The Role of Sensory Input for Students with Autism Spectrum Disorder in Physical Education

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Kelsey Williams

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Abstract

Addressing sensory needs creates an inclusive environment to help students reach their full potential. 1 in 36 in the United States are estimated to have autism spectrum disorder (ASD). For

students with ASD sensory needs might not look the same as their peer with ASD. Individuals with autism may experience hypersensitivity or hyposensitivity to sights, sounds, smells, tastes, touch, balance (vestibular), body position and movement (proprioception), awareness of body cues (interoception). As physical education teachers, depending on your college class background, knowledge, and or experience working with individuals with autism you might not completely understand sensory input and how to integrate sensory needs into your PE lessons. Thus, the purpose of this synthesis is to review literature on the educational implications of stimulant identification in students with ASD.

Chapter 1 - Introduction

On average 1 in every 36 children in the United States have autism spectrum disorder. In the U.S., about 4 in 100 boys and 1 in 100 girls have ASD (Autism Speaks, 2023). An early diagnosis of autism spectrum disorder is crucial to early intervention (Cidav et al., 2017). Early intervention allows services to be in places tailored to the needs of individuals with autism.

Monitoring of ASD will start at a young age and must include early stimulation to promote typical development, detection of risk factors in development, as well as identification of neurodevelopmental disorders at initiate the respective early interventions (Witwer et al. 2022). The programs included in early intervention are family training, speech therapy, hearing impairment services, physical therapy, and nutritional services.

Early identification, accompanied by intervention since preschool, is recommended, according to needs and potential, for the development of good prognoses for identification of deficits (Zaqueu et al., 2015). Sensory deficits have an early onset and are one the first signs of ASD, as early as observed in the first months of life (Alateyat et al., 2022). Sensory deficits can look like hypersensitivity or hyposensitivity to sights, sounds, smells, tastes, touch, balance (vestibular), body position and movement (proprioception), awareness of body cues (interoception). If a child with autism is not receiving the adequate amount of sensory input it is correlated to isolation, reactivity to change, disinterest and indifference, self-aggression, irritability, or emotional lability (Gonthier et al., 2016).

Autism is now seen as a spectrum that can range from very mild to serve. Autism Spectrum disorder level one requires supports, experiences difficulty starting social interactions, and needs organization reminders. ASD level two requires substantial support within social interactions, finding interests and displays repetitive behaviors. ASD level three requires support beyond level two, uses a communication device or picture exchange communication system (PECS) and has difficulty focusing. Students with autism will have sensory deficits and may present with hyposensitivity, where the individual seeks sensory input from various modalities. These individuals may also display hypersensitivity, presenting as an aversion to particular sensory inputs (Ward et al., 2017).

It is vital for physical education teachers to incorporate sensory input into our lessons, so that children do not have sensory deficits. For example, a study by Lord et al. found that sensory integration has improved sensory and motor skills (Lord et al. 2018) According to Case and Yun (2015), teachers of students with ASD have difficulty supplying task instructions and display little attention or direct focus to inappropriate tasks. When supplying task instructions, less is more, and using the three communication pieces: verbal, visuals, and sign language are techniques to use for tasks. When a child with ASD is self-stimulating, that child is seeking to keep their sensory systems in balance. When sensory deficits for students with ASD, there should be a parallel sensory-based needs component infused into the curriculum, strategies, and techniques that will increase the quality of life for students living with autism.

Statement of the Problem

One of the most important jobs of educators is to be able to differentiate instruction to meet the diverse needs of all students. In physical education, this means ensuring that educators are adequately trained to incorporate sensory needs and adapt activities and skills in the gym. Every physical education teacher is going to have different experiences and backgrounds. While some physical education teachers may have only taken a single adapted physical education course in college, others may have completed a master's degree in APE or took the Adapted Physical Education certification exam (APENS). Regardless of PE teachers background, all educators need access to ongoing learning to improve their instruction and reflect on their teaching to foster a safe and inclusive learning environment.

Purpose of the Study

The purpose of this synthesis is to review literature on the role of sensory input for students with autism spectrum disorder in physical education.

