants could use the video modeling, playing the video for visual and aural reference for musical performance improvement.

24.) The computer-assisted instruction system and video modeling could be used and replayed as many times as needed for the participant within the ten intervention time period.

Second Submission Period:

25.) After the 10-minute intervention, the participant submitted a second recording of their performance of the musical selection.

26.) The video recorder was stopped at the end of the second submission.

Participant Reflection Feedback Period:

27.) Once the probe and intervention period were completed, the participant completed a music perception survey on the intervention during the remaining time in the 30-minute slot.

28.) The participant was provided the music perception survey.

29.) The participant was provided a pencil.

Study Session Scheduling

The researcher scheduled a weekly meeting with each individual for the study. Once the criteria had been met for each participant to participate in the study, the researcher conducted a probe session to assess the individual's current ability and establish a baseline for each musical selection. The current abilities in each probe session were compared with those in the intervention session to determine whether improvement had occurred.

The researcher conducted all sessions with each participant in a one-on-one setting. Each participant will participate in all phases, conducted once per day and once per week over five weeks. The probe period lasted five minutes unless the participant did not meet the baseline for the measure, in which case the participant proceeded to the intervention phase. The intervention phase was ten minutes for the weekly session. At the end of both the probe and intervention period, the participant will play the musical selection. The learning management system was utilized to measure student achievement. The recordings in the probe and intervention periods were compared to assess musical improvement resulting from the intervention.

Researcher Positionality

The sample size of this study did not fully represent the diverse population with disabilities due to the scope of ASD. Additionally, students with intellectual disabilities and ASD varied in individual needs, having different abilities and skill sets. Additionally, the instructor's and the student's respective cultures may influence how music is taught and learned in educational settings. The researcher was a Caucasian male in his fifties who speaks English. There were no perceived power imbalances between the participants and the researcher. The researcher adopted a neutral stance towards the study to identify potential intervention strategies that may enhance students' musicianship and learning.

Trustworthiness

The following sections outlined multiple strategies that employed rigor and integrity in data collection and analysis to ensure trustworthiness across four domains: credibility, transferability, dependability, and confirmability. Prolonged engagement with the participant across multiple instructional sessions provided credibility by allowing observation of consistent behavioral and performance patterns over time. Establishing triangulation involved using multiple data sources, such as field notes, video and audio recordings, and recorded performance submissions. The triangulation provided cross-verification of emerging patterns or themes. The repeated sessions provided opportunities to confirm consistently identified behaviors and responses within the implemented intervention.

Transferability of this study to other contexts and populations was enabled by rich descriptive data, including participants' accounts collected through a perception survey, the educational context, and the study's instructional environment. The study provided detailed descriptions of the structured sessions during the probe period, submission procedures, and targeted instruction delivered through intervention strategies, including computer-assisted instruction and video modeling. Through these details, the reader can determine the extent of the findings and how they may be applicable in an instructional setting, such as instructional music education, for students with ASD.

Dependability in this study ensured consistency in implementing instructional procedures across all sessions. Each session followed a structured format, maintaining procedural uniformity. Documentation was preserved through field notes and records, providing a clear account of the process. The level of documentation allowed the potential replication of this study.

The confirmability of this study's findings was grounded in the data and not influenced by researcher bias or subjective interpretation. The data provided objective evidence supporting the identified themes and patterns, derived from direct, observable behaviors, documented materials, and performance submissions. Multiple sources ensured that interpretations were supported by consistent evidence across all data types.

The study maintains its credibility by presenting findings aligning with the perspectives of both participants and researchers. Sufficient engagement with participants yielded a comprehensive understanding of ASD within the specific interventions in the video study, generating additional findings on the applications of intervention supports in music education and assisting in advancing music educators' teaching practices for students with ASD. The researcher maintained a detailed record throughout the study. Data analysis is cross-referenced to ensure accuracy and reliability. Lastly, the findings were shaped objectively by the participants rather than by the researcher.

Data Analysis Process

The case study implemented a systematic coding process comprising open, axial, and selective coding to organize, refine, and interpret data collected through observations, performance recordings, surveys, and field notes. Open coding during the initial phase of analysis examined data in discrete segments across each session component of the study. Data sources included the five-minute probe session, the two-minute recorded performance submissions, the ten-minute intervention sessions, the participant perception survey, field notes, and video recordings. Data from these components of the study identified meaningful units of information. The researcher's organization and preparation of data involved sorting data groupings into identifiable trends and patterns, thereby yielding evidence-based results. The

application of open, axial, and selective coding facilitates connections to the overall themes discovered within the research. The process ensured participants' responses were grounded directly in each phase of the study. These themes may reveal similarities, differences, or cause-and-effect relationships in the application of the intervention across the study, as perceived by participants or observed by researchers. The findings were presented in charts, figures, and tables, all within the study's theoretical framework.

Scoring of Music Abilities

Participants' music abilities were assessed at the end of both the probe session and the intervention session each week for five consecutive periods using MakeMusic, an interactive online platform for music education that supports instrumental and vocal learning through computer-assisted instruction. The platform enables participants to practice independently and receive immediate feedback on pitch and rhythm via audio input. Tools within the platform include tuners, metronomes, accompaniments, fingering charts, instrument note-pitch sounds, play-alongs, and recorded assessments. This online platform enabled the researcher to assign repertoire and monitor progress via technology. Assessments for both probe and intervention sessions within the weekly period were classified into performance ranges to assist the researcher in documenting and interpreting progress between those sessions. Scoring included the percentage of correct notes in each recording of the weekly musical selection during both the probe and intervention periods.

These performance ranges appear as follows:

***Exemplary** (90-100%) reflects high accuracy of pitch, rhythmic precision, and strong support of tone quality.

***Proficient** (80-89%) indicates solid technical control, accurate notes, and rhythms.

***Developing** (70-79%) displays emerging accuracy in pitch and rhythm, but with noticeable inconsistencies at times.

***Beginning** (60-69%) reflects limited note accuracy, inconsistent rhythm, and frequent errors, indicating the need for foundational support.

***Emerging** (50-59%) demonstrates partial recognition of notes and rhythms but with frequent errors. There may be moments of accuracy, yet performance lacks consistency. This level suggests the student is beginning to connect visual notation with performance but needs guided repetition and support.

***Limited** (40-49%) shows minimal accuracy in pitch and rhythm. Errors are frequent, and there may be difficulty maintaining a steady tempo or recognizing patterns. At this stage, foundational concepts (note reading, fingering, and counting) likely need reteaching or alternative strategies.

***Pre-emergent** (30-39%) is largely unable to perform the passage accurately. There may be little alignment between the written music and what is performed.

***Unrecognizable** (0-29%), little to no alignment with notated music. Notes and rhythms are largely incorrect or inconsistent, and there may be an absence of steady tempo, correct fingerings, or recognizable melodic contour. In some cases, the student may be producing sounds but not demonstrating understanding of how sounds connect to written notation.

Beginning Level

The beginner students have not completed their first year of band. Assignment of musical tasks was based on age and experience, with appropriate approximations of performance skills. At the beginning level, students play notes accurately within a limited range with appropriate tone quality. In addition, beginning students should be able to read basic music notation,

including note names, rhythms, rests, dynamics, and simple articulation markings. They should be able to maintain a steady pulse and count rhythms involving whole, half, quarter, and eighth notes. Students should be able to demonstrate correct posture, hand position, breathing, and embouchure control while playing. Explanation of the following musical tasks appears in the next section for the beginning level.

Beginning Sessions

The five beginning musical tasks for each session incorporate a variety of musical concepts, including dynamics, phrasing, articulation, rhythmic variation, and interval movement. Session One featured a familiar folk song in B-flat concert, with simple rhythms, stepwise motion, interval jumps, and basic articulation marked by a breath mark and a rest. Session Two introduced a selection in concert E-flat with 3/4 meter, an anacrusis, first and second endings, ties, and interval leaps up to a sixth. Session Three had a holiday tune in E-flat, marked in Allegro, incorporating first and second endings, a slur, a fermata, and quarter and eighth-note rhythms, with primarily stepwise motion. Session Four incorporates crescendos, decrescendos, slurs, phrasing without breaks, and more varied rhythms in F concert. Session Five featured another holiday tune in F concert with repeated eighth-note patterns, first and second endings, quarter rests, and moderate interval movement.

Intermediate Level

Intermediate-level participants have entered the second or third year of playing their instrument. Generally, they possess a developing foundation of musical knowledge and performance skills, supported by their growing independence as performers and by reading more complex musical literature. They typically show proficiency in music reading, note identification, key signatures, time signatures, and common rhythm patterns, while maintaining

tempo and pulse. Production of characteristic tone quality, use of articulation, dynamic control, and improved intonation, along with technical accuracy, is expected in their playing. They should be able to follow the conductor, balance with the ensemble, count rests accurately, and respond to musical cues. They should also start forming effective practice strategies, such as isolating difficult passages, slowing tempos, repeated practice, and self-correction, all while becoming more independent musically. The intermediate years of instrumental music instruction mark transitions from basic skill acquisition to greater music literacy and the development of expressive performance and self-directed learning, enabling participants to approach more challenging musical tasks.

Intermediate Sessions

The musical tasks across the five sessions incorporated a variety of musical concepts, including dynamics, rhythmic patterns, articulation, phrasing, and interval movement. Session One featured a shaker melody in concert E-flat with stepwise motion and simple eighth- and quarter-note rhythms. This musical task included dynamic shaping throughout, with crescendos and ritardandos. Session Two introduced a Tchaikovsky selection in concert F that will include first and second endings, varied note values, slurs, ties, dynamic contrasts, and interval leaps primarily in thirds. Session Three implemented a Sibelius tune in A-flat major with more rhythmic variation, recurring quarter rests, a wider range, and contrasting dynamics. Session Four presented a Mahler excerpt in concert B-flat that emphasized marcato style, fortissimo dynamics, repeated measures, and rhythmic precision. Session Five involved a Brahms selection with an anacrusis, a broader dynamic range, ties, and an expanded pitch range extending from low B-flat concert to high C concert.

Advanced Level

Advanced-level participants have been involved in instrumental music for over four years. At this level, they should be able to read and interpret complex musical notation fluently, perform accurately in a variety of key signatures and meters, and consistently execute advanced rhythmic patterns, articulation, and dynamic contrasts. Tone quality, accurate intonation, and instrumental technique should be maintained while performing expressive stylistic interpretation of musical tasks. These individuals should demonstrate strong ensemble skills, including balance, blend, listening awareness, and responsiveness to the conductor and the performing group. They should be able to employ learning strategies independently, such as identifying performance errors, isolating challenging musical passages, adjusting tempo when appropriate, and utilizing resources to refine their playing skills.

Advanced Sessions

The five musical tasks introduced advanced musical concepts, including varied rhythms, dynamics, articulation, phrasing, and expressive techniques. Session One featured a Rossini selection in concert E-flat, with cut time, simple rhythms, rests, dynamic contrast, and a crescendo. Session Two introduced a Tchaikovsky piece in 3/4 time that included ties, fermata, crescendos, and decrescendos with moderate rhythmic variation. Session Three expanded musical demands through a 32-measure selection in B-flat concert that incorporated a wider range, slurs, ties, staccato markings, accidentals, breath marks, and dynamic shaping. Session Four emphasized articulation and rhythmic precision through sixteenth notes, slurs, tenuto and staccato markings, repetition, and contrasting dynamics. Session Five concluded with a Mozart selection featuring mixed rhythmic values, rests, ties, slurs, fermata, and extensive dynamic contrast with crescendos leading to forte.

Safeguards

The placement of safeguards reduced the risk of compromising the research integrity in the study. This IRB-approved study adhered to ethical standards for human-subjects research. Participation was voluntary, with the option to withdraw at any time without penalty. Confidentiality was protected through the use of pseudonyms and secure data storage, with access limited to the researcher and the faculty supervisor. Established qualitative methods and secure systems were used to ensure research rigor and integrity. The researcher completed the required ethics training and followed standardized disclosure procedures to reduce bias and protect participants.

Participants and their parents were informed about the study's purpose, risks, and participants' rights, as well as the study procedures. Appropriate consent forms were issued, including a child assent form (Appendix K), adult participants' consent form (Appendix L), parent participants' consent form (Appendix M), and a combined parent consent and child assent form (Appendix N) authorizing participation in the study. Participants could withdraw from the study at any time. If a participant withdrew from the study, any recordings and/or photographs collected were destroyed immediately and would not be included in the study. No new data were collected after their withdrawal.

Data integrity was maintained by the researcher through collection and analysis, taking careful steps in preventing manipulation or loss. The researcher organized data, grouping it to identify trends and patterns, thereby producing evidence-based results. Securing data storage with an encrypted, access-controlled database reduced the risk of tampering or unauthorized access. Additional version control ensured that all changes to data or analysis became documented and traceable. All records of this study are kept confidential, using an assigned

pseudonym or identification number system to replace names and other identifiers and conceal participants' identities. No names or identifying information appeared on reports or publications while research sessions were conducted. The use of private settings protected participants' confidentiality. The linking list, which links pseudonyms to participants, is kept in a separate password-protected folder on a password-protected computer. Securing data storage with an encrypted, access-controlled database reduces the risk of tampering or unauthorized access. Additional version control ensures that all changes to data or analysis are documented and traceable. Electronic data is stored using a password-locked computer.

Data will be destroyed after three years. Applying the secure erase function will ensure the deletion of recordings and photographs of withdrawn participants. Electronic data stored on computers will be destroyed through data wiping. In addition, video cards on digital devices will be wiped until the three-year retention period is complete. Hard-copy data on paper will be shredded upon completion of the three-year retention period.

Open, axial, and selective coding facilitate connections to overall themes, revealing similarities, differences, and cause-and-effect relationships among interventions that were observed throughout the study. Methodological rigor is transparent, with clear documentation of procedures, materials, and analyses, allowing for replication and verification. A probe session, with a baseline in the methodology, was conducted before the intervention session, applying standardized protocols to reduce bias and measurement error. Additionally, the validated instruments for video modeling and computer-assisted instruction were used with a learning management system for intervention record-keeping. Supervisors and the reading committee reviewed the study's methodology during the Liberty University proposal defense, assessing its purpose, significance, and potential to contribute to the body of work on the topic. Content

experts in the review process evaluated the quality and validity of the research and addressed potential issues related to safeguards against risks in the study involving human subjects.

The researcher is responsible for receiving training on plagiarism, data analysis, and authorship ethics. The study has disclosure policies requiring the disclosure of personal, financial, or institutional interests that might bias the work. The researchers promote accountability and open communication with all study participants.

Summary

The qualitative instrumental case study examined the complexities of ASD in music education. Specifically, music educators have a lack of training to cope with the issues and challenges of the disorder. Furthermore, the implementation of intervention strategies for ASD and their results appear to be undocumented in music education. Detailed information from scored musical sections, participant perceptions (Appendix O), and the researcher's observations provides a contextual framework for understanding the findings. Future data analysis may reveal thematic trends in the study's results.

Chapter Four: Results

Introduction

This qualitative instrumental case study aims to identify effective intervention strategies for students with ASD participating in instrumental music courses. The purpose of this study is to investigate established evidence-based practices from general education research for students with ASD and to apply them to instrumental music instruction. The study aims to bridge the gap between established interventions for ASD and specific pedagogy in music education by providing a framework for inclusive, effective instructional approaches in the music classroom that answers the central and sub-research questions.

1.) Central Research Question: What specific teaching strategies can be implemented to produce positive learning outcomes in instrumental music, as outlined in educational goals, standards, and objectives for the ASD student?
2.) Sub Research Question 1: How do the educational outcomes of the autistic student determine future lesson planning by their educational plan as prescribed by state and federal law?
3.) Sub Research Question 2: How can instrumental music educators execute teaching approaches toward ASD students that allow them to be fully included in the classroom?

This chapter is organized to move logically from context to findings, beginning with a restatement of the study's purpose. The second section describes the case study, detailing who and what are being studied, including relevant demographics within the context. The core of the chapter presents findings, supported by evidence from observations and artifacts, that reveal the

major themes in the research. The integration of visual aids, such as tables and diagrams, supports those findings.

Description of this Case Study along with Participants

This instrumental case study examines the effects of elicited instructional strategies incorporating computer-assisted instruction and video modeling as interventions to support music literacy development among participants with Autism Spectrum Disorder (ASD). The purpose of the study is to evaluate these supports for their potential to increase learning outcomes and instructional delivery. By adapting evidence-based practices commonly used in other academic disciplines, these technology-based interventions can be applied in music education. Examining how participants implement these resources as learning supports may reduce educational barriers and enhance skill acquisition in instrumental music education. In addition to investigating musical outcomes, the study provides insight into the broader range of factors that influence access to and engagement with music instruction. Participant performance data were collected, analyzed, and compared to the Sound of Intent framework for musical development and learning outcomes throughout the study.

The participant sample consisted of ten students diagnosed with Autism Spectrum Disorder, as seen in Table 9 below. The sample included four Hispanic males (40%), two Caucasian males (20%), three Caucasian females (30%), and one African American male (10%). Overall, seven participants were males (70%), and three were females (30%). The demographic representation provides a range of participants for the examination of individualized instructional responses across diverse learners with ASD.

Table 9. Study Participants

Students	Age	Gender	Race	Diagnosis
A	12	Male	Hispanic	Autism
B	12	Female	Caucasian	Autism
C	13	Male	Caucasian	Autism
D	15	Male	Caucasian	Autism
E	15	Male	Black	Autism
G	15	Female	Caucasian	Autism
H	15	Male	Hispanic	Autism
I	16	Male	Hispanic	Autism
J	17	Female	Caucasian	Autism
K	18	Male	Hispanic	Autism

The study was conducted outside the regular school day in a middle school band classroom familiar to the participants. Sessions occurred in practice rooms equipped with a chair, a music stand, sheet music, a computer, headphones, a musical instrument, and video recording equipment. The study setting is a rural-suburban, unincorporated community with low population density and proximity to urban resources. The community is characterized by a predominantly residential environment consisting of single-family homes, farmland, and ranch-style properties. The local school district serves as the central institution for academic, athletic, and fine art activities, including instrumental music programs. The school environment’s context is vital to understanding participants' experiences with the instructional strategies observed in this study. Characteristics of the community may be comparable to those of other rural area school districts in which school-centered activities play a significant role, supporting the transferability of findings to similar educational contexts.

Coding Identified

Codes assigned to observable behaviors witnessed include levels of engagement, task completion, response to prompts, accuracy of musical performance, and behavioral regulation. Open Codes are as follows:

Open Codes

Involvement in the musical task during probe sessions

On Task (OT), Sustained Attention (SA), Immediate Engagement (IE), Task Persistence (TP), Task Refusal (TR), Visual Focus (VF), Off Task (OF) Avoidance (A), Delayed Engagement (DE), Distractibility (D)

Musical Task Performance

Correct Notes (CN), Incorrect Notes (IN), Rhythm Errors (RE), Tempo Fluctuation (TF), Inconsistent Performance (IP), Restarting Passage (RP), Steady Tempo (ST), Improved Accuracy (IA)

Cognitive Process

Hesitation (H), Processing Delay (PD), Confused (C), Self-Correction (SC), Quick Response (QR), Recall Difficulty (RD), Anticipation of Task (AoT), Error Recognition (ER)

Response to Instruction

Responds to Modeling (RtM), Imitates Correctly (IC), Partially Imitates (PI), No Response to Model (NRtM), Response to Prompt (RtP), Requires Prompt (RP), Follow Directions (FD), Needs Repetition (NR)

Intervention-Specific Behaviors

Modeling Effective (ME), Prompt Fading (PF), Guided Practice (GP), Repetition Effective (RE), Scaffolding Support (SS), Guided Practice (GP), Independent Practice (IP), Error Correction (EC), Reinforcement Given (RG)

Skill Development

Independent Initiation (II), Requires Initiation Cue (RIC),

Increased Independence (II+), Skill Generalization (SG)

Transfer to Learning (TtL), Consistent Performance (CP), Emerging Skill (ES)

Axial coding organizes and connects initial codes into broader categories, examining relationships across probe, submission, and intervention segments. Patterns were identified by comparing participants' performance and behavior before, during, and after the implementation of instructional intervention strategies. For example, codes related to off-task behavior during the probe session were compared with engagement levels during the intervention periods, while performance accuracy in initial submissions was analyzed alongside subsequent improvements following the targeted instruction and intervention. Relationships among categories, including similarities and differences across sessions, as well as potential cause-and-effect relationships between specific intervention strategies and the observed outcomes, were identified.

Axial Codes are as follows:

Axial Codes

Involvement

E- Engagement = OT, SA, IE, TP, VF D-Disengagement = OF, UF, D

R- Resistance = TR, A EO-Engagement Onset = IE, DE

Musical Performance

TA- Technical Accuracy = CN, IN, RE, IA

PE- Performance Execution = ST, TF, IP, RP

Cognitive Processing

B- Barriers = H, PD, C, RD S- Supports = QR, SC, ER, AoT

Responsiveness to Instruction

ER- Effective Response = IC, FD, RtM SN- Supports Needs = NR, NRtM

Effectiveness of Intervention

SS- Supported Strategies = ME, SS, GP, RE

MTI- Movement Toward Independence = PF, IP

Development of Independence

DoI- Development of Independence = ES, RIC, II, II+, CP

AtI- Application to Learning = S, G, TtL

Selective coding integrates categories into overarching themes, seen in Table 10 below, that are consistent with patterns across the study components. The identification of core themes reflects the central findings of this study, capturing how participants respond to structured instructional intervention strategies over time.

Selective codes are as follows:

Selective Codes

IIPMG = Individualized Instruction Promotes Musical Growth

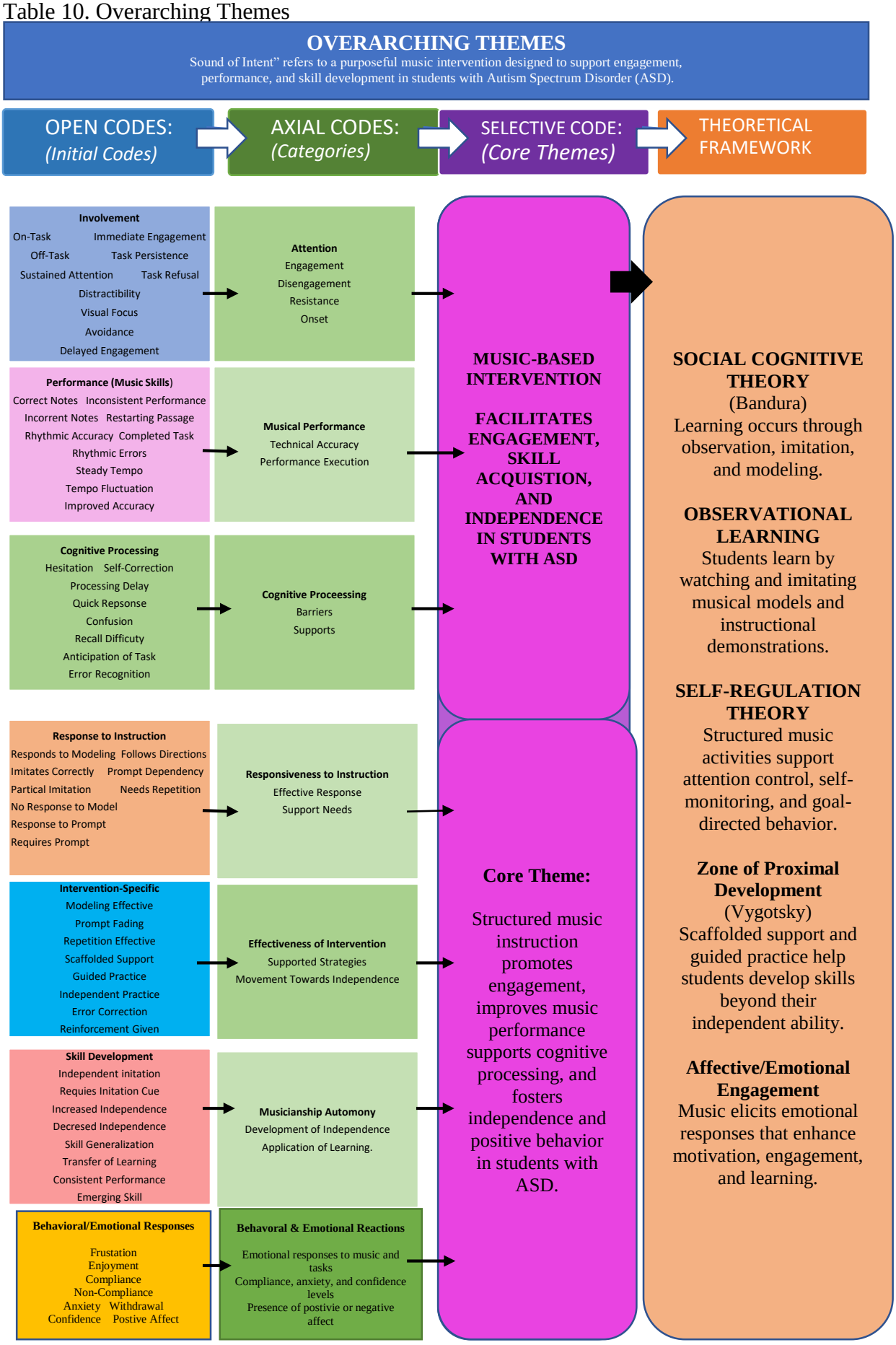
SSIEI = Structured Supports Increase Engagement and Independence

TEFSR = Technology Enhances Feedback and Self-Regulation

EBSTL = Evidence-Based Strategies Transfer to Learning

The theoretical frameworks provide a foundation for understanding how students with ASD can develop musical skills through individualized and structured instruction. In addition to Sound of Intent Theory, Social Cognitive Theory, Observational Learning, Self-Regulation Theory, Vygotsky's Zone of Proximal Development, and Affective/Emotional Engagement all support the use of modeling, individualized instruction, guided practice, and feedback toward learning.

Table 10. Overarching Themes



Presentation of Findings

A major theme of the study is technology-facilitated independence in developing instrumental music skills among students with ASD, as effective instruction employing computer-assisted instruction and video modeling supports participants' growth in independent practice and music literacy, strengthens performance skills, and increases engagement.

Frequency of Average Musical Ability (Assessment)

The frequency chart displays the average musical ability scores, indicating a measurable increase from the end of the probe session to the end of the intervention phase. During the probe period, scores were distributed, usually but not always, within a narrower range, with relatively few instances of higher performance scores. The distribution remained fairly consistent across ability levels and participant age. The average progress by level (age/exposure) for all sessions is documented in Figure 2 and Table 11 below.

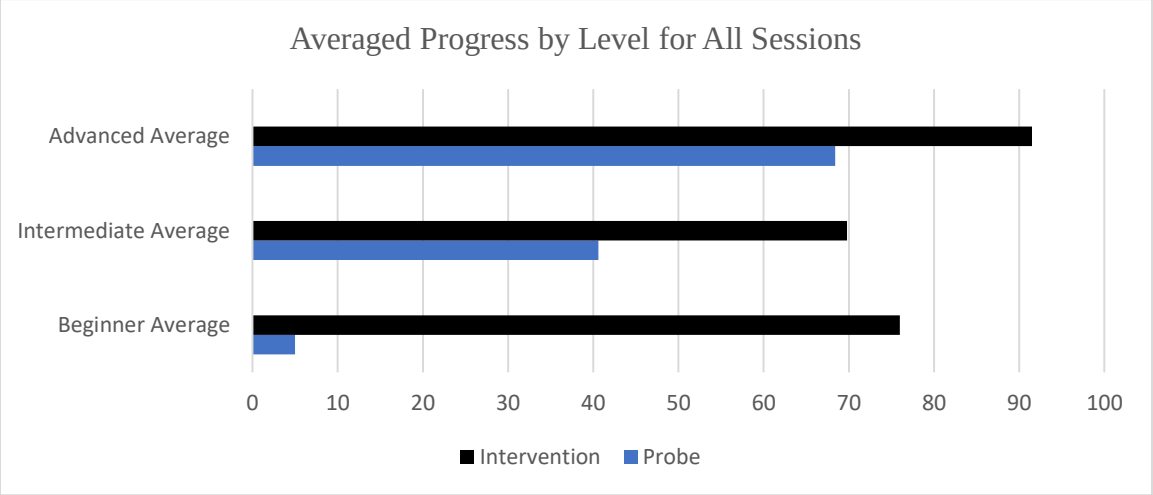


Figure 2. Averaged Progress by Level for All Sessions

Table 11. Average Progress by Level for All Sessions

	Beginning	Intermediate	Advanced
Probe	6.8	40.6	68.4
Intervention	68.2	69.4	91.51
Growth	61.4	28.8	23.11

The distribution of scores shifted upward following the introduction of the intervention. There was an average increase in the frequency of higher scores and a corresponding decrease in the frequency of lower scores from the probe period to the intervention period of the session. Scores usually became more concentrated within upper ranges of the scales as the intervention progressed.

Overall, the frequency chart in Table 12 below reflects a clear change in the distribution of scores between the probe and intervention phases, with increases in musical ability scores across sessions. Each week's session shows variability in scores, with wider ranges among younger participants than among older peers, indicating tighter clusters and lower average values. The individual participants' results are included in the Appendix section: first week (Appendix P), second week (Appendix Q), third week (Appendix R), fourth week (Appendix S), and fifth week (Appendix T).

Table 12. Averaged Frequency Chart

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A, B		-2
30-39	Pre-Emergent			0
40-49	Limited	D, H, J		-3
50-59	Emerging	I		-1
60–69	Beginning	C	A, B	+1
70-79	Developing	E, K	C	-1
80-89	Proficient	G, H	D, I	0
90-100	Exemplary		E, G, H, J, K	+5

Beginning Ability Level

Participant A

Across the five sessions, Participant A consistently demonstrated engagement, persistence, and sustained attention toward the musical tasks; however, significant processing delays, hesitation, recall difficulties, with inconsistent musical performance being observed during the probe periods. Initial recordings frequently included incorrect notes, tempo fluctuations, rhythmic inaccuracies, and weak tone production, with performance levels ranging from unrecognizable to limited. Participant A often struggled with interval jumps, repeated patterns, endings, and fingering accuracy, while occasionally becoming distracted or frustrated during performance attempts. Individual results of each session can be viewed in Appendix U.

