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Supporting the Mental Health Needs of Students with Autism Spectrum Disorder

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SUPPORTING THE MENTAL HEALTH NEEDS OF STUDENTS WITH AUTISM SPECTRUM DISORDER

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Abstract

This thesis studies interventions to support the mental health of students with autism spectrum disorder. According to Mazefsky (2019), more than 70% of youth with ASD have mental health conditions such as depression and anxiety. According to the National Alliance on Mental Illness, mental illness can impact an individual's thoughts, mood, behavior, daily functioning, and ability to relate to others. Schools must establish effective treatment measures that are efficient and cost-effective. The literature indicated several school-based interventions with promising evidence to reduce anxiety for ASD students. Mindfulness practices, physical fitness programs, school-based cognitive behavior therapy strategies, technology, and environmental accommodations all produced promising outcomes in reducing anxiety levels. School-based interventions increase accessibility to the curriculum and positively impact the generalization of learned skills.

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CHAPTER I: INTRODUCTION

Autism spectrum disorder (ASD) refers to a range of conditions that are characterized by challenges impacting an individual's social skills, repetitive behaviors, speech, and nonverbal communication skills. ASD affects the ways a person learns, thinks, and problem-solves. ASD is considered a spectrum disorder because it impacts individuals with a wide variation in the type and severity of symptoms. The ASD population ranges from highly skilled individuals who live independently to severely challenged individuals who require significant support to function in their daily lives. Each person with ASD has a distinct set of strengths and challenges.

Some common ASD symptoms included deficits in social and nonverbal communication, including a lack of eye contact, facial expressions, and gestures. Vocal characteristics such as flat, exaggerated, or monotone quality may also be atypical. Individuals with ASD commonly struggle to read the facial expressions, gestures, and emotions in others. ASD is also characterized by symptoms of repetitive patterns of behavior, restricted interests, and resistance to change. Children and adults with ASD typically have a lack of interest in others and a preference for objects. Children often use the objects in a nontypical way of play, including lining up or for self-stimulation linked to unusual responses to sights, sounds, smells, or textures. Individuals with ASD also typically present with rigid thinking, which may include ritualistic habits of the same routines and difficulty adjusting to any change. Another common ASD characteristic is restrictive or intense interests in an object or topic.

According to the Centers for Disease Control (CDC), the prevalence of ASD in the United States is 1 in 36 children. The ASD population commonly has higher stress and anxiety levels than neurotypical children. More specifically, ASD individuals frequently have comorbid conditions such as anxiety and depression (Lever & Geurts, 2016).

Anxiety disorders are the most common mental disorder in the United States. Anxiety is an emotion marked with heightened alertness caused by uncontrolled thoughts and beliefs that interfere with an individual's daily life. According to the Autism Research Institute, common symptoms of anxiety disorders include feelings of fear or doom, restlessness, increased heart rate, difficulty concentrating, muscle tension, irritability, changes in appetite, and sleep disturbances. An anxiety disorder may be diagnosed if symptoms continue after a stressor is removed or when symptoms become chronic. Some symptoms overlap with common ASD symptoms, such as repetitive behavior, rigid routines, rituals, flat affect, and limited social interactions. The most common form of anxiety in individuals with ASD is specific phobias, which causes extreme distress when exposed to a particular situation or stimulus. Having autism and anxiety can intensify the challenges for individuals living with these disorders.

There are several ways that anxiety and autism may interact (Hollander, 2018). People with ASD are often detail-focused, making transitions and changes to routines more difficult. These challenges can lead to an increase in anxiety. Individuals with ASD often have sensory sensitivities to noise, touch, sight, smell, taste, temperature, pain, and other factors that can lead to sensory overload, which can create anxiety. Having social interaction difficulties can also increase anxiety in ASD individuals, especially when preparing for or in social situations. A significant cause of anxiety is a sense of being misunderstood or not accepted, which are common feelings in the ASD population. Many ASD people process language differently, creating challenges with expressing wants and needs, which may increase anxiety levels. Difficulties in motor skills, executive functioning, and abstract thinking are common symptoms of ASD that can also create task frustration, leading to anxiety.

According to Mazefsky 2019, more than 70% of youth with ASD have mental health conditions such as depression and anxiety. These mental health conditions typically persist and even worsen into adolescence and adulthood. Mental health problems can impact an individual's thinking, mood, and behavior. Individuals with ASD are vulnerable to social, emotional, and behavioral issues. High levels of stress and anxiety heighten these problems and lead to exhaustion and meltdowns. Recognizing anxiety in patients with ASD can be challenging due to the overlapping and varying presentations of symptoms. Communication difficulties and challenges with understanding emotions may impact an ASD individual's ability to verbalize their anxious feelings.

Common features of anxiety that may present in ASD students include specific phobia, obsessive-compulsive disorder, social anxiety, and separation anxiety (Hollander, 2018). A specific phobia is an intense, irrational fear of something that poses little to no actual danger. Specific phobias are often associated with highly unusual stimuli such as balloons popping, vacuum cleaners, and fire alarms. They can also involve specific fears, such as insects or being in the dark. Obsessive-compulsive disorder is a form of anxiety associated with obsessive thoughts and compulsive behaviors. The symptoms of obsessive-compulsive disorder can be challenging to detect in ASD individuals because compulsions and repetitive behaviors are very similar. The difference between repetitive behaviors and compulsions is that compulsions are performed as a coping mechanism to manage anxiety, but repetitive behaviors are not. Social anxiety is another form of anxiety that is commonly seen in the ASD population. Social Anxiety is an intense anxiety or fear of being socially rejected. Social anxiety often impacts higher-functioning individuals in their adolescent to adult years when they become more aware of their social incompetence. Separation anxiety can also affect ASD individuals. Separation Anxiety occurs when an individual

experiences excessive fear or worry when separating from an attached person. The person is typically a close relative or an intimate partner.

Recognizing and treating anxiety in ASD individuals is crucial and can have a significant impact on the course of the disorder. Untreated comorbid anxiety is connected with the development of depression, aggression, and self-injury. There are many treatments for anxiety in ASD individuals, including pharmacotherapy, psychotherapy, educational therapy, occupational therapy, physical therapy, and family interventions. School-based interventions are needed to help ASD individuals cope with anxiety and reduce disruptive behaviors. Educators need to recognize anxiety and depression symptoms and know how to support the mental health of ASD students.

Despite the growing need, there is a lack of evidence-based anxiety-reducing interventions for individuals with ASD. The purpose of this literature review is to answer the research question: What are some school-based interventions that are effective in reducing the anxiety levels of ASD students? Interventions that will be discussed are mindfulness-based strategies, software applications, and technology support, school-based cognitive behavioral therapy, physical activity programs, and environmental accommodations and sensory techniques.

Supporting ASD individuals is an important issue to me, both professionally and personally. I have been a special education teacher for over 20 years. I have worked with many special education students in those years, and I am always looking for new and innovative ways to support my students. My awareness of anxiety symptoms in ASD students and knowledge of how anxiety can impact their daily functioning has dramatically increased. My aspiration to support my students with the challenges of ASD and anxiety has also increased. On a personal level, my nephew has ASD. I feel empowered to support him in his life-long journey to embrace all his positive qualities and manage his challenges. Increasing my expertise on the topic of ASD and

anxiety has increased my confidence level and knowledge of interventions to support my nephew, my ASD students, and their families.

CHAPTER II: LITERATURE REVIEW

Literature Search Procedures

The Bethel University Library was used as a search engine to locate literature and information for this thesis. Filters used to narrow the search included only peer-reviewed journals with publication dates of 2011-2023. The keywords used in the investigations included "mindfulness and ASD anxiety," "mindfulness and ASD mental health," "physical fitness and ASD anxiety," "physical activity and ASD anxiety," "physical activity and ASD mental health," "supporting ASD anxiety in the classroom," "anxiety and ASD," "school-based interventions for ASD anxiety," "applications to support ASD anxiety and mental health," "apps to support and ASD anxiety," "school-based CBT programs and ASD anxiety," "cognitive behavioral therapy and ASD anxiety" "Facing Your Fears curriculum and ASD anxiety," "assistive technology and ASD anxiety" and "ASD sensory over stimulation in the classroom." This chapter reviews school-based interventions in the following order: Mindfulness-Based Interventions to Support Anxiety in ASD Students, School-Based Cognitive Behavioral Therapy Interventions to Support Anxiety in ASD Students, Physical Activity Interventions to Support Anxiety in ASD Students, Technology-Based Interventions to Support Anxiety in ASD Students and Environmental Interventions to Support Anxiety in ASD Students.

Mindfulness-Based Interventions to Support Anxiety in ASD Students

Growing evidence indicates that mindfulness interventions reduce psychological distress and support well-being in the general population (Blanck, 2018). Mindfulness interventions are being used in schools to support students and teachers. Two mindfulness-based interventions (MBIs) have been widely accepted, including mindfulness-based stress reduction (MBSR), which was launched by Jon Kabat-Zinn in 1979 (Kabat-Zinn, 2003), and mindfulness-based

cognitive therapy (MBCT) by Segal, Teasdale, and Williams (Segal, et al. 2004). Despite the high percentage of individuals with autism spectrum disorder (ASD) who also suffer from anxiety and depression, there is limited evidence supporting the effectiveness in increasing the mental health of individuals with ASD and their families.