Operational Definitions

1. Autism spectrum disorder- neurodevelopment disorder that affects a person's ability to perceive and socialize with others.
2. Hypersensitivity- over reaction to a sensory stimulus
3. Hyposensitivity- under reaction to a sensory stimulus
4. Sensory seeking- to actively seek out sensory experiences to fulfill sensory needs
5. Sensory input- sights, sounds, smells, tastes, touch, balance (vestibular), body position and movement (proprioception), awareness of body cues (interoception).
6. Students- children who attend and are in grade k-12

Research Questions

The following questions will be used in order to guide the primary focus of this synthesis review:

1. What are effective strategies to meet sensory needs in a physical education lesson?
2. What are the underlying reasons for a student with ASD exhibiting challenging behavior?
3. How can physical educators be better prepared teaching to students with ASD?

Delimitations

1. All resources are used from within the past 10 years (2014-present)
2. The articles used in this synthesis were peer-reviewed and presented accurate information related to this topic.
3. The synthesis only focuses on children in grades k-12.
4. The focus of the synthesis is solely on students with ASD in physical education.

Chapter 2- Methods and Procedures

The purpose of this chapter is to review the methods and procedures used to determine the role of sensory input for students with ASD in Physical Education. Multiple searches of sensory processing and planning in physical education for students with ASD were conducted in order to obtain the necessary information so that the synthesis could be completed. The studies collected for this synthesis were located using the EBSCO database from The SUNY Brockport's Drake Library. Within the EBSCO database the following databases were searched: Academic Search Complete, SPORTDiscus, ERIC, and The KSSPE Library Search. The databases allowed me to find credible resources that connect to the synthesis.

Keywords were used to filter out articles that were not relevant to the synthesis. These keywords included autism spectrum disorder, physical education, sensory experiences, behaviors, and children. Primary keywords were autism spectrum disorder, physical education, and sensory experiences. Additional keywords such as behaviors and children narrowed down the results when searching through the databases.

The first search conducted was in the Academic Search Complete and SPORTDisucs using keywords autism spectrum disorder and physical education. The keywords led to 234 results. A date range was filtered from 2015-present, and peer reviewed article filters were selected which brought the results down to 190 articles. Three articles were used for the synthesis.

The second search was found using ERIC database. The keywords used were autism spectrum disorder and behaviors. The keywords led to 8,218 results. A date range was filtered from 2015-present which brought the results down to 3,766 articles. A custom filter was added to filter out peer reviewed and full text articles and came back with 2,127. The keyword physical

education was used to narrow down the results. This produced 34 results, and three were used through ERIC.

The third search used Education Source through the KSSPE Library Search database. The keywords were autism spectrum disorder, sensory experiences, and children. The keywords led to 160 results. A date range was filtered from 2015-present which brought the results down to 111 articles. A custom filter was added to filter out non-peer reviewed journal articles, which gave 105 results. Four research articles were used through SPORTDiscus.

There were ten articles selected to be in this synthesis. They were chosen for their relevance to the synthesis topic. Four additional articles were used for background information in Chapter one. The articles and studies collected were found by using the EBSCO database from Drake Memorial Library. The articles found were through Journal of Physical Education, Recreation, and Dance (3 articles); Autism: the international journal of research and practice (3 articles); International Journal of Physical Education and Health (1 article); Sport, Education, and Society (1 article); Kinesiology Review (1 article); and Journal of Autism and Developmental Disorders (1 article).

The critical mass for this synthesis consisted of ten research articles and 225 pupils with ASD and 27 educators. Data was collected in the United Staes as well as Türkiye, England, and Wales. There was a mix of article types including qualitative, quantitative, mixed methods, and case studies. Data was gathered in a variety of ways including various technologies, visual cues, The Weschler Preschool and Primary Scale of Intelligence scales, tables, observations questionnaires, and individual, group, and semi-structured interviews which provided relevant information to the researcher and the reader. The following methods were used to analyze the data: selective coding, descriptive statistics, content analysis, and thematic analysis.