During the intervention periods, Participant A responded positively to the computer-assisted instruction system through repeated practice, modeling, guided instruction, scaffolding, and technology-based prompts. Accuracy generally improved with each repetition, and the participant frequently used support tools such as fingering charts and modeled examples. Video modeling was inconsistently used across sessions, with Participant A relying primarily on the computer-assisted instruction system. Participant independence in employing those strategies and interventions is placed in Figure V.1-5 and Table V.1-5 in Appendix V. Evidence of emerging musical skill development was observed through improved note accuracy, rhythmic consistency, tempo control, and overall performance quality. Performance gains across sessions progressed from unrecognizable or beginning performance levels toward developing and, in one session, exemplary performance.

The researcher frequently disagreed with Participant A’s self-assessments in the perception surveys, noting that the participant appeared to evaluate overall post-intervention

performance rather than probe-session performance specifically. Despite this discrepancy, Participant A consistently reported that the computer-assisted instruction system supported musical improvement. Participant A averaged an unrecognizable level in the probe period and increased to a beginning level in the intervention period. Overall, Participant A averaged a 61.4% increase from the probe to intervention periods, seen in Figure 3 and Table 13 below.

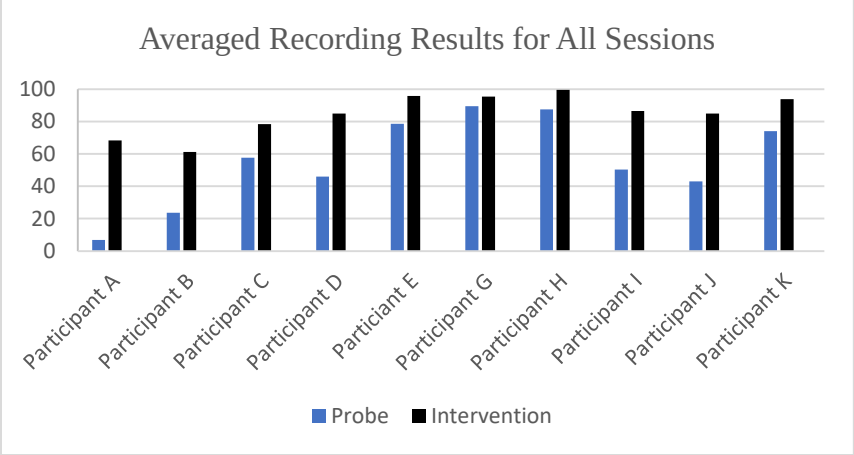


Figure 3. Averaged Progression from First Recording to Second Recording.

Table 13. Average Progression from First Recording (Probe) to Second Recording (Intervention)

Participant	A	B	C	D	E	G	H	I	J	K
Probe	6.8	23.6	57.6	46	78.6	89.4	87.4	50.4	43	74
Intervention	68.2	61.2	78.4	84.8	95.8	95.4	99.6	86.4	84.8	93.8
Growth	61.4	37.6	19.6	38.8	17.2	6	12.2	36	41.8	19.98

Intermediate Ability Level

Participant B

Participant B showed gradual improvement in musical performance throughout the intervention sessions while continuing to experience challenges with rhythmic accuracy, note reading, and tempo control. During early probe recordings, performances often included repeated errors, inconsistent pacing, and limited accuracy, particularly when the participant rapidly repeated passages without identifying mistakes. Even with these difficulties, Participant B

remained actively involved in the learning activities, demonstrating persistence, attention to task, and willingness to continue practicing difficult material.

Performance growth was observed in every session following the intervention period, as documented in Appendix X, Figure U.2, and Table U.2. In Session One, scores increased from 29% to 43%, reflecting a 14% improvement. Session Two demonstrated a larger gain, with scores rising from 11% to 63%, a 52% increase after repeated guided practice. In Session Three, Participant B improved from 43% to 77%, representing a 34% gain and stronger overall musical consistency. The greatest improvement occurred in Session Four, where performance increased from 20% to 82%, a 62% improvement supported by repeated intervention practice and video modeling. Session Five showed continued progress, improving from 15% to 41%, a 26% increase between recordings.

Throughout the study, Participant B was observed frequently using visual and auditory supports, including video modeling, fingering demonstrations, and sound examples, to guide performance attempts. Participant B employed strategies and interventions listed in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant B averaged an unrecognizable level on the musical task in the probe period. They increased to a beginning level during the intervention period (Table 12). Overall, Participant B averaged a 37.4% increase from the probe to intervention periods (Figure 3, Table 13).

Participant C

The participant repeatedly played passages without identifying mistakes in her playing during early probe recordings. Difficulties with tempo/rhythms and notes related to key-signature awareness were observed. In one instance, the participant got caught in an endless restart loop and did not complete the musical task during the probe period. As musical tasks became more

complex, the participant sometimes repeated only familiar sections rather than working through the entire exercise. The participant's independence in employing those strategies and interventions is placed in Figures V.1-V.5 and Tables V.1-V.5 in Appendix V.

Performance outcomes improved in every session (Appendix U, Figure U.3, Table U.3). In Session One, Participant C improved from 36% to 63%, demonstrating a 27% increase and progressing from a pre-emergent to a beginning performance level. Session Two reflected growth from 60% to 76%, representing a 16% improvement and continued movement toward a developing level. During Session Three, scores increased from 50% to 81%, resulting in a 31% gain and advancement from an emerging to a proficient performance level. Session Four showed additional improvement from 72% to 84%, a 12% increase, while Session Five improved from 70% to 88%, an 18% gain, with stronger overall consistency. Across all five sessions, Participant C demonstrated improvement percentages of 27%, 16%, 31%, 12%, and 18%, with gains ranging from 12% to 31%. Participant C averaged a beginning performance level on the musical tasks during the probe period, then increased to a developing level during the intervention period (Table 12). Participant C averaged a 20.8% increase from the probe to intervention periods (Figure 3, Table 13).

Advanced Ability Level

Participant D

Session One reflected Participant D’s greatest increase in achievement, with scores rising from 9% during the probe recording to 93% after the intervention, representing an 84% improvement. Difficulties with tempo, synchronization, and sixteenth-note passages gradually decreased through repeated guided practice, use of the metronome, and targeted repetition strategies by the individual participant. Moreover, this participant began Session Two’s musical

task at a much higher level, improving from 92% to 100% (an 8% gain), while maintaining exemplary performance throughout the intervention; however, during Session Three, Participant D struggled with an initial performance at 20% accuracy, moving to 60% in the second performance, demonstrating a 40% increase between recordings. Session Four showed another substantial increase, with scores rising from 36% to 84%, representing a 58% gain. Lastly, in Session Five, Participant D improved from 73% to 87%, reflecting a 14% increase in performance accuracy, again employing repetition and self-correction strategies.

Across the five sessions, Participant D demonstrated improvement percentages of 84%, 8%, 40%, 58%, and 14%, with overall gains ranging from 8% to 84%. (Appendix U, Figure U.4, Table U.4). Participant D's independence in employing those strategies and interventions is presented in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant D averaged a limited performance level during the probe period, increasing to a proficient level at the end of the intervention period. Participant D averaged a 38.6% increase from the probe to intervention periods (Figure 3, Table 13).

Participant E

Participant E's largest improvement occurred during Session One, where Participant E increased from 43% to 92%, demonstrating major growth in note accuracy, rhythmic control, and pulse consistency. Additional gains were observed in Sessions Three, Four, and Five, with the participant reaching exemplary performance levels in several recordings. Participant E demonstrated improvement percentages of 49%, 0%, 9%, 19%, and 9% across the five sessions, with overall gains ranging from 0% to 49% (Appendix U, Figure U.5, Table U.5). Notably, Session Two reflected consistent mastery, as the participant maintained a 100% score throughout both recording periods.

Participant independence in employing those strategies and interventions is presented in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant E averaged a developing performance level during the probe period, increasing to an exemplary level at the end of the intervention period with a 17.2% increase between recordings (Figure 3, Table 13).

Participant G

Participant G showed noticeable improvements throughout the study, with scores increasing from 79% to 93% in Session One, 95% to 97% in Session Two, 96% to 100% in Session Three, 95% to 99% in Session Four, and 82% to 88% in Session Five. Respectively, Participant G demonstrated improvement percentages of 24%, 2%, 4%, 4%, and 6% across the five sessions, with overall gains ranging from 2% to 24% (Appendix U, Figure U.6, Table U.6). This individual utilized strategies and interventions during sessions, as presented in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant G averaged a proficient performance level during the probe period and reached an exemplary level, having a 6% increase from the probe to the intervention period (Figure 3, Table 13).

Participant H

Participant H's performance improvements were observed across several sessions, including increases from 85% to 100% in Session One, from 90% to 100% in Session Three, and from 68% to 100% in Session Four. Sessions Two and Five maintained exemplary performance levels at or near 100% (Appendix U, Figure U.7; Table U.7). The largest improvement occurred in Session Four, following the participant's initial practice of the incorrect musical example. Repeated practice, isolation of difficult passages, and guided intervention strategies helped Participant H recover and achieve exemplary performance after the intervention period. Participant H employed strategies and interventions listed in Figures V.1-V.5 and Tables V.1-

V.5 in Appendix V. Participant H averaged a proficient performance level during the probe period, increasing to an exemplary level at the end of the intervention period, a 12.2% increase (Figure 3, Table 13).

Participant I

Participant I had significant performance gains, including improvements from 43% to 85% in Session One, 33% to 96% in Session Three, and 41% to 87% in Session Five (Appendix U, Figure U.8; Table U.8). Session Two showed continued refinement at a high performance level, improving from 91% to 97%. Although Session Four began with substantial difficulties, including a 44% probe score, Participant I's score improved to 67% after repeated practice and focused work on difficult passages. Other strategies employed by Participant I are listed in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant I averaged an emerging performance level during the probe period and increased to a proficient level at the end of the intervention period, with a 36% gain. (Figure 3, Table 13).

Participant J

Participant J’s performance gains were evident in every session. In Session One, the score increased from 11% during the probe period to 91% following the intervention period, representing an 80% improvement. Session Two showed similar growth, with the score increasing from 11% to 94% after several attempts at computer-assisted instruction. In Session Three, performance improved from 72% to 83%, despite ongoing challenges with tempo consistency and key-signature recognition. Session Four reflected substantial improvement from 36% to 75%. During Session Five, the participant increased from 34% to 81%, demonstrating continued gains through repeated practice and independent error correction. Participant J demonstrated positive growth in every session, achieving gains of 80, 83, 11, 39, and 47

percentage points from the probe-to-intervention recordings across sessions (Appendix U, Figure U.9; Table U.9). The participant frequently slowed the tempo, isolated difficult passages, and repeated musical sections to improve accuracy. Additional strategies employed by this participant are listed in Figure V.1-5 and Table V.1-5 in Appendix V. Participant J averaged a 41.80% increase from the probe to the intervention periods, progressing from a limited to an exemplary level (Figure 3, Table 13).

Participant K

Participant K's performance increased during every intervention session, with scores improving from 48% to 95% in Session One, 97% to 100% in Session Two, 93% to 98% in Session Three, 55% to 91% in Session Four, and 77% to 85% in Session Five. Participant independence in employing those strategies and interventions is listed in Figure V.1-V.5 and Table V.1-V.5 in Appendix V. Participant K demonstrated positive growth in every session, achieving gains of 47, 3, 5, 46, and 8 percentage points from the probe to intervention recordings across the sessions (Appendix U, Figure U.10; Table U.10). Participant K averaged a 19.8% increase, progressing from a developing level on the probe to an exemplary level during the intervention periods (Figure 3, Table 13).

Increased Independence

A major theme emerged, demonstrating increased independence, stronger self-initiation, and consistent task completion throughout the intervention. During the study session, there was a decreased need for prompting to start the task due to hesitancy or communication issues associated with ASD and to comprehend expectations during task completion. Participants increasingly began sessions with selected musical materials, preparing for performance recordings with prompts, thereby supporting self-initiation and active engagement throughout the

learning process in both the probe and intervention periods. All participants completed the probe and intervention, used full practice segments, submitted recordings, repeated exercises, and remained on task throughout the session, with consistent task completion. All participants independently initiated the computer-assisted instruction and video modeling system. No prompts were needed using this technological intervention. Participants used the computer-assisted instruction and video modeling system appropriately, implementing learning strategies in the intervention period compared to the probe period.

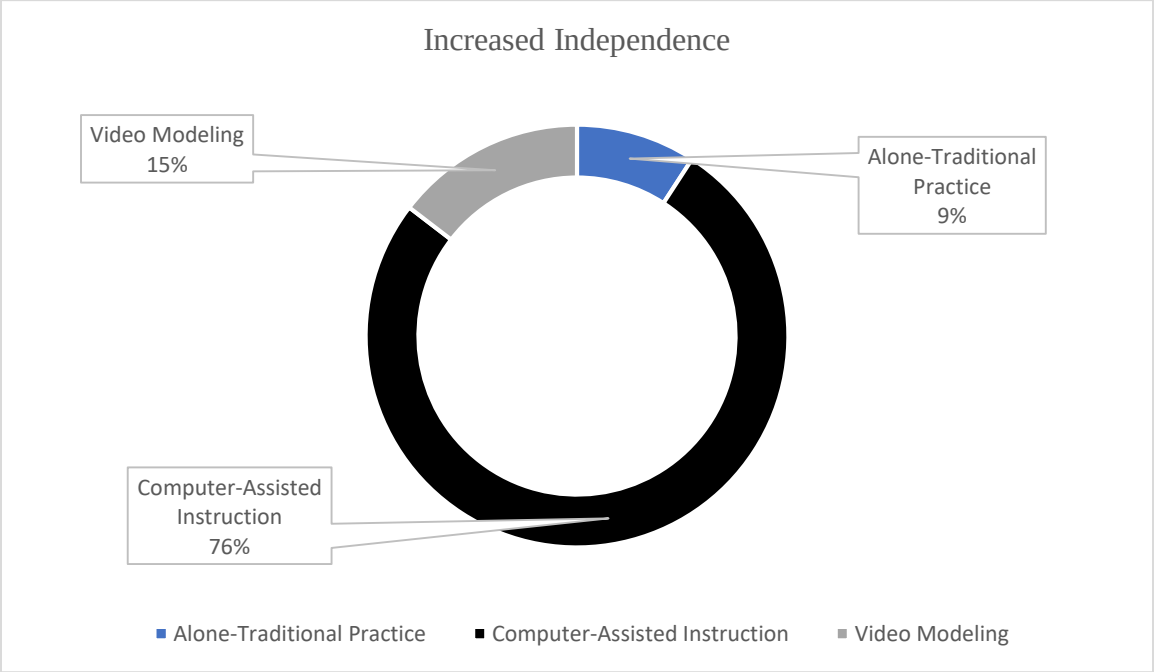


Figure 4. Increased Independence

Table 14. Increased Independence

Attempts	Alone-Traditional Practice	Computer-Assisted Instruction Listen or Play	Video Modeling Listen, Play, Both, Finger Only
Total 610	56	465	89

Participants demonstrated varying levels of independence in their learning process across 610 fully completed musical task attempts (Figure 4). While 56 of those musical performances (9%) were completely independent, played alone without support, participants also exercised

autonomy by selecting and utilizing available instructional interventions. Computer-assisted instruction was applied in 465 performances (76%), and video modeling was implemented in 89 performances (15%) (Table 14). Rather than relying exclusively on their individual musical backgrounds, participants independently engaged with technological resources to guide practice, monitor performance, and correct errors. Although only 9% of performances were completed without support, participants demonstrated substantial self-directed learning through computer-assisted instruction and video modeling. Video modeling and computer-assisted instruction interventions applied for each session are displayed in Appendix V, Table V.6.

Musical Skill Acquisition

Musical skill acquisition was the second major theme to emerge, demonstrating measurable, observable improvements in rhythm, pitch, tempo accuracy, and expressive performance during the intervention period. While each participant entered the study with varying musical experiences and abilities, the collected data show steady progress in foundational performance skills for participation in instrumental music. Specifically, rhythmic accuracy is an area for growth, as most participants displayed inconsistent note durations, missed rests, and difficulty maintaining a steady pulse throughout the probe session when playing with the accompaniment in the first recording. As the study progressed, however, performances became more rhythmically stable, with improved ability to count patterns, align note values correctly, and sustain consistent timing throughout musical selections. Short-term musical skill acquisition is documented in Appendix U for each participant in each session, from the probe to the intervention period. Table 15 below identifies the average growth percentage between the probe and intervention periods for all sessions.

Table 15. Participant Growth Heat Map (Intervention vs. Probe)

Participant	Probe (%)	Intervention (%)	Growth (%)	
A	6.8	68.2	61.4	**Growth Key (%)**
B	23.6	61.2	37.4	50% Plus Very High Growth
C	57.6	78.4	20.8	
D	46	84.8	38.6	30%-49% High Growth
E	78.6	95.8	17.2	
G	89.4	95.4	6	15%-29.9% Moderate Growth
H	87.4	99.6	12.2	
I	50.4	86.4	36	5%-14.9% Low Growth
J	43	84.8	41.8	
K	74	93.8	19.80	0%-4.9% Minimal Growth

Pitch Accuracy

Next, most participants demonstrated initial issues during the probe period of each session, including incorrect fingerings, missed notes, intonation issues, tone inconsistencies, and/or delayed note changes. Pitch accuracy improved for most participants during the intervention period, as they demonstrated better note production, cleaner transitions between pitches, and greater consistency in performing correct notes in musical passages. As noted earlier in this chapter, pitch recognition and error detection varied across participants.

Tempo Control

Over time, tempo control improved for most participants from the probe session to the intervention session. On average, regardless of ability level, recorded performances varied in speed, rushing through less technical passages and slowing or skipping entirely when errors occurred. Through repeated guided practice during the intervention period, participants increasingly maintained a steady tempo, as evidenced by better pacing in their second recorded performance. It was observed that students using the computer-assisted instruction system would follow the cursor while playing, incorporating the metronome to improve rhythm, tempo, pulse, and vertical alignment, resulting in more stable performances. Higher scores from the probe-to-

intervention period reflect improvements in tempo, as observed by the researcher and documented in the recordings. The computer-assisted instruction system generates a performance score based on students' pitch accuracy and tempo control after playing the musical task. Pitch accuracy reflected the percentage of correctly performed notes, while tempo control reflected the accuracy of note timing relative to the prescribed rhythm and tempo. Together, these metrics provided an objective assessment of overall musical performance during both probe and intervention sessions, as seen in Figure 5 below.

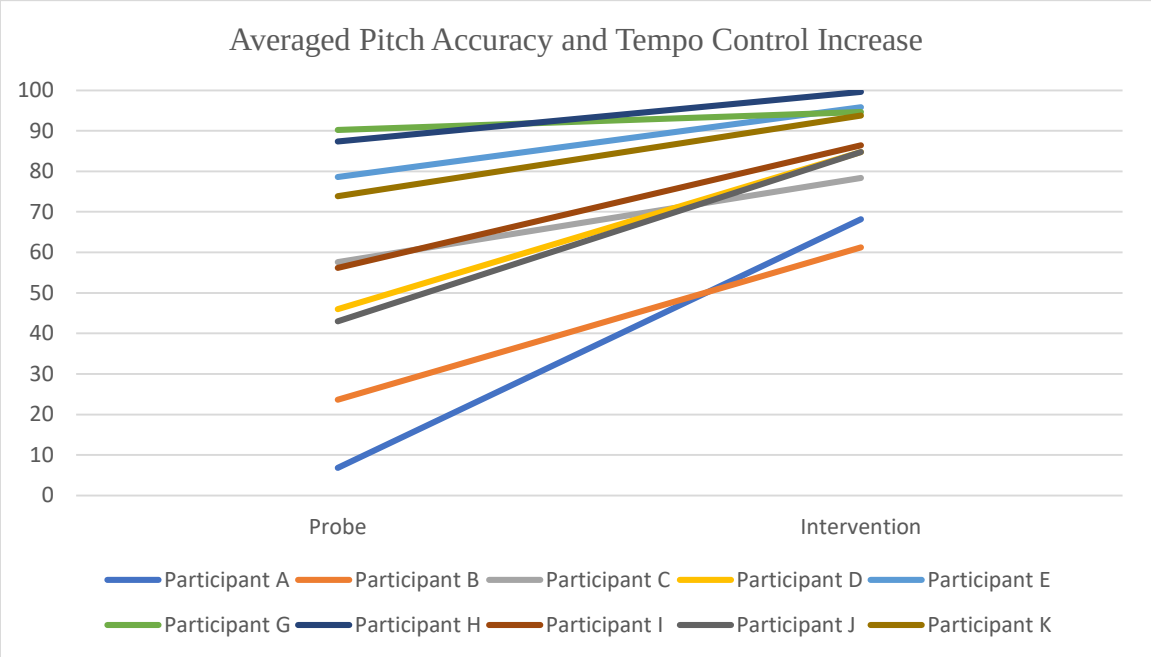


Figure 5. Averaged Pitch Accuracy and Tempo Control Increase

Overall Performance Accuracy

The continuity of music performance developed for most participants with increased overall performance accuracy. Correct notes, rhythms, articulations, and entrances continued to improve during repeated playing during the intervention sessions. Fewer interruptions and mistakes were observed by the researcher, with the participant appearing more capable of

completing the musical tasks with confidence and consistency. The increased overall performance accuracy indicates technical improvement for the musical performance task. The standard deviation between probe and intervention scores decreases for both intermediate and advanced ability levels, displaying greater consistency and reliability of results; see Tables 16 and 17 below.

Table 16. Advanced Standard Deviation Scores

Condition	Mean(%)	Standard Deviation (SD)
Probe	68.4	27.1
Intervention	91.51	9.62

Table 17. Intermediate Standard Deviation Scores

Condition	Mean(%)	Standard Deviation (SD)
Probe	42.4	24.96
Intervention	68	16.14

Musical Expression

The researcher observed that some participants exhibited expressive qualities in musical performance that might not be captured by computer-assisted instruction. Some of these expressive musical qualities include dynamics, articulations, phrasing, and tone quality. It appears from observation that certain participants began to play with greater musical intent, rather than simply reproducing musical notes mechanically, in their post-probe and intervention-session recordings. This occurs more frequently among individuals in higher grades, such as those in the advanced group. It is an observed phenomenon documented in the recordings. However, the computer-assisted instruction system cannot measure these nuances. Nevertheless, the researcher can differentiate these nuances, and some participants can produce and refine them over the course of the sessions.

Enhanced Engagement With Long Sustained Attention and Focus

A third theme emerged: enhanced engagement and focus, as evidenced by sustained attention and reduced off-task behavior during musical learning activities. Throughout the intervention period, for all participants across all sessions, progressively stronger involvement in instructional tasks was accompanied by increased ability to remain mentally and behaviorally engaged. Throughout each session, participants remained engaged for extended periods while completing the music tasks without redirection or additional prompts. Additionally, participants invested time in completing the musical task by voluntarily playing the musical sections repeatedly to improve their performance toward a desired intrinsic outcome. It is clear that consistent effort, through repeated practice during the intervention periods, improved performance between the probe and intervention sessions. The Enhanced Engagement and Focus Among Participants, shown in Figure 6 below, shows a 78 percent increase in completed music task attempts, more than doubling from the probe to the intervention period. This increase in attempts from the probe-to-intervention period indicates a connection to prolonged sustained attention observed in the majority of sessions during this study. More importantly, the intervention session is longer than the probe session, supporting sustained attention.

Reduced Off-Task Behavior

Off-task behaviors, such as escape or avoidance behaviors, are nonexistent. On average, strong self-regulation was observed during both the probe and the intervention, reducing the likelihood of off-task behavior. Participants moved quickly to cues and transitioned between tasks, as engagement appeared to be internally sustained and independent of prompts. According to the Enhanced Engagement and Focus Among Participants (Table 18), only 8 percent of the total study doubled from the probe to the intervention periods.

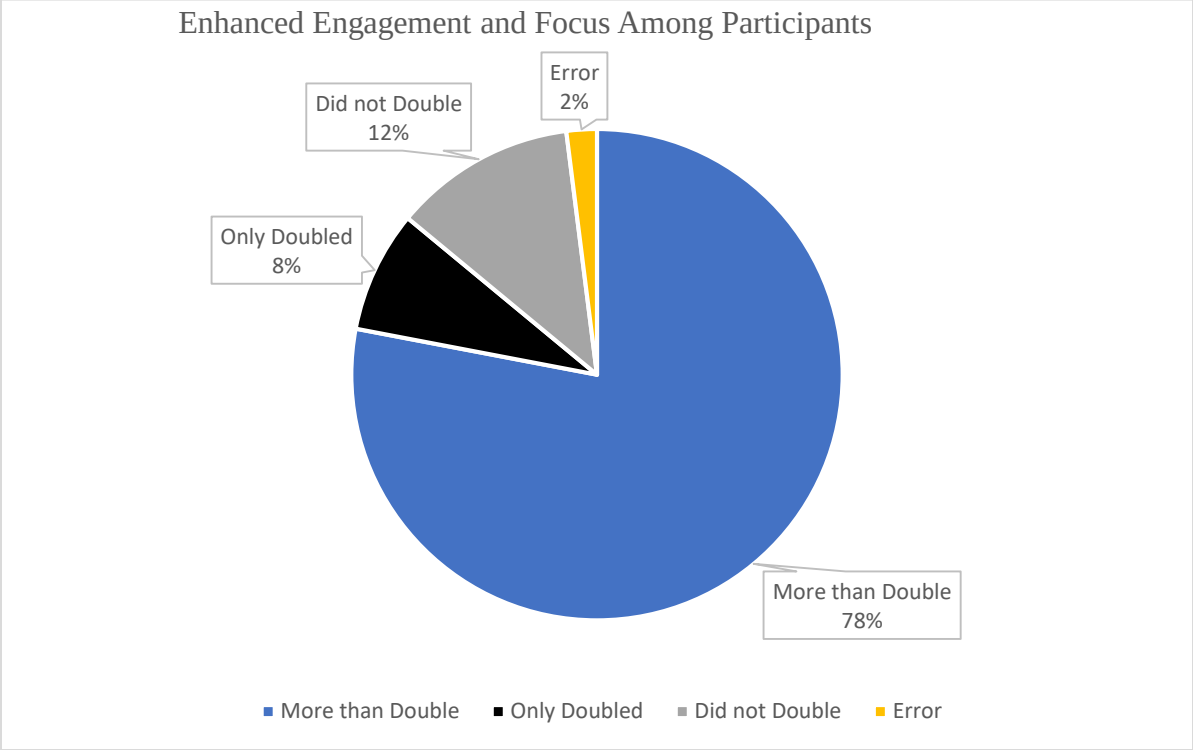


Figure 6. Enhanced Engagement and Focus Among Participants

Table 18. Enhanced Engagement and Focus Among Participants[1]

	Sesssion 1	Session 2	Session 3	Session 4	Session 5	Doubled	Did Not Double	Equaled Probe	Error Occurred
A	E 3/6	Y 3/11	Y 5/12	Y 3/7	Y 3/11	8	0	2	0
B	Y 5/11	Y 5/11	E 5/10	Y 6/14	N 5/8	6	2	2	0
C	Y 1/13	N 9/16	N 9/12	Y 7/18	Y 3/6	6	4	0	0
D	Y 7/19	Y 8/15	E 5/10	N 7/12	N 5/8	4	4	2	0
E	Y 1/8	Y 4/12	Y 2/8	Y 3/9	N 4/7	8	2	0	0
G	Y 7/19	Y 6/17	Y 4/10	Y 4/14	E 6/12	8	0	2	0
H	Y 4/16	Y 5/14	Y 3/8	Error17	Y 4/10	8	0	0	2
I	Y 5/19	Y 3/16	Y 3/9	Y 2/14	Y 2/6	10	0	0	0
J	Y 4/16	Y 2/15	Y 3/12	Y 3/10	Y 3/11	10	0	0	0
K	Y 6/20	Y 3/15	Y 3/11	Y 5/15	Y 5/14	10	0	0	0
Total	-	-	-	-	-	78	12	8	2

[1] Note: First number is full attempts in probe period, for Session 1-5. The second number is the ful number of attempts during the intervention peiod, Session 1-5. The letter Y denotes more than a doubling of attempts from the probe to the intervention period. N denotes that the doubling of attempts did not occur, and E denotes the exact doubling of attempts.

In most cases, when the intervention did not double the probe period, the participant came close to meeting the doubling criteria in attempts, as shown by the 12% who did not double or more than doubled from the probe period to the intervention period. It was observed that participants were checking notes for pitch and fingering or isolating sections that did not include full runs of the musical task in the computer-assisted instruction or video modeling systems. Only one participant worked on the wrong musical task during the probe period, which resulted in an error.

Self-Regulation Through Feedback

The fourth theme that emerged was self-regulation through feedback. Technology during the intervention period provided feedback to assist in monitoring, evaluating, and adjusting their initial performance during the probe period towards their individual musical improvement after the intervention period. Throughout this study, during the intervention periods, participants increasingly relied on information derived from performance data, including visual indicators, scoring results, playback features, and corrective prompts provided by instructional technology. It was observed that participants could only rely on their personal knowledge of self-monitoring and reflection during the probe session. However, during the intervention sessions, participants were able to use computer-assisted instruction and video modeling for musical tasks, which provided multiple data points on improvements in musical performance.

Identify Performance Errors Independently

During the probe periods in most sessions, errors in their musical practice went unnoticed and uncorrected. Immediate intervention included computer-assisted instruction and video modeling, which provide technological feedback and allow for direct, objective information after each attempt. As highlighted, when using the recording feature, incorrect notes, rhythm discrepancies, and tempo inconsistencies become more noticeable to the individual participant.

Even though most participants used the recorded feature in the computer-assisted instruction system, some did not. When this occurred, there was limited growth between the probe and intervention periods, as some participants were unable to identify errors in their musical performance and typically missed notes within the key signature. Missed notes and rhythms were more common among beginning and intermediate participants than among their advanced peers.

Adjustment Towards Performance Becomes Based on Feedback

Most participants were able to use computer-assisted instruction and video modeling during each session of the intervention period, making improvements in their second musical recording performance. Unlike the probe, many participants made repeated mistakes that were unnoticed and unchanged. Mistakes in musical performance included incorrect rhythmic placements, wrong notes, and tempo inconsistencies. However, many of those errors were corrected during the intervention period, especially among advanced-group students.