Mindfulness-based interventions are one intervention that is being studied as a way to reduce a multitude of mental health problems. The founder of Mindfulness, or mindfulness meditation, describes his working definition as "non-judgmental and non-reactive attention to experiences occurring in the present moment, including bodily sensations, cognitions, emotions and urges" (Kabat-Zinn 1990, 1994). It is based on Buddhist traditions. Mindfulness is an awareness of thoughts, feelings, bodily sensations, and the surrounding environment without interpretation or judgment. Practices can be formal or informal. Formal practices can include breathing exercises and body scans. Informal practices incorporate exercises into everyday life, such as observing the sounds, sights, and feelings around us. Mindfulness training is cost-efficient and time-efficient. It has proven to be effective with a variety of populations. However, very few studies have been done on the effectiveness of mindfulness training with the ASD population.

Understanding effective practices for reducing anxiety is essential for educators and may be especially effective for reducing anxiety and depression in the ASD population. Mindfulness is a powerful tool for supporting and teaching students to calm, focus, and interact with others. When teachers participate in mindfulness training, they can better manage their stress and emotional responses. Mindfulness can transform school culture and benefit teachers, parents, and children. It is a reasonably easy intervention to implement. Mindfulness has been associated with improving academic learning and social and emotional learning. Mindfulness can teach students lifelong strategies for coping with stress and anxiety.

One of the first controlled trials that demonstrated that adults with ASD benefit from Mindfulness-based therapy (MBT) was conducted in the Netherlands by Spek, et. al. (2013). Forty-two participants were placed in a nine-week MBT training or a waitlist group. The participants were adults with high-functioning autism. The intervention consisted of body scans, mindful movements, and meditations focused on breathing and body sensations. Home practices were also utilized to support incorporating mindfulness skills into daily routines in the home environment. Self-reporting questionnaires were used to measure the impact of the training. The results indicated a notable reduction in depression, anxiety, and rumination in the intervention group when compared to the waitlist group. This study consisted of participants with average to high verbal abilities, so it cannot be generalized to ASD populations with below-average verbal abilities. Future studies should incorporate other measures beyond self-reporting.

In 2020, Zhang, Lee, Mak, Ho, and Wong completed an overall review of mindfulness-based interventions (MBIs). The authors agreed that MBIs had been established as beneficial in healthcare, school, and the workplace. This study was conducted to gain information on the efficacy of MBIs on many specific problems. The study was conducted to gain evidence on the effects of MBIs on Post Traumatic Stress Disorder (PTSD), Attention Deficit Hyperactivity Disorder (ADHD), ASD, eating disorders, loneliness, and physical symptoms of cardiovascular diseases, diabetes, and respiratory conditions.

In the area of ASD, a systematic review completed in 2017 analyzed 16 studies, but definite conclusions and recommendations could not be made. The dilemma was due to diverse age groups and outcome measures. Some potential benefits of MBIs in the ASD population included reducing anxiety, thought problems, rumination, aggression, and parental stress.

Mindfulness-based interventions also potentially increase the individual's and the caregiver's well-being.

Hartley, et al. (2019) conducted a meta-analysis of 10 independent studies to summarize the effectiveness of mindfulness-based interventions for families impacted by ASD. The studies included children or adults with a primary disability of autism, Asperger's, or pervasive developmental disorder. The studies primarily focused on mindfulness interventions, including Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) with a trained practitioner. The training included face-to-face therapy and formal home practice. The mindfulness interventions occurred weekly from 1.5 to 2.5 hours. Interventions were delivered over five weeks up to 12 months, and total intervention hours ranged from 6.5 to 28 hours. Some modifications to the mindfulness training were made to meet individual ASD needs. Children with ASD and their caregivers were given mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT) components. Intervention effectiveness was measured using a standardized subjective well-being (SWB) self-evaluation that was given as a baseline, post-intervention, and at a follow-up. Both quasi-experimental and randomized controlled trials were used. The pooled sample consisted of 241 caregivers and 454 individuals with ASD, including 74 children and 139 adults.

The findings of the meta-analysis provided preliminary evidence of the effectiveness of mindfulness with individuals with ASD and their caregivers. Significant short-term improvements were indicated on the SWB and were maintained up to three months after the intervention. However, the results are weakened by the high risk of methodological and publication bias identified in the research (Hartley et al., 2019). Findings did support that when parents practice mindfulness, there was a reduction in aggression and self-injurious behaviors in children and an

increase in attention span (Neece, 2014; Singh et al., 2006, 2007, 2014). Reliable gains were reported in adults with ASD post-intervention and at the follow-up. Caregivers also reported noteworthy gains from the intervention.

Another systematic review was completed by Loftus, et al. (2023) and was published in March of 2023. This systematic review examined the efficacy of mindfulness-based therapy with anxiety, social skills, and aggressive behaviors in children and young people with autism spectrum disorder. The results suggested promising evidence that mindfulness interventions positively support ASD individuals. The study examined 23 articles describing quantitative and qualitative research implementing mindfulness-based interventions with ASD individuals aged 6-25. There were a total of 435 participants. The studies consisted of substantial variance in the types of mindfulness interventions. Some interventions were movement-focused, while others were mind-based mindfulness strategies. Some modifications were needed to meet the individual needs of the participants. The duration of the interventions varied from two weeks to 1.7 years.

The review results indicated that three out of the five studies measuring anxiety found an improvement. Eleven of the 14 studies measuring social skills found an improvement. All 14 studies measuring aggressive behaviors reported a significant reduction or a trend toward improvement following a mindfulness-based intervention. No notable differences were found between the outcomes of movement-based interventions compared to mind-based interventions. In conclusion, the children, adults, and caregivers all reported significant gains in their well-being after the intervention.

The recommendation was to interpret the results with caution. The study was considered weak due to a lack of randomized control trials and comparison conditions, poor fidelity, and

minimal reporting. Of the 23 articles, over half needed better methodological quality. Four articles were of strong quality, and five were of adequate quality.

The Tübinger Training for Autism Spectrum Disorders (TüTASS) program focuses on using mindfulness-based training elements to improve the emotion and body perception of patients with ASD. The goal of the program is to support children with ASD in the understanding of their emotions and bodies as well as gain a better understanding of the body language of others. Improving these skills will improve social interactions, management of daily routines, and decrease atypical behaviors. The program was implemented in groups of 6 to 8 children aged 7-12. The children practiced mindful perception of body and emotion for twelve 90-minute sessions provided weekly. The training was divided into four parts. Part 1 was labeled "Mindfulness perception of emotions and body." Part 2 was named "Characterizing one's perception of emotions and body." Part 3 focused on "Coping with the perception of emotions and body." Part 4 was classified as "Perception of oneself and others."

Drüsedau, et al. (2022) completed a study to assess the effectiveness of the program. The study used psychometric assessments and rating scales to compare the symptoms of 25 children with ASD before and after the program. The children completed the assessments as well as their parents. The results indicated that after completing the program, symptoms substantially declined in the areas of emotional and social problems, externalizing behavior, and attentional and schizoid-compulsive behavior. Parents and children reported positive evaluations of the program. The reports indicated that participants were motivated to participate, liked the group setting, and found the training helpful. There were almost no negative comments. Some limitations of the study include unequal gender distribution and self-rating reports with no blind observer ratings.

Assessing the impact of mindfulness (MF) in improving emotional regulation is challenging due to the reliance on self-reporting tools. Electroencephalography (EEG) has been shown to be a successful measure in determining neural responses to emotional arousal and mediation in other studies of populations without ASD. A review completed by Lomas, et al. (2015) determined that MF strategies were associated with increased alpha and theta power in healthy individuals based on 56 papers on EEG samples. Susam, et al. (2022) conducted an EEG-based study to measure mindfulness meditation's impact on 35 youth with ASD. The study used a classification framework to analyze the brain signals of the participants after a brief MF exercise. The classifier measured resting states preceding (Pre-MF) and following (Post-MF) mindfulness meditation exercises to identify a change in neural response. The participants were between the ages of 12-21 with a diagnosis of ASD. EEG data was recorded using a Wearable Sensing DSI-24 wireless dry electrode EEG headset.

Participants were asked to complete a task consisting of four card games with breaks between games. The card games included deception and were based on an Affective Posner task. An “Affective Posner task is a neuropsychological test often used to investigate the effects of covert orienting of attention in response to different cue conditions” (Posner, 1980). The mindfulness condition included participants listening to an MF meditation. The MF mediation was led by an MF-Based Stress Reduction teacher with clinical expertise working with ASD individuals. For this study, the MF exercise consisted of a 2-minute awareness of a breathing task delivered through an audio recording. The MF task focused on the physical sensations of breathing and non-judgmental awareness of any inattention. The study investigated the changes in rest-state brain activities when there is a mindfulness exercise or not mindfulness exercise. A Wilcoxon rank-sum test was used to evaluate the results. The results indicated that alpha band

power and theta band power significantly increased with a 2-minute mindfulness meditation exercise for ASD individuals.

The study supports that MF exercises, even brief, have a promising effect on youth with ASD. This study supports further exploration of this topic. More evidence is needed on whether the detected neural responses will indicate more positive outcomes on the mental health and adaptive behaviors of ASD individuals. Limitations to this study include no control group, which limits the ability to make conclusions about the lasting impact. The study also included a small sample within a limited age range, so conclusions cannot be made for other age groups. Future study recommendations included exploring the effects of different durations of MF mediation exercises and studying regular mediation versus occasional mediation.