Chapter 3 – Review of Literature

The purpose of this chapter is to present a review of literature on the role of sensory input for students with autism spectrum disorder in physical education. The World Health Organization (WHO) estimates about one in 100 children globally have ASD. Over the past few decades, the prevalence of autism has been increasing in schools. Physical education teachers' general understanding of ASD is important to foster a safe and supportive learning environment. Sortwell et al. (2024) explained that children with ASD are more likely to encounter atypical sensory experiences, often associated with cognitive difficulties, which may impact their perception of the environment. The prevalence of atypical sensory experiences across numerous realms is estimated to be over 96% in children with ASD, and categorized as hypersensitivity or hyposensitivity (Sortwell et al., 2024). Physical education teachers need the support and resources to teach students with ASD if they have limited or no background knowledge. The following occurring themes will be reviewed: Sensory processing, underlying reason to a behavior, barriers and benefits in PE, planning considerations, and a need for professional development.

Sensory Processing

Atypical sensory refers to sensory responses that differ from typical responses to sight, hearing, touch, smell, proprioception, and vestibular stimuli. People with ASD can either be hypersensitive or hyposensitive to sensory stimuli. Hypersensitivity is an over-intake to sensory stimuli and hyposensitivity is an under-reactive response to sensory stimuli. Kadlaskar et al. (2023) examined data of two to five year–olds, including 383 participants with ASD. Participants were enrolled in either the Autism Phenome Project (APP) study or the Girls with Autism—Imaging of Neurodevelopment (GAIN) study. The studies were approved by the University of

California. Behavioral assessments were used included the SSP, Mullen Scales of Early Learning (MSEL), Autism Diagnostic Observation Schedule (ADOS), Social Responsiveness Scale (SRS-2), Vineland Adaptive Behavior Scales (VABS-2), and the Childhood Behavior Checklist (CBCL) in the study. The study uses person-centered methods to identify homogeneous sensory classes. The sensory classes connect to quantitative methods focusing on participants in each identified sensory class to the numerical data of percentages. The study's findings identified sensory processing classes in autistic children and explored them related to characteristics of autism, adaptive skills, and ADHD symptoms.

In addition, Unwin et al. (2022) explored multi-sensory environments with children who have autism and the effect of having control of sensory changes. The study tested 42 children with autism, ages four to 12 years, who used the multi-sensory environments both with and without control over sensory changes. An autism diagnosis was confirmed through the Wales autism research laboratory administered the Autism Diagnostic Observation Results. The Weschler Abbreviated Scale of Intelligence (WASI-II) was used to measure cognitive ability. The study used tools to provide numerical data and statistical analysis connecting to quantitative research. The study showed when children with autism control the sensory equipment, they paid more attention and performed fewer repetitive and sensory behaviors. The mean of the active-change condition was 364.93 sensory changes, and the mean of the passive-change condition mean was 240, indicating more sensory changes in the active-change condition. The findings of the study also showed children with ASD also used less stereotyped speech, produced fewer vocalizations, and showed lower levels of activity. Control of the Multi-Sensory Environment can allow the child to better satisfy their needs.

Underlying Reason to a Behavior

Physical education class can be an environment that could cause overstimulation for students with ASD from an overreaction or underreaction to the environment stimuli. Sensory systems can elevate input and make it difficult to organize thoughts, which may result in overstimulation and non-desired behaviors (Weiner & Grenier., 2020). The case study includes qualitative aspects, describing struggles for a first-year New York State public school physical education teacher. Mr. Garcia is four weeks into the school year and has been focusing on developing a supportive and comfortable learning environment. Garcia's teaching load consists of a challenging third grade class of 30 students, including 4 with ASD. The students' behaviors with and without ASD have impacted class and Mr. Garcia's struggles to understand and manage sensory-related behaviors in students with ASD.

Tables displayed from the study of Weiner and Grenier. (2020) gave Mr. Garcia support from colleagues to reflect on his teachings to create a more supportive learning environment based on the needs of the students. Table one explained sensory systems associated with behavior. The behavior categories included poor balance, poor coordination, poor posture, deep pressure, fleeing the area, repetitive movements, making random noises, and avoiding holding equipment. The tactile sensory system (any input that comes through touch) indicates poor coordination, poor posture, seeks deep pressure, repetitive movements, and avoids holding equipment. Auditory sensory system (any input that comes through noise) indicates poor balance, poor coordination, fleeing the area, repetitive movements, and makes random noises. Visual sensory system (any input that comes through vision) indicates poor balance, poor coordination, fleeing the area, and repetitive movements. Proprioceptive (where the body is in space) indicates poor balance, poor coordination, poor posture, seeks deep pressure, and repetitive movements. The Vestibular sensory system (body's reaction to movement and balance) indicates poor balance, poor coordination, and repetitive movements. Table two gave

examples on roles and responsibilities for teacher assistants and paraeducators to support the learning environment. With support, Mr. Garcia developed a picture schedule board, a keyring with common directional picture communication symbol cards (stop, sit, stand, listen, toilet, calm body, etc.), and a first-then board with reinforcements that can be given immediately to the students upon completion of their first task and has improved his ability to support the students with ASD.