Strategies Observed

Numerous strategies were observed to improve musical performance, as seen in Figure 7 below. Some were applied with feedback, while others were utilized through personal error detection from self-monitoring. The strategies listed in this section include approaches that did not require individual participants to complete a full playing attempt on the musical task. When participants isolated a musical passage, it was considered a brief section that was either played and listened to using the computer-assisted instruction system or played alone. Isolated musical passages may be planned or occur when a playing attempt using the computer-assisted instruction system is cut short of full completion of the musical task. Another strategy included participants using the note/fingering/sound feature in the computer-assisted instruction system. Participants may also have adjusted the tempo to practice at a more manageable pace or changed

the volume controls so only the part or accompaniment plays. Usually, the part was played only, or the sound was muted to follow the cursor along to learn the part. Some participants were observed singing, humming, or whistling while learning their musical task. In addition, some participants used foot and hand motion as a strategy. Lastly, participants could use the recording feature to review errors through performance assessment, allowing them to listen to a playback of their performance.

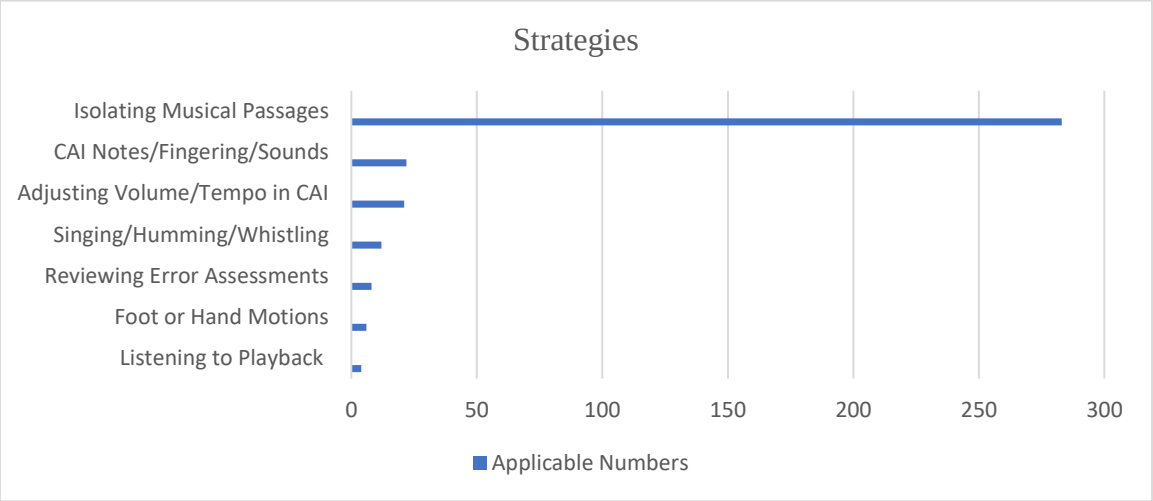


Figure 7. Strategies Applied Autonomously (Total Sum for All Sessions)

Table 19. Strategies Applied Autonomously (Total Sum for All Sessions)

	Isolate	Notes Sounds	Tempo/ Volume	Sing/ Hum	Hand/Foot Motion	Listen Self	Records/Checks Error
Total	283	22	21	12	6	4	8

Persistence and Error Recovery

Isolating musical passages was by far the most common strategy (Table 19). Participants frequently broke difficult musical selections into smaller sections and practiced them repeatedly. Other strategies included adjusting tempo or volume (21 instances), reviewing notes/fingering/sounds (22 instances), and examining errors (8 instances). This figure shows participants actively engaged in self-monitoring and corrective practice behaviors.

It was observed that participants remained persistent even when performance setbacks were apparent. There was a consistent focus on reattempting the musical selections to increase performance scores in both the probe and intervention periods. It appeared that participants viewed errors as part of the learning process rather than a failed attempt. The researcher noticed that participants were motivated when receiving high scores after the second recording.

Individualized Learning Support

Individualized learning support emerged as a theme for this study. The instructional platform functioned not only as a practice tool but also as a personalized support system, allowing participants to engage in their musical tasks at an appropriate rate, level of difficulty, and degree of repetition. As participants went through the process, major differences occurred between the probe and intervention periods, seen in Table 20 below. Error identification went from self-monitoring and self-awareness to technology-assisted feedback. Pitch correction often went unnoticed among younger participants compared to older ones, but with technology-assisted feedback, they were more likely to correct. Rhythmic adjustments were more limited during the probe period than during the intervention period, when they were more accurate. Tempo regulation was inconsistent during the probe period compared to the intervention period, which had access to tempo tools, such as a metronome. Performance review was through personal reflection during the probe period, but during the intervention period, playback and score feedback could be assessed. Error recovery during the probe period included musical mistakes that often persisted, whereas during the intervention period, those errors were more likely to be corrected.

Participants manipulated the technology systems, initially selecting video modeling, while others selected the computer-assisted instruction system first. Some participants rapidly

repeated playing the technology systems while others checked sounds and fingering. Moreover, some participants sang, hummed, and fingered along while listening to the musical task being played on one of the systems. Lastly, some participants recorded themselves and used the playback feature to review their performance. The researcher did not teach these strategies; they were undertaken autonomously by the individual participants. The usage of interventions per session is documented in Figure Z.1-Z.5, in Appendix W.

Table 20. Categorical Differences Between Probe and Intervention Period

Musical Category	Probe Period	Intervention Period
Error identification	Primarily self-awareness	Technology-assisted feedback
Pitch correction	Often unnoticed	More frequently corrected
Rhythm correction	Limited	More accurate adjustments
Tempo regulation	Inconsistent	Supported through tempo tools
Performance review	Personal reflection only	Playback and score review
Error recovery	Repeated mistakes often persisted	Errors more likely to be corrected
Practice decisions	Based on memory	Based on objective feedback

Structured Pacing

It was observed that this technology-based intervention enabled participants to progress through musical selections at their own pace. These musical selections could be slowed, repeated, paused, or revisited. This flexibility allowed participants to make choices about how to implement strategies and interventions for their learning, as observed.

Targeted Repetition

Musical skill acquisition in instrumental music involves proficiency in note reading, rhythmic fluency, and technical coordination. During both the probe and intervention periods across all sessions, repetition became a central component in developing and enhancing instrumental music performance skills, as evidenced by improvements in musical performance. Repeated practice provided participants with opportunities to reinforce musical concepts, strengthen technical skills, and increase accuracy and fluency in performance.

Codes Assignments

Averaged open, axial, and selective codes, placed in Tables 21 and 22 below, provide clear documentation of emerging themes in the study. The data demonstrate an increasing ability to initiate tasks, follow prompts, sustain attention, self-correct errors, and transfer learning towards musical skills into performance settings. In addition, participants demonstrated greater autonomy, persistence, and task engagement throughout the intervention process. Averaged responses for the perception surveys are listed in Table 23 below.

Visual Aids

Table 21. Codes for All Sessions-Probe Period (Averaged)

		Probe Period- Averaged All Sessions		
Participant	**Domains**	**Open Codes**	**Axial Codes**	**Selective Codes**
A	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IC, TF, IP, IA, IN	TA, PE	TEFSR, EBSTL
	Cognition	PC, H, SC, RD	B, S	
B	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, IP, TF, RE, CN, IA	TA, PE	TEFSR, EBSTL
	Cognition	H, C, PD, ER	B, S	
C	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, TF, IP, IA, ST	TA, PE	TEFSR, EBSTL
	Cognition	H, SC, ER	B, S	
D	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, TF, RE, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, ER	S	
E	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	
G	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IC, CN, RE, TF, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
H	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
I	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
J	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
K	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	

Table 22. Codes for All Sessions-Intervention Period (Averaged)

Intervention Period- Averaged All Sessions				
Participant		**Open Codes**	**Axial Codes**	**Selective Codes**
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	GP, EC, SS, ME	SS	
	Independence	RIC, CP, ES	DOI	
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	SS, GP	SS	
	Independence	RIC, II, ES, CP	DOI	
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	SS, GP	SS	
	Independence	II, CP, ES	DOI	
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtI	
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtL	
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
G	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC, IP	SS, MtI	
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtL	
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	

Table 23. Average Participant Responses to the Weekly Music Perception Survey

Probe Session (First Five Minutes)
Participant Performance Perception

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with a developmentally appropriate tone.		A, C, E, I	B, D, G, H		J
Musical sections are played with appropriate intonation.		A, C, E, I	B, D, G, H		J
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.		A, B, C, E, G, H, I, J	D		
Students perform accurate rhythms.		E, G, I, J	A, B, C, D, H		
Students perform with precise vertical alignment and consistent pulse.		E, G, I, J	A, C, H	B, D	
Students perform with correct, suitable, and consistent articulations.		C, E, I	A, G, H, J	B, D	
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	A	C, E, I	B, G, H, J	D	
Dynamic contrast is obvious and effective.		A, E, G, I, J	B, D	C, H	
The student performs the section with the appropriate tempo.	E	A, B, H, I		C, D, G, J	

After the Intervention Session (Ten Minutes)
Participant Perception

Tone	Video Modeling		Computer-Assisted. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	A, B, D, H, I, K	C, E, J	A, B, C, D, E, H, I, J	K
Musical sections are played with appropriate intonation.	B, D, H, K	A, C, E, I, J	A, C, E, H, I, J	B, D, K
Technique	**Yes**	**No**	**Yes**	**No**
Students perform the correct notes.	A, B, H, I, J, K	C, D, E	A, B, C, D, E, H, I, J, K	
Students perform accurate rhythms.	B, D, H, I, J, K	A, C, E	A, C, D, E, H, I, J, K	B
Students perform with precise vertical alignment and consistent pulse.	A, B, D, H, I, J, K	C, E	A, C, D, E, H, I, J, K	B
Students perform with correct, suitable, and consistent articulations.	B, D, H, I, J, K	A, C, E	A, E, H, I, J, K	B, D
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	A, B, D, H, I, J, K	C, E, J	A, B, C, D, E, H, I, J, K	
Dynamic contrast is obvious and effective.	A, B, D, H, I, J, K	C, E	A, D, E, H, I, J	B, C, K
The student performs the section with the appropriate tempo.	B, D, H, I, J, K	A, C, E	A, B, C, D, E, H, I, J, K	

Summary

This chapter presented the findings of a study investigating the use of computer-assisted instruction and video modeling in an instrumental music education context for students with Autism Spectrum Disorder (ASD). The study emphasized the potential of explicit instructional strategies as interventions to increase learning and develop skill sets that foster musical growth. Results indicated improvements in musical performance, including increased accuracy, performance consistency, engagement, task persistence, self-regulation, and independent task completion during intervention periods. Evidence from observations, performance recordings, participant artifacts, and survey data documented improvements in musical outcomes through technology-supported learning.

Findings illustrate participants' engagement in observing and documenting musical performances, as well as their skill development through instructional intervention. Analysis of the data through open, axial, and selective coding revealed several major emerging themes, including increased independence, musical skill acquisition, enhanced engagement and focus, self-correction through feedback, and individualized learning supports. These themes provided a structured understanding of participant experiences and responses to the instructional interventions. The findings presented in this chapter serve as the foundation for discussion and interpretation presented in Chapter Five.

Chapter Five: Conclusion/Discussion

Summary of Study

As ASD students often face barriers to learning in a traditional instrumental music instruction setting, these manifest in multiple ways, including difficulties with sustained attention, task initiation, error tolerance, behavior issues, and skill generalization. Since conventional teaching relies heavily on verbal instruction, delayed feedback, and group-based pacing, these approaches may be more challenging for ASD students, as they may not align with their individualized learning needs. As a result, students may exhibit increased off-task behavior or avoidance or become completely dependent on teacher prompting, limiting their individual musical abilities and development toward achieving desired educational outcomes.

The study aims to address the concerns above through the following research question: What specific teaching strategies can be implemented to achieve positive learning outcomes in instrumental music, as outlined in educational goals, standards, and objectives for the ASD student? Through the literature review, it was determined that elicited instruction, using computer-assisted instruction along with video modeling, could yield promising results in instrumental music education. Examining targeted teaching intervention strategies for computer-assisted instruction and video modeling to improve musical educational outcomes for students with ASD helps fill those gaps in the literature. Moreover, the study examines how computer-assisted instruction and video modeling may influence learning behaviors, musical skill development, and student engagement towards music education.

The researcher examined the musical outcomes of the interventions and analyzed how connections could be made to shape future lesson planning in accordance with individualized educational plans. The researcher determined that the performance data from the weekly sessions

were valid and credible for instructional decision-making within the continuous cycle of educational planning. Indicators from the study's results and findings, across various music categories such as rhythmic accuracy, pitch control, tempo consistency, and task completion, were examined for their implications for the educational process towards standards and objectives within the music education curriculum.

Discussion and Interpretation of Performance Data

Beginning Level Results

As the sole participant in the beginning performance group, Participant A could not be directly compared with others at the same level. Throughout the study, the participant demonstrated consistent effort and attention, with gradual improvement despite ongoing struggles with recall, tempo, rhythm, and note accuracy. The participant responded positively to computer-assisted instruction, guided practice, and repeated modeling, with performance gains ranging from 39% to 94% across sessions following the intervention, while observations documented consistent use of guided practice and repeated modeling (Appendix X, Figure X.1; Table X.1). The findings suggest that computer-assisted instruction, combined with guided practice and scaffolding, contributed to improvements in musical performance development. At the same time, ongoing challenges with processing speed, recall, and error correction indicate a continued need for instructional support. Lastly, Participant A appears to evaluate the intervention outcome rather than the probe period, as individual responses do not align with the researcher's observations. (Table 23)

Intermediate Level Results

Participants B and C shared several similarities throughout the intervention process. Both participants demonstrated ongoing difficulties with rhythm accuracy, tempo consistency, and note recognition during the probe periods. Repetition was a common strategy for both individuals, although repeated practice occasionally reinforced incorrect patterns when errors were not independently recognized. Each participant demonstrated persistence, sustained attention withactive engagement during practice activities, responding positively to modeling, scaffolding, and computer-assisted instruction. In both cases, performance improved across every session, suggesting that repeated exposure to the intervention tools contributed to greater musical accuracy and consistency over time.

Despite these similarities, clear differences emerged between the two participants. Participant B relied heavily on visual and auditory supports such as video modeling, finger demonstrations, along with sound examples, often appearing to learn through imitation and visual association rather than note decoding. These supports seem particularly helpful for developing note accuracy and understanding of rhythm. While self-correction and independent error detection remained inconsistent, repeated exposure to the intervention tools contributed to stronger performance stability, improved engagement, and emerging musical skill development across the sessions.

In contrast, Participant C depended more consistently on the computer-assisted instruction system itself and used video modeling less frequently. Over the course of the intervention periods, Participant C relied primarily on the technology-based intervention rather than on video modeling, using repetition, isolated practice, and guided prompts to improve performance on difficult passages. Although the participant’s self-assessments occasionally

differed from the researcher's observation, the collected data indicate meaningful musical growth.

Neither Participant B nor C used the recorded feature to receive feedback on rhythm and notes. Participant C also demonstrated stronger overall growth and musical understanding, while Participant B continued to struggle more noticeably with self-monitoring and independent error correction throughout the study. The rate and patterns of improvement also differed between the participants. Participant B showed larger fluctuations in performance, including major gains in Sessions Two and Four, but lower overall probe scores in several sessions. Participant C demonstrated steadier and more moderate improvement across all sessions. While Participant B's performance often shifted dramatically depending on the session and level of difficulty, Participant C displayed more gradual progression and increasingly stable performance outcomes as the intervention continued.

Several trends were evident across both participants. First, computer-assisted instruction appeared to support measurable musical growth regardless of initial performance level. Second, repeated practice and guided intervention contributed to improved note accuracy, rhythmic precision, and overall task completion. Finally, both participants demonstrated increased persistence and stronger engagement over time. However, difficulties with self-correction and independent error detection remained ongoing areas of development, particularly during more complex musical passages.

Advanced Level Results

A major similarity among Participants D, E, G, H, I, J, and K indicates the positive effect of computer-assisted instruction as an intervention on improved musical performance outcomes. All participants demonstrated improvements in musical accuracy, rhythmic understanding,

tempo control, and overall performance consistency after repeated use of the intervention tools. Common learning strategies observed across participants included slowing tempos, isolating difficult passages, repeating sections multiple times, restarting after mistakes, and responding positively to guided practice, modeling, and scaffolding. Researcher observations consistently documented strong engagement, persistence, sustained attention, and increased accuracy through repetition and technology-supported practice. Growth was commonly observed in correct notes, articulation, pulse alignment, rhythm, tempo consistency, and musical expression.

In the advanced group of participants, a trend towards greater musical independence and self-monitoring was evident throughout the intervention process. Participants increasingly corrected their own errors, repeated difficult passages without prompting, and used strategies such as section isolation and tempo reduction to improve performance. Sessions with the greatest gains often focused on rhythmic precision, note production, and accompaniment alignment. In most cases, later sessions demonstrated better implementation of the computer-assisted instruction system, leading to stronger musical fluency than early sessions.

Although all participants benefited from the interventions, clear differences emerged in individual skill levels, ranges of improvement, and use of instructional supports. Participant H consistently maintained the strongest overall performance, frequently scoring near or at 100% and sustaining exemplary achievement across sessions. Participant J began with some of the lowest initial scores, including 11% in Sessions One and Two, yet demonstrated dramatic improvement. Participant D also demonstrated substantial gains, particularly in Session One, improving from 9% to 93% (an 84% increase), which was among the largest gains observed in the study. Participant D frequently struggled with tempo synchronization, rhythmic execution,

and fingering speed early in sessions but responded positively to repeated guided practice, metronome work, and intervention support.

Participant E showed great early improvement but occasionally relied more heavily on independent playing than on intervention tools. Participant G demonstrated the most stable high-level performance throughout the study, maintaining strong musical literacy and consistent accuracy with smaller but steady improvements. Participant I showed wide performance variability between sessions, with substantial growth following repeated intervention practice periods through persistent effort towards more difficult musical tasks. Participant K employed a variety of learning strategies such as singing, tapping, air-fingering, and movement with the pulse, displaying consistent engagement. Participants D and I averaged a proficient performance level after the interventions, whereas Participants E, G, H, J, and K averaged an exemplary performance level (Table 12).

Evident differences were apparent in the use of the video modeling system. Participants G, H, K, and D appeared to incorporate video modeling more consistently into practice sessions. At the same time, Participants E, I, and J sometimes reported benefits from video modeling despite limited or unobserved use during those intervention periods. In several cases, including Participants D, E, I, and J, the researcher's observations differed from the participants' self-assessments regarding performance quality or intervention effectiveness. Participants G and H generally demonstrated stronger alignment between self-evaluation and observed outcomes.

Several overall trends emerged across the study for the advanced group of participants. First, computer-assisted instruction led to measurable improvement, regardless of participants' ability levels. Second, participants with lower initial scores often demonstrated the largest percentage gains, whereas participants who already performed at an exemplary level showed

smaller gains. Third, repeated practice techniques, including rhythmic isolation and tempo modification, guided error correction proved effective in addressing difficult musical passages. Finally, the application of computer technology for evidence-based instruction and intervention appears to strengthen musical performance skills.

Summary of Findings and Prior Research

Findings indicate that structured interventions could promote measurable musical growth in performance, including improved rhythm, pitch accuracy, tempo control, task completion, and overall consistency. These results supported Hypothesis 1, demonstrating that individualized instruction can positively influence instrumental music achievement for students with ASD. Furthermore, the literature reviews examine how instrumental music educators can implement effective teaching approaches within computer-assisted instruction and video modeling as interventions to improve musical performance and abilities, thereby enabling full inclusion in the instrumental music classroom.

During the study, participants demonstrated increased independence, with a decreased need for prompting and strong self-initiation towards consistent task completion. This suggests that the computer-assisted instruction and video modeling created a predictable, structured intervention that helped participants understand the task, advance comprehension of the weekly session's educational objective, and build confidence through routine and repetition. The study also suggests that participants developed a stronger sense of self-initiation, moving from passivity to active engagement in the educational process, which is a meaningful step towards academic and functional autonomy. As participants progressed through the study, some became more efficient at the task, using their autonomous choices to improve their musical performance. Individual autonomy then extends beyond unaided performance to include the self-directed

application of computer-assisted instruction and video-modeling learning tools. It appears that participants were not simply dependent on supports; rather, they engaged in autonomous learning behaviors by choosing and accessing assistance that fit their individual needs. The high frequency of computer-assisted instruction and video modeling suggests that learners were actively managing their own learning process. Participants consistently completed musical tasks, demonstrating improved independence, increased stamina, regulated attention, and personal responsibility, as well as individual learning outcomes and development in musicianship. These tools served as scaffolds that enabled learners to independently identify errors, repeat passages, regulate the pace of practice, and make performance decisions without direct teacher intervention. Consequently, the study indicates growth in autonomous learning behaviors, even when full performance independence was not consistently observed. It is suggested that increased independence is crucial for individual practice and performance and requires self-monitoring of progress towards music literacy. Interestingly, the intervention supports musical growth and may also transfer self-management skills through computer-assisted instruction.

It appears that computer-assisted instruction reduces participants' reliance on teacher-mediated attention while still meeting their individual needs through non-social means, such as digital feedback (scores, visual aids, and sounds). Participants shifted their attention from seeking teacher praise to computer-based instructional feedback, as shown by the direct improvement observed between sessions. The study suggests that attention-seeking behaviors toward the teacher may decrease, while task-focused engagement increases. Escape/avoidance behaviors may decrease as the musical tasks become more approachable and less aversive. These musical tasks within the computer-assisted instruction may use strategies such as chunking, repetition, and self-paced learning to reduce students' anxiety. In addition, since errors are

framed as low-risk and correctable, using a computer-assisted instruction system that allows immediate retries removes the relativity of failure. Moreover, motivation appears to be embedded directly within the musical task activity, as the tangible reward shifts towards sustained participation. Participants receive continuous sensory input through computer-assisted instruction, with auditory feedback, visual animations, and interactive elements. They may experience intrinsic enjoyment, even if it is not measured, which fosters greater persistence or mastery-driven motivation. These persistent reattempts and error-recovery attempts are hallmarks of gamified learning environments.

In addition, Hypothesis 2 is supported when appropriate accommodations and modifications promote inclusion given the advancements in methods and pedagogy through computer-assisted instruction and video modeling. Findings show that students using computer-assisted instruction learn to play musical selections faster at a higher level of musicianship. Technology-based interventions provide visual supports, repetition, structured routines, scaffolded instruction, and modified pacing with immediate feedback, which enhance music learners' musicianship. Computer-assisted instruction and video modeling may be used to supplement learning outside the school day (at home), during remedial/tutorial times (before and after school), or during short periods of class time (in autonomous settings).

Connection to Zygonic Theory

Zygonic Theory proposes that musical understanding develops through the recognition and creation of relationships. As music learning is not purely technical, the theory emphasizes how individuals connect one musical event to another, forming patterns of understanding and engagement. As participants improve their performance, scores reflected in their practice are compared against reference points. Participants in this study reflected by identifying what needs

to change and what needs to stay the same in musical performance development, aligning with the zygonic process of replication and refinement. Persistence is not just a behavioral pattern but also a cognitive one built through repetition. Error recovery is a part of relational learning in zygotic theory. Mismatches between the intended and produced patterns require relational adjustment in real time. As this happens, the individual learns to hear and correct deviations from expected musical structures. Error recovery requires developing sensitivity to musical relationships, not just correctness. The game-like nature observed demonstrates that zygonic engagements were scored and feedback created clear, repeatable cycles, such as attempt, feedback, and adjustment. Individuals using computer-assisted instruction systems become motivated to refine patterns to achieve higher accuracy; in turn, self-competition reinforces pattern recognition within the musical task. It appears that using the computer-assisted instruction system has become a game for individual improvement, appealing to both extrinsic and intrinsic motivators. Gamified elements amplify zygonic cycles of imitation, variation, and improvement. It is unclear what causes this phenomenon, but perfectionism in ASD is a coping mechanism; however, participants display self-motivating and self-correcting behavior, internalizing musical relationships, and shifting from external instruction to internally guided pattern processing and music literacy, as fostered by the national music standards.

Significance of the Findings/Implications for Practice

Effective Intervention of Digital Formats

The study demonstrated that the outcomes from the probe and intervention are education-based and could be used to shape future lessons. These results included ongoing assessment data, observational notes, and student performance trends, providing meaningful guidance for possible adaptations in future instruction. Effective instruction, including computer-assisted instruction

and video modeling, may be used to meet performance expectations, with Section 504 accommodations appropriate for the individual with ASD. The computer-assisted instruction modeled pitch, rhythm, fingering, and note names while allowing the individual to record their performance, enabling real-time feedback for error correction. Nevertheless, lesson planning becomes more effective when informed by documented student growth and progress that aligns with their individual needs.

Instructional Planning

The study findings demonstrate that computer-assisted instruction may be used in lesson planning. The educational process cycle includes assessing the student's needs, identifying their current abilities through formal assessment and observations in formal and informal settings, and reviewing prior performance data. Planning and goal setting, usually fostered through backward design and spiral learning approaches, align with instructional goals in curriculum standards, objectives, and individual educational plans. In music, the national standards focuses on music literacy, including note reading, rhythmic accuracy, tone production, and ensemble participation. The instructional process within the educational cycle employs appropriate teaching strategies. Computer-assisted instruction and video modeling may be appropriate as supplemental learning strategies. For music education and ASD, the use of computer-assisted instruction and video modeling may be within the least restrictive learning environment, as it promotes modeling, visual supports, chunking tasks, and technology tools to enhance educational opportunities, with continuous monitoring and feedback to determine whether these strategies are effective.

Weak Central Coherence Learning Barriers

Weak central coherence may be relevant in this study, as it helps explain how participants with ASD process musical information, as some individuals may hyper-focus on smaller details

rather than integrating all information into a broader context. In turn, participants may excel in isolated rhythms, individual notes, or small segments of playing; they may struggle with phrasing, connecting larger sections, or understanding the “big picture” of the piece. Participants may treat the musical task as a set of rules, focusing on the goal instead of interpreting the music. High accuracy may occur in short musical tasks, with less improvement in longer musical performances. The computer-assisted instruction system provides participants in the study with the opportunity to break the musical task into smaller, measurable units and to receive immediate, detailed, specific feedback, which aligns well with weak central coherence by reinforcing repetition of smaller sections and focusing on correctness at a micro level. Participants may become fixated on specific musical errors, missing broader patterns, such as timing. This was not noticed, and fixation was infrequent; however, learning may appear highly productive with multiple retries and corrections across both parts of the session, probe and intervention, as some individual participants experienced minimal progress. Nevertheless, as observed, the study's impact appears to increase the likelihood of persistence and repetition, thereby improving scores. It is difficult to determine whether participants apply feedback globally, including to musical understanding, long-term memory, and learning.

Educational Cycle

Teachers may also use data from computer-assisted and video modeling to observe student responses, behavior, engagement, and progression of performance levels. To assist ASD students, checklists and rubrics can be provided as supplemental resources, not displayed in the study, to enhance comprehension and musical understanding, aligned with feedback from performance recordings assigned in lessons or objectives by the teacher. The study showed continued difficulties for some students in certain sessions, however, indicating the need for

reteaching, modified pacing, additional scaffolding, repetition, more time, or alternative instructional strategies. Since the evaluation of educational progress determines whether students meet goals, teachers' analysis of data from a computer-assisted instruction system must be viewed as guidance for the next stage of instruction. The reflection and adjustment stage of the educational cycle can use student data from the computer-assisted instruction system to modify future lessons, revise goals with additional supports, and adjust lesson pacing. This cyclical process of assessment, planning, teaching, evaluation, and revising continuously supports the evolving needs of the student with ASD. The computer-assisted learning system provides this instructionally relevant data to enhance learning in instrumental music education in the repeated educational process cycle. Moreover, findings reveal that interventions, including computer-assisted instruction, video modeling, visual supports, repetition, structured routines, scaffolded instruction, and modified pacing with immediate feedback, possibly foster increased participation, independence, and engagement.

Interventions Focus on Individualized Learning

As the literature review details, collaborative efforts among music educators, special educators, administrators, and families are essential in fostering the educational needs of students with ASD. Clearly documented performance outcomes using computer-assisted instruction and video modeling may be shared during meetings, progress reviews, and annual planning meetings to discuss revisions in goals, services, and accommodations. The study findings suggest that data from computer-assisted instruction and video modeling may strengthen accountability, helping to integrate music education into the broader educational goals of students with ASD. The findings show that the use of technology in the intervention period demonstrates that structured pacing,

repeated practice opportunities, and adaptive learning experiences using computer-assisted instruction may be a successful intervention strategy for instrumental music learning.

Relationships to Other Evidence-Based Interventions

The intervention methods of this study, computer-assisted instruction and video modeling, embody evidence-based elements of explicit instruction by integrating multiple evidence-based practices. There is a strong connection to Discrete Trial Training (DTT), with a clear stimulus, learner response, immediate feedback, and repetition evident in participants' repeated attempts, error correction through immediate feedback, and incremental improvement. However, DTT is adult-led and highly controlled, whereas in this study, the individual participant had autonomous control of learning. There was a moderate connection to Natural Environment Teaching (NET), as music is an authentic, meaningful activity, driven by interest, and less rigid than formal drills. The computer-assisted instruction is too formal to align with NET. The musical tasks are pre-selected rather than being spontaneous. There are conceptual connections between this study and Pivotal Response Treatment (PRT), which focuses on motivation, responsiveness, and self-initiation. Connections to PRT are evident in the study's findings, including increased engagement, sustained attention, greater persistence despite errors, game-like intrinsic motivation, and increased independence with reduced prompting. PRT is usually child-initiated and socially embedded; however, this study supports PRT principles but does not fully implement them. The study has an indirect connection to Functional Behavior Assessment (FBA), which identifies the function of behavior. These findings relate to FBA by suggesting increased engagement and a shift in behavioral function, with the musical task serving as a reinforcer rather than an avoidant behavior. As a result, off-task behavior is reduced, with less escape-maintained behavior, providing more access to the preferred stimuli, namely

music technology. The study does not conduct an FBA, but the outcomes can be interpreted through an FBA lens to explain the positive behaviors observed in pursuit of the desired outcomes of musical improvement. The principles of explicit instruction in computer-assisted instruction include clear task expectations, immediate corrective feedback, structured sequencing, and repetition to achieve musical mastery. The session intervention process functions as a hybrid of the instructional models. The study does not attempt to implement DTT, NET, PRT, or FBA; it just shares key connections to the mechanics of those interventions. Computer-assisted instruction operationalizes core features of evidence-based behavioral interventions through structured practice, immediate feedback, and motivational reinforcement supported by engagement, driving participants' musical skill acquisition.