Another study that investigated the effectiveness of a mindfulness strategy was conducted in Hong Kong (Ho, et al. 2021). The mindfulness program investigated was MYmind, and the participants included Chinese adolescents with autism spectrum disorder and their parents. Participants were divided into two groups. One group received the program immediately (MYmind group), and the second group received the program nine weeks later (waitlist group). The intervention consisted of 9 weekly 90-minute mindfulness sessions for the adolescents and their parents. During the sessions, the adolescents learned strategies to increase their concentration, enhance their mental and emotional capacity, and improve their ability to relate to others. The parent sessions focused on strategies to reduce stress and apply mindfulness to interact with their child positively. The mindfulness program included yoga and meditation exercises focused on breathing, body, sound, thought, and walking. The exercises were based on mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction therapy (MBSR)(Kabat-Zinn, 1982). Homework assignments were also part of the program, including

reading handouts, listening to instruction audios to practice mindfulness exercises, and diary registrations.

Multiple checklists, rating scales, inventories, and questionnaires collected data. Thirty-seven families participated in the study. The average age of the adolescents was 13, and 76% were boys. The results indicated that the MYmind program was practical in the Chinese context. Significant findings were indicated in the parent's rumination, mindful parenting, parenting style, and parenting stress. Overall, the Chinese adolescents with ASD and their parents considered the MYmind program "comprehensible and acceptable" in terms of program contents, helpfulness to parents, and satisfaction with the program. Parents rated the program as helpful to a small extent to their children. No significant differences were found in the waitlist group and the MYmind group. This could be because the timing of the study was during the summer, which is typically less stressful without having to attend school. Future research recommendations included another study conducted during school, including self-reporting methods and not just parental checklists and rating scales.

Children with ASD also struggle with executive functioning, which can impact their mental health. The Center on Developing Children at Harvard University defines executive function as the mental processes that enable us to plan, focus attention, remember, and juggle multiple tasks. There are three primary executive processes: Inhibition (self-control), working memory (ability to use information), and cognitive flexibility (changing one's perspective) (Diamond, et al. 2013). Inhibition and selective attention are two challenge areas that many students struggle with. Executive functioning deficits are associated with a reduced quality of life and fewer adaptive behaviors. Juliano, et al. (2020) aimed to investigate the effectiveness of a

school-based mindfulness program for improving inhibition and selective attention in children with ASD. The intervention followed the *Mindful Schools* intervention program.

An eight-week school-based mindfulness program was provided to 27 students with ASD. The participants all had a primary disability of ASD. Eleven had one comorbid mental health diagnosis, and ten had at least two comorbid mental health diagnoses. The comorbid mental diagnoses included ADHD, Anxiety Disorder, Sensory Processing Disorder, and Speech or other Language Disorder.

Three neuropsychological measures were used to evaluate the effectiveness of the school-based program *Mindful Schools.* The Walk/Don't Walk (W/DW) and Color-Word Interference tests (CWIT) were used to measure inhibition and interference control. Selective attention was measured using a cancellation test (CN) from the Wechsler Scale of Intelligence for Children, Fourth Version.

The mindfulness intervention included 30-minute sessions delivered twice weekly for eight consecutive weeks. Each session followed a similar routine of 5-10 minutes to transition, a mindful tone using a gong to focus attention, and mindful breathing for 1-2 minutes. Next, the participants had the opportunity to discuss any experiences with mindful practices. The remainder of the session were activities from the *Mindful Schools* curriculum. The curriculum includes 16 sessions on mindful breathing, body, listening, thoughts, and emotions.

The results indicated significant advancement following the intervention in prepotent response inhibition (ability to stop a response that has already started), interference control (persistence when given distractions), and overall selective attention. These results indicate that school-based mindfulness is promising in increasing the executive functioning abilities of children with ASD.

School-Based Cognitive Behavioral Therapy Interventions to Support Anxiety in ASD Students

Social deficits associated with ASD often make it difficult for these students to connect with peers, leading to anxiety. This anxiety can lead ASD students to withdraw from social situations and be isolated from their peers. A promising intervention to support anxiety levels in ASD students is cognitive behavior therapy (CBT). Cognitive-behavioral treatments (CBT) are evidence-based treatments for anxiety in the general population that are provided in clinical settings. CBT has been proven to be one of the most effective interventions for treating anxiety in clinical settings (Higa-McMillan, et al. 2016). CBT is a psychological intervention that uses gradual exposure to develop skills that engage in metacognition to modify thoughts and behaviors (Beck, 2011). A significant limitation of CBT is that it typically occurs in clinical settings with clinical staff. Researching CBT in school settings is essential to help generalize skills learned and support success in school.

The core components of CBT treatments for anxiety include psychoeducation, somatic management, attention to automatic negative thoughts, and graded exposure. Modified CBT interventions have been developed for ASD youth. Modifications have been made to CBT to increase accessibility. Examples of improvements included visual schedules, checklists, repetition and practice, role play, incorporation of special interests, use of video self-modeling, and regular parent participation (Moree, et al. 2010). With many ASD youth also struggling with anxiety, there is a crucial need to bring modified CBT into school settings to increase accessibility. Some CBT treatments have been designed specifically for ASD youth, such as the Facing Your Fears (FYF) program. The FYF program was modified for implementation in a school setting.

One of the first school-based treatment programs for youth with ASD was studied in Singapore using the Facing Your Fears (FYF) Intervention Program by Drmic, et al. (2017). The study aimed to modify the FYF program to support anxiety management in ASD youth in a school setting. The study included training and coaching non-clinicians to implement the FYF program. The study assessed the program's initial feasibility, acceptance, and effectiveness.

The participants included school staff and students from 22 mainstream secondary schools. The school staff included Allied Educators who implemented the program and psychologists who supported them as coaches. Forty-four students with ASD and anxiety participated. The students received an adapted version of the Facing Your Fears program, the FYF school-based program (FYF-SB). The FYF-SB version maintains the main components for anxiety treatment, including psychoeducation, development of coping skills, emotional regulation strategies, problem-solving, cognitive self-control, and graded exposure. Two outcome measures, the Screen for Child Anxiety Related Disorders (SCARED) and Developmental Behaviour Checklist- Teacher Version (DBC-T), were included in the study.

Overall, the study results indicated that the original program was successfully modified and implemented in secondary schools by non-clinicians in Singapore. Treatment outcomes indicated a significant decrease in anxiety symptoms after the intervention, as self-reported by students and reported by parents. More specifically, 44% of youth with anxiety in the clinical range showed a significant improvement after the intervention. The results indicate a potential for implementing FYF-SB in a school setting to support the anxiety of ASD youth. Some limitations of the study include a need for more information on the fidelity of the program. The sample size was also small, and there was no control group. It was also noted that the results might be different in other countries. The outcome measures were considered a limitation as

neither were specifically designed for individuals with ASD. Suggestions for future studies include pre- and post-ratings and separate clinical and research teams.

Rosen, et. al. (2022) conducted a case study on two students participating in the Facing Your Fears: School-Based program (FYF-SB). The FYF-SB intervention consisted of 13 group sessions. Sessions 1-7 focused on psychoeducation, and sessions 8-12 focused on graded exposure. Three parent sessions were also part of the FYF-SB intervention.

The two students were between 8-14 years old and had known or suspected ASD. Luis was diagnosed with Social Anxiety, two Specific Phobias (i.e., bugs and loud noises), and Special Interest Fears. His parents also reported school avoidance symptoms. He participated in the FYF-SB intervention. According to the SCARED parent report and self-report, Luis significantly decreased anxiety, panic, Generalized Anxiety Disorder (GAD), and school avoidance symptoms after the FYF-SB intervention.

The second student was a ten-year-old female named Frankie. Frankie was not formally diagnosed with ASD but presented with social/communication impairments consistent with ASD. She had been diagnosed with Attention Deficit Hyperactivity Disorder, GAD, Other Social Fear, and Specific Phobia. After the intervention, her parents reported a meaningful decrease in total anxiety symptoms, panic, GAD, and separation anxiety. Frankie self-reported a meaningful decrease in total anxiety. She no longer met the criteria for Specific Phobia or GAD.

According to data collected through clinical interviews, parent reports, and self-reports, the students improved anxiety in multiple domains after the intervention. The results support modified CBT interventions in school to lower students' anxiety levels with ASD. Some limitations of the study included that both students were receiving other school-based services, which may have impacted the decrease in anxiety. Other factors that may have impacted anxiety

levels were not examined, such as attendance, class participation, academic performance, or disciplinary referrals. Future studies were recommended to gather more information and expand on the limitations.

Delivering CBT programs in schools could help generalize skills from one context to another and minimize disruption to education caused by students needing to travel to clinics. Clark, et al. (2017) conducted a study to investigate a school-based CBT using a quasi-experimental design. The study utilized Tony Attwood's Exploring Feelings; Cognitive Behavioural Therapy to Manage Anxiety for children aged 10-12. The intervention consisted of one-hour sessions once a week for six weeks. Session one focused on the participants exploring their strengths and unique talents. The next session focused on the physical symptoms of anxiety and relaxation techniques. The third session explored relaxation techniques. Session four was a reflection of how the participants used the relaxation techniques. In the following session, the children were instructed to write a social story to help them understand situations that cause them anxiety. The final session had the participants identify the most helpful relaxation tools. The participants then wrote a social story.

Three categories of measures were used in the study: descriptive measures, outcome measures, and qualitative data. Descriptive measures included The Wechsler Abbreviated Scale of Intelligence (WASI) and Social Responsiveness Scale (SRS). Descriptive measures describe the participants and were collected before the intervention. Outcome measures provide information on the effectiveness of the intervention. The outcome measure used in this study was the Spence Children's Anxiety Scale (SCAS). Qualitative measures included semi-structured interviews.

The results indicated that the children who received the CBT intervention had a reduction in anxiety levels compared to the control group. Follow-up data indicated that anxiety levels increased slightly compared to the post-intervention data, but it was still significantly below the pre-intervention level. These findings support that school-based CBT programs can support ASD children in managing their anxiety levels.