A study through Lee and Haegele. (2016) connects to the previous research through a qualitative lens to help physical education teachers understand the challenging behaviors of students with ASD. The term "challenging behavior" is defined as culturally abnormal behavior(s) of such intensity, frequency, or duration that the physical safety of the person or others is likely to be placed in serious jeopardy, or behavior which is likely to seriously limit use of, or result in the person being denied access to, ordinary community facilities (Lee & Haegele., 2016).

Physical education is among the most challenging educational contexts for students with ASD because of the considerable stimuli existing in the gymnasium. For example, the diverse colors and shapes of equipment, peers running around or talking loudly, and the teacher's commands and signals can cause sensory overflow which can lead to frustration and can aggravate behavior issues (Lee & Haegele., 2016). The research found three potential factors that can trigger or aggravate the challenging behaviors of the students with ASD which includes sensory overload, aversive or over-focused sensory inputs, or the teacher not knowing the function of the behavior. It is essential for educators, including physical education teachers, to understand the why of the behaviors. The why could be medical, setting, activities, equipment, or the student needs support and if possible, ask the student how they feel. Each child is unique, and

it is important to know that for students with ASD one strategy might work with one student, but it might not work with every student.

Barriers and Benefits in PE

Physical activity has benefits to your mental and physical wellbeing and for students with ASD they fall short of the nationally recommended physical activity levels (Menear & Neumeier., 2015). According to the physical activity guidelines of the Center for Disease Control (CDC) children and adolescents ages six through seventeen years do 60 minutes or more of moderate to vigorous physical activity daily. Menear and Neumeier. (2015) explain the barriers, benefits, and strategies for students with ASD. Higher rates of overweight, obesity, and inactivity are reported in students with ASD and sensory stimulation is one of the contributing factors. The research showed some situations in physical education require social understanding or lack structure and this can be challenging for students with ASD. Some students with autism may struggle following rules, comprehending instructions, level of speed, communicating with peers, and adapting to rule change during gameplay. It is crucial for physical education teachers to understand the challenges for students with ASD and be able to universally design their lessons to support the needs of all the students in the class. The qualitative analysis research of Menear and Neumeier. (2015) explains that strategies can be used to increase the rates of success in PE. Strategies include using social stories to prepare students for activity, preparing the environment in advance to address the student's sensory challenges, and being able to adapt to the curriculum and utilize different teaching practices.

In addition, Lamb et al. (2016) research a qualitative small-scale case study at one school in eastern England, exploring physical education through the eyes of five children, aged 12–16 years with ASD. Photo-elicitation was adopted as a research tool to empower students with ASD

to share their feelings towards physical education. The study utilized Bourdieu's conceptual framework to explore specific challenges through theoretical concepts of field, habitus and capital provides us with tools from which to develop an understanding of the student's experience in physical education. The findings of the study included children with ASD face unique challenges in social interactions, chaotic environments of changing rooms, and an increase level of anxiety and fear. The study emphasized the critical role of effective inclusion and taking the time to effectively plan and accommodate to every child's educational needs. Creating a more inclusive and supportive environment is the main challenge for students with ASD.

Correspondingly, Kirby et al. (2015) included first-person perspectives of children with ASD. The qualitative study used the perspectives of 12 children diagnosed with autism, ages four to 13 years. The interviewees share their sensory experiences during qualitative interviewing. Questionnaires, caregiver interviews, and observational measures have been the primary modes of data collection in sensory-related research among children with ASD. The analysis process discussed challenges such as maintaining focus, interpreting abstract concepts, and indication of facial expressions. Three main themes emerged from the data: normalizing, storytelling, and describing responses. In the study, it was found that it is feasible to interview children with ASD in first-person perspective about their sensory experiences. It is critical that educators, including physical education teachers see the child first then the disability and emphasize what they can do and not always on what they cannot do.