Bridging the Gap to Equitable Access to Music Curriculum

Ultimately, the study found that educational outcomes are essential for measuring successful musical performance, shaping future lesson design and planning, ensuring legal compliance, fostering inclusive educational practice, while sustaining meaningful long-term progression for ASD students in instrumental music education. The documented outcomes from computer-assisted instruction and video modeling provide evidence that students have equitable access to curriculum content and receive appropriate accommodations in an inclusive, conducive learning environment that offers meaningful educational opportunities aligned with the Every Student Succeeds Act (ESSA) and the Free Appropriate Public Education (FAPE).

Limitations

Several limitations should be considered when interpreting the findings, which have implications for instrumental music education and students with ASD. The study uses a single-subject design to examine ASD in the instructional setting of music education. The study

provides an in-depth analysis but also significantly limits its generalizability. The observed outcomes may not reflect the experiences of all learners with ASD. Participants self-reported without additional details on possible comorbidities, thereby protecting the individual's personal health and educational records.

When interpreting results in this study, it is vital to recognize that factors beyond the intervention strategies themselves may have influenced participant outcomes. As detailed in the literature review, the individual characteristics associated with ASD, including differences in sensory processing, communication, attention, and learning processes, may affect how participants respond to the interventions. Therefore, changes in performance should be interpreted within the context of each participant's individual learning characteristics, baseline musical proficiency, and response to the instructional environment.

In addition, these learning barriers can influence engagement, performance, and responsiveness to instruction. Barriers may include fluctuations in sustained attention; even though technology may appear to increase engagement, attention may drop due to cognitive fatigue. This could lead to inconsistent performance data across multiple sessions. Hypersensitivity or phonosensitivity to sound, visuals, or touch can affect how students interact with the musical task and digital interface, as certain tones, volumes, or even visual displays may overwhelm or distract participants, reducing accuracy and participation. Difficulty with transitions may also pose a barrier, as changes within sections of the weekly sessions could lead to resistance or delayed engagement with the musical task. Some ASD participants may have expressive or receptive language differences that affect their understanding of instructions, feedback, or goals. Misunderstanding of task expectations may lead to errors that do not reflect their actual skill level. Challenges with planning, organization, working memory, and self-

monitoring, which are associated with executive function, may affect task completion. Participants may respond differently to intrinsic and extrinsic motivators. Their performance anxiety, frustration with errors, or sensitivity to feedback may affect their level of participation and persistence. Some participants may also require additional time to interpret instructions, auditory input, or visual cues.

The study's small sample size and lack of a neurodiverse (ASD) vs. neurotypical (control) group may limit the ability to draw causal inferences about the intervention's effectiveness. Although the improvements were observed across multiple performances within the weekly session, it cannot be conclusively determined that these gains result solely from the intervention, as other factors, such as musical maturity or prior musical skill development may affect the results. However, video modeling and computer-assisted instruction may be used within a universal lesson design, but they were not employed in this study, which focused on ASD in music education. Skills learned in one context may not transfer easily to another. It is difficult to know whether the full transfer of musical skill acquisition occurs into long-term memory. At the same time, repetition may support musical skill development; the study, by design, limits exploration of new musical material to assess the effectiveness of the interventions. Participants may repeatedly practice a preferred section rather than progressing through the assigned content, which can affect overall performance outcomes. Correct application of the computer-assisted instruction system may aid in identifying individual pitch issues. However, when the computer-assisted instruction system is not used correctly, the individual participant (student) may not benefit fully, as errors may not be identified or corrected for future performances. It is important to utilize the recording, fingering, and sound features to achieve optimal musical outcomes. For this reason, music educators still need to monitor, adjust, and address musical performance issues

as they arise, as participants do not comprehend or acknowledge them, assisting in musical development.

The observer and researcher serve as the study's primary data collectors and procedural facilitators. The dual role may influence the interpretation of student behavior, engagement levels, and performance outcomes. The researcher declares no potential conflicts of interest regarding the research and authorship.

Recommendations for Future Study

Several recommendations for future research concerning instrumental music education for students with Autism Spectrum Disorder (ASD) should be considered. The following recommendations may assist in understanding effective instructional practice, inclusive pedagogy, and long-term student outcomes for students with ASD within instrumental music classes. Future studies should include larger participant samples, spanning different ages, grade levels, musical backgrounds, and cognitive profiles. Since ASD presents a wide range of communication, sensory processing, social interaction, and learning styles, larger sample sizes would improve the generalizability of the findings and help determine which strategies are most effective for specific learner profiles in music education.

Instead of relying solely on a single-case examination of elicited instruction using computer-assisted instruction and video modeling, multiple-subject or comparative study designs should be considered. With a larger sample size, comparison groups, control groups, and alternating-intervention designs could provide stronger evidence on the effectiveness of specific interventions, such as technology-assisted learning, peer modeling, or traditional classroom approaches, in music education.

Future research should investigate the long-term effects of music interventions on music literacy in relation to national and state music standards. Longitudinal data may provide a clearer understanding of musical development over time. In addition to skill retention, transfer of learning, individual musical independence, continued musical engagement, and sustained school ensemble participation, the evolving needs of the ASD student could be examined. Additional studies exploring the effectiveness of technology-based instructional tools in music education should continue. These platforms could be used in research to compare and contrast individual learning needs across rhythm accuracy, pitch development, self-regulation, motivation, and independent practice for students with ASD. Technology platforms should be examined in light of their evidence-based intervention approaches, which involve task analysis, positive reinforcement, visual supports, modeling, structured routines, and self-monitoring, to determine whether they can be employed and adapted to meet the specific needs of instrumental instruction in music education.

Lastly, future research should examine inclusive ensemble settings. Investigations in instrumental music settings could identify meaningful strategies to integrate ASD students with their peers fully. Topics could include rehearsal modifications, social integration, peer mentoring, sensory accommodations, and seating arrangements. The literature review shows that teachers' perceptions of ASD students have improved over the last couple of decades. Future investigations should document teachers' perceptions of teaching ASD students, as well as students' and families' viewpoints. Understanding teachers' influence on ASD students, along with students' preferences, motivation, perceptions, and backgrounds, may yield valuable insights beyond what typical data alone reveal.

Summary

The findings of this study demonstrate that computer-assisted instruction and zygonic theory are supported by evidence that facilitates repeated, feedback-driven engagement with musical patterns. Participants' persistence, willingness to reattempt tasks, and positive response to errors suggest that learning occurred through iterative recognition and refinement of relationships through imitation and variation. However, the study cannot rule out that some gains may reflect comfort established by structured feedback loops rather than pure musical growth. The observed learning outcomes may reflect detail-oriented processing rather than comprehensive musical understanding. Nevertheless, the computer-assisted intervention appears to generally promote both musical skill acquisition and learner independence for most participants in this small case study. Additionally, the computer-assisted instruction system may amplify strengths associated with weak central coherence, improving musical accuracy through repetition and motivational persistence. Computer-assisted instruction may reallocate behavioral functions: escape and attention-seeking behaviors may decrease, while automatic reinforcement and tangible motivation increase, even though these changes were not directly observed due to the small sample size. Nevertheless, the emergence of intrinsic, game-like persistence as a motivator for individual improvement when using the computer-assisted learning system was observed. Participants view errors as part of their musical journey or progression, a meaningful shift in how students experience musical learning that encourages persistence and positive responses to errors through immediate feedback. Moreover, it is possible, in some cases, that musical outcome may be represented through processing issues associated with ASD, and not because of a lack of ability. Additionally, the study demonstrates that computer-assisted instruction improves instrumental music outcomes of students with ASD. Analysis of the results

shows that technology-based learning environments promote independent task engagement while supporting the acquisition of musical skills in rhythm, pitch, tempo, and accuracy. The findings show improvements in musical accuracy and performance consistency through sustained attention that may influence rehearsals for broader impact. The study further demonstrated that individualized and technology-supported instructional practice may remove barriers while supporting positive educational outcomes for instrumental musicians with ASD.

Appendix A: Thesis Proposal Defense Approval Letter

Doctor of Music Education

Doctoral Thesis Proposal Decision

The Committee Chair and Reader have rendered the following decision

Concerning the proposal status for

Ian Lee Mitchell

on the research topic titled

Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education

as submitted on October 12, 2025

X **Full Approval to proceed with no proposal revisions.**

The student may fully engage in the research and writing process in accordance with the established timeline. Upon full approval, the student may apply for IRB approval, if applicable (see STEP 4 concerning the IRB approval process).

_____ **Provisional Approval to proceed with proposal pending cited revisions.**
This is the most common decision. The student must resubmit the proposal with cited revisions according to the established timeline. The Advisor will indicate the committee's status on your response to the required revisions. The student may NOT apply for IRB approval until full approval is granted.

_____ **Redirection of Proposal**
The student is being redirected to develop a new proposal because minor revisions will not meet the research project's expectations. The student may NOT apply for IRB approval.

Dr. Lori J. Danielson	[redacted]	October 13, 2025
Print Name of Chair	**Signature**	**Date**
Dr. Stanely N. Harris, II.	[redacted]	October 13, 2025
Print Name of Reader	**Signature**	**Date**

Appendix B: IRB Final Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

March 4, 2026

Ian Mitchell
Lori Danielson

Re: IRB Approval - IRB-FY25-26-748 Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education

Dear Ian Mitchell, Lori Danielson,

Your study has been approved by the Liberty University Institutional Review Board (IRB) under the expedited review category (45 CFR 46.110) for the following reason(s):
7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

Modifications: Most changes to your study must be submitted in Cayuse as a modification and receive IRB approval **before** you implement them. See our IRB Process Timeline for guidance.

Access your approval letter and documents:

1. Log in to your Cayuse dashboard and click your study number in the My Studies card.
2. On the Study Details page, click the Submission bar.
3. Under Submission Type, select Initial. Then, click the Letters tab for your approval letter.
4. Find your stamped consent form(s) and final study documents under the Attachments tab. Use the stamped consent form(s) for participant consent. If using electronic consent, provide the stamped consent form(s) contents without alteration.

You may begin your research using the data-safeguarding methods described in your application. If you have questions, please email irb@liberty.edu.

Sincerely,

G. Michele Baker, PhD, CIP
Administrative Chair
Research Ethics Office

Appendix C: Site Request Letter

Appropriate Modified Instruction Benefits

Autistic Spectrum Disorder

Students in Instrumental Music Education

Dear Dr [redacted],

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. The title of my project is Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education, and the purpose of my research is to determine intervention strategies for students with ASD by investigating established, evidence-based general education interventions and applying them to instrumental music instruction to develop a body of empirical data that supports desired music education outcomes.

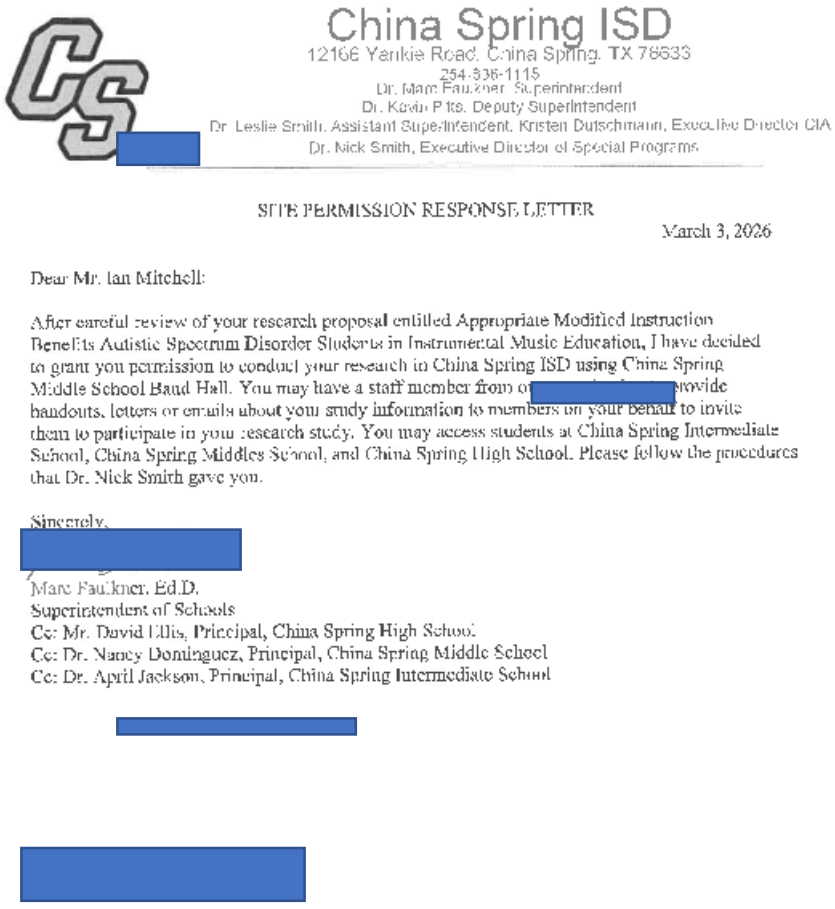
I am writing to request your permission to conduct research at [redacted]. I am requesting that parents of eligible students and eligible 18+19 year olds be sent a recruitment email describing my research.

Participants will be asked to complete a total of five weekly 30 minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling and receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed. Parents and students will be presented with consent information prior to participating. Taking part in this study is completely voluntary, and participants are welcome to discontinue participation at any time.

Thank you for considering my request. If you choose to grant permission, please provide a signed statement of official school district letterhead indicating your approval or respond by email to [redacted] IA emailed permission is acceptable if the time-and-date are stamped and have the appropriate email signature which retained and visible. A permission letter document is attached for your convenience.

Sincerely,
Ian Mitchell
[redacted]

Appendix D: Site Response Letter



China Spring ISD
12166 Yankie Road, China Spring, TX 76633
254-836-1115
Dr. Marc Faulkner, Superintendent
Dr. Kevin Pitts, Deputy Superintendent
Dr. Leslie Smith, Assistant Superintendent, Kristen Dutschmann, Executive Director CIA
Dr. Nick Smith, Executive Director of Special Programs

SITE PERMISSION RESPONSE LETTER

March 3, 2026

Dear Mr. Ian Mitchell:

After careful review of your research proposal entitled Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education, I have decided to grant you permission to conduct your research in China Spring ISD using China Spring Middle School Band Hall. You may have a staff member from o[redacted]rovide handouts, letters or emails about your study information to members on your behalf to invite them to participate in your research study. You may access students at China Spring Intermediate School, China Spring Middles School, and China Spring High School. Please follow the procedures that Dr. Nick Smith gave you.

Sincerely,

[redacted]

Marc Faulkner, Ed.D.
Superintendent of Schools
Cc: Mr. David Ellis, Principal, China Spring High School
Cc: Dr. Nancy Dominguez, Principal, China Spring Middle School
Cc: Dr. April Jackson, Principal, China Spring Intermediate School

[redacted]

[redacted]

Appendix E: Written Recruitment Letter of Parent of Potential Participants (Under 17)

Dear Parent of Potential Participant,

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. I am writing to invite your child to join my study. The purpose of my research is to determine intervention strategies for students with ASD by investigating established, evidence-based general education interventions and applying them to instrumental music instruction to develop empirical data that support desired music education outcomes.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) play and receive instrumental music instruction at school
j) be between 10-17

Your child will be excluded from this study if they previously viewed or performed, through instrumental playing, one of the five selections in the learning management system using the computer-assisted instruction. Your child will also be excluded from this study if they have previously viewed or studied the video modeling of the music selections that correspond to the learning management system.

Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

In order for your child to participate, please read, sign, and return the attached appropriate parent consent document to your child's school. Your child will also need to sign an assent form. Children aged 13-17 can sign the same consent form as parents. Children aged 10-13 will need to sign a separate assent form. After you have returned the consent document, I will work with you to schedule your child's study sessions.

A consent document is attached to this email. The consent document contains additional information about my research. If you choose to allow your child to participate, you will need to sign the consent document and return it to me through your child's school.

You are welcome to contact me with any questions.

Appendix F: Verbal Recruitment of Parents of Potential Participants (Under 17)

Hello, parent of Potential Participant

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. The purpose of my research is to determine intervention strategies for students with ASD by investigating established, evidence-based general education interventions and applying them to instrumental music instruction to develop a body of empirical data that supports desired music education outcomes, and I would like to invite your child to join my study.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) be between 10-17
j) play and receive instrumental music instruction at school

Your child will be excluded from this study if they previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. Your child will also be excluded from this study if they have previously viewed or studied the video modeling of the music selections that correspond to the learning management system.

Does your child meet the criteria listed?

[“Yes” response:] Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

[“No” response:] Unfortunately, your child does not meet my participant criteria, so I am unable to include them in my study. Thank you for your time.

Would you allow your child to participate?

["Yes" response:] Great, could I get your email address and contact information so I can send you the consent form? To have your child participate, please read, sign, and return the attached parent consent form to me at [redacted] After you have returned the consent document, I will work with you to schedule your child's study sessions.

["No" response:] I understand. Thank you for your time.

A consent form will be emailed/Here is a consent form. The consent document contains additional information about my research. If you allow your child to participate, you will need to sign the consent form and return it to me at [redacted] Your child will also need to sign an assent form. Children aged 13-17 can sign the same consent form as parents. Children aged 10-13 will need to sign a separate assent form.

Thank you for your time. Do you have any questions?

Appendix G: Follow-Up Recruitment of Parents of Potential Participants (Under 17)

Dear parent of Potential Participant,

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. Two weeks ago, you received a letter inviting your child to participate in a research study. This follow-up letter is being sent to remind you to complete the attached survey and questionnaires to assess study eligibility, and to return them to Ian Mitchell by placing them in the provided envelope. The deadline for participation is _____.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) play and receive instrumental music instruction at school
j) be between 10-17

Your child will be excluded from this study if they previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. Your child will also be excluded from this study if they have previously viewed or studied the video modeling of the music selections that correspond to the learning management system.

Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

In order for your child to participate, please read, sign, and return the attached parent consent document to your child's school. Your child will also need to sign an assent form. Children aged 13-17 can sign the same consent form as parents. Children aged 10-13 will need to sign a

separate assent form. After you have returned the consent document, I will work with you to schedule your child's study sessions.

A consent document is attached to this email. The consent document contains additional information about my research. If you choose to allow your child to participate, you will need to sign the consent document and return it to me through your child's school.

You are welcome to contact me with any questions.

Sincerely,

Ian Mitchell

Appendix H: Written Recruitment Letter of Potential Participants (18-19)

Dear Potential Participant,

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. I am writing to invite you to join my study. The purpose of my research is to determine intervention strategies for students with ASD by investigating established, evidence-based general education interventions and applying them to instrumental music instruction to develop empirical data that support desired music education outcomes.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) play and receive instrumental music instruction at school
j) be 18 or 19 years old

You will be excluded from this study if you have previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. You will also be excluded from this study if you have previously viewed or studied the video modeling of the music selections, which corresponds with the learning management system.

Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

To participate, please read, sign, and return the attached consent document to your school. After you have returned the consent document, I will work with you to schedule your sessions.

A consent document is attached to this email. The consent document contains additional information about my research. If you choose to participate, you will need to sign the consent document and return it to me through your school.

You are welcome to contact me with any questions.

Sincerely,

Ian Mitchell

Appendix I: Verbal Recruitment Potential Participants (18-19)

Hello Potential Participant

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. The purpose of my research is to determine intervention strategies for students with ASD by investigating established, evidence-based general education interventions and applying them to instrumental music instruction to develop a body of empirical data that supports desired music education outcomes, and I would like to invite you to join my study.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) play and receive instrumental music instruction at school
j) be 18 or 19 years old

You will be excluded from this study if you have previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. You will also be excluded from this study if you have previously viewed or studied the video modeling of the music selections, which corresponds with the learning management system.

Do you meet the criteria listed?

[“Yes” response:] Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of each session, participants will be asked to complete a music perception survey. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

[“No” response:] Unfortunately, you do not meet my participant criteria, so I am unable to include you in my study. Thank you for your time.

Would you like to participate?

["Yes" response:] Great, could I get your email address and contact information so I can send you the consent form? To participate, please read, sign, and return the consent document to me at [redacted] After you have returned the consent document, I will work with you to schedule your sessions.

["No" response:] I understand. Thank you for your time.

A consent form will be emailed/Here is a consent form. The consent document contains additional information about my research. If you choose to participate, you will need to sign the consent form and return it to me at [redacted]

Thank you for your time. Do you have any questions?

Appendix J: Written Follow-Up Recruitment Letter of Potential Participants (18–19)

Dear Potential Participant,

As a doctoral candidate in the School of Music at Liberty University, I am conducting a study researching Appropriate Modified Instruction to better understand the phenomenon of Autism Spectrum Disorder (ASD) in Instrumental Music as part of the requirements for a Doctor of Music Education degree. Two weeks ago, you received a letter inviting your child to participate in a research study. This follow-up letter is being sent to remind you to complete the attached survey and questionnaires to assess study eligibility, and to return them to Ian Mitchell by placing them in the provided envelope. The deadline for participation is _____.

Participants must be:

a) enrolled in school
b) have disability based on eligibility requirements for ASD
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals
d) have no hearing or vision impairments that might impede instruction or interventions
e) have adequate visual discrimination to respond to stimuli, music notation, and visual cues
f) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling
g) have adequate motor skill ability and the skill to operate the computer software and video modeling independently
h) have a history of independent computer use
i) play and receive instrumental music instruction at school
j) be 18 or 19 years old

You will be excluded from this study if you have previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. You will also be excluded from this study if you have previously viewed or studied the video modeling of the music selections, which corresponds with the learning management system.

Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. Participants will also complete a survey at the conclusion of the session. Names and other identifying information will be requested as part of this study, but participant identities will not be disclosed.

To participate, please read, sign, and return the attached consent document to your school. After you have returned the consent document, I will work with you to schedule your sessions.

A consent document is attached to this email. The consent document contains additional information about my research. If you choose to participate, you will need to sign the consent document and return it to me through your school.

You are welcome to contact me with any questions.

Sincerely,

Ian Mitchell

Appendix K: Child Assent Form

Child Assent Form (10–13)
Child Assent to Participate in a Research Study

What is the name of the study, and who is doing the study?
The name of the study is "Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education," and the person conducting the study is Ian Mitchell.

Why is Ian Mitchell doing this study?

Ian Mitchell wants to find out if teaching methods that work in regular classrooms can also work for students with Autism Spectrum Disorder (ASD) in band and orchestra classes. You may get better at playing your instrument; we cannot promise that the study will help, but what we may learn is how to help other students learn music in the future.

Why am I being asked to be in this study?

You are being asked to be in this study because you attend school, play an instrument, and have Autism Spectrum Disorder. To be in the study, you also have to be able to use a computer, hear sounds, see and read music, and have permission from your parents to be videotaped. You have a specific learning plan and can use a computer independently. You learn to play an instrument and play your instrument at school. You have not already seen or performed instrumentally one of the five selections used in the computer system. You have not already seen or studied the videos of the music selections.

If I decide to be in the study, what will happen, and how long will it take?

If you choose to be in the study, you will practice and study a piece of music for five minutes while being observed, which is called the “probe session.” After that, you will record yourself playing the music (2 minutes). Then you will use a computer program and watch videos for about 10 minutes to help you improve. After that, you will make another recording (2 minutes). At the end of the second recording, you will fill out a short survey (10 minutes). There will be five 30-minute sessions over five weeks. The study will keep your identity private and will not be shared with others. During the recordings, it is okay to feel nervous or frustrated; do your best. Only Ian Mitchell and other adults helping in the study will see and hear the recordings. These videos will be safely stored, and your name will not be on any reports.

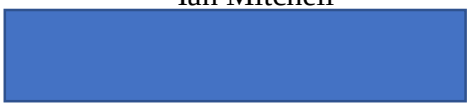
Do I have to be in this study?
No, you do not have to be in this study. If you want to be in this study, then tell the researcher. If you do not want to, it is OK to say no. The researcher will not be angry. You can say yes now and change your mind later. It is up to you.

What if I have a question?
You can ask questions any time. You can ask now. You can ask later. You can talk to the researcher if you do not understand something. Please ask the researcher to explain it to you again.

Signing your name below means that you want to be in the study.

Signature of Child/Witness Date

Ian Mitchell



Lori Danielson



Liberty University Institutional Review Board
1971 University Blvd, Green Hall 2845, Lynchburg, VA 24515
irb@liberty.edu

Appendix L: IRB – Consent Forms for 18 and over

Consent (18 & 19-year-olds)

Title of the Project: Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education
Principal Investigator: Ian Mitchell, Doctoral Candidate, School of Music, Liberty University

Key Information about the Research Study

You are invited to participate in a research study. To participate, you must be

a) enrolled in school,
b) have a disability based on eligibility requirements for ASD,
c) have existing interventions, accommodations, or modifications identified for instruction in IEP goals,
d) be 18 or 19 years old,
e) no hearing or vision impairments that might impede instruction or interventions,
(f) adequate visual discrimination to respond to stimuli, music notation, and visual cues,
g) adequate auditory discrimination) ability to respond to stimuli in the computer-assisted instruction and video modeling,
h) adequate motor skill ability and skill to operate the computer software and video modeling independently,
I) have a history of independent computer use
I) play and receive instrumental music instruction at school.

You will be excluded from this study if you have previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. You will also be excluded from this study if you have previously viewed or studied the video modeling of the music selections, which corresponds with the learning management system.

Things you should know:

- The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.
- Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of this intervention, participants will be asked to complete a music perception survey.

- Participants should not expect to receive a direct benefit from participating in this research.
- Taking part in this research project is voluntary. You do not have to participate, and you can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to take part in this research project.

What is the study about, and why is it being done?

The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.

What will participants be asked to do in this study?

If you agree to be in this study, I will ask you to do the following:

Complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of this session, participants will be asked to complete a music perception survey.

How could participants or others benefit from this study?

Participants should not expect to receive a direct benefit from participating in this research. The direct benefits participants may receive from taking part in this study include improved instrument playing and the application of musical concepts through video modeling and computer-assisted instruction.

Benefits to society include increased access to inclusive education, such as music education through interventions using video modeling and computer-assisted instruction, which help individuals with autism spectrum disorder develop music skills and implement visual, predictable, and repeatable formats.

What risks might participants experience from being in this study?

The expected risks from participating in this study are minimal, meaning they are equal to the risks you would encounter in everyday life. This study will involve the use of Artificial Intelligence (AI) tools to assist with data analysis/data interpretation/the generation of research-related content. While efforts will be made to ensure data accuracy and confidentiality, AI tools

may pose minimal risks of misinterpretation and compromise participant privacy. Any AI-assisted processes will follow strict ethical guidelines, and your child's data will not be used to train or refine AI systems. AI within the learning management system for computer-assisted instruction is in use. The learning management system collects and analyzes participants' musical performances; however, it is confidential and password-protected.

I am a mandatory reporter. During this study, if I receive information about child abuse, child neglect, elder abuse, or intent to harm self or others, I will be required to report it to the appropriate authorities.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher and the researcher's faculty supervisor will have access to the records.

- Participant responses will be kept confidential by replacing names with pseudonyms.
- Study sessions will be conducted in a location where others will not easily overhear the conversation.
- Data collected from you may be used in future research studies and/or shared with other researchers. If data collected from you is reused or shared, any information that could identify you, if applicable, will be removed beforehand.
- Digital data will be stored on a password-locked computer, and hard copy data will be stored in a locked cabinet in the band office. The researcher and his faculty supervisor will have access to the data. After three years, all electronic records will be deleted and/or all hardcopy records will be shredded.
- Recordings will be stored on a password-locked computer. The researcher and his faculty supervisor will have access to the recordings. After three years, the recordings will be deleted.
- The data from this study will be collected and analyzed using a learning management system that may use AI. Participants will use computer-assisted instruction in the learning management system during the intervention session to receive feedback on their performance. At the end of the intervention session, participants will submit a performance, which will be recorded, collected, and analyzed by the learning management system. Data will be stored on a password-locked computer. The researcher and faculty supervisor will have access to the data. After three years, the data will be deleted.

Is the researcher in a position of authority over participants, or does the researcher have a financial conflict of interest?

The researcher serves as a band teacher at [redacted]. This disclosure is intended to help you decide whether this relationship will affect your willingness to participate. No action will be taken against an individual based on their decision of whether or not to participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University or [redacted] If you decide to participate, you are free not to answer any question or withdraw at any time without affecting those relationships.

What should be done if a participant wishes to withdraw from the study?

If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the following paragraph. Should you choose to withdraw from the study, data collected will be destroyed immediately and will not be included in this study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Ian Mitchell. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] or [redacted]. You may also contact the researcher's faculty sponsor, Dr. Lori Danielson, at [redacted]

Whom do you contact if you have questions about rights as a research participant?

If you have any questions or concerns about this study and would like to speak with someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted ethically as defined and required by federal regulations. The topics covered, and viewpoints expressed or alluded to by student and faculty researchers, are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to participate in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy of the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to audio-record and video-record me as part of my participation in this study.

_____

Printed Subject Name

_____

Signature & Date

Appendix M: Parent Consent Form

Parental Consent (10-13 years old)

Title of the Project: Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education
Principal Investigator: Ian Mitchell, Doctoral Candidate, School of Music, Liberty University

Key Information about the Research Study

Your child is invited to participate in a research study. To participate, they must be

a.) enrolled in school,
b.) have disability based on eligibility requirements for ASD,
c.) have existing interventions, accommodations, or modifications identified for instruction in IEP goals,
d.) have no hearing or vision impairments that might impede instruction or interventions,
e.) have adequate visual discrimination to respond to stimuli, music notation, and visual cues,
f.) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling,
g.) have adequate motor skill ability and skill to operate the computer software and video modeling independently,
h.) have a history of independent computer use,
i.) Play and receive instrumental music instruction at school, and
j.) be between 10 and 13

Your child will be excluded from this study if they previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. Your child will also be excluded from this study if they have previously viewed or studied the video modeling of the music selections that correspond to the learning management system.

Things you should know:

- The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.
- Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a

follow-up performance for comparison. At the conclusion of this intervention, participants will be asked to complete a music perception survey.

- Participants should not expect to receive a direct benefit from participating in this research.
- Taking part in this research project is voluntary. You do not have to allow your child to participate, your child does not have to participate, and they can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to allow your child to take part in this research project.

What is the study about, and why are we doing it?