Some limitations to the study included that there were a low number of participants, and they were all male. Another limitation of the study is that the CBT intervention was implemented in a school setting but not by school staff. Parents and children were also aware of which group the children were in, which could create a rater bias. Recommendations for future studies included having a control group and an experimental group in the same school. Future studies should also include some female participants.

Luxford, et al. (2017) conducted another study on the effectiveness of school-based Cognitive Behavioral Therapy (CBT) using the Exploring Feelings intervention to reduce anxiety and social worry symptoms in the ASD population. Thirty-five individuals with ASD between 11-14 years old participated in the study. The participants were randomly assigned into six sessions of either Exploring Feelings or a waitlist control group. The intervention sessions were 90 minutes long. A home project and worksheets were taken home at the end of each session.

After the intervention, the CBT group, compared to the waitlist group, showed more significant decreases in anxiety symptoms, school anxiety, and social worry. These results were maintained for six weeks post-intervention. The results supported previous findings to show that CBT is an effective intervention for reducing anxiety and social worry symptoms in students with ASD. The study supports the Exploring Feelings intervention in the school setting.

A review completed by Rotheheram-Fuller, et al. (2011), examined existing literature on CBT interventions and suggested methods for using similar interventions in school settings. Five studies were reviewed of CBT intervention used with individuals with ASD. The sample sizes were greater than 20. The majority of the studies were completed in private settings. Suggested ASD accommodations included modifications to language, including the use of concrete language and developmentally appropriate vocabulary. Also, providing a list of rules is more helpful than focusing on cognitive restructuring. Scripts or comic strip conversations were also recommended. When discussing anxiety, talking about physical symptoms instead of emotional experiences may be easier for ASD individuals. Other accommodations included using hands-on activities and visual aids and providing explicit direct instruction. Additional adaptations included using a child's strengths, specific strategies for generalization, and behavioral supports to increase attentiveness and participation. Training parents is also recommended to increase consistency across settings.

The study noted that a few concerns need to be addressed to implement a CBT program in a school successfully. The first is the training and skills of the individuals implementing the program. Many school staff have multiple responsibilities that conflict with the addition of another responsibility. The time needed to dedicate to CBT interventions may also be a concern in a school setting. Traditional CBT sessions typically consist of one to two hours a week.

The review results indicated several benefits of integrating CBT programs in schools. ASD children often have the most challenges at school. Bringing effective strategies into school offers more support to these students. CBT interventions include behavioral methods proven effective with children with ASD. CBT strategies focus on both thoughts and behaviors. Behavior strategies address immediate problems and longer-term cognitive issues. Applying

CBT in school settings supports the generalization of skills learned in school, including the playground, where children often have more social interactions.

More research was recommended to determine the specific skills most effectively addressed with CBT. Overall, the study provided preliminary evidence supporting that CBT should be an intervention option in schools. Specific requirements were mainly considered unknown. It was noted that it is essential that school-based providers would need training in CBT methods and ASD. Since the ASD population can be impacted in differing areas and have very individual needs, evaluating a student's language, emotional, and adaptive skills would be necessary before any CBT interventions.

A study completed by Kester, et al. (2019) researched the perspectives of key stakeholders regarding the acceptability, feasibility, and sustainability of using the Facing Your Fears (FYF) program in a school setting. Focused group discussions used the integrated knowledge translation (IKT) framework to gain information from educators and parents of ASD children with anxiety. The second part of the study focused on applying the knowledge gained to identify adaptations to the FYF to aid school implementation.

The participants included teachers and parents from one public school district in Vancouver, British Columbia, Canada. Three educators from three different schools were included in the study. All the educators had experience with students with ASD and some experience with the FYF program. The parent group included two mothers of children with ASD comorbid with anxiety symptoms. The children were between ten and twelve years old and fully integrated into mainstream classrooms. Both groups engaged in two group discussions lasting between 60-75 minutes.

The discussion's guiding questions focused on strengths, barriers, and adaptations. All participants agreed that it was essential to provide school-based anxiety interventions and that the team approach was crucial. To ensure effectiveness and sustainability, educating and including mental health therapists, school-based counselors, psychologists, and other staff not directly implementing the program was essential. Parent involvement was also rated critical.

The educators and parents report that including classmates in a class-wide session is the highest priority. Reasons given included that a class-wide session would provide opportunities for peers to develop empathy and understanding among peers. Peers may also benefit from the intervention if they are experiencing anxiety within themselves.

Multiple recommendations were reported regarding the structure of an FYF school-based program. One recommendation was to make FYF a district-based program with cohort training sessions. Parent coaching strategies were recommended to support the implementation of learned strategies outside of the school setting. Another recommendation was to provide active rehearsal of emotional self-regulation. Implementation recommendations included adjusting the session duration and program length to fit the school schedule. Individual sessions should be reduced from 90 to 60 minutes, and the program duration should be reduced from 14 weeks to 10 weeks. Other adaptations included using changes to vocabulary, modifying graphics, and using visual supports. A final recommendation was to allow individual modifications while implementing the program.

Three limitations were identified in the study. The first limitation included the study’s small sample size. Another limitation was that the educators involved in the study were not in various roles. All educators were in the position of learning support teachers (LSTs) even though effort was made to recruit school counselors, classroom teachers, and educational assistants.

In conclusion, the study provided valuable information to help bridge the gap between researching and implementing a school-based anxiety program for students with ASD. Recommendations for future studies included additional studies using the Integrated Knowledge Translation (iKT) approach and adding the perspectives of counselors and psychologists. The next step would be to study the effectiveness of a school-based version of FYF.

A study was conducted by Sizoo, et al. (2014) to compare and investigate the effectiveness of mindfulness-based stress reduction (MBSR) and cognitive behavioral therapy (CBT) in reducing anxiety and depression symptoms in adults with ASD. CBT is used to treat anxiety and depression and can be described as a type of talk therapy that helps patients become aware of inaccurate or negative thinking so individuals can view challenging situations more clearly and respond more effectively (Mayo Clinic, 2019). MBSR is an eight-week evidence-based program that offers intensive mindfulness training to support individuals in managing stress, anxiety, depression, and pain (Kabat-Zinn, 2005).

Fifty-nine adults participated in the study. All had anxiety and depression scores of above seven on the Hospital Anxiety and Depression Scale. Twenty-seven participants received a CBT intervention; thirty-two followed an MBSR protocol. Baseline scores were recorded in the areas of anxiety, depression, autism symptoms, rumination, and global mood. The MBSR and the CBT groups consisted of 9-11 individuals. Both groups received 13 weekly interventions for 90 minutes.

The results suggested that both interventions are equally effective in improving anxiety and depressive symptoms. Improvements were also noted in global mood, rumination, and autistic symptoms. The positive effects were sustained at a three-month follow-up. The study's results did not indicate any evidence that one intervention is more effective than the other. Some

evidence suggests that MBSR is more effective in treating anxiety than CBT, but this conclusion should be taken with caution.

Limitations to the study included that researchers needed to measure treatment integrity formally. There was also no active control group to explore whether CBT was more effective than other interventions. Considerations for future research included exploring the efficacy and feasibility of a school-based CBT intervention that focuses on reducing anxiety and increasing social competence and attention. Larger sample sizes were also recommended. Some suggestions for further research included conducting the study with a control group, which limited these study results.

A study completed by Simpson, et al. (2019) examined existing literature on the use of CBT in school settings with school personnel. The review included ways school personnel were incorporated into the CBT interventions and evaluated the results of the intervention on reducing anxiety in ASD students. Eight studies were included in the review, with 187 participants with ASD within the age ranges of seven to fifteen years old.

The CBT intervention sessions lasted 60-90 minutes, focusing on strategies to recognize symptoms of anxiety and cognitive restructuring approaches to manage anxiety. Gradual exposure techniques were used to change behaviors to anxiety-provoking situations. Homework activities were often included after the sessions.

The study identified and examined studies of CBT interventions implemented in schools by teachers and other school personnel to reduce anxiety levels in ASD students. The study found that implementing a school-based CBT program helped participants to generalize skills across settings and provided more consistency with behaviors and expectations. Teachers and paraprofessionals could redirect students during episodes of high anxiety better. Training of

multiple school personnel would be necessary to implement school-based CBT interventions. Collaboration between school psychologists, special education teachers, and counselors would be vital.

Some limitations to the review included a need for more specific detail on how school personnel were included in the CBT interventions. Additional research was recommended to determine which CBT interventions would be best suited for school. Other limitations included that only studies published in English were included in the review. Some reviews may have reported on the same research affecting the sample size reported. Another limitation reported was that no single anxiety measure was used across all studies.

Technology-Based Interventions to Support Anxiety in ASD Students

The use of gamified mobile apps and other forms of technology has also shown promising results in reducing anxiety in students with ASD. Clinicians and educators are exploring technology to support existing therapies and teaching methodologies for individuals with ASD. Technology can assist the generalization of skills through naturally motivating features and providing immediate feedback. Technology can also be used by a variety of caregivers and clinicians in a variety of settings. Children and adults with ASD are also often interested in technology, making it a suitable treatment method.

With the continuous advancement of technology, electronic devices have been integrated into many aspects of life. The use of emotion regulation applications is another strategy explored to support the mental health of ASD students in the mainstream classroom. Emotional Regulation (ER) is often addressed in special education settings but is often not generalized to general education settings. Many strategies rely on the active presence of an adult or paper-based

supports such as pictures. Mobile technological devices can support and accompany individuals with ASD in their daily lives while avoiding stigmatization.