Support and Planning

The reduced participation in physical activity is concerning given the additionally heightened risk of obesity among children with ASD (Sortwell et al., 2024). It is critical

educators, including physical education teachers build a positive self-concept towards fundamental movement skills (FMS). In prior research, it was stated that Children with ASD have difficulties understanding verbal directions therefore, they tend to prefer basic gross motor activities requiring low motor coordination similar to those preferred in typically developing children at a lower developmental stage. Sortwell et al. (2024) through a qualitative approach indicates factors that should be considered when planning for the teaching of FMS. The challenges that teachers need to consider when teaching PE include students' undeveloped interpersonal and intrapersonal skills, delayed neuromuscular development, difficulty processing, sensory information, and the environmental factors of the school and classroom. Each student with ASD is unique and careful planning and designing learning must be considered. The PE teacher needs to consider the following variables; types of movement activities, length of lessons, frequency of lessons per week, length of the learning unit, and motor skill development co-factors that also contribute significantly to the development of FMS (Sortwell et al., 2024).

Bassette et al. (2024) conducted an intervention study using video-based instruction to promote independent performance of physical activity skills in students with developmental disabilities. Three participants (Rob, Ike, and Ivan) were recruited through a convenience sample from a local high school between 14 and 22 years. The participants had to have eligibility for special education services of moderate to severe developmental disabilities, and recommendations from a teacher that they would benefit from functional physical activity instruction. The primary focus is on testing the effectiveness of the intervention. The study also involves qualitative observations of participants' progress and challenges, which supports the intervention's effectiveness.

The purpose of this study was to determine whether an intervention using Video-Based Instruction (VBI) such as Video Prompting (VP) delivered through an Evidence-Based (EB) app

could effectively teach a sequence of skills to individuals with developmental disabilities. Rob, Ike, and Ivan showed an initial delay in achieving independence during the school teaching trials, but their independence increased over time. The three participants showed high levels of independence during the Video Prompting phase. Rob completed an average of 14.3% of the task analysis steps independently, consistently performing only two specific steps. Ike completed an average of 3.97% of the task analysis steps independently, occasionally performing a few specific steps. Ivan showed very low performance, completing an average of 0.6% of the steps independently. Overall, the study gave evidence proving custom-made videos were effective in providing individualized instruction and an increase in independence during the intervention phase. The planning considerations connect to everyday planning of physical educators to improve their teaching and foster an inclusive and supportive learning environment.

In a qualitative Turkish study by Erhan et al. (2024) a group of 27 educators (19 women, 8 men) ages ranging from 23 to 36 years and most started their careers working with individuals with special needs. The data conducted in the study was a personal information form and a semi-structured interview form. Drafted questions were formulated, and each interview spanned between 30-45 minutes. The findings of the study concluded that educators working with individuals that have ASD generally lack sufficient knowledge and pedagogical education specific to special needs. There is a need for specialized undergraduate and graduate programs to train educators in APE for ASD and to learn about the other wide range of disabilities. This will allow physical education teachers to best support their students' needs and to create a safe, supportive, and inclusive learning environment.

Summary

Research has shown that physical education teachers need support through professional development when teaching students with ASD to understand sensory processing. It is essential

for physical education teachers, and other educators, to understand sensory processing to foster a supportive and inclusive learning environment. By understanding the sensory experiences from the first-person perspective of children with autism, educators can better recognize how the students communicate their needs and see them from a whole person's perspective, not just the child's disability.

Chapter 4- Discussion, Conclusion, and Recommendations

The purpose of this chapter is to present the results of the review of literature on sensory input for students with autism spectrum disorder in physical education. These findings will be analyzed in relation to the research questions which guided this synthesis project. Additionally, recommendations for future research, particularly concerning the experiences of physical educators working with students who have disabilities.