The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.

What will participants be asked to do in this study?

If you agree to allow your child to be in this study, I will ask them to do the following:

Complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of this intervention, participants will be asked to complete a music perception survey.

How could participants or others benefit from this study?

Participants should not expect to receive a direct benefit from participating in this research. The direct benefits participants may receive from taking part in this study include improved instrument playing and the application of musical concepts through video modeling and computer-assisted instruction.

Benefits to society include increased access to inclusive education, such as music education through interventions using video modeling and computer-assisted instruction, which help individuals with autism spectrum disorder develop music skills and implement visual, predictable, and repeatable formats.

What risks might participants experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks your child would encounter in everyday life. This study will involve the use of Artificial Intelligence (AI) tools to assist with data analysis/data interpretation/the generation of research-related content. While efforts will be made to ensure data accuracy and confidentiality, AI tools may pose minimal risks of misinterpretation and compromise participant privacy. Any AI-assisted processes will follow strict ethical guidelines, and your child's data will not be used to train or refine AI systems. AI within the learning management system for computer-assisted instruction is in use. The learning management system collects and analyzes participants' musical performances; however, it is confidential and password-protected.

I am a mandatory reporter. During this study, if I receive information about child abuse, child neglect, elder abuse, or intent to harm self or others, I will be required to report it to the appropriate authorities.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher and the researcher's faculty supervisor will have access to the records.

- Participant responses will be kept confidential by replacing names with pseudonyms.
- Study sessions will be conducted in a location where others will not easily overhear the conversation.
- Data collected from your child may be used in future research studies and/or shared with other researchers. If data collected from your child is reused or shared, any information that could identify your child, if applicable, will be removed beforehand.
- Digital data will be stored on a password-locked computer, and hard copy data will be stored in a locked cabinet in the band office. The researcher and his faculty supervisor will have access to the data. After three years, all electronic records will be deleted and/or all hardcopy records will be shredded.
- Recordings will be stored on a password-locked computer. The researcher and his faculty supervisor will have access to the recordings. After three years, the recordings will be deleted.
- The data from this study will be collected and analyzed using a learning management system that may use AI. Participants will use computer-assisted instruction in the learning management system during the intervention session to receive feedback on their performance. At the end of the intervention session, participants will submit a performance, which will be recorded, collected, and analyzed by the learning management system. Data will be stored on a password-locked computer. The researcher and faculty supervisor will have access to the data. After three years, the data will be deleted.

Is the researcher in a position of authority over participants, or does the researcher have a financial conflict of interest?

The researcher serves as a band teacher at [redacted]. This disclosure is intended to help you decide whether this relationship will affect your willingness to allow your child to participate. No action will be taken against an individual based on their decision to allow their child to participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to allow your child to participate will not affect you or their current or future relations with Liberty University or [redacted]. If you decide to allow your child to participate, they are free not to answer any questions or to withdraw at any time without affecting those relationships.

What should be done if a participant wishes to withdraw from the study?

If you choose to withdraw your child from the study, please contact the researcher at the email address/phone number included in the following paragraph. Should you choose to withdraw your child from the study, data collected from or about your child will be destroyed immediately and will not be included in this study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Ian Mitchell. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] or [redacted] You may also contact the researcher's faculty sponsor, Dr. Lori Danielson, at [redacted]

Whom do you contact if you have questions about rights as a research participant?

If you have any questions or concerns about this study and would like to speak with someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted ethically as defined and required by federal regulations. The topics covered, and viewpoints expressed or alluded to by student and faculty researchers, are those of

the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to allow your child to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy of the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to my child's participation in the study.

☐ The researcher has my permission to audio- and video-record my student as part of my student's participation in this study.

_____

Printed Child's/Student's Name

_____

Parent/Guardian's Signature Date

Appendix N: Parent Consent and Child Assent Form

Combined Parental Consent and Child Assent (13-17 years old)

Title of the Project: Appropriate Modified Instruction Benefits Autistic Spectrum Disorder Students in Instrumental Music Education
Principal Investigator: Ian Mitchell, Doctoral Candidate, School of Music, Liberty University

Key Information about the Research Study

Your child is invited to participate in a research study. To participate, they must be

a.) enrolled in school,
b.) have a disability based on eligibility requirements for ASD,
c.) have existing interventions, accommodations, or modifications identified for instruction in IEP goals,
d.) have no hearing or vision impairments that might impede instruction or interventions,
e.) have adequate visual discrimination to respond to stimuli, music notation, and visual cues,
f.) have adequate auditory discrimination to respond to stimuli in the computer-assisted instruction and video modeling,
g.) Have adequate motor skill ability and the skill to operate the computer software and video modeling independently,
h.) have a history of independent computer use
i.) play and receive instrumental music instruction at school, and
j.) be between 13 and 17.

Your child will be excluded from this study if they previously viewed or performed through instrumental playing one of the five selections in the learning management system using the computer-assisted instruction. Your child will also be excluded from this study if they have previously viewed or studied the video modeling of the music selections that correspond to the learning management system.

Things you should know:

- The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.
- Participants will be asked to complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of this intervention, participants will be asked to complete a music perception survey.
- Participants should not expect to receive a direct benefit from participating in this research.
- Taking part in this research project is voluntary. You do not have to allow your child to participate, your child does not have to participate, and they can stop at any time.

Please take time to read this entire form and ask questions before deciding whether to allow your child to take part in this research project.

What is the study about, and why are we doing it?

The purpose of the study is to determine intervention strategies for students with ASD participating in instrumental music classes by investigating established, evidence-based interventions from general education research and applying them to instrumental music instruction.

What will participants be asked to do in this study?

If you agree to allow your child to be in this study, I will ask them to do the following:

> Complete a total of five weekly 30-minute study sessions. The sessions will consist of playing a musical selection, recording the performance, observing video modeling, receiving computer-assisted instruction, and recording a follow-up performance for comparison. At the conclusion of this intervention, participants will be asked to complete a music perception survey.

How could participants or others benefit from this study?

Participants should not expect to receive a direct benefit from participating in this research. The direct benefits participants may receive from taking part in this study include improved instrument playing and the application of musical concepts through video modeling and computer-assisted instruction.

Benefits to society include increased access to inclusive education, such as music education through interventions using video modeling and computer-assisted instruction, which help individuals with autism spectrum disorder develop music skills and implement visual, predictable, and repeatable formats.

What risks might participants experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks your child would encounter in everyday life. This study will involve the use of Artificial Intelligence (AI) tools to assist with data analysis/data interpretation/the generation of research-related content. While efforts will be made to ensure data accuracy and confidentiality, AI tools may pose minimal risks to data accuracy and participant privacy. Any AI-assisted processes will follow strict ethical guidelines, and your child's data will not be used to train or refine AI systems. AI within the learning management system for computer-assisted instruction is in use. The learning management system collects and analyzes participants' musical performances; however, it is confidential and password-protected.

I am a mandatory reporter. During this study, if I receive information about child abuse, child neglect, elder abuse, or intent to harm self or others, I will be required to report it to the appropriate authorities.

How will personal information be protected?

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher and the researcher's faculty supervisor will have access to the records.

- Participant responses will be kept confidential by replacing names with pseudonyms.
- Study sessions will be conducted in a location where others will not easily overhear the conversation.
- Data collected from your child may be used in future research studies and/or shared with other researchers. If data collected from your child is reused or shared, any information that could identify your child, if applicable, will be removed beforehand.
- Digital data will be stored on a password-locked computer, and hard copy data will be stored in a locked cabinet in the band office. The researcher and his faculty supervisor will have access to the data. After three years, all electronic records will be deleted and/or all hardcopy records will be shredded.
- Recordings will be stored on a password-locked computer. The researcher and his faculty supervisor will have access to the recordings. After three years, the recordings will be deleted/erased.
- The data from this study will be collected and analyzed using a learning management system that may use AI. Participants will use computer-assisted instruction in the learning management system during the intervention session to receive feedback on their performance. At the end of the intervention session, participants will submit a performance, which will be recorded, collected, and analyzed by the learning management system. Data will be stored on a password-locked computer. The researcher and faculty supervisor will have access to the data. After three years, the data will be deleted.

Is the researcher in a position of authority over participants, or does the researcher have a financial conflict of interest?

The researcher serves as a band teacher at [redacted] This disclosure is intended to help you decide whether this relationship will affect your willingness to allow your child to participate. No action will be taken against an individual based on their decision to allow their child to participate in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to allow your child to participate will not affect you or their current or future relations with Liberty University [redacted] ISD. If you decide to allow your child to participate, they are free not to answer any questions or to withdraw at any time without affecting those relationships.

What should be done if a participant wishes to withdraw from the study?

If you choose to withdraw your child from the study, please contact the researcher at the email address/phone number included in the following paragraph. Should you choose to withdraw your child from the study, data collected from or about your child will be destroyed immediately and will not be included in this study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Ian Mitchell. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact him at [redacted] You may also contact the researcher's faculty sponsor, Dr. Lori Danielson, at [redacted]

Whom do you contact if you have questions about rights as a research participant?

If you have any questions or concerns about this study and would like to speak with someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted ethically as defined and required by federal regulations. The topics covered, and viewpoints expressed or alluded to by student and faculty researchers, are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to allow your child to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy of the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to my child's participation in the study.

☐ The researcher has my permission to audio- and video-record my student as part of my student's participation in this study.

_____
Printed Child's/Student's Name

_____
Parent/Guardian's Signature Date

_____
Minor's Signature Date

Appendix O: Participant Music Perception Survey

Participant Music Perception Survey

After the Probe Session (First Five Minutes)

Rate your performance during the probe session? Circle the appropriate rating for each section.

Tone	**1**	**2**	**3**	**4**	**5**
Performs with developmentally appropriate tone.	Consistently	Usually	Sometimes	Infrequently	Rarely
Musical sections are played with appropriate intonation.	Consistently	Usually	Sometimes	Infrequently	Rarely
Technique	**1**	**2**	**3**	**4**	**5**
Students perform the correct notes.	Consistently	Usually	Sometimes	Infrequently	Rarely
Students perform accurate rhythms.	Consistently	Usually	Sometimes	Infrequently	Rarely
Students perform with precise vertical alignment and consistent pulse.	Consistently	Usually	Sometimes	Infrequently	Rarely
Students perform with correct, suitable, and consistent articulations.	Consistently	Usually	Sometimes	Infrequently	Rarely
Music Understanding	**1**	**2**	**3**	**4**	**5**
Students perform all musical markings.	Consistently	Usually	Sometimes	Infrequently	Rarely
Dynamic contrast is obvious and effective.	Consistently	Usually	Sometimes	Infrequently	Rarely
The student performs the section with the appropriate tempo.	Consistently	Usually	Sometimes	Infrequently	Rarely

After the Intervention Session (Ten Minutes)

Did the Video Modeling and Computer-Assisted Learning Intervention help you play better? Circle the appropriate response.

Tone	**Video Modeling**		**Computer-Assisted Learning**	
Performs with developmentally appropriate tone.	Yes	No	Yes	No
Musical sections are played with appropriate intonation.	Yes	No	Yes	No
Technique				
Students perform the correct notes.	Yes	No	Yes	No
Students perform accurate rhythms.	Yes	No	Yes	No
Students perform with precise vertical alignment and consistent pulse.	Yes	No	Yes	No
Students perform with precise vertical alignment and consistent pulse.	Yes	No	Yes	No
Students perform with correct, suitable, and consistent articulations.	Yes	No	Yes	No
Musical Understanding				
Students perform all musical markings.	Yes	No	Yes	No
Dynamic contrast is obvious and effective.	Yes	No	Yes	No
Student performs the section with appropriate tempo.	Yes	No	Yes	No

Appendix P: First Session Results/ Visual Aids

Table P.1. First Session of Music Ability Scores

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A, B, D, J		-4
30-39	Pre-Emergent	C		-1
40-49	Limited	E, I, K	B	-2
50-59	Emerging			
60–69	Beginning		C	+1
70-79	Developing	G	A	0
80-89	Proficient	H	E, I	+1
90-100	Exemplary		D, G, H, J, K	+5

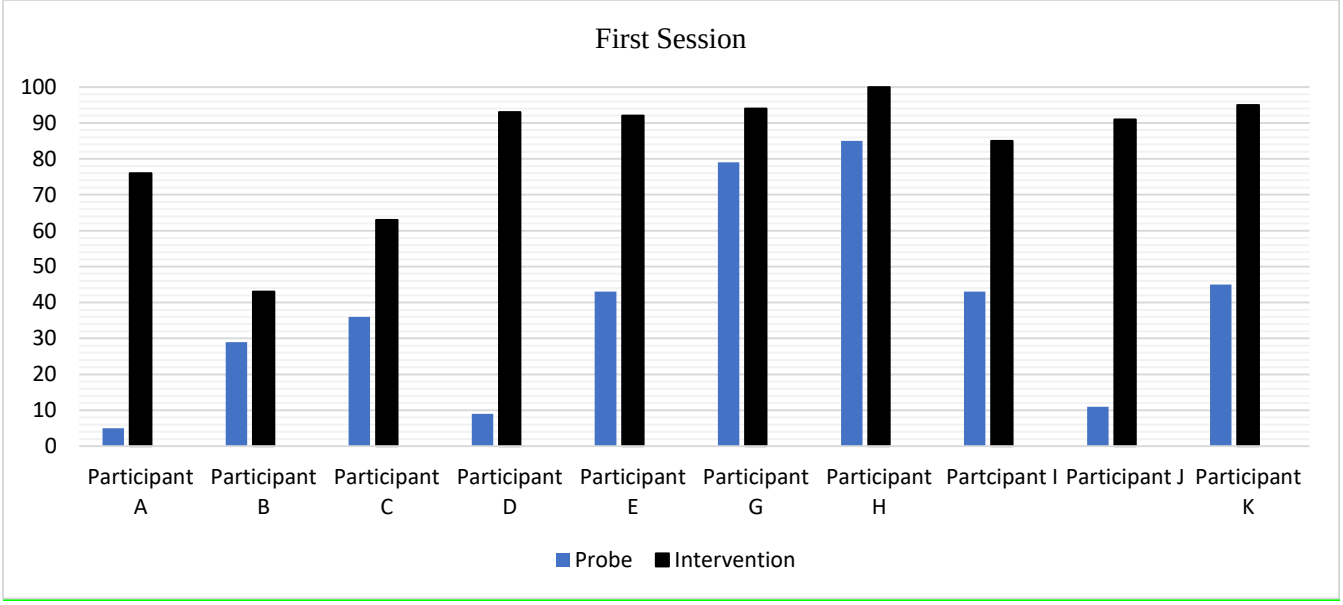


Figure P.1 First Session Detailed Scoring for Probe and Intervention Period

Table P.2 First Session Detailed Scoring for Probe and Intervention Period

Participant	A	B	C	D	E	G	H	I	J	K
Probe	5	29	36	9	43	79	85	43	11	45
Intervention	76	43	63	93	92	94	100	85	91	95
Growth	71	14	27	84	49	15	15	42	80	50

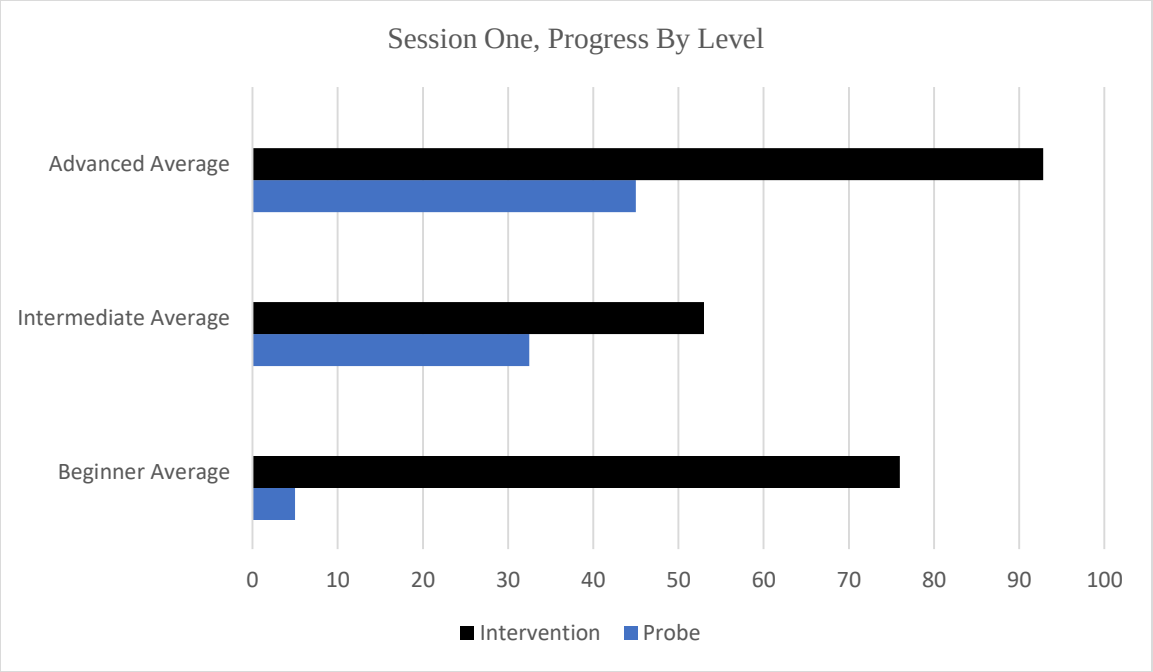


Figure P.2 First Session, Progress By Level (Averaged)

Table P.3 First Session, Progess By Level (Averaged

	Beginning	Intermediate	Advanced
Probe	5	32.5	45
Intervention	76	53	92.8
Growth	71	20.5	47.8

Table P.4 Codes for First Session-Probe Period

Probe Period –First Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IC, TF, IP, IA, IN	TA, PE	TEFSR, EBSTL
	Cognition	PC, H, SC, RD	B, S	
B	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, IP, TF, RE, CN, IA	TA, PE	TEFSR, EBSTL
	Cognition	H, C, PD, ER	B, S	
C	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, TF, IP, IA, ST	TA, PE	TEFSR, EBSTL
	Cognition	H, SC, ER	B, S	
D	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, TF, RE, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, ER	S	
E	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	
G	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IC, CN, RE, TF, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
H	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
I	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
J	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
K	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	

Table P.5 Codes for First Session-Intervention Period

Intervention Period- First Session				
Participant		**Open Codes**	**Axial Codes**	**Selective Codes**
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI,
	Intervention Specific	GP, EC, SS, ME	SS	TEFSR, EBSTL
	Independence	RIC, CP, ES	DOI	
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	RIC, II, ES, CP	DOI	
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	II, CP, ES	DOI	
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtI	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtL	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
G	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC, IP	SS, MtI	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	

Table P.6 First Session Participant Music Perception Survey

Probe Session (First Five Minutes)
Participant Performance Perception

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with developmentally appropriate tone.		I	A, B, C, D, E, H	G, K	J
Musical sections are played with appropriate intonation.	I	A	B, D, E, G, H	C	J, K
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.	K	A, E, D, I, J	B, C, G, H		
Students perform accurate rhythms.		E, I	A C, G, H, K	B	D, J
Students perform with precise vertical alignment and consistent pulse.		E	G, I	A, B, C, H	D, J, K
Students perform with correct, suitable, and consistent articulations.		C	A, D, E, G, H, I		B, J, K
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	A	G, I	C, D, E, H, K	B	J
Dynamic contrast is obvious and effective.	G, K	A	D, I	B, E, H	C, J
The student performs the section with the appropriate tempo.		E, H,I	A, B	G	C, D, J, K

After the Intervention Session (Ten Minutes)
Participant Performance Perception

Tone	Video Modeling		Computer-Asst. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	I, G, K	C, D, E, H, J	A, B, C, D, E, G, H, I, J	K
Musical sections are played with appropriate intonation.	I, G, K	C, D, E, H, J	A, C, D, E, G, H, I, J	B, K
Technique	**Yes**	**No**	**Yes**	**No**
Students perform the correct notes.	I, D, G, J, K	C, D, E, H	A, C, D, E, G, H, J, K	B, I
Students perform accurate rhythms.	I, D, G, J, K	C, E, H	A, C, D, E, G, H, I, K	B, J
Students perform with precise vertical alignment and consistent pulse.	I, D, G, J, K	C, E, H	A, C, D, E, G, H, I, K	B, J
Students perform with correct, suitable, and consistent articulations.	I, D, G, J, K	C, E, H	A, C, G, H, K	B, D, E, I, J
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	I, J, G, K	C, D, E, H	A, D, E, G, H, I, J, K	B, C
Dynamic contrast is obvious and effective.	I, D, G, J, K	C, E, H	A, C, D, E, G, H, J	B, I, K
Student performs the section with appropriate tempo.	D, G, J, K	C, E, H, I	A, B, C, D, E, G, H, I, J, K	

Appendix Q: Second Session Results/ Visual Aids

Table Q.1. Second Session of Music Ability Scores

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A		-1
30-39	Pre-Emergent	B		-1
40-49	Limited			
50-59	Emerging		A	+1
60–69	Beginning	C	B	0
70-79	Developing	J	C	0
80-89	Proficient			
90-100	Exemplary	D, E, G, H, I, K	D, E, G, H, I, J,K	+1

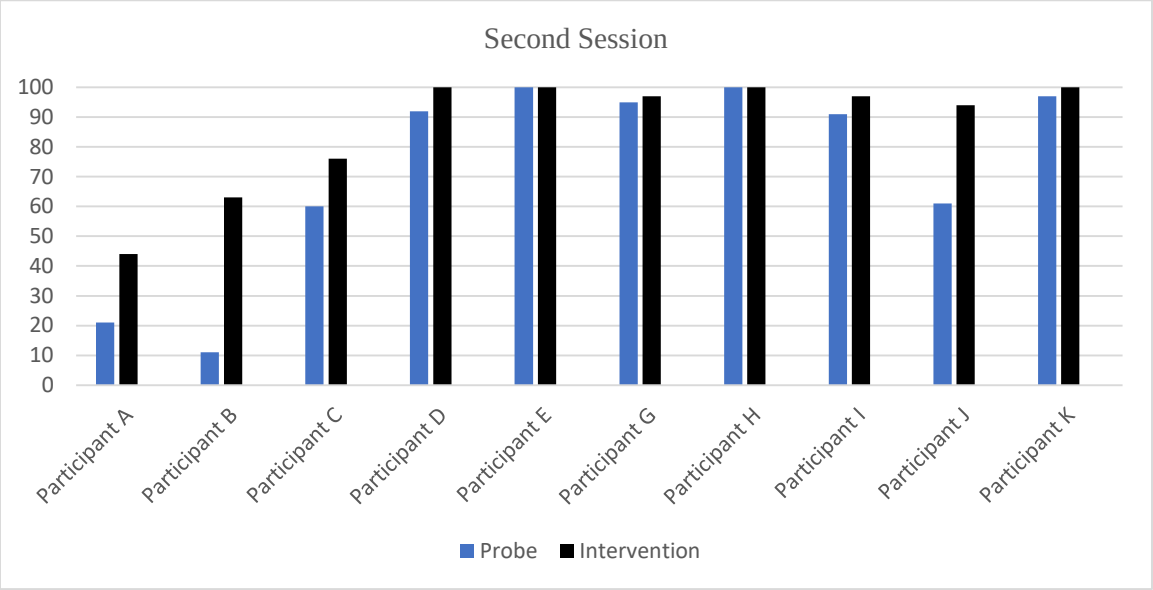


Figure Q.1. Second Session Detailed Scoring for Probe and Intervention Period

Table Q.2. Second Session Detailed Scoring for Probe and Intervention Period

Participant	A	B	C	D	E	G	H	I	J	K
Probe	21	11	60	92	100	95	100	91	61	97
Intervention	44	63	76	100	100	97	100	97	94	100
Growth	23	52	16	8	0	2	0	6	33	3

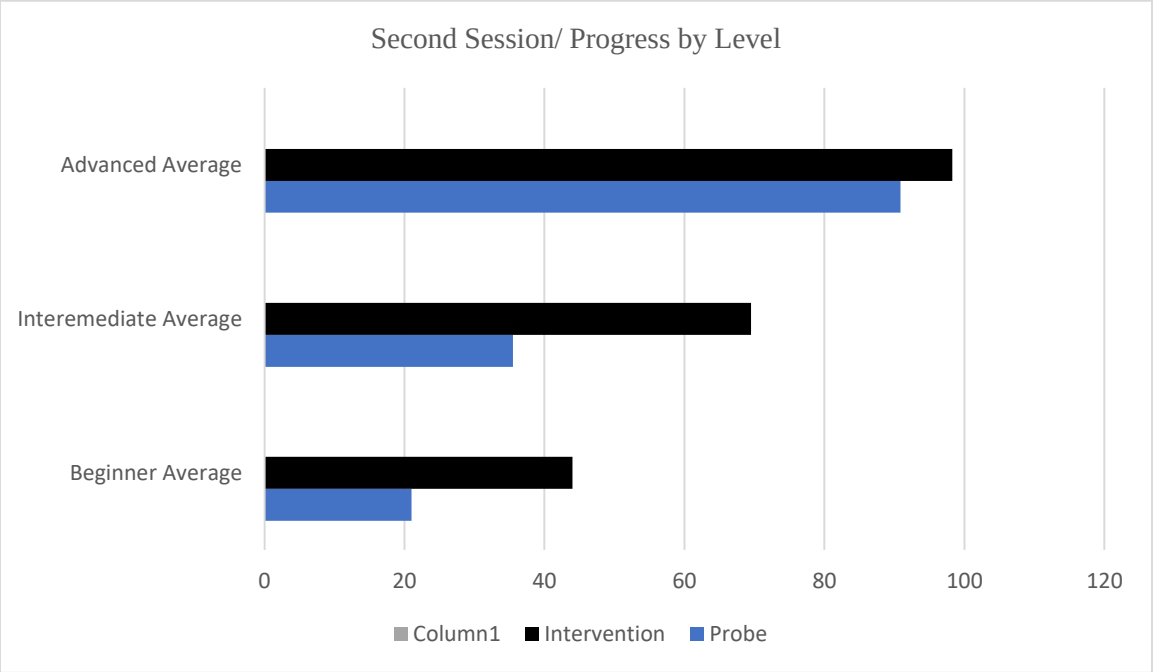


Figure Q.2. Second Session/Progress by Level for All Sessions (Averaged)

Table Q.3. Second Session/Progress by Level for All Sessions (Averaged)

	Beginning	Intermediate	Advanced	Mean	Median
Probe	21	35.5	90.85	72.8	91.5
Intervention	44	69.5	98.28	87.1	97
Growth	23	34	8.57	14.3	5.5

Table Q.4. Codes for Second Session-Probe Period

Probe Period –Second Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IC, TF, IP, IA, IN	TA, PE	TEFSR, EBSTL
	Cognition	PC, H, SC, RD	B, S	
B	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, IP, TF, RE, CN, IA	TA, PE	TEFSR, EBSTL
	Cognition	H, C, PD, ER	B, S	
C	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, TF, IP, IA, ST	TA, PE	TEFSR, EBSTL
	Cognition	H, SC, ER	B, S	
D	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, TF, RE, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, ER	S	
E	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	
G	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IC, CN, RE, TF, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
H	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
I	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
J	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
K	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	

Table Q.5. Codes for Second Session-Intervention Period

Intervention Period- Second Session				
Participant		**Open Codes**	**Axial Codes**	**Selective Codes**
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI,
	Intervention Specific	GP, EC, SS, ME	SS	TEFSR, EBSTL
	Independence	RIC, CP, ES	DOI	
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	RIC, II, ES, CP	DOI	
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	II, CP, ES	DOI	
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC,RG	SS, MtI	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC,RG	SS, MtL	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
G	Repsonse to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC, IP	SS, MtI	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	

Table Q.6. Second Session Participant Music Perception Survey

Probe Session (First Five Minutes)
Participant Performance Perception

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with a developmentally appropriate tone.	H	A, C,E, G, I	B, D, K		J
Musical sections are played with appropriate intonation.		A, C, E, G, H, K	B, I	D	J
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.	E, G, H, K	C, D, I, J	B		A
Students perform accurate rhythms.	E, G, H, K	B, C, D, I	A, J		
Students perform with precise vertical alignment and consistent pulse.		E, G, H, I	A, C, D, J, K	B	
Students perform with correct, suitable, and consistent articulations.	G, H, I	C, E	A, K	D, J	B
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	E	A, C, G, H, I, J, K			B, D
Dynamic contrast is obvious and effective.	A	H	B, E, G, I	C, K	D, J
The student performs the section with the appropriate tempo.	E, H	A, B, I		C, D, G, K	J

After the Intervention Session (Ten Minutes)
Participant Performance Perception

Tone	Video Modeling		Computer-Asst. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	A, B, D, G, H, I, K	C, E, J	A, D, G, I, J	B, C, E, H, K
Musical sections are played with appropriate intonation.	B, D, G, H, I, K	A, C, E, J	C, G, H, I, J, K	A, B, D, E
Technique	**Yes**	**No**	**Yes**	**No**
Students perform the correct notes.	A, B, G, H, I, K	C, D, E, J	A, C, D, G, H, I, J, K	B, E
Students perform accurate rhythms.	B, D, G, H, I, K	A, C, E, J	A,C, D, G, H, I, J, K	B, E
Students perform with precise vertical alignment and consistent pulse.	A, B, G, H, I	C, D, E, J, K	A, C, D, G, H, J, K	B, E, H, I
Students perform with correct, suitable, and consistent articulations.	A, B, D, G, H, I, K	C, E, J	A, C, G, H, J, K	B,D, E, I
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	A, B, D, G, H, I, K	C, E, J	A, C, D, G, I, J, K	B, E, H
Dynamic contrast is obvious and effective.	A, B, D, G, H, I, K	C, E, J	A, D, E, G, H, J	B, C, I, K
The student performs the section with the appropriate tempo.	B, D, G, H, K	A, C, E, I, J	A, B,C,D, G, H, I, J, K	E

Appendix R: Third Session Results/ Visual Aids

Table R.1. Third Session of Music Ability Scores

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A, D		-2
30-39	Pre-Emergent	I		-1
40-49	Limited	B		-1
50-59	Emerging	C		-1
60–69	Beginning	H	D	0
70-79	Developing	J	B, C	+1
80-89	Proficient	E	A, J	+1
90-100	Exemplary	G, K	E, G, H, I, K	+3