Fage, et al. (2019) completed a study to determine if the emotional regulation of adolescents with ASD could be supported in the mainstream classroom through a mobile application prototype. The study participants included 14 adolescents with ASD utilizing the application for three months in mainstream schools. This group was compared to 15 adolescents who did not use the application. The ER interventions included two steps: 1) emotion identification and 2) regulation strategy. First, the individual identified emotion and then the level of emotional intensity. Each intensity level was paired with a different coping strategy. The participant was observed in a new mainstream class where new situations were feasible. The class occurred once a week for three months. A school aid supporting the study accompanied the student.

Data collected consisted of times students used the application and the types and levels of emotions noted. Data was also collected pre and post-intervention using self-regulation questionnaires filled out by special education teachers. Emotion word fluency data was also collected. In addition, the students filled out Self-Levels of Emotion Awareness. The results showed that the application had high usability scores and resulted in better self-regulation in the mainstream classroom for adolescents with ASD. Limitations to the study were reported as the participants did not cover the spectrum of intellectual functioning. The experiment also did not include a control group. Future recommendations included adding a visual timer due to the report that aides had to prompt students to quit the application. Some participants requested that additional emotions be added to the application, indicating that a broader range of emotions may be needed.

Bossenbroek, et al. (2020) completed a study at the Behavioural Science Institute at Radboud University to evaluate the effects of utilizing a virtual reality biofeedback game DEEP to address daily anxiety and disruptive behaviors. DEEP is an underwater fantasy world players explore using their breathing to control their movement. There are no goals to attain. Players just experience a relaxing and immersive experience. Players wear a belt with a sensor located below their diagram. The sensor monitors the individual's breathing and then controls the player's movement in the game. The slower the player's breathing is, the better they can move around in the game.

The participants of the study included eight adolescents with behavioral and psychiatric problems. The participants completed six DEEP sessions over four weeks. Self-reported assessments of anxiety levels were collected three times a day. Teacher-reported data was collected for classroom behavior. The results found that six participants experienced decreased anxiety, and five showed decreased disruptive behavior on days when the participants played DEEP. Researchers also discovered that the calm state lasted for about two hours. The study supported using the game DEEP to reduce anxiety for adolescents with behavioral problems. Bossenbroek, et al. (2020) recommended future research to support the results of this study.

“Gamified mobile apps using behavior change techniques (BCTs) demonstrate a promising way to increase physical activity and consequently reduce anxiety in adults with ASD” (Lee, 2021). A study completed by Lee, et al. (2022) compared the success of the mobile app PuzzleWalk versus the commercial app Google Fit in increasing physical activity and reducing sedentary time as a treatment for anxiety in ASD individuals. The participants included 24 adults with ASD. The participants were given either PuzzleWalk or Google Fit.

Data was collected for seven days, targeting physical activity, sedentary time, and anxiety levels over three different data collection periods. Anxiety level data was collected using results from the Beck Anxiety Inventory. Physical Activity was measured through triaxial accelerometers. Triaxial accelerometers provide simultaneous measurements in three orthogonal directions to count all the vibrations experienced by a person or structure (PCB Piezotronics, 2023).

The results indicated that PuzzleWalk and Google Fit effectively decreased sedentary time and increased moderate to vigorous physical activity among adults with ASD. The PuzzleWalk group spent more time on the app than the GoogleFit group. Anxiety levels were positively connected to light physical activity, steps, and total activity counts. Anxiety levels were negatively impacted by sedentary time following the intervention. Future research was recommended to evaluate the sustainability of the results and the relationship between the apps and anxiety symptoms (Lee, et al. 2022).

Students with ASD may also experience anxiety on the school bus ride and other forms of public transportation. Riding public transportation can impact an individual's ability to be active in their community. Community engagement is essential to a healthy and prosperous life (Davis, 2010). Data indicates that 72% of ASD individuals miss out on activities due to not having a personal driver (Lubin, 2016).

Rezae, et al. (2021) created and tested a mobile application to manage anxiety associated with public transportation in individuals with ASD. The initial step was to gather information on the common issues related to public transportation faced by ASD individuals. A literature review was completed to address the challenges for ASD individuals when utilizing public transit. The most prevalent challenges included safety and spatial concerns. Specific challenges included

finding one's way to the bus stop, boarding the correct services, and getting off at the right stop. Anxiety about unexpected events and sensory sensitivity were also obstacles.

To prioritize the designed features based on the order of importance, a survey was given to 27 young adults with ASD aged 18-30 and their families who ranked design features based on the order of importance and their needs. Based on the survey results, 18 software requirements were designed to meet the needs of ASD individuals while using public transportation. One important feature was that the application automatically found the most efficient route between two points. The app also provided step-by-step walking navigation to the initial stop. This feature was important because more than 40% of ASD individuals could not get to the bus stop without help, and more than 50% did not know how to cross the street safely (Deka, 2016). A third important feature predicted how crowded the vehicle would be.

Additionally, the app helped users know where they were on their journey. The app also detected and alerted users when they deviated from the planned route and calculated a new course. The app included an anxiety management option that integrated evidence-based anxiety coping strategies to help reduce anxiety levels. Through the application, individuals could also contact a safe person.

The mobile application developed and currently being tested with a pilot group is a beginning step to facilitating the use of public transportation. Future studies are recommended to assess the efficacy of the proposed mobile application. Some limitations of the study included expanding the literature review to include individuals with intellectual disabilities and post-stroke patients. Limitations to the testing sample included that participants were based in two Australian states that may have different types of public transport infrastructures and

environments. Lastly, autism diagnoses in the testing sample were self-reported and may have included individuals without a diagnosis.

Birtwell, et al. (2019) explored a program called Sidekicks! for children with ASD. Sidekicks! is an interactive clinical application that utilizes an individual's restricted interests to improve communication and other skills. Sidekicks! uses a coach (i.e., parent, therapist) to facilitate therapeutic interactions with the "hero," a self-selected avatar chosen by the child with ASD. The application aims to provide the child a way to communicate with a parent, therapist, or other individuals through a highly motivating platform. Interacting partners can communicate through their avatars and view video clips. The video clips can be set up to include the child's unique interests to teach new skills. Sidekicks! can be used across various settings and accessed by various facilitators.

Researchers completed a case study of a boy with ASD named Sam. Sam loved *Thomas the Tank Engine & Friends* from an early age. As he got older, he became frustrated that others did not share his interest in trains. A counselor introduced Sam to Sidekicks. Sam was motivated by the video clips that involved *Thomas the Tank Engine* and other trains. The counselor and Sam watched the video clips together and discussed them through their Sidekicks! avatars. The counselor guided conversations and video clip selections to address Sam's specific areas of need. Sam's particular interest was incorporated into every aspect of his treatment, including identifying emotions, perspective-taking, and problem-solving. Sidekicks! was highly motivating for Sam and supported his treatment goals (Birtwell, et al. 2019).

Sidekicks! has the potential to address barriers to treatment for ASD. Clinical trials had yet to be completed when the article was published. As a result, formal evidence through a clinical study is recommended to support the benefits of this treatment option.

A study was completed by Zhang, et al. (2021) addressing the emotional design of Internet of Things (IoT) smart toys. The IoT smart toys enhance human intelligence and imagination. The research also explored how IoT smart toys could improve a child's analysis, composition, comparison, judgment, and reasoning skills, improving depth and flexible thinking. Research methods used in the study included literature and ethnographic research, observations, and user testing.

Research supports that between the ages of one to six, children experience rapid cognitive growth. When children with ASD are treated during this period, the disorder can be inhibited. IoT toys can analyze the physical, psychological, cognitive, and behavioral characteristics of autistic children. The design focuses on the players' behavioral interactions to establish a relationship between the child and the games.

To some extent, electronic devices can provide emotional experiences by observing and helping autistic children. Researchers can explore the design of human-computer interactions by studying children's cognitive habits, cognitive psychology, and usage preferences.

Software applications (apps) have been increasingly adapted to support the needs of individuals with ASD. One specific concern is the gap between the number of autistic students and non-autistic students who are employed. One study found that in the United Kingdom, 30% of autistic graduates have full-time jobs compared to 70% of graduates without disabilities (Pesonen, 2021). Individuals with ASD can face many challenges regarding work, such as a lack of appropriate employment resources and difficulties adjusting to new environments.

A feedback analysis was completed by Haoues, et al. (2023) to investigate the use of apps to improve the quality of life for ASD students and employees. The study analyzed user reviews of highly ranked ASD apps for college students and workers. Thirteen ASD apps were studied

through 97,057 reviews. The opinions of ASD app users were investigated to understand the perspectives of autism-friendly environments better. Reviews were classified into positive, negative, or neutral categories.

A summary of the reviews concluded that smartphones and ASD apps benefit adults with ASD in managing their daily activities and improving their communication with colleagues and supervisors. ASD-specific apps can also help with task organization. One finding concluded that despite being satisfied with the app's main features, users complained about the quality, mainly in usability, reliability, etc. Other findings indicated that developers should focus more on improving the quality of the ASD apps by adding features like a notification system that works correctly and a to-do list.

Limitations of the study included that the study was based on feedback from users, which is subjective vs objective. There was also no guarantee that autistic people wrote the reviews. Another limitation was that each review was categorized into one category (positive, negative, or neutral) when some reviews included more than one feedback category. Other evaluation metrics may have been a better choice. The article proposed that future work should classify user reviews according to quality characteristics, including usability, reliability, portability, etc. (Haoues, et al. 2023)

Robot-assisted autism therapy (RAT) is an emerging field of study. Most Robot-mediated interventions have been completed with a minimal sample size. Marino, et al. (2020) conducted a study investigating the feasibility and efficacy of using a partially controlled social robot (NAO) in a group-based CBT intervention. The intervention was aimed at emotional comprehension and related mentalizing skills. The robots act as co-therapists by taking turns, directing attention,

delivering cues and prompting, and reinforcing adequate responses and behaviors. The stress of social interactions causes anxiety in many individuals with ASD.