The results of this review of literature revealed a few common themes. The first theme was sensory processing. All students learn differently, especially students with autism spectrum disorder. Students with ASD will be hypersensitive (overreaction to senses) or hyposensitive (underreaction to senses). Physical education teachers and other educators must create a supportive and inclusive environment using a variety of different teaching and learning styles. Underlying reasons for a behavior led to the second theme, lack of knowledge of understanding sensory processing needs could cause you to think your class is "uncontrollable". On the other hand, it is because when students with ASD do not receive the necessary sensory input, they may engage in behaviors to seek or avoid certain stimuli in an attempt to self-regulate their sensory experiences. Understanding these behaviors as responses to sensory needs rather than a distraction to class can help educators best support the students with ASD in achieving sensory balance. A third theme consistently appeared throughout the research indicating barriers that physical education teachers face on how to best support students with ASD. The research

repeatedly reported that physical education teachers lack the knowledge needed to support students with disabilities. Most physical education teachers take only one adapted physical education class as an undergraduate and typically do not take any more classes throughout college.

Most literature through sensory input for students with ASD highlights the lack of knowledge among physical education teachers in understanding ASD. However, it also led to positive outcomes through first-person perspectives. Individuals with ASD often have a unique perspective on the world, which can encourage educators to take a step back and think on how they can best support and create inclusive practices for all learners in their class. This perspective fosters a positive environment that celebrates the diverse talents of individuals with ASD.

Discussion

Interpretations

As part of this literature review, three research questions were composed. The first research question was, what are effective strategies to incorporate sensory needs into a physical education lesson? The results of the literature review showed that every child with ASD learns differently, and it is critical to understand if the student is hyperactive or hypoactive. It is also important to understand the different levels of sensory processing. Kadlaskar et al. (2023) reported that using a short Sensory Profile to identify homogeneous classes of sensory reactivity in children with ASD based on both severity and modality and examined whether sensory classes differed in terms of autism characteristics, adaptive skills, and attention-deficit/hyperactivity disorder symptoms. Based on the pattern of both severity and modality, four sensory classes emerged and were named *Moderate/Mixed* (35.5%; probable-to-definite differences in all modalities except in movement sensitivity and low energy/weakness), *Severe/Mixed* (8.5%;

definite sensory differences in all modalities except in low energy/weakness), *Moderate/Broad* (14.6%; probable-to-definite differences in all modalities), and *Low/Mixed* (41.1%; typical scores in most modalities with probable differences in taste/smell sensitivity, under-responsive/seeks sensation, and auditory filtering). The *Severe/Mixed* class exhibited greater problems in a variety of areas such as social, adaptive, and attention-deficit/hyperactivity disorder symptoms, while the *Low/Mixed* class showed overall fewer problems. Menear and Neumeier. (2015) reported that physical educators should prepare the environment in advance by addressing the student's sensory challenges. Weiner and Grenier. (2020) found strategies to support students with ASD by using a picture schedule board, keyring with common directional picture communication symbol cards (stop, sit, stand, listen, toilet, calm body), and a first-then board with reinforcements that can be given immediately to the students upon completion of their first task. It is important to note that all students are going to learn differently, and it is not one size fits all. (Kirby et al. (2015) reported that three themes were found in the study of first-person perspectives from children with ASD. The themes were normalizing, storytelling, and describing responses. The children with ASD frequently framed that they either felt or wanted to feel “normal”, they interviewees used storytelling techniques to share their experiences, and the children often characterized a sensory experience by the reaction they had to their experience. Unwin et al. (2022) confirmed in the study that when children with autism could control the sensory equipment, they paid more attention and performed fewer vocalizations and showed lower levels of activity. Providing control of sensory changes helps create positive conditions for learning to create a supportive environment.

The second research question was, what are the underlying reasons for a student with ASD exhibiting challenging behavior? The results of the literature repeatedly reported learning more about sensory processing. Lamb et al. (2016) reported in the study individuals with ASD

face challenges in education and each child is different. The design and management of physical spaces, especially the chaos in the locker rooms and increase the emotional well-being of an individual with ASD. It is crucial that teachers plan for inclusion through informed awareness of the barriers in the environment they are teaching in to decrease challenging behaviors. Physical educators are in control of policies and ensuring that the start of a lesson adopts expectations and policies elevates distress and behaviors. Lee and Haegele. (2016) findings state physical education teachers must be mindful of sensory overloading while the students are in the gym. The gym could be overcrowded, with multiple pieces of