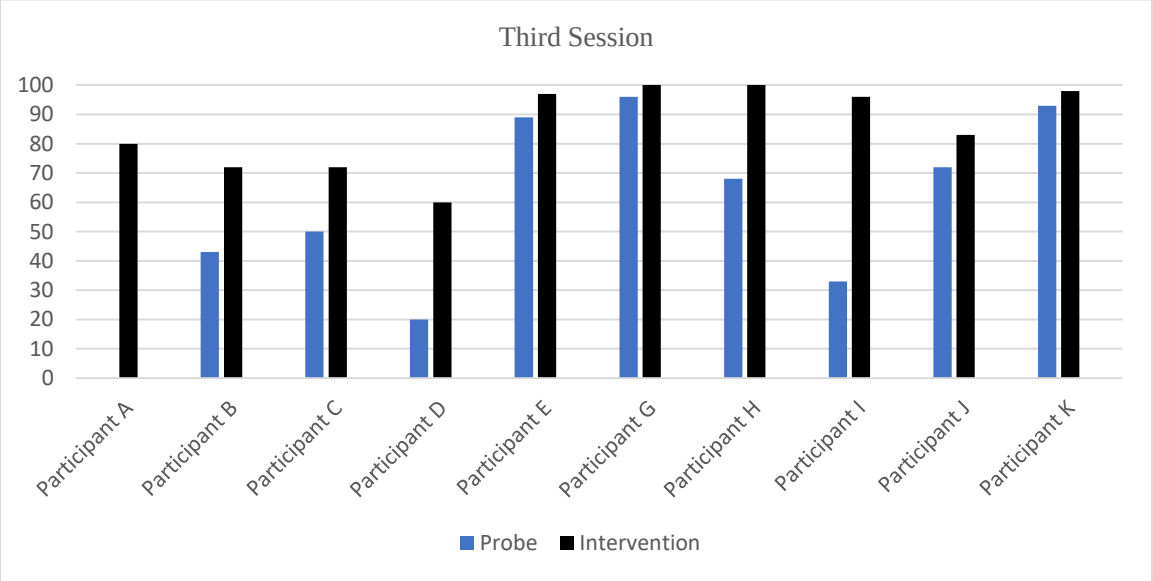


Figure R.1. Third Session Detailed Scoring for Probe and Intervention Period

Table R.2. Third Session Detailed Scoring for Probe and Intervention Period

Participant	A	B	C	D	E	G	H	I	J	K
Probe	0	43	50	20	89	96	68	33	72	48
Intervention	80	72	72	60	97	100	100	96	83	95
Growth	80	29	22	40	8	4	32	63	9	47

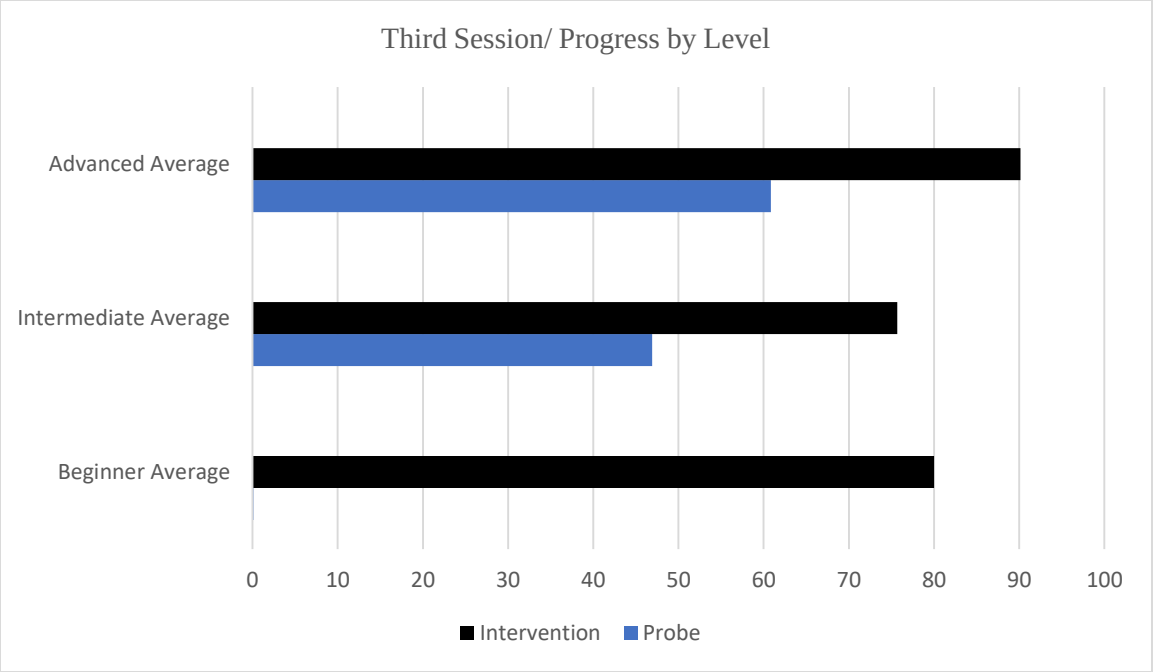


Figure R.3. Third Session, Progress By Level (Averaged)

Table R.3. Third Session, Progress By Level (Averaged)

	Beginning	Intermediate	Advanced
Probe	0	46.90	60.85
Intervention	80	75.7	90.14
Growth	80	28.8	29.29

Table R.4. Codes for Third Session-Probe Period

Probe Period –Third Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IC, TF, IP, IA, IN	TA, PE	TEFSR, EBSTL
	Cognition	PC, H, SC, RD	B, S	
B	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, IP, TF, RE, CN, IA	TA, PE	TEFSR, EBSTL
	Cognition	H, C, PD, ER	B, S	
C	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, TF, IP, IA, ST	TA, PE	TEFSR, EBSTL
	Cognition	H, SC, ER	B, S	
D	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, TF, RE, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, ER	S	
E	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	
G	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IC, CN, RE, TF, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
H	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
I	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
J	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
K	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	

Table R.5. Codes for Third Session-Intervention Period

Participant		Intervention Period- Third Session Open Codes	Axial Codes	Selective Codes
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	GP, EC, SS, ME RIC, CP, ES	SS DOI	EBSTL
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	SS, GP RIC, II, ES, CP	SS DOI	EBSTL
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	SS, GP II, CP, ES	SS DOI	EBSTL
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, IP, EC, RG II, RIC, II+, TtL, CP	SS, MtI DOI, AtI	EBSTL
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, IP, EC, RG II, RIC, II+, TtL, CP	SS, MtL DOI, AtI	EBSTL
G	Repsonse to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, EC, IP II, II+, SG, TtL, CP	SS, MtI DOI, AtI	EBSTL
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, EC II, II+, SG, TtL, CP	SS DOI, AtI	EBSTL
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, EC II, RIC, II+, SG, TtL, CP	SS DOI, AtI	EBSTL
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, EC II, RIC, II+, SG, TtL, CP	SS DOI, AtI	EBSTL
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR,
	Intervention Specific Independence	ME, RE, SS, GP, EC II, II+, SG, TtL, CP	SS DOI, AtI	EBSTL

Table R.6. Third Session Participant Music Perception Survey

Probe Session (First Five Minutes)*Participant Performance Perception*

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with developmentally appropriate tone.	A, G	B, E, I, K	C, D, H		J
Musical sections are played with appropriate intonation.	I	C, E, G, K	A, B, D, H		J
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.		A, B, D, E, H, I, J	C, G	K	
Students perform accurate rhythms.	G, I	E, J	A, B, C, D, H, K		
Students perform with precise vertical alignment and consistent pulse.	A, G	E, I	C, D, H, K	J	B
Students perform with correct, suitable, and consistent articulations.		C, E, I	H	A, D, G, K	B, J
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	A, E	C	D, I	G, H, J, K	B
Dynamic contrast is obvious and effective.	E	I	A, C, D	B, G, K	H, J
The student performs the section with the appropriate tempo.	A, E	B, D, K	G, H, I, J	C	

After the Intervention Session (Ten Minutes)
Participant Performance Perception

Tone	Video Modeling		Computer-Asst. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	A, B, C, D, G, H, I, K	E,J	B, D, E, G, I, J, K	A, C, H
Musical sections are played with appropriate intonation.	A, B, C, D, G, H, K	E, I, J	A, C, E, G I, J	B, D, H, K
Technique	**Yes**	**No**	**Yes**	**No**
Students perform the correct notes.	A, B, C, G, H, K	D, E, I, J	A, B, C, D, E, G H, I, J, K	
Students perform accurate rhythms.	C, B, D, G, H, I, K	A, E, J	C, D, E, G, H, I, J, K	A, B
Students perform with precise vertical alignment and consistent pulse.	A, B, C, D, G, H, I, K	E, J	B, C, D, E, G, H, I, J, K	A
Students perform with correct, suitable, and consistent articulations.	A, B, C, D, G, H, K	E, I, J	A, C, E, G,H, I, J, K	D, B
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	B, C, D, G, H, I, K	A, E, J	A, B, C, D, E, G, J, K	E, H, I
Dynamic contrast is obvious and effective.	B, C, D, G, H, I, K	A, E, J	C, D, G, H, I, J	A, B, K
Student performs the section with appropriate tempo.	A,B, C, G, H, I, K	D, E, J	A, C, D, G, H, I, J, K	B, E

Appendix S: Fourth Session Results/ Visual Aids

Table S.1 Fourth Session of Music Ability Scores

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A		-1
30-39	Pre-Emergent	B, D, J		-3
40-49	Limited	I, K		-2
50-59	Emerging			0
60–69	Beginning	H	A, I	+1
70-79	Developing	C, E	J	-1
80-89	Proficient		B, C, D	+3
90-100	Exemplary	G	E, G, H, K	+3

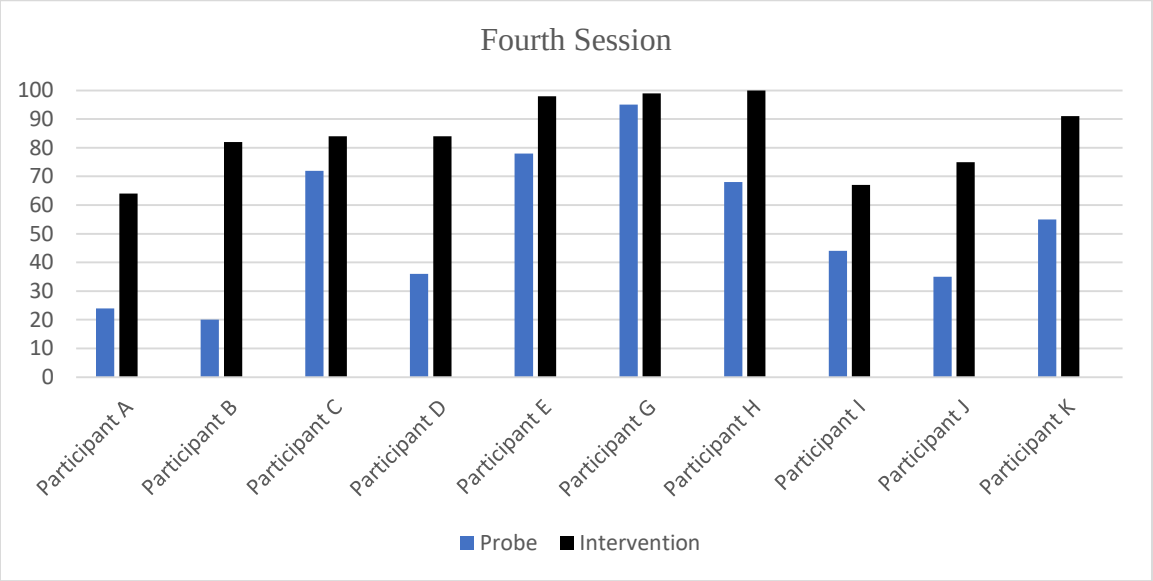


Figure S.1. Fourth Session Detailed Scoring for Probe and Intervention Period

Table S.2. Fourth Session Detailed Scoring for Probe and Intervention Period

Participant	A	B	C	D	E	G	H	I	J	K
Probe	24	20	72	36	78	95	68	44	35	55
Intervention	64	82	84	84	98	99	100	67	75	91
Growth	40	62	6	48	20	4	32	23	40	36

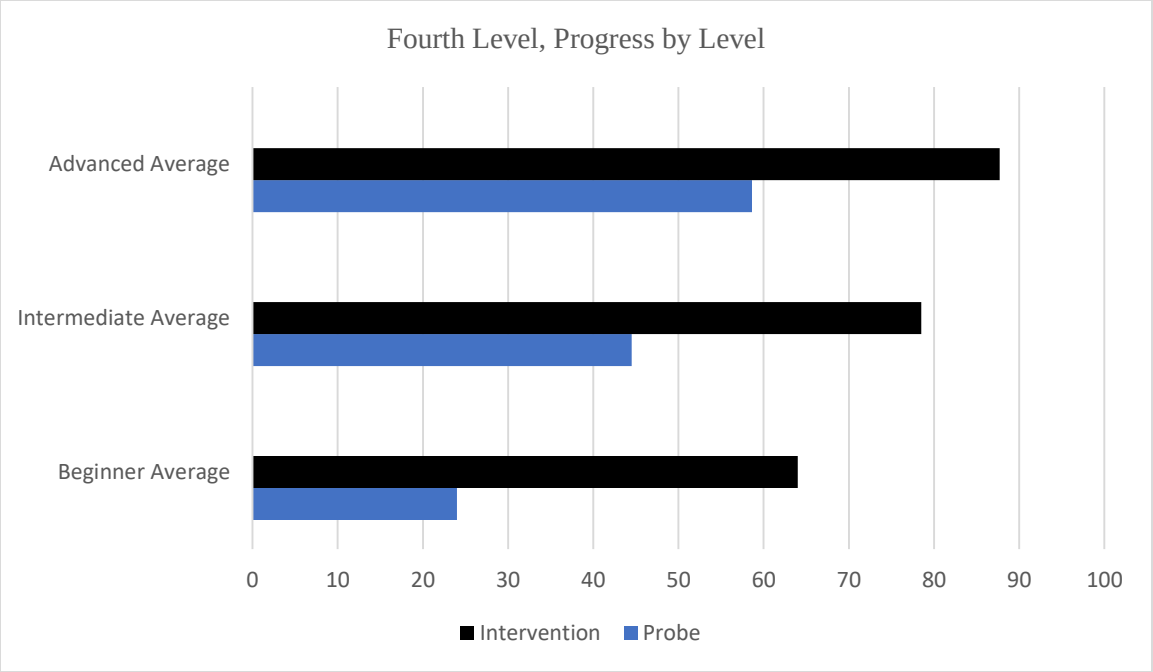


Figure S.2. Fourth Session, Progress By Level (Averaged)

Table S.3. Fourth Session, Progress By Level (Averaged)

	Beginning	Intermediate	Advanced
Probe	24	44.52	58.62
Intervention	64	78.5	87.71
Growth	40	33.98	29.09

Table S.4. Codes for Fourth Session-Probe Period

Probe Period –Fourth Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Engagement Performance Cognition	DE, OF, OT, D IN, CN, RP, RE H, PD, RD	E, EO TA, B, S	IIPMG, SSIEI, TEFSR, EBSTL
B	Engagement Performance Cognition	OT, SA, IE, TP IN, IP, TF, RE, CN, IA H, C, PD, ER	E, EO TA, PE B, S	IIPMG, SSIEI, TEFSR, EBSTL
C	Engagement Performance Cognition	OT, SA, IE, TP CN, IN, RE, TF, IP, IA, ST H, SC, ER	E, EO TA, PE B, S	IIPMG, SSIEI, TEFSR, EBSTL
D	Engagement Performance Cognition	OT, SA, IE, TP IN, CN, TF, RE, RP, IA SC, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL
E	Engagement Performance Cognition	OT, SA, IE, TP CN, IN, RE, RP, ST, IA SC, ER	E, EO ST, TA S	IIPMG, SSIEI, TEFSR, EBSTL
G	Engagement Performance Cognition	OT, SA, IE, TP IC, CN, RE, TF, IA SC, QR, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL
H	Engagement Performance Cognition	OT, SA, IE, TP CN, ST, IA SC, QR, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL
I	Engagement Performance Cognition	OT, SA, IE, TP IN, CN, RE, TF, IP, RP, ST, IA SC, QR, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL
J	Engagement Performance Cognition	OT, SA, IE, TP IN, CN, RE, TF, IP, RP, IA SC, QR, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL
K	Engagement Performance Cognition	OT, SA, IE, TP CN, ST, IA SC, QR, ER	E, EO TA, PE S	IIPMG, SSIEI, TEFSR, EBSTL

Table S.4. Codes for Fourth Session-Intervention Period

Intervention Period- Fourth Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	GP, EC, SS, ME	SS	
	Independence	RIC, CP, ES	DOI	
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	SS, GP	SS	
	Independence	RIC, II, ES, CP	DOI	
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	SS, GP	SS	
	Independence	II, CP, ES	DOI	
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	SS, MtI	
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, IP, EC, RG	S, MtL	
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
G	Repsonse to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC, IP	SS, MtI	
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI, TEFSR, EBSTL
	Intervention Specific	ME, RE, SS, GP, EC	SS	
	Independence	II, II+, SG, TtL, CP	DOI, AtI	

Table S.6 Fourth Session Participant Music Perception Survey

Probe Session (First Five Minutes)
Participant Performance Perception

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with developmentally appropriate tone.	A	B, C, G, I	E	D, J	H, K
Musical sections are played with appropriate intonation.		B, C, I	A, E, G	D, J	H, K
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.	A, B, J	C, E, G, K	I	D, H	
Students perform accurate rhythms.		B, E	G, I	A, C, H, K	D, J
Students perform with precise vertical alignment and consistent pulse.		A, B, E, I	G, K	C, J	D, H
Students perform with correct, suitable, and consistent articulations.	A	E	B, C, G, I	H, J, K	D
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	B	A, C, E, I	G	D, K	H, J
Dynamic contrast is obvious and effective.	A, I	B, E	D	C, G, H	J, K
The student performs the section with the appropriate tempo.	B	E, I	A, G, H	C, K	D, J

After the Intervention Session (Ten Minutes)
Participant Performance Perception

Tone	Video Modeling		Computer-Asst. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	A, B, C, D, G, H, J, K	E, I	A, B, C, E, G, H, I, J	D, K
Musical sections are played with appropriate intonation.	C, D, G,H, J, K	A, E, I	B, C, E, G, H, I, J	A, D, K
Technique				
Students perform the correct notes.	A, B, C, D, G, H, J, K	E, I	B, C, D, E, G, H, I, J, K	A
Students perform accurate rhythms.	A, B, C, D, G, H, I, J, K	E	A, B, C, D, E, G, H, I, J, K	
Students perform with precise vertical alignment and consistent pulse.	A, B, C, D, G, H, J, K	E, I	A, C, D, E G, H, I, J, K	B, E
Students perform with correct, suitable, and consistent articulations.	B, C, D, G, H, I, J, K	A, E	C, E, G, H, I, J, K	A, B, D
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	A, B, C, D, G, H, J, K	E, I	A, B, C, D, E, G, H, I, J, K	
Dynamic contrast is obvious and effective.	A, B, D, G, H, I, K	C, E	D, E, G, H, I, J	A, B, C, K
The student performs the section with the appropriate tempo.	B, C, G, H, J, K	A, D, E, I	A, B, C, D, E, G, H, I, J, K	

Appendix T: Fifth Session Results/ Visual Aids

Table T.1. Fifth Session of Music Abiity Scores

Score	Classification	Probe Frequency	Intervention Frequency	Net Change
0-29	Unrecognizable	A, B		-2
30-39	Pre-Emergent	J		-1
40-49	Limited	I	B	0
50-59	Emerging		A	+1
60–69	Beginning			
70-79	Developing	C, D, K		-3
80-89	Proficient	E, G	C, D, G, I, J, K	+4
90-100	Exemplary	H	E, H	+1

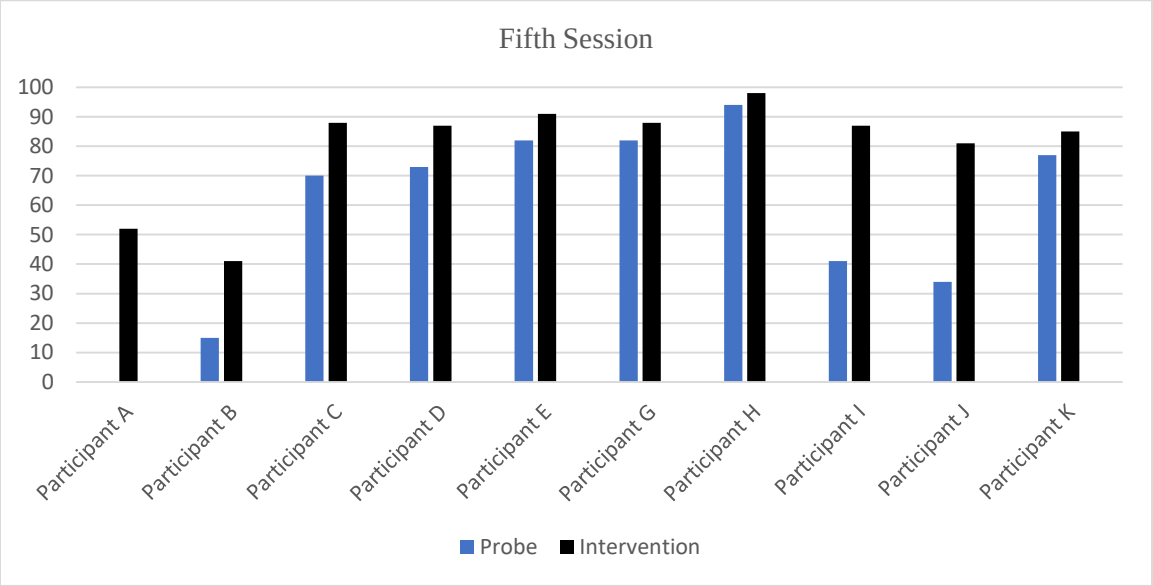


Figure T.1. Fifth Session Detailed Scoring for Probe and Intervention Period

Table T.2. Fifth Session Detailed Scoring for Probe and Intervention Period

Participant	A	B	C	D	E	G	H	I	J	K
Probe	0	15	70	73	82	82	94	41	34	77
Intervention	52	41	88	87	91	88	98	87	81	85
Growth	52	26	18	14	9	6	4	46	47	8

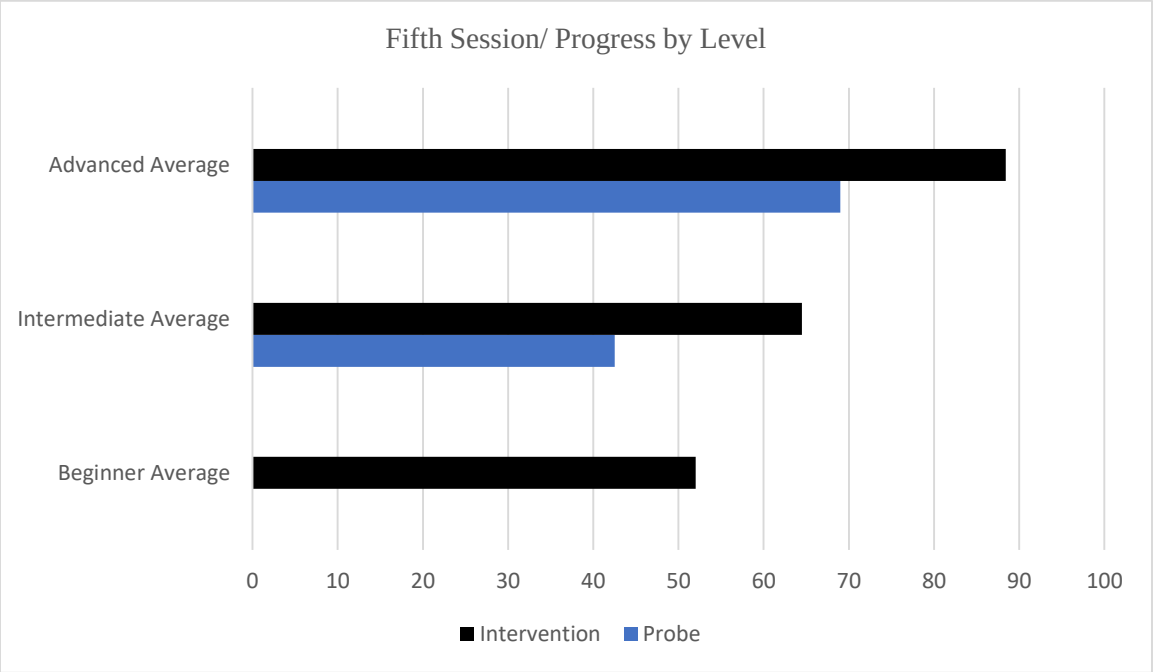


Figure T.2.Fifth Session, Progress By Level (Averaged)

Table: T.3. Fifth Session, Progress By Level (Averaged)

	Beginning	Intermediate	Advanced
Probe	0	42.5	69
Intervention	52	64.5	88.4
Growth	52	22	19.4

Table T.4. Codes for Fifth Session-Probe Period

Participant		Probe Period –Fifth Session Open Codes	Axial Codes	Selective Codes
A	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IC, TF, IP, IA, IN	TA, PE	TEFSR, EBSTL
	Cognition	PC, H, SC, RD	B, S	
B	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, IP, TF, RE, CN, IA	TA, PE	TEFSR, EBSTL
	Cognition	H, C, PD, ER	B, S	
C	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, TF, IP, IA, ST	TA, PE	TEFSR, EBSTL
	Cognition	H, SC, ER	B, S	
D	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, TF, RE, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, ER	S	
E	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, IN, RE, RP, ST, IA	ST, TA	TEFSR, EBSTL
	Cognition	SC, ER	S	
G	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IC, CN, RE, TF, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
H	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
I	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
J	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	IN, CN, RE, TF, IP, RP, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	
K	Engagement	OT, SA, IE, TP	E, EO	IIPMG, SSIEI,
	Performance	CN, ST, IA	TA, PE	TEFSR, EBSTL
	Cognition	SC, QR, ER	S	

Table T.5. Codes for Fifth Session-Intervention Period

Intervention Period- Fifth Session				
Participant		Open Codes	Axial Codes	Selective Codes
A	Response to Instruction	RtM, FD, NR, PD, RTP,	ER, SN	IIPMG, SSIEI,
	Intervention Specific	GP, EC, SS, ME	SS	TEFSR, EBSTL
	Independence	RIC, CP, ES	DOI	
B	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	RIC, II, ES, CP	DOI	
C	Response to Instruction	RtM, PI, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	SS, GP	SS	TEFSR, EBSTL
	Independence	II, CP, ES	DOI	
D	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC,RG	SS, MtI	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
E	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, IP, EC,RG	SS, MtL	TEFSR, EBSTL
	Independence	II, RIC, II+, TtL, CP	DOI, AtI	
G	Repsonse to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC, IP	SS, MtI	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
H	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	
I	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
J	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, RIC, II+, SG, TtL, CP	DOI, AtI	
K	Response to Instruction	RtM, IC, RtP, FD, NR	ER, SN	IIPMG, SSIEI,
	Intervention Specific	ME, RE, SS, GP, EC	SS	TEFSR, EBSTL
	Independence	II, II+, SG, TtL, CP	DOI, AtI	

Table T.6. Fifth Session Participant Music Perception Survey

Probe Session (First Five Minutes)
Participant Performance Perception

Tone	1 Consistently	2 Usually	3 Sometimes	4 Infrequently	5 Rarely
Performs with a developmentally appropriate tone.	A	C, E. I	D, H, K	B, G, J	
Musical sections are played with appropriate intonation.	A, I	C, D, E, H	G, K	J	B
Technique	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform the correct notes.	I	A, C, E, G, H	B, D, K	J	
Students perform accurate rhythms.	A, E	G, H, I	C, D	J, K	B
Students perform with precise vertical alignment and consistent pulse.		E, I	A, C, G, H	D, J	B, K
Students perform with correct, suitable, and consistent articulations.	E, I		C, D, H, K	A, G, J	B
Music Understanding	**1 Consistently**	**2 Usually**	**3 Sometimes**	**4 Infrequently**	**5 Rarely**
Students perform all musical markings.	A, E, I	C, H	B, D, G	K	J
Dynamic contrast is obvious and effective.		D, E, I	A, B, H	C, G	J, K
The student performs the section with the appropriate tempo.	B, E	A, H, I		C, D, K	G, J

After the Intervention Session (Ten Minutes)
Participant Performance Perception

Tone	Video Modeling		Computer-Asst. Learning	
	Yes	No	Yes	No
Performs with a developmentally appropriate tone.	A, B, G, K	C, D, E, H, I, J	C, D, G, H, I, J	A, B, E, K
Musical sections are played with appropriate intonation.	B, D, G, K	A, C, E, H, I, J	A, C, D, G, H, I, J	B, E, K
Technique	**Yes**	**No**	**Yes**	**No**
Students perform the correct notes.	A, B, G, H, I, J, K	C, D, E	A, B, C, D, G, J, K	E, H
Students perform accurate rhythms.	A, B, D, G, H, I, J, K	C, E	C, D, E, G, J, K	A, B, H
Students perform with precise vertical alignment and consistent pulse.	B, D, G, H, I, J, K	A, C, E	A, B, C, D, E, G, H, J, K	
Students perform with correct, suitable, and consistent articulations.	B, G, H, I, J, K	A, C, D, E	C, D, E, G, H, J, K	A, B
Musical Understanding	**Yes**	**No**	**Yes**	**No**
Students perform all musical markings.	A, B, D, G, H, K	C, E, I, J	A, B, D, E, G, H, I, J, K	C
Dynamic contrast is obvious and effective.	A, B, D, G, H, I, J, K	C, E	A, D, E, G, H, I	B, C, J, K
The student performs the section with the appropriate tempo.	B, D, G, H, I, J, K	A, C, E	B, C, D, E, G, I, J, K	A, H