The participants were between the ages of four and eight with a clinical diagnosis of ASD. The participants did not receive any other interventions relating to emotional or social skills during the intervention. The intervention protocol consisted of a program based on rational emotive behavior therapy (REBT) principles and a social robot's assistance. The intervention included 12 sessions that lasted 90 minutes, delivered twice weekly. The robot selected was NAO. NAO provided emotional and social prompts through body movements and recorded scripts, head and gross motor orientation of gaze shifts, and arm and hand points. A therapist activated the robot through an application on an iPad. The robot was programmed to recognize faces and eyes. NAO maintained eye contact and equally distributed attention to the children.

The outcome measures were completed before and after the intervention. Outcome measures included the Test of Emotional Comprehension (TEC), the Emotional Lexicon Test (ELT), and statistical analyses. The study's results supported the idea that using a partially controlled assistive robot can positively foster children’s learning of emotional nature, causes, and regulation. The results are considered preliminary findings, and future studies using larger samples were recommended.

Recent research suggests that video games may be an effective and practical approach to decreasing anxiety levels in children. Wijnhoven, et al. (2015) completed a study on the effect of the video game Mindlight on managing anxiety symptoms in ASD children. Mindlight uses several treatment strategies. It uses exposure techniques by gradually exposing individuals to threatening cues. Mindlight also uses neurofeedback mechanisms that focus on arousal levels associated with anxiety through relaxation and concentration. Attention bias modification is also

utilized in the game. Attention bias teaches children to disregard threatening cues and shift their attention to positive aspects.

The participants included 122 children ages 8-16 with ASD and clinical anxiety symptoms. The participants were divided into an experimental group and a control group. The experimental group played Mindlight for one hour per week for six consecutive weeks. The control group played the puzzle game Triple Town for one hour per week for six consecutive weeks. Assessments were completed by the participants, teachers, and parents at baseline, post-intervention, and three months following the intervention.

The study results indicated that both groups showed a decrease in anxiety symptoms. However, there were no differences in anxiety reduction between the experimental group that played *Mindlight* and the control group that played *Triple Town*. The results suggested preliminary evidence of video games' positive effect on anxiety levels in children with ASD.

Physical Activity Interventions to Support Anxiety in ASD Students

Physical activity has been shown to reduce specific anxiety disorders in neurotypical adolescents and adults. More specifically, separation anxiety, generalized anxiety disorder, panic disorder, agoraphobia, and post-traumatic stress disorder symptoms were positively impacted by physical activity. There is also some evidence of the effectiveness of physical activity in reducing anxiety in individuals with ASD. Physical exercise interventions have many therapeutic benefits for reducing anxiety and are low-cost and typically easy to implement. ASD Children and adolescents between 6-12 are less likely to engage in physical activity than their neurotypical peers. Physical activity can address anxiety and also improve general health and sleep.

ASD children and adolescents are less likely to engage in physical activity than their neurotypical peers. Physical exercise interventions have many therapeutic benefits. Physical

interventions are low-cost and typically easy to implement. Physical activity can address anxiety and also improve general health and sleep. There is also some evidence of the effectiveness of physical activity in reducing anxiety in individuals with ASD. However, there is limited information regarding the optimal amount and length of the exercise program. Carey, et al. (2022) completed a study to assess the effects of a 16-week exercise program on anxiety management in ASD individuals. The participants included twenty-four children aged 5-18 with moderate to severe ASD.

A school-based exercise program was implemented for one hour thrice a week for 16 weeks. One-hour sessions included a ten-minute warm-up, 40 minutes of the main physical activity, and 10 minutes for stretching. Intervention groups had six to ten children. Anxiety levels were assessed three times by parents and teachers filling out the Anxiety Scale for Children for ASD (ASC-ASD). The ASC-ASD was given to twenty teachers and twenty parents to collect baseline data and again at week eight and week 16 of the intervention.

The results indicated that a 16-week exercise program can reduce anxiety in children with moderate to severe ASD in the school setting. The teacher-rated ASC-ASD scores revealed a significant decrease in the performance anxiety, anxious arousal, and uncertainty subscales. Minor improvements were also rated on the separation anxiety subscale. Parents in the home setting reported no significant decrease in anxiety. The difference in results from home and school could be explained by the differences reported at baseline. Teachers reported higher anxiety levels than the parent group. Another possible explanation is that the positive effects of the exercise may only be evident temporarily after the session and not extend into home hours. Teachers were also more closely involved in the intervention, possibly leading to expectancy bias compared to the parent group.

Limitations of the study include excluding a control group and having all male participants. A low response rate from parents and teachers on all three measures was also reported. Future studies should explore other methods to measure anxiety, such as cortisol levels. Further investigations were recommended utilizing study designs to clarify how to use physical activity to decrease anxiety in individuals with ASD.

A study completed by Gehrick, et al. (2022) aimed to investigate the effect of an 8-week physical exercise intervention compared to a sedentary activity intervention of playing Minecraft and LEGOs. The physical exercise was designed for younger ASD children to reduce anxiety. The participants included Latino and rural families with children identified by the Autism Treatment Network as underserved populations. One hundred forty-eight children participated in the study and were randomly divided into either the physical exercise intervention group or the sedentary intervention group. The outcome measure was the Child Behavior Checklist Diagnostic Statistical Manual 5th edition anxiety subscale (CBCL DSM-5). The Screen for Child Anxiety Related Disorders (SCARED), the Child's Sleep Habits Questionnaire (CSHQ), and salivary cortisol analyses were also used as secondary measures. The CBCL DSM-5 anxiety subscale was administered at baseline, week 3, week 6, week 8, week 12, and week 16. The SCARED, CSHQ, and salivary cortisol were assessed at baseline, week 3, week 6, and week 8.

The physical activity intervention involved a 40-50 minute session provided up to 3 times a week for eight consecutive weeks. The sessions included a 10-minute warm-up, 10 minutes of moderate-intensity aerobic exercise (65-85% of maximum heart rate), 18-38 minutes of continued exercise (>65% of predicted maximum heart rate), 5 minutes of bone and muscle strength activities, 5 minutes of a timed obstacle course, and 5 minutes of a cool-down activity. Every session also included two three-minute water breaks. Exercise intensity was measured

with sports watches with heart rate monitors. The sedentary activity intervention included 45 minutes of LEGO or Minecraft activities up to thrice a week for eight consecutive weeks. LEGO sessions had an "engineer" who gave verbal directions to a "builder" for 15 minutes. The participants then switched roles for an additional 15 minutes. In the last 15 minutes, participants cleaned up and reflected on the session. The Minecraft intervention consisted of a five-minute introduction, 20 minutes of group play in daytime mode, and 15 minutes of play in night mode. The last 5 minutes were available to discuss the experience.

The results of the study indicated that after both 8-week interventions of physical exercise and sedentary Lego/Minecraft activities, ASD children between 6-12 years old showed significant improvements in anxiety levels. There was no statistically significant difference between the two groups. These findings suggest LEGO and Minecraft interventions may also reduce anxiety in ASD children. As measured by the CSHQ, the physical exercise group showed some improvement in sleep quality. The sedentary group did not show improvement in sleep. Limitations to the study included that the physical exercise group was only compared to an alternative activity comparison group and not a non-activity control group.

Hillier, et al. (2011) examined decreases in stress and anxiety in response to a low-intensity physical exercise and relaxation intervention. The study utilized salivary cortisol and a self-report to measure anxiety levels. The participants included eighteen adolescents and young adults with ASD between 13 and 27. Inclusion criteria required participants to be considered "high functioning."

The intervention program took place once a week for 75 minutes and lasted eight weeks. The program was run once a year for two years. The participants were divided into groups of six or fewer and had four to five facilitators. The physical activity program consisted of a warm-up,

aerobic exercise, flexibility, balance, strengthening, team activities, and a cool down. All activities were considered low-intensity, as observed by breathing observations.

Salivary cortisol was used to measure anxiety levels in the participants. Saliva samples were collected at the beginning and end of each exercise session only on weeks 2, 4, and 6 due to the financial constraints of the study. Changes to the methodology of the study occurred in week 8 when it was decided that a portion of the last week would be dedicated to celebrating the achievements of the participants. The change invalidated the analysis of the salvia samples for week 8. Participants also completed a self-report measure of anxiety before and after each of the eight sessions.

The study's results supported the hypothesis that participating in exercise and relaxation techniques would significantly reduce cortisol levels and self-reported anxiety levels in a group of ASD adolescents and young adults. Some limitations noted were the short length of the intervention and that the sessions were only provided once a week. These factors may have impacted the reduction levels. Recommendations for future studies included a delay in the initial saliva collection to rule out the possibility that changes before or after the session impacted the cortisol levels. Future studies should also include a control group to support the findings.

Mindfulness-based cognitive therapy (MBCT), cognitive behavioral Therapy (CBT), and physical activity (PA) may also benefit sensory over-responsibility (SOR) or sensory hyper-reactivity symptoms, which are prevalent in 56-79% of ASD individuals (Yuna, et al. 2022). ASD individuals often have sensory over-responsibility (SOR) symptoms, also known as sensory hyper-reactivity. Unusual or heightened responses to sensations characterize SOR. SOR has two subtypes of symptoms, which are internalizing symptoms and externalizing symptoms. Heightened sensitivity to sensory input is associated with an increased chance of developing an

anxiety disorder. A literature review by Yuna, et al. (2022) aimed to identify and summarize some effective interventions for SOR.

The study identified four types of interventions that may benefit SOR in ASD individuals. The interventions included physical activity (PA), Ayres Sensory Integration Therapy (SIT), Mindfulness-Based Training (MBCT), and Cognitive Behavioral Therapy (CBT). The results of the literature review suggest that these interventions have the potential to help children with ASD develop emotional regulation methods in response to sensory stimuli. However, many factors contribute to the outcomes of these interventions, such as the duration of the intervention, the participant's age, and cognitive ability. It needs to be made clear how these factors affect the sensitivity to sensory input. Existing literature needs more precise measurement standards for various age groups.

In conclusion, the results are considered inconclusive. Further investigation was recommended due to the heterogeneity of ASD individuals and the inconclusiveness of determining the neural mechanism underlying SOR. These issues are essential to determine the effectiveness of interventions focused on SOR.

Environmental Accommodations and Sensory Strategies to Support Anxiety in ASD Students

Environmental accommodations can also support ASD students in managing their anxiety levels. Some accommodations include having a predictable environment with structured rules and routines. Providing opportunities for relaxation throughout the school day can support students. Students with ASD often need additional prompting and support to use learned strategies.

Delli, et al. (2018) did a study to review, update, and critically analyze interventions for managing anxiety symptoms in individuals with ASD, both in and outside of the school setting. Research papers and reviews were selected within the parameters of the 1980s and 2017 and were based on two criteria. The first criterion was that the participants in the sample were individuals with ASD and anxiety. Secondly, the studies had to pertain to interventions for managing anxiety. The search provided 137 articles for review.

The literature review included publications from various professionals, including psychologists, psychiatrists, pediatricians, and teachers, acknowledging that interventions must be interdisciplinary. The interventions included pharmacological treatment, social skills instruction, cognitive behavior therapy (CBT), and social recreational programs (SR).

A combination of psychosocial interventions and medication is recommended for all anxiety disorders. Psychosocial interventions such as CBT and SR were reported as effective options for reducing anxiety in ASD youth. An advantage of CBT and SR is that they can be implemented in a group setting.

Some environmental accommodations can also reduce anxiety in students with ASD. Having a supportive adult and a predictable environment can reduce confusion and create a sense of calm. A smooth, structured educational approach is recommended. Relaxation techniques and emotional well-being strategies can also impact a student's mood. Common anxiety triggers for children with ASD include disruptions or changes to routines, new experiences, and particular events such as dentist visits. Hormonal changes can also trigger more anxiety. Teachers can help reduce anxiety by providing predictable routines, providing opportunities for relaxation, limiting sensory overload, providing strategies in moments of stress and anxiety, and helping students understand their responses. There is an overall increase in schools to support students' mental

and emotional health. Integrating additional curriculum to support well-being is beneficial for ASD students.

Results from the review also indicated that multifaceted assessments should be administered to implement individualized interventions and treatments. A mix of intervention methods was more effective than one single approach. The first step in an anxiety intervention should be recognizing the symptoms. Other steps include clearly defining treatment outcomes. The collaboration and coordination between parents and teachers is critical. Further research was recommended to continue updating information on interventions to manage the anxiety of ASD individuals better.

It is estimated that 40- 90% of the ASD population has sensory integration (SI) difficulties (Baranek, 2014). Despite the common use of sensory techniques and modifications, evidence is lacking in the effectiveness. Bodison, et al. (2018) did a systematic review to examine the effectiveness of specific sensory techniques and sensory environmental modifications in improving the functional performance and participation of ASD individuals.

The review included the abstracts of 11,436 articles published between 2007 and 2015. To meet the inclusion criteria, the studies had to have participants with sensory integration (SI) difficulties, high levels of outcome evidence, and measures that addressed function or participation. Six studies on specific sensory techniques met the criteria. One study of sensory environmental modifications met the criteria.

Specific sensory techniques are defined as the application of sensory stimuli. This includes strategies that directly apply sensory stimuli to the individual's body, such as brushing, listening to music with headphones, or wearing compression vests. Specific sensory techniques include the child’s body being placed on or in an object, such as sitting on a therapy ball.

Specific environmental modifications are described as changing the intensity, complexity, or quality of one or more sensory elements in an environment. Examples include modifying the room lighting, soundproofing, reducing extraneous visual stimuli, and changing sensory features of furniture or objects. One study evaluated sensory environmental modifications for ASD children in a dental clinic.

These specific sensory techniques studied included Qigong massage, weighted vests, slow swinging, and the incorporation of multisensory activities. The techniques were incorporated into the routines of a preschool classroom. The results indicated that some of the specific sensory techniques and environmental modifications were effective in increasing the participation of ASD individuals.

Based on the results, Qigong massage had the most substantial evidence of effectiveness. A program of daily Qigong massage for 15 minutes delivered by parents to ASD children ages two to seven resulted in improvements in self-regulation behaviors, tactile abnormalities, ASD symptoms, and parenting stress. The findings need to be more generalizable as all the studies on Qigong massage were conducted by the same research group. Additional research was recommended in a different geographic region.

Limited evidence was found on the effectiveness of using weighted vests to improve classroom participation for children with ADHD. One study supported the positive effects of weighted vests on increasing children's attention on controlled laboratory tasks. However, it was excluded from the review because classroom performance was not the outcome measure used. Future research was recommended to evaluate the use of weighted vests in the classroom setting. The study also only included participants with ADHD, so additional research is also needed to evaluate the benefits of wearing weighted vests for participants with ASD.

The evidence was considered insufficient regarding the effectiveness of slow linear swinging to improve the on-task behavior of children with ASD. No significant differences were evident between students swinging before a tabletop activity and students who did not swing prior to a tabletop activity. Only 2 out of the 15 ASD participants showed improved on-task behavior. The lack of evidence may have been because slow linear swinging has been known to reduce arousal levels and may not be appropriate or effective with already calm students. A limitation of this study was that arousal levels were not assessed prior to the swinging. Future research was recommended to examine the possibility of individualized vestibular stimulation improving the on-task behavior of children with ASD.

There needs to be more evidence for the effectiveness of incorporating specific sensory strategies and sensory enrichment inventions in a preschool classroom. A review of a twelve-week intervention of embedding tactile, proprioceptive, and vestibular activities into a preschool classroom also resulted in insufficient evidence. This study was also considered limited due to a minimal sample size. Only 1 study was analyzed, and both study groups participated in the same regimen of sensory strategies. Improvements were made, but they were considered limited as the results may have been due to typical developmental gains. Additional research with a control group was recommended.

Additional studies on specific sensory strategies examined the Wilbarger brushing protocol, therapy ball chairs, sensory diets, and auditory stimulation programs, including therapeutic listening. The studies were not included in the systematic review due concerns with research design and validity and reliability of the conclusions.

One study was examined on sensory environmental modifications. The results provided moderate evidence supporting sensory modifications in a dental environment to support ASD

children with dental cleanings. Auditory and visual environmental accommodations were researched in addition to deep touch pressure through a weighted wrap. Significant improvements in child-reported measures of pain and sensory discomfort. Improvements were also noted in the cooperation of dental cleaning for both ASD children and neurotypical children. Stress and anxiety levels were also moderately to vastly reduced as measured by changes in electrodermal responses. This evidence suggests that reducing physiological stress increases participation. Future research was recommended to strengthen the evidence of the intervention.

Overall, the results of the systematic review revealed multiple issues that should be addressed in future studies of the effectiveness of specific sensory techniques or sensory environmental modifications on the on-task behavior of children with SI difficulties, including ASD children. One implication is that the strongest research designs need to be used. Most of the studies included in the review had relatively low levels of evidence. Also, future research should have a more focused outcome objective. For example, the linear swinging study did not have an outcome measure that aligned with the treatment's primary function: decreasing arousal levels. Research on any adverse effects of sensory techniques and modifications was also recommended.

CHAPTER 3: DISCUSSION AND CONCLUSION

Summary of Literature

In recent years, there has been an overall focus on supporting the mental health of all students in schools. Neurotypical individuals develop neurocognitive processes naturally. ASD individuals have underdeveloped neurocognitive skills, which impact their cognitive flexibility, inhibitory control, and working memory. Children with ASD often struggle with their ability to control their behavior in response to stress, arousal, and anxiety, which can impact their inclusion into mainstream classes. Heightened anxiety levels can also lead to social isolation, unemployment, substance abuse, homelessness, incarceration, suicide, and a poor quality of life. Schools must establish effective treatment measures that are efficient and cost-effective.

I researched school-based interventions to support the management of anxiety levels in ASD individuals. School-based interventions that reduce anxiety may also increase social functioning, emotional well-being, and academic performance in children with ASD. The interventions discussed in this thesis are mindfulness-based interventions (MBIs), physical activity interventions (PA), cognitive behavioral therapy (CBT), technology and applications, and environmental accommodations and sensory strategies. Two of the most favorable interventions are MBI and CBT. Sizoo, B. (2014) determined that mindfulness-based stress reduction and cognitive behavioral therapy are equally effective in reducing anxiety and depression in adults with ASD.

The studies I researched indicated that mindfulness-based interventions (MBIs) have a positive impact relating to anxiety in individuals with ASD. Common MBI strategies include awareness of breathing, walking meditation, body scans, and mindful movements in an open and non-judgmental manner. (Spek, et al., 2013). MBI strategies can be easily tailored to the

individual cognitive and functional needs of individuals with ASD. MBIs are practical and low-cost. Other Benefits of school-based MBI include increased inclusion for students with ASD and a reduction in anxiety and stress, which lessens the physical discomfort associated with stress. Loftus, et al. (2023) found that MBIs effectively reduce aggressive behaviors, improve social skills, and reduce anxiety. Juliana, et al. (2020) concluded that school-based mindfulness holds promise for increasing executive functioning skills in students with ASD. Research supports increased time on task and academic success (Stocktail, et al., 2022). Susam, et al.(2022) analyzed electroencepalography and found preliminary evidence that mindfulness meditations resulted in positive neural responses in the brain.