Appendix U: Participant Results

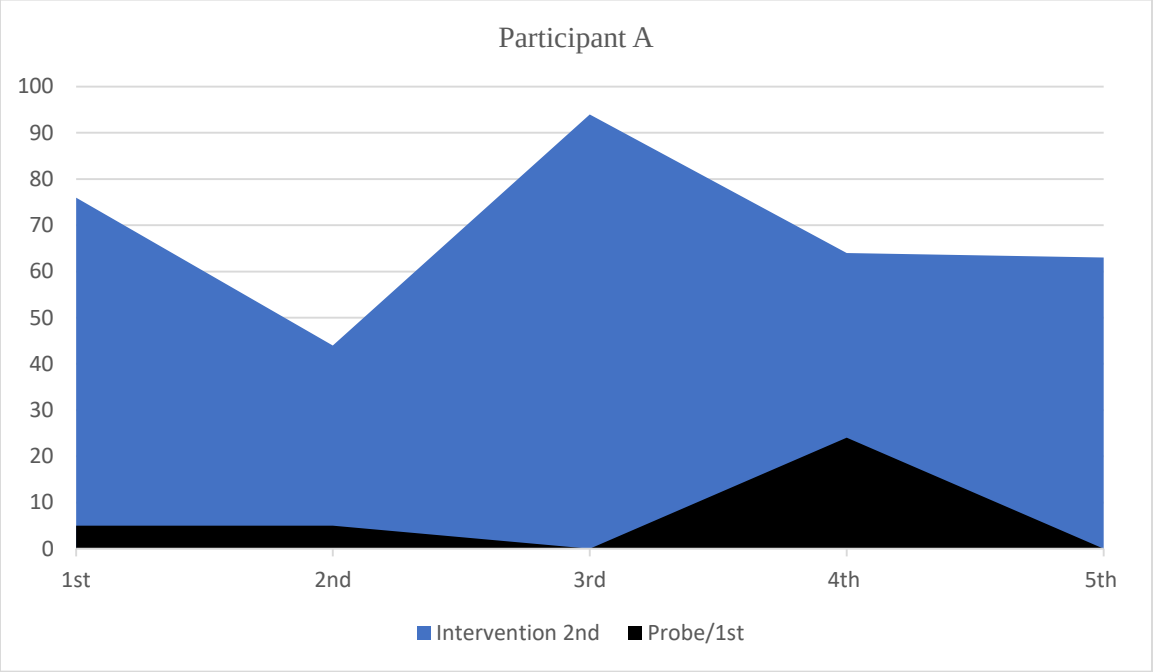


Figure U.1. Participant A Performance Differences Between Recordings

Table U.1. Participant A Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	76	44	94	64	63
1st Recording	5	5	0	24	0
Growth	71	39	94	40	63

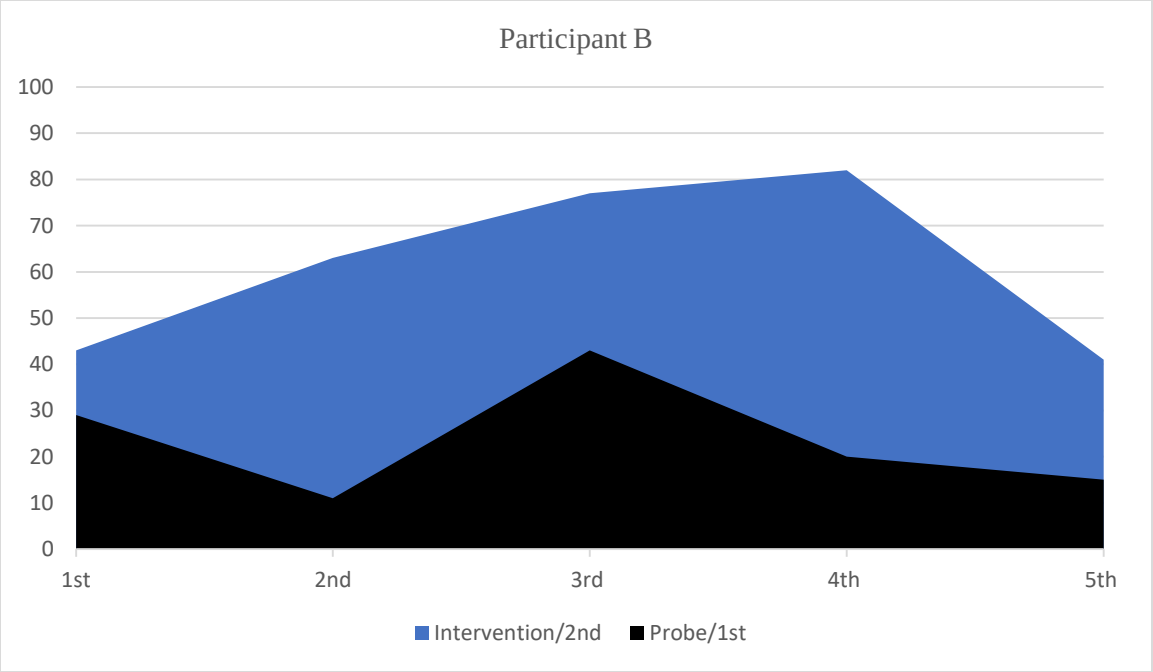


Figure U.2. Participant B Performance Differences Between Recording Results

Table U.2. Participant B Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	43	63	77	82	41
1st Recording	29	11	43	20	15
Growth	14	52	34	62	26

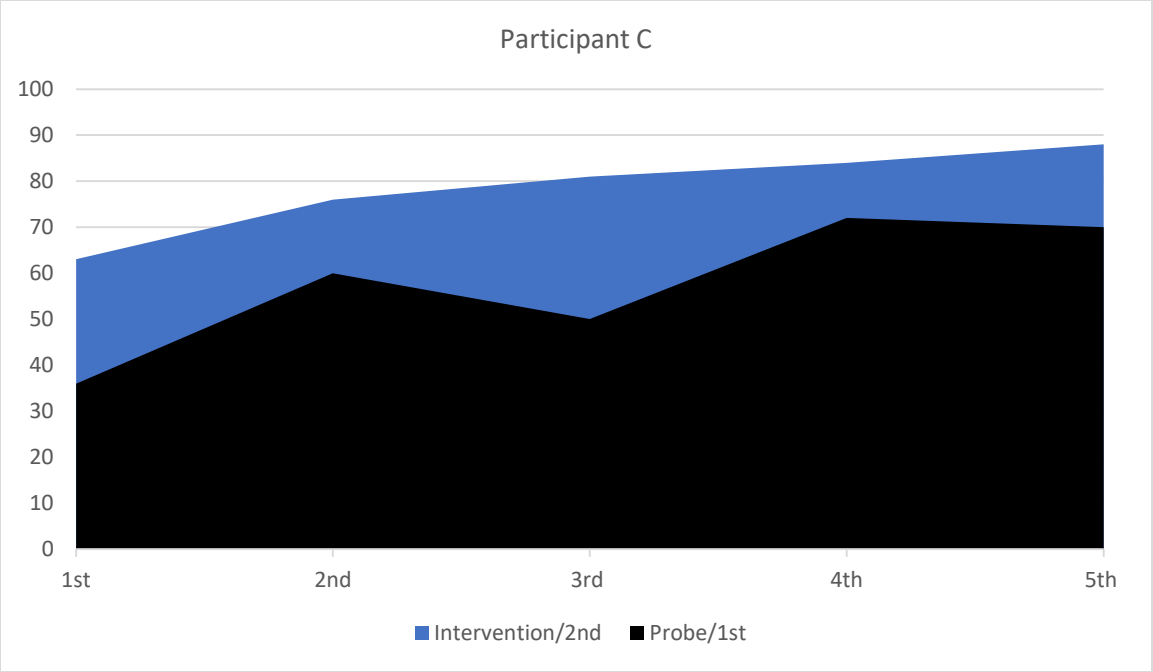


Figure U.3. Participant C Performance Differences Between Recordings

Table U.3. Participant C Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	63	76	81	84	88
1st Recording	36	60	50	72	70
Growth	27	16	31	6	18

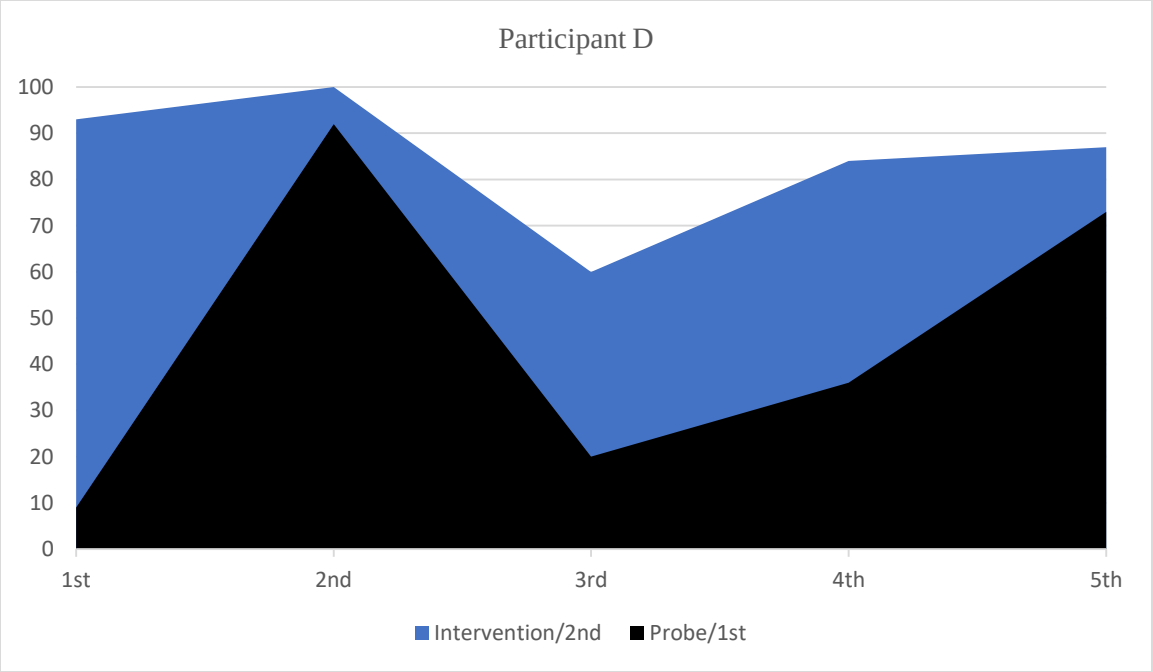


Figure U.4. Participant D Performance Differences Between Recording

Table U.4. Participant D Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	93	100	60	84	87
1st Recording	9	92	20	36	73
Growth	84	8	40	48	14

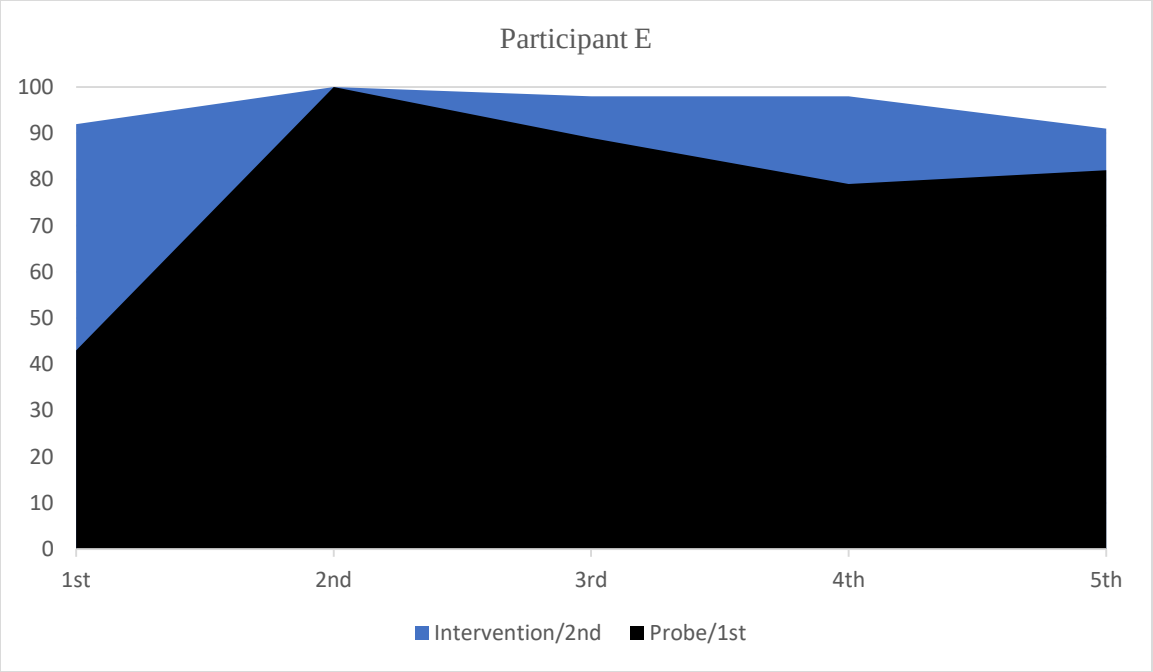


Figure U.5. Participant E Performance Differences Between Second Recording

Table U.5. Participant E Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	92	100	98	98	91
1st Recording	43	100	89	79	82
Growth	49	0	9	19	9

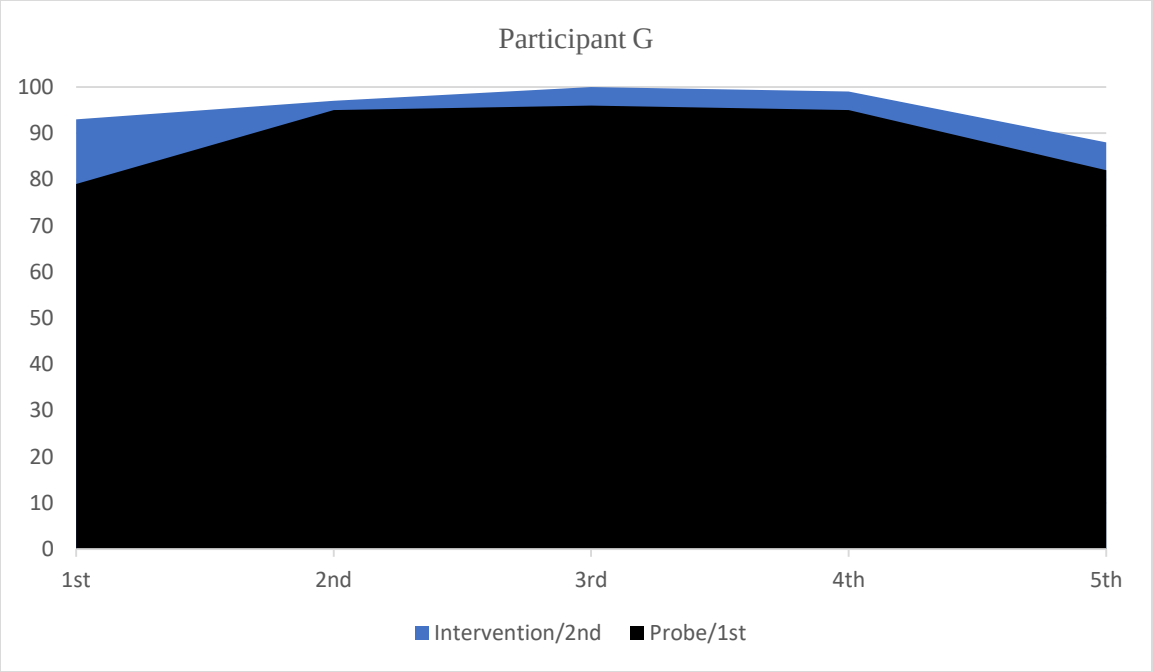


Figure U.6. Participant G Performance Differences Between Recording

Table U.6. Participant G Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	93	97	100	99	88
1st Recording	79	95	96	95	82
Growth	14	2	4	4	6

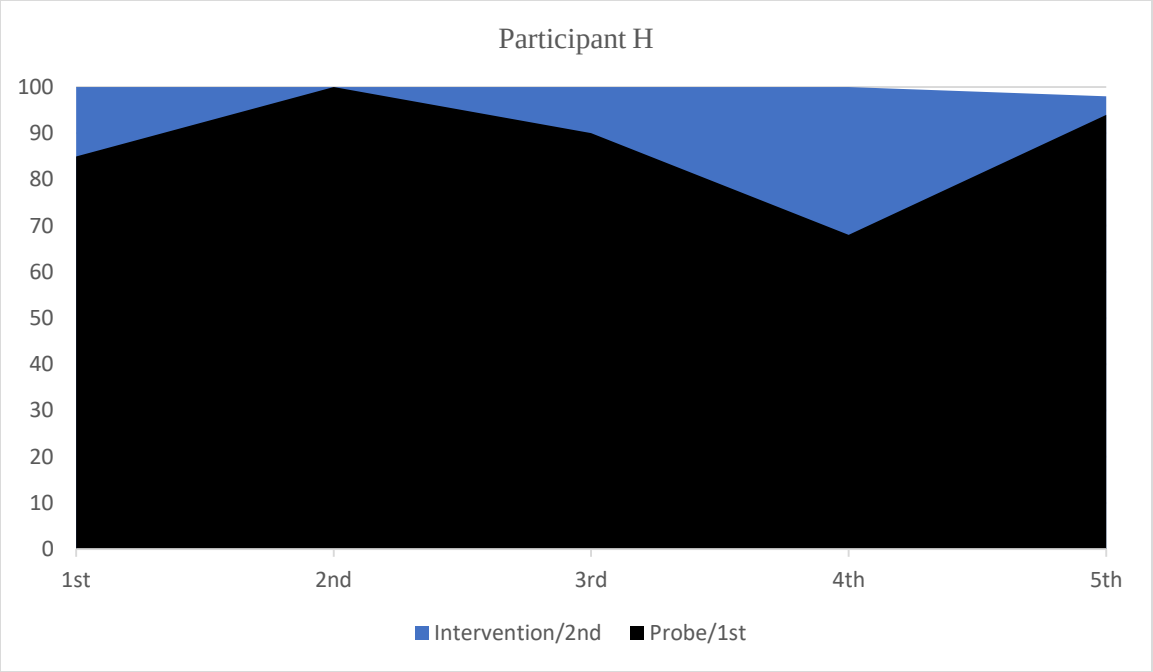


Figure U.7. Participant H Performance Differences Between Recording

Table U.7. Participant H Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	100	100	100	100	98
1st Recording	85	100	90	68	94
Growth	15	0	10	32	4

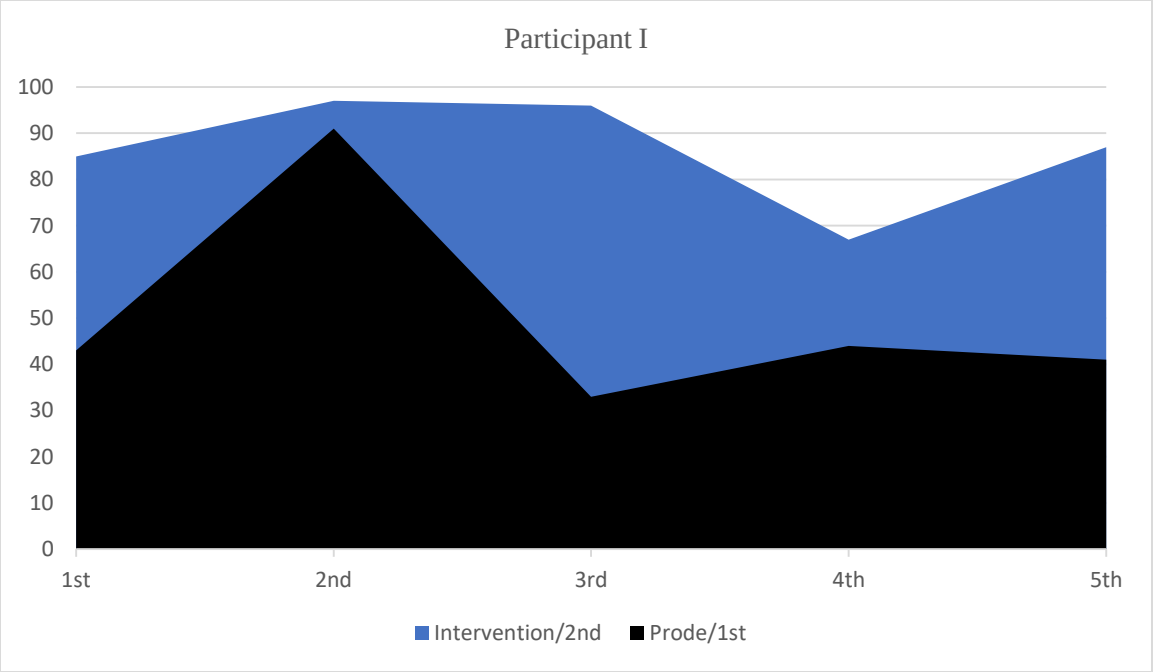


Figure U.8. Participant I Performance Differences Between First and Second Recording

Table U.8. Participant I Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	85	97	96	67	87
1st Recording	43	91	33	40	41
Growth	42	6	63	27	17

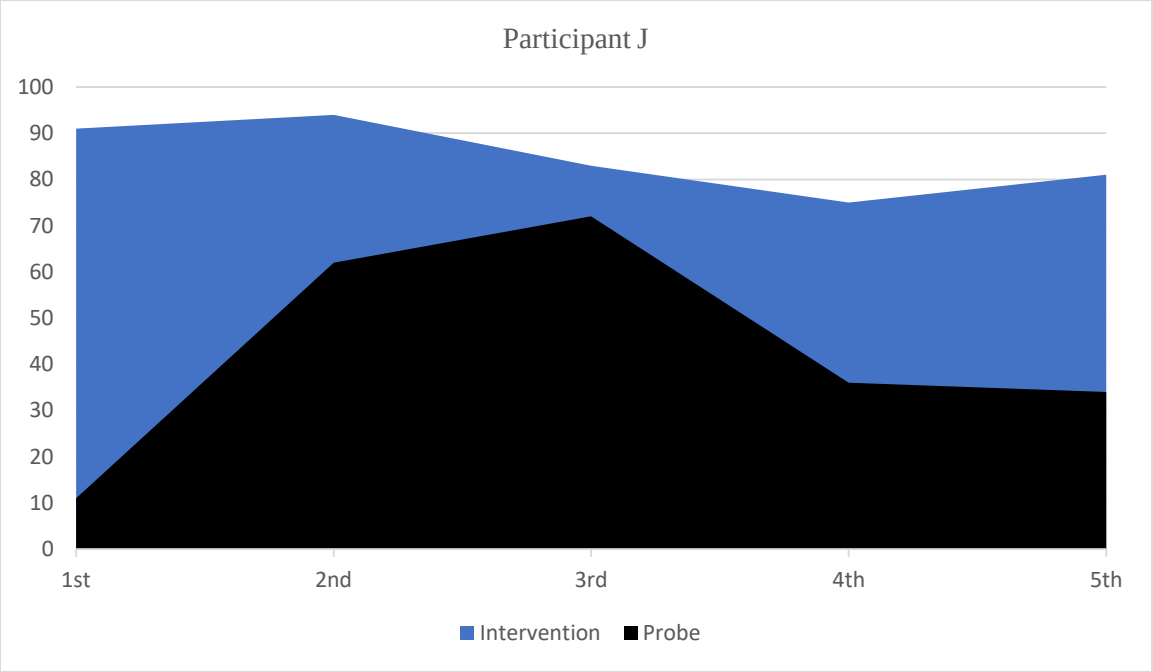


Figure U.9. Participant J Performance Differences Between First and Second Recording

Table U.9. Participant J Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	91	94	83	75	81
1st Recording	11	62	72	36	34
Growth	80	32	9	39	47

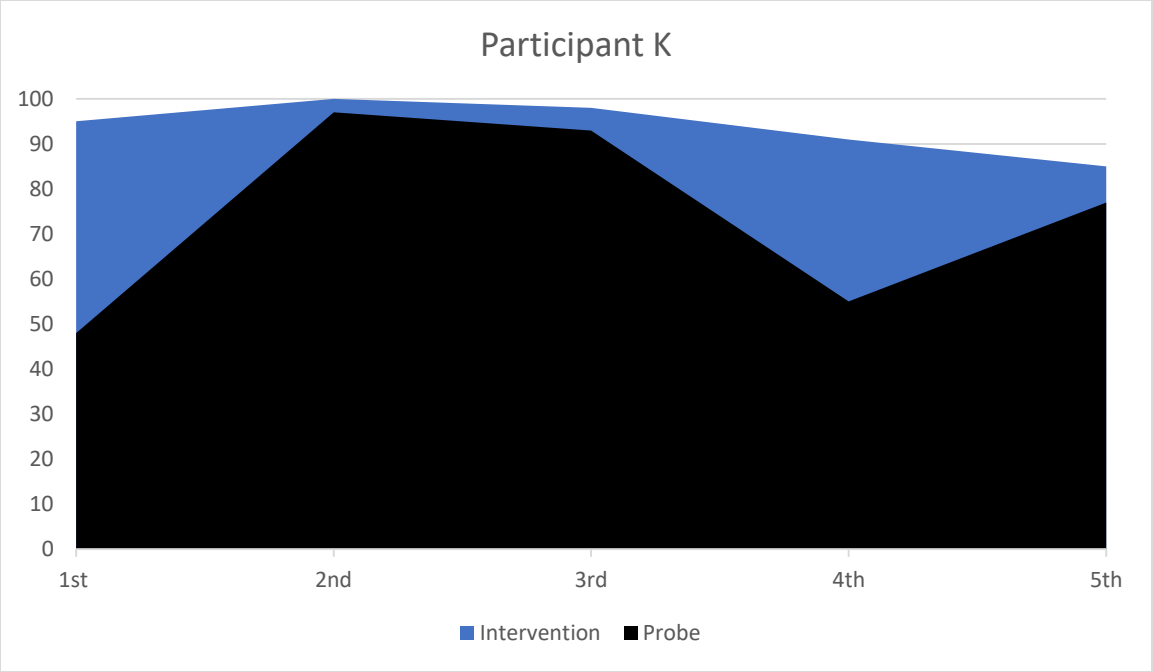


Figure U.10. Participant K Performance Differences Between First and Second Recording

Table U.10. Participant K Results

Sessions	1st	2nd	3rd	4th	5th
2nd Recording	95	100	98	91	85
1st Recording	48	97	93	55	77
Growth	47	3	5	36	8

Appendix V: Categorized Interventions Applied by Participants Per Session

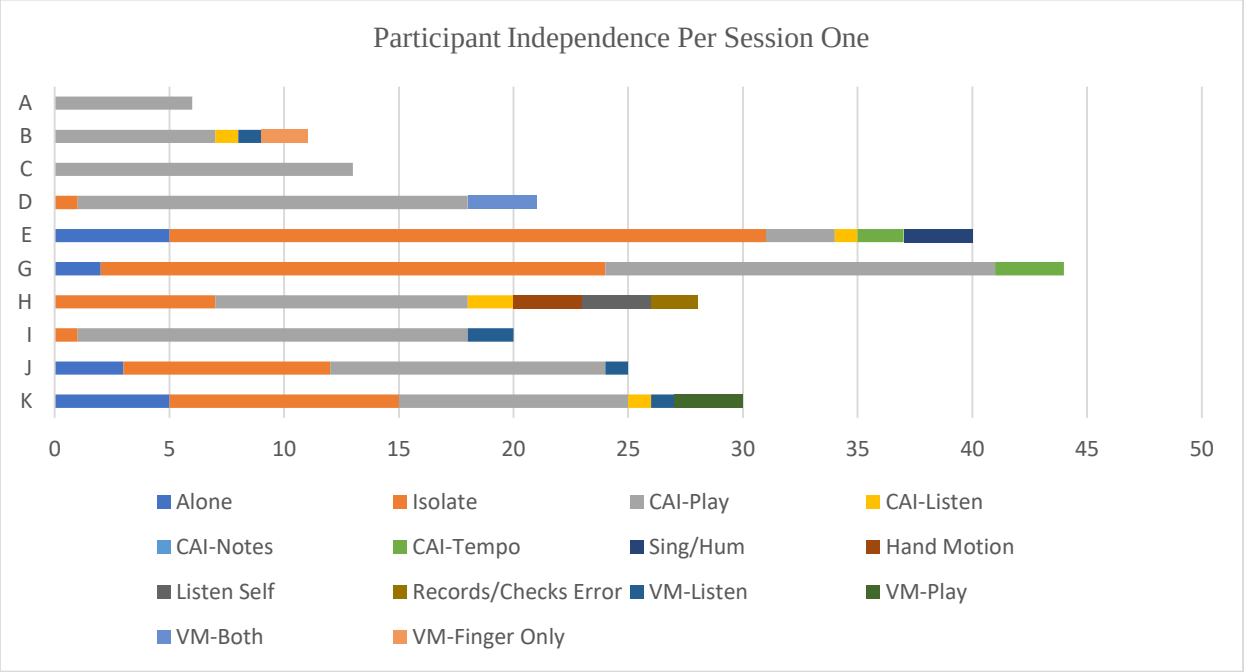


Figure V.1. Participant Independence Per Session One

Table V.1. Participant Independence Per Session One

Participant	Alone	Isolate	CAI-Play	CAI-Listen	CAI-Notes	CAI-Tempo Volume	Sing/Hum	Hand Motion	Listen to Self Playing	Records/Checks Error	VM-Listen	VM-Play	VM-Both	VM-Finger Only
K	5	10	10	1	0	0	0	0	0	0	1	3	0	0
J	3	9	12	0	0	0	0	0	0	0	1	0	0	0
I	0	1	17	0	0	0	0	0	0	0	2	0	0	0
H	0	7	11	2	0	0	0	3	3	2	0	0	0	0
G	2	22	17	0	0	3	0	0	0	0	0	0	0	0
E	5	26	3	1	0	2	3	0	0	0	0	0	0	0
D	0	1	17	0	0	0	0	0	0	0	0	0	3	0
C	0	0	13	0	0	0	0	0	0	0	0	0	0	0
B	0	0	7	1	0	0	0	0	0	0	1	0	0	2
A	0	0	6	0	0	0	0	0	0	0	0	0	0	0
Totals	15	76	113	5	0	5	3	3	3	2	5	3	3	2