Mindfulness is also beneficial to the parents and caretakers of ASD children. Hartley et al. (2019) found that mindfulness interventions, including Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), resulted in preliminary evidence of the effectiveness of mindfulness with ASD individuals and their caretakers. The findings of Neece, et al. (2014) and Singh, et al.(2014) supported that when parents practice mindfulness, aggression and self-injurious behaviors were reduced, and attention span were increased in ASD children. Adults with ASD have also seen an anxiety reduction when participating in mindfulness (Spek, et al. 2013).

The Tübinger Training for Autism Spectrum Disorders (TüTASS) is an effective mindfulness program (Drüsedau, et al. 2022). MYmind was rated as “comprehensible and acceptable” by Chinese ASD adolescents and their parents. However, no significant evidence was found between the waitlist and experiment groups (Ho, et al. 2021). *Mindful Schools* had promising results in improving the executive functioning skills of ASD students (Juliana, et al. 2020).

School-based CBT programs appear to be one the most effective treatments for anxiety in ASD students. The benefits of implementing CBT in schools included more generalization of skills across settings and more consistency with behavior redirection and expectations. ASD students often have the most challenges and anxiety in the school setting. Research completed by Kester, et al. (2019) and Rotheheram-Fuller, et al. (2011) provided evidence that school-based CBT programs can be successfully implemented in schools with some modifications such as making a district-based program, including parents in the program, adjusting the session length and duration, changes to vocabulary, and adding visual support.

Studies focusing on CBT in the school setting found positive perspectives from school personnel, parents, and students (Simpson, et al. 2019). The Facing Your Fears (FYF) Intervention Program and the Exploring Feelings program had promising results for successfully being modified and implemented in schools (Clark, et al. 2017 & Rosen, et al. 2022). Drmic, et al. (2017) studied a modified version called FYF school-based program (FYF-SB) and found that 44% of the youth participants with ASD and anxiety showed a significant improvement. Rosen, et al. (2022) also found positive results with a case study completed of two students participating in an FYF-SB intervention. The school-based CBT program Exploring Feelings was also effective in a study by Luxford, et al. (2017).

Technology can also reduce anxiety in the ASD population. Technology is often motivating and engaging for students. Emotional regulation applications are being explored as a support system. Fage, et al. (2019) completed a study and found that applications could successfully support ASD students with self-regulation in a classroom setting. Bossenbroek, et al. (2020) found that incorporating virtual reality games like DEEP could effectively support students. Mindlight and Triple Town also suggested preliminary evidence of the effectiveness of

video games on anxiety in ASD individuals (Wijnhoven, et al. 2015). Google Fit and PuzzleWalk reduced anxiety through increased physical activity (Lee, et al. 2022). Using the application Sidekicks! is a motivating way to support ASD students with skills such as identifying emotions, perspective, and problem-solving (Birtwell, et al. 2019). Rezae, et al. (2021) created and tested a transportation app to support ASD individuals with anxiety when utilizing public transportation. An app similar to this may support students with riding the bus to school. Internet of Things (IoT) smart toys and robot-assisted autism therapy show optimistic evidence in human-computer interactions (Zhang, et al. 2021 & Marino, et al. 2020). A review of thirteen highly ranked apps by Haouses, et al. (2023) found that apps can support ASD individuals with managing daily activities and improving communication and organizational skills.

The studies in this review also supported that physical activity programs have positive effects on the anxiety levels of individuals with ASD. Physical fitness interventions reduce anxiety and the behavior challenges experienced by many ASD students (Carey, et al. 2022 & Gehrick, et al. 2022). Hillier, et al. (2011) found that physical exercise significantly reduced cortisol levels and self-reported anxiety levels in ASD adolescents and young adults. Other positive effects included more engagement in school activities and increased social interactions. The participants were typically motivated to participate in the physical fitness programs. Physical activity needs to continue to be researched for the development and maintenance of the overall health of ASD students. Teachers can implement a 15-minute exercise routine daily to support the overwhelmingly positive benefits. Teachers modeling and participating in the routines will also feel the benefits. Physical exercise interventions are typically low-cost and easy to implement.

A study completed by Yuma, et al. (2022) suggests that physical activity (PA), Ayres Sensory Integration Therapy (SIT), mindfulness-based training (MBCT), and cognitive behavioral therapy (CBT) may also help ASD children with sensory over-responsibility (SOR) which is prevalent in many ASD individuals.

Based on a review completed by Delli, et al. (2018), some environmental accommodations can reduce anxiety in ASD students, such as having a supportive adult and a predictable environment in classrooms with structured rules and routines to limit confusion. Teachers should also limit sensory overstimulation. Teachers can promote calmness and provide opportunities for relaxation. Teachers should also support students during times of stress and anxiety by helping them understand their feelings and providing strategies to help manage their emotions. A systematic review completed by Bodison, et al. (2018) supported parents' implementation of Qigong massages on their children before school. Future research was recommended on other sensory techniques. Evidence suggested that auditory and visual environment accommodations resulted in lower stress and anxiety levels in individuals with ASD.

This paper researched some promising interventions for supporting ASD students with their anxiety levels. Encouraging evidence was found in mindfulness-based strategies, software applications and technology support, school-based cognitive behavioral therapy, physical activity programs, and environmental accommodations and sensory techniques. Some interventions may be more effective than others based on individual student needs and interests. Most of the interventions are cost-effective and efficient. Some technology interventions, such as robot-assisted intervention, may be the most challenging to implement. Collaboration between all school staff and parents is critical in effectively implementing the interventions.

Limitations of Research

Continued research is needed to address the limitations listed in the studies researched. Most of the studies had smaller sample sizes. Some limitations impacted the result's ability to reflect the ASD community accurately, such as excluding lower-functioning ASD individuals and having participants who were disproportionately male. Some of the studies were conducted in other countries or in only one region of the United States. Most of the outcomes of the studies were limited based on the use of self-rating scales or measures not explicitly designed for ASD individuals. Most studies that did not include blind observation ratings also impacted the results. Fidelity ratings of the programs were also low due to most studies not having a control group.

Implications for Future Research

Supporting the mental health of ASD individuals is critical. More research is needed on how to best support ASD students with life-long strategies for managing anxiety, depression, and other mental health disorders. Recommendations from the studies included further research with stronger research designs and more precise measurement standards and methods. Future studies should include an increase in fidelity and accessibility of the interventions. Participants with a broader demographic of the ASD population should be included in future studies.

Professional Application

Interventions to support ASD students need to be implemented in the classroom. Environmental accommodations such as modifying the room lighting, soundproofing, reducing extraneous visual stimuli, and changing sensory features of furniture or objects can be modified to meet the individual needs of ASD students. Mindfulness-based interventions, school-based cognitive behavioral therapy, technology devices, and applications should also be explored with ASD students.

Implementing a successful mindfulness intervention in schools could be incorporated into the school day without significantly impacting student or teacher schedules. It would require a manual program, 30-minute sessions a trained instructor delivers twice weekly. Starting a mindfulness approach in a school would require a few steps. The first step is creating a collaborative team approach involving students, parents, teachers, and school administrators. After the agreement has been acquired, a structure will need to be developed for implementing a mindfulness-based program. The key structural components include program facilitator, curriculum, professional development, setting, schedule, and progress monitoring (Stocktail, et al., 2022). Schools must decide between creating their program or purchasing an existing MT program. A knowledgeable mindfulness practitioner should facilitate the sessions. The sessions should be in a quiet, comfortable setting with yoga mats or bean bags. Practices may need to be adapted for ASD students. Common modifications include using concrete language and examples. The addition of social stories, visuals, and schedules can also be used. Modifications to lighting and sound-based activities, such as bell ringing, should also be considered. Adjustments to the length of the session may also be needed.

Based on information from a study completed by Kester, et al. (2019), multiple recommendations were made regarding implementing a school-based CBT program. One recommendation is to educate and include parents, classmates, mental health therapists, school-based counselors, psychologists, and other staff not directly implementing the program. Adjustments to the session duration and program length were also recommended to include sixty-minute sessions for ten weeks.

Collaboration with an occupational therapist is essential to implement specific sensory techniques and sensory environmental modifications. Training by a professional is strongly

recommended, and knowledge of which strategies are most appropriate for different students is critical. Monitoring responses and progress is also essential.

Progress monitoring should include student progress and program implementation for all the interventions. The data should be used to make decisions and evaluate the program. Student progress data should include emotional regulation, attention, awareness, executive functioning, and coordination. Program implementation data may include fidelity checklists.

Conclusion

The ASD population commonly has comorbid conditions, including anxiety. Mental health conditions can impact an individual's thoughts, mood, behavior, daily functioning, and ability to relate to others. Schools must establish effective treatment measures that are efficient and cost-effective. The results of this study indicated that several school-based interventions have promising evidence in reducing anxiety in ASD individuals. Mindfulness practices, physical fitness programs, school-based cognitive behavior therapy strategies, technology, and environmental accommodations are all interventions that produced promising outcomes in reducing the anxiety levels in ASD individuals. School-based interventions increase accessibility and the generalization of learned skills. Since the ASD population can be impacted in differing areas and have very individual needs, evaluating a student's language, emotional, and adaptive skills would be necessary before any interventions.

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