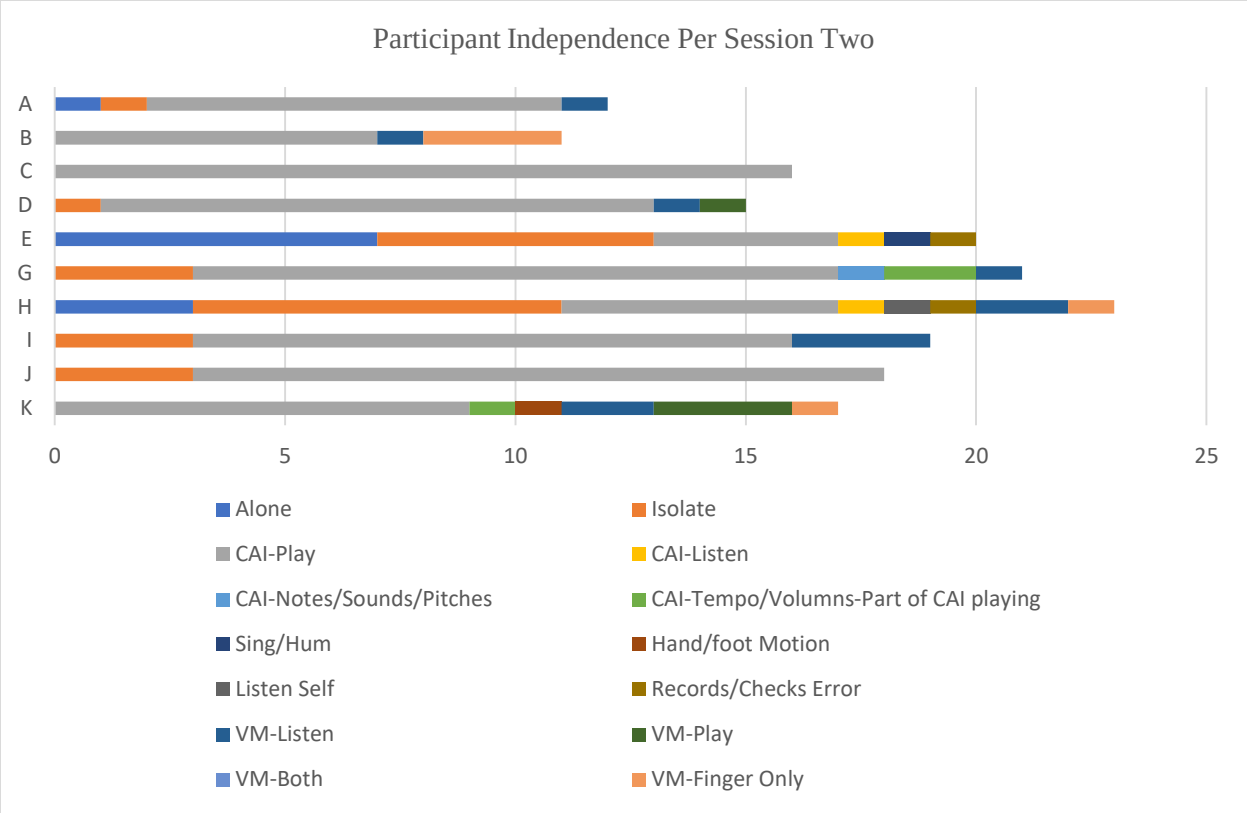


Figure V.2. Participant Independence Per Session Two

Table V.2. Participant Independence Per Session Two

Participant	Alone	Isolate	CAI-Play	CAI-Listen	CAI-Notes	CAI-Tempo /Volume	Sing/Hum	Hand/foot Motion	Listen Self	Records /Checks Error	VM-Listen	VM-Play	VM-Both	VM-Finger Only
K	0	0	9	0	0	1	0	1	0	0	2	3	0	1
J	0	3	15	0	0	0	0	0	0	0	0	0	0	0
I	0	3	13	0	0	0	0	0	0	0	3	0	0	0
H	3	8	6	1	0	0	0	0	1	1	2	0	0	1
G	0	3	14	0	1	2	0	0	0	0	1	0	0	0
E	7	6	4	1	0	0	1	0	0	1	0	0	0	0
D	0	1	12	0	0	0	0	0	0	0	1	1	0	0
C	0	0	16	0	0	0	0	0	0	0	0	0	0	0
B	0	0	7	0	0	0	0	0	0	0	1	0	0	3
A	1	1	9	0	0	0	0	0	0	0	1	0	0	0
Total	11	25	105	2	1	3	1	1	1	2	11	4	0	5

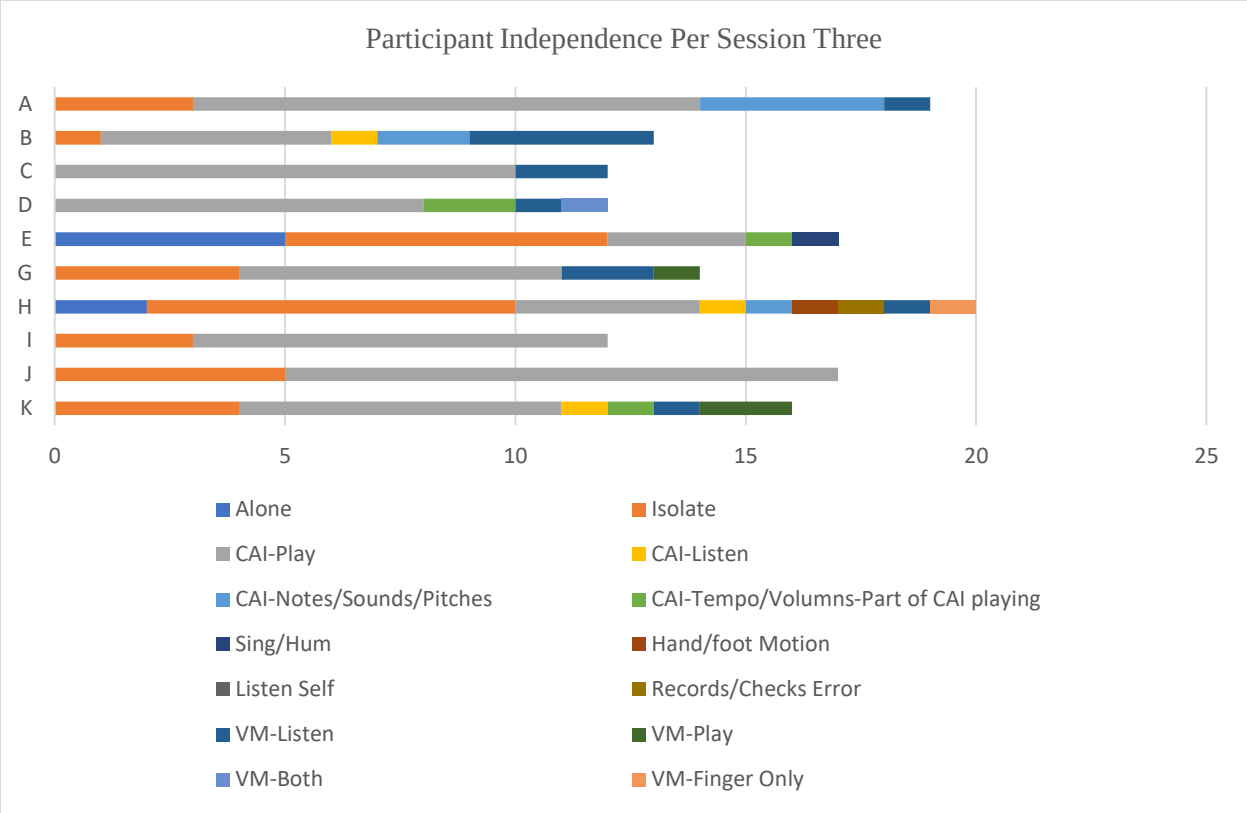


Figure V.3. Participant Independence Per Session Three

Table V.3. Participant Independence Per Session Three

Participant	Alone	Isolate	CAI-Play	CAI-Listen	CAI-Notes/Sounds/Pitches	CAI-Tempo/Volume	Sing/Hum	Hand/foot Motion	Listen Self	Records/Checks Error	VM-Listen	VM-Play	VM-Both	VM-Finger Only
K	0	4	7	1	0	1	0	0	0	0	1	2	0	0
J	0	5	12	0	0	0	0	0	0	0	0	0	0	0
I	0	3	9	0	0	0	0	0	0	0	0	0	0	0
H	2	8	4	1	1	0	0	1	0	1	1	0	0	1
G	0	4	7	0	0	0	0	0	0	0	2	1	0	0
E	5	7	3	0	0	1	1	0	0	0	0	0	0	0
D	0	0	8	0	0	2	0	0	0	0	1	0	1	0
C	0	0	10	0	0	0	0	0	0	0	2	0	0	0
B	0	1	5	1	2	0	0	0	0	0	4	0	0	0
A	0	3	11	0	4	0	0	0	0	0	1	0	0	0
Total	7	35	76	3	7	4	1	1	0	1	12	3	1	1

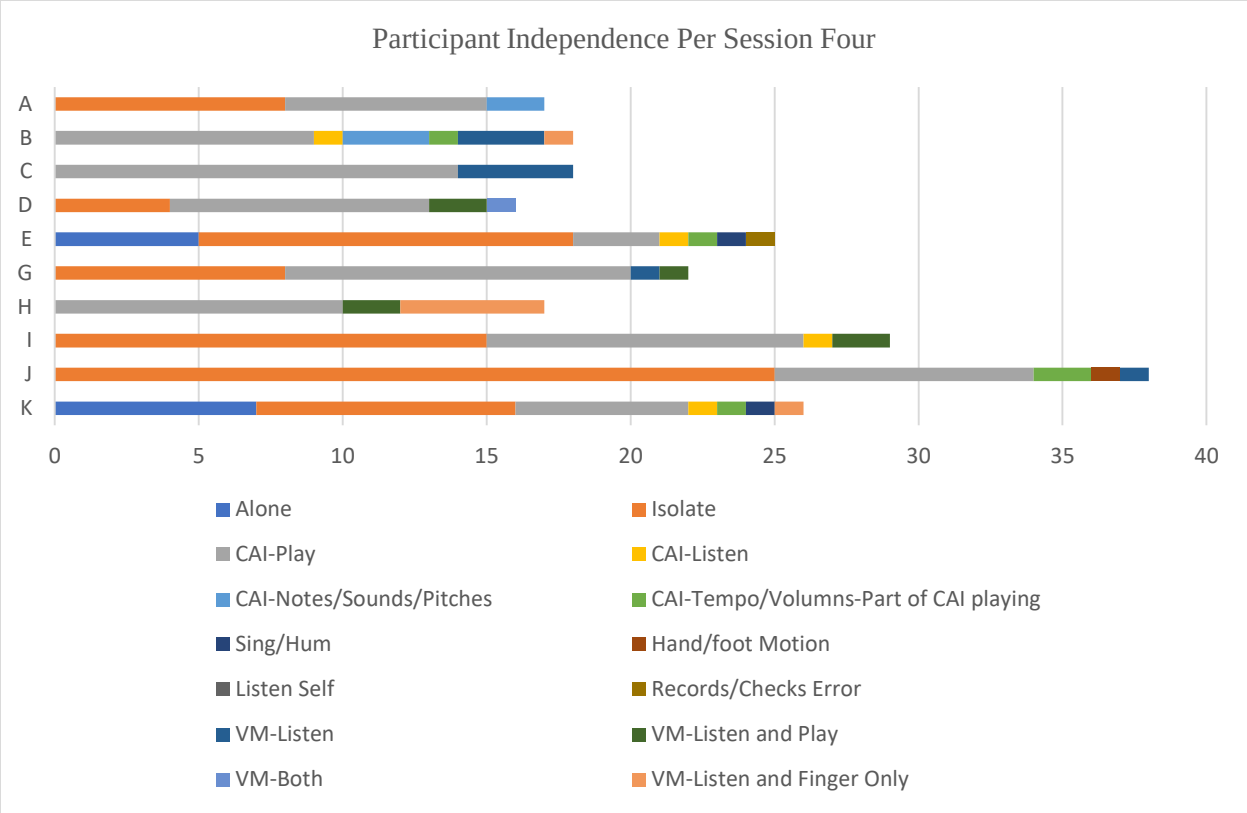


Figure V.4. Participant Independence Per Session Four

Table V.4. Participant Independence Per Session Four

Participant	Alone	Isolate	CAI-Play	CAI-Listen	CAI-Notes/Sounds/Pitches	CAI-Tempo/Volume	Sing/Hum	Hand/foot Motion	Listen Self	Records/Checks Error	VM-Listen	VM-Play	VM-Both	VM-Finger Only
K	7	9	6	1	0	1	1	0	0	0	0	0	0	1
J	0	25	9	0	0	2	0	1	0	0	1	0	0	0
I	0	15	11	1	0	0	0	0	0	0	0	2	0	0
H	0	0	10	0	0	0	0	0	0	0	0	2	0	5
G	0	8	12	0	0	0	0	0	0	0	1	1	0	0
E	5	13	3	1	0	1	1	0	0	1	0	0	0	0
D	0	4	9	0	0	0	0	0	0	0	0	2	1	0
C	0	0	14	0	0	0	0	0	0	0	4	0	0	0
B	0	0	9	1	3	1	0	0	0	0	3	0	0	1
A	0	8	7	0	2	0	0	0	0	0	0	0	0	0
Total	12	82	90	4	5	5	2	1	0	1	9	7	1	7

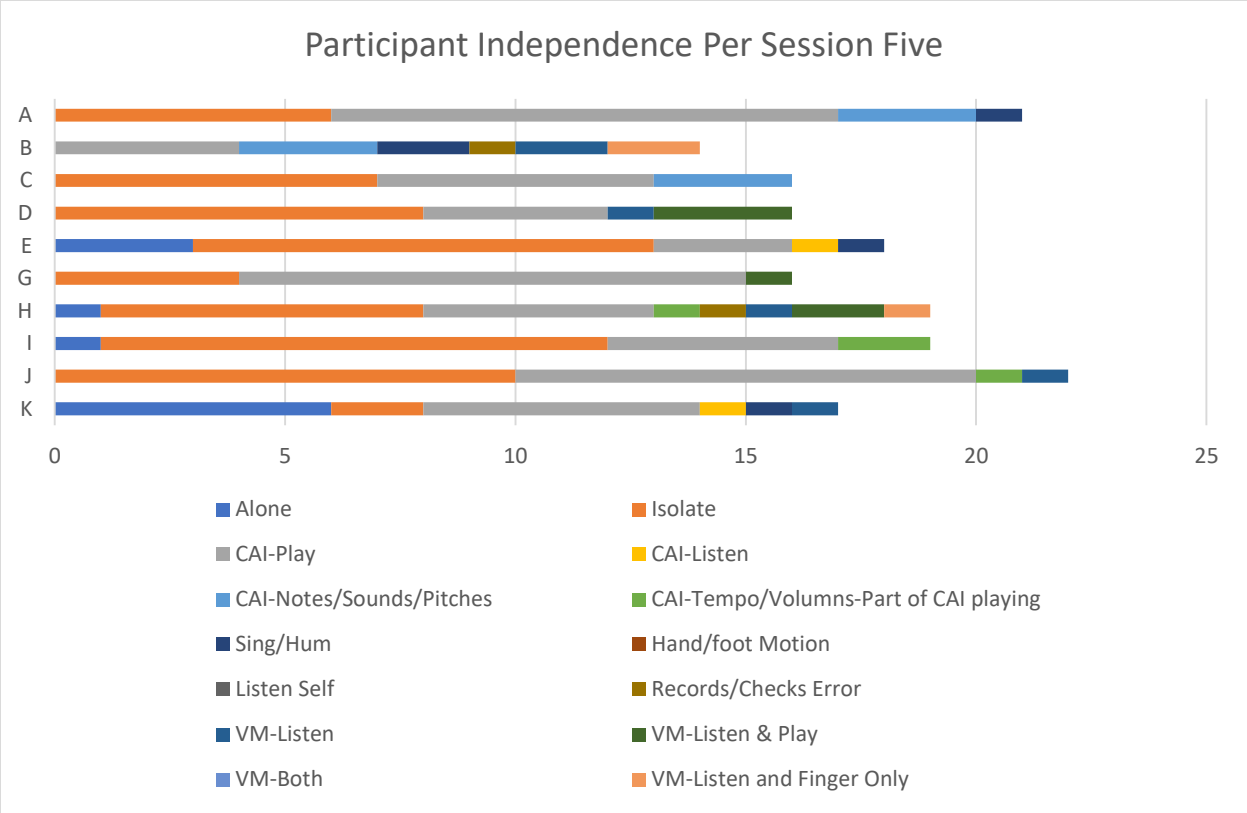


Figure V.5. Participant Independence Per Session Five

Table V.5. Participant Independence Per Session Five

Participant	Alone	Isolate	CAI-Play	CAI-Listen	CAI-Notes/Sounds/Pitches	CAI-Tempo/Volume	Sing/Hum	Hand/foot Motion	Listen Self	Records/Checks Error	VM-Listen	VM-Play	VM-Both	VM-Finger Only
K	6	2	6	1	0	0	1	0	0	0	1	0	0	0
J	0	10	10	0	0	1	0	0	0	0	1	0	0	0
I	1	11	5	0	0	2	0	0	0	0	0	0	0	0
H	1	7	5	0	0	1	0	0	0	0	1	2	0	1
G	0	4	11	0	0	0	0	0	0	0	0	1	0	0
E	3	10	3	1	0	0	1	0	0	0	0	0	0	0
D	0	8	4	0	0	0	0	0	0	0	1	3	0	0
C	0	7	6	0	3	0	0	0	0	0	0	0	0	0
B	0	0	4	0	3	0	2	0	0	1	2	0	0	2
A	0	6	11	0	3	0	1	0	0	0	0	0	0	0
Total	11	65	65	2	9	4	5	0	0	1	6	6	0	3

Table V.6. Total of Intervention and Individual Strategy Use

Interventions	Alone	Isolate	CAI-Play CAI-Listen	CAI-Notes/Sounds /Pitches	CAI-Tempo/ Volume	Sing/ Hum	Hand/foot Motion	Listen Self	Records/Checks Error	VM-Listen VM-Play VM-Both VM-Finger Only
Total	56	283	465	22	21	12	6	4	8	89

Appendix W: Percentage Interventions Applied Per Sessions

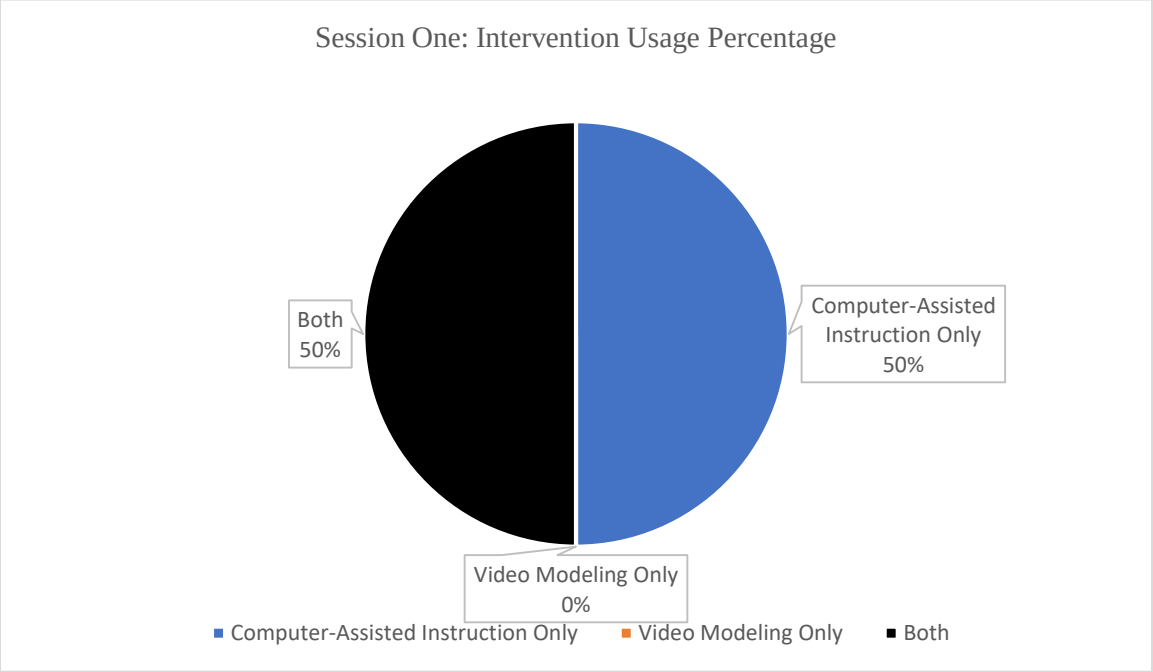


Figure W.1. Session One: Intervention Usage Percentage

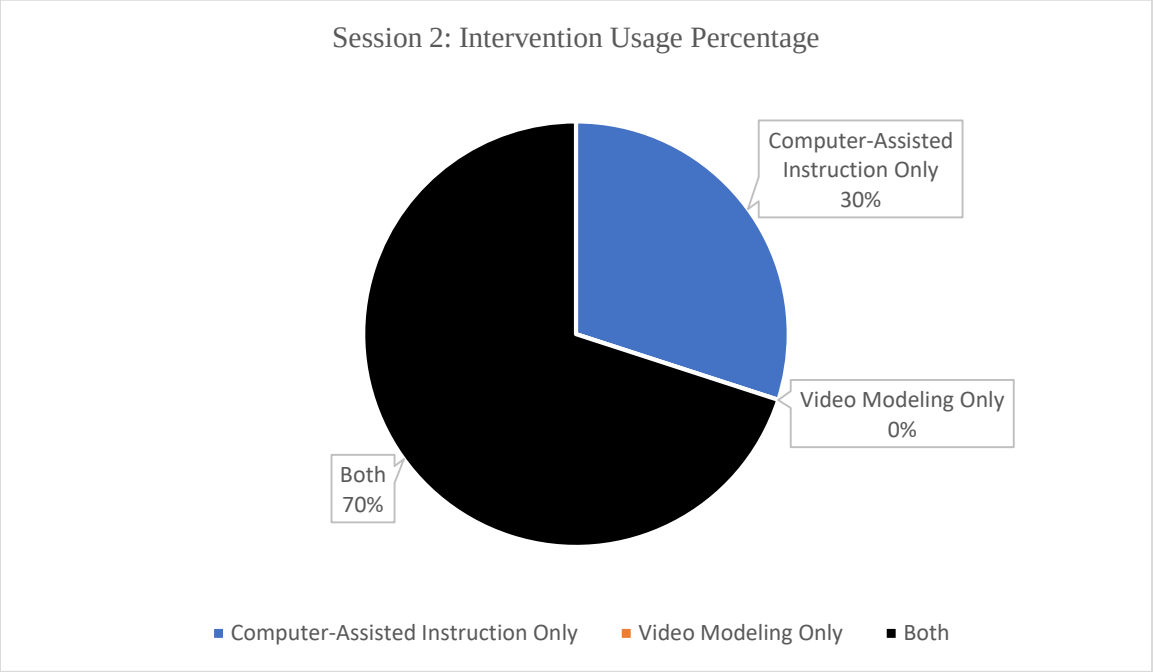


Figure W.2. Session Two: Intervention Usage Percentage

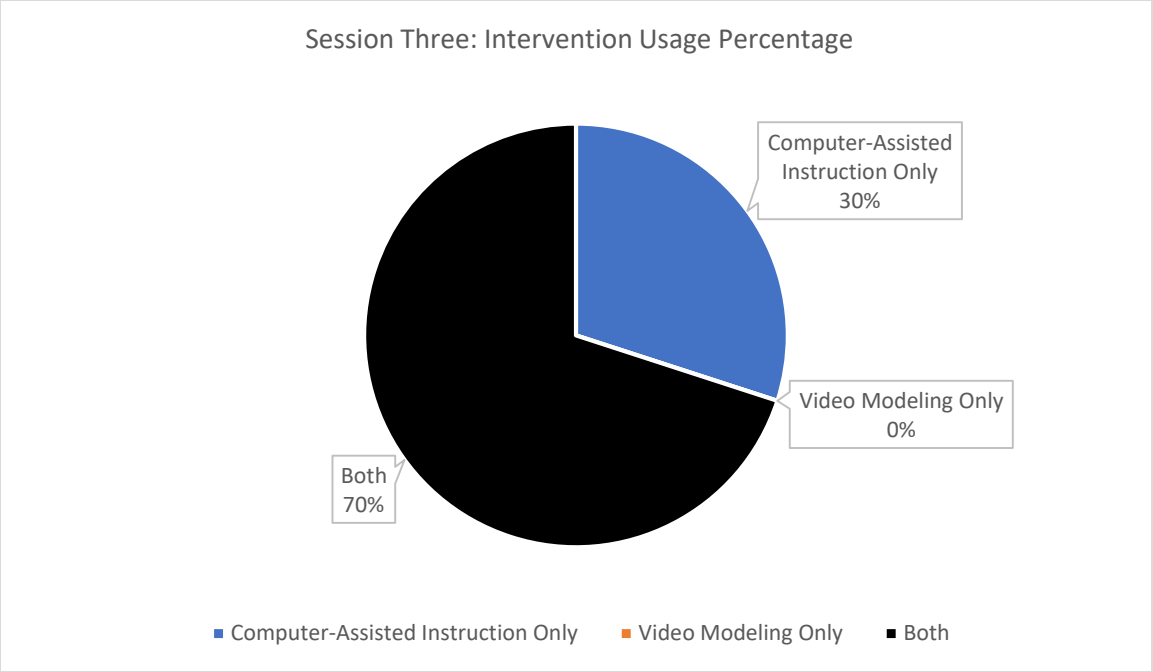


Figure W.3. Session Three: Intervention Usage Percentage

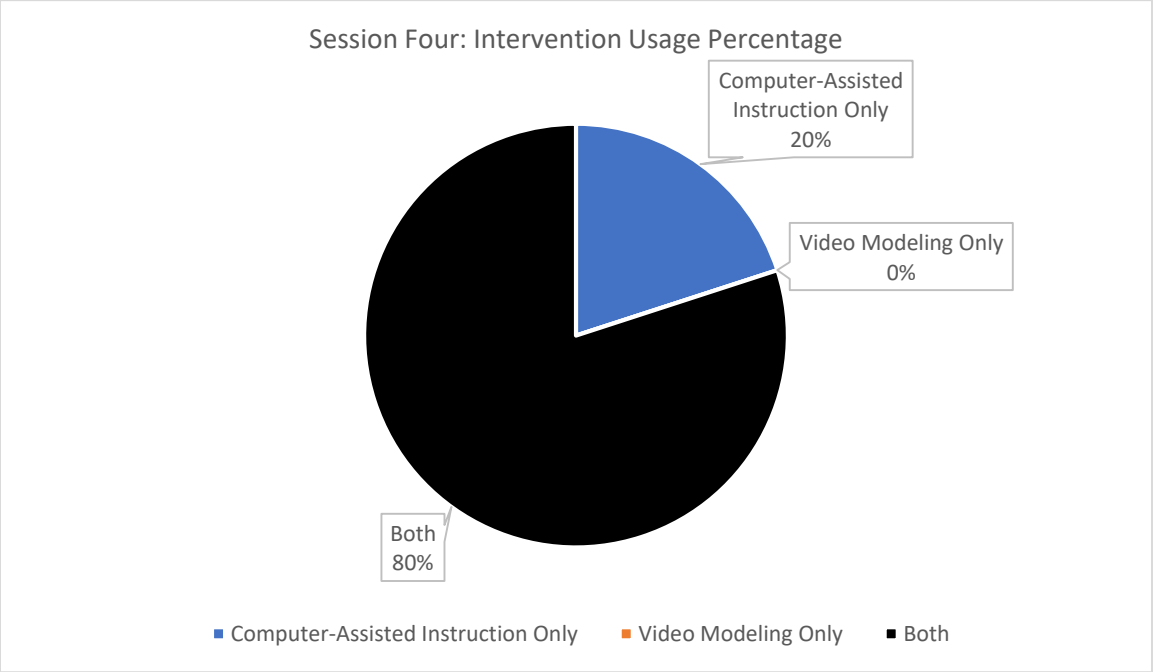


Figure W.4. Session Four: Intervention Usage Percentage

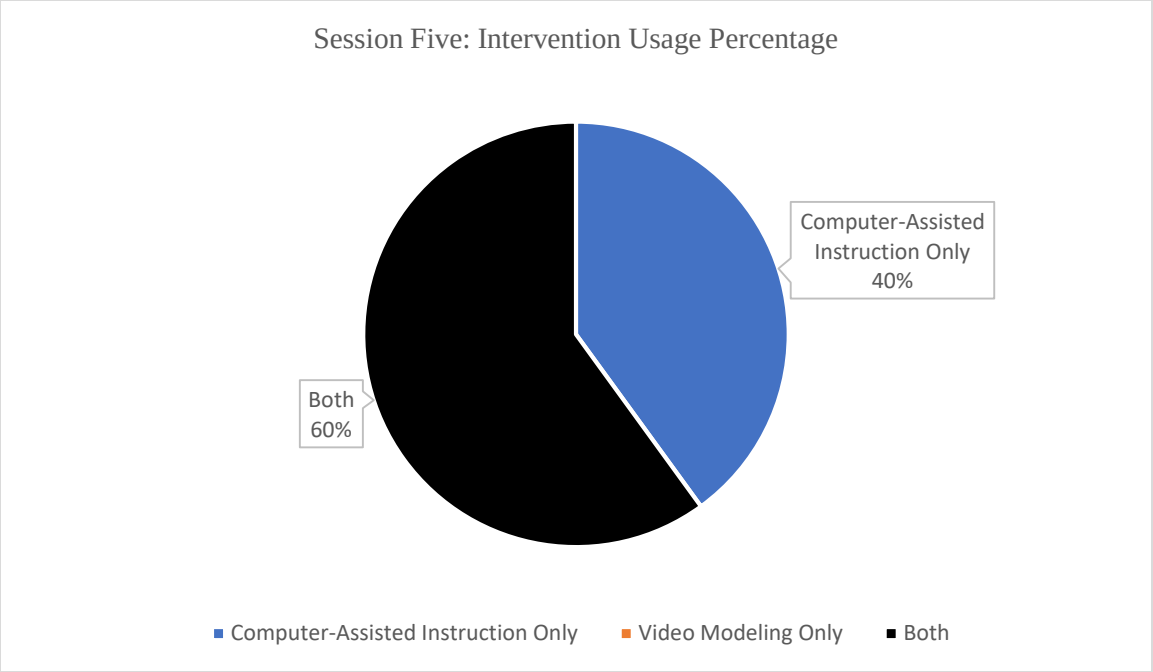


Figure W.5. Session Five: Intervention Usage Percentage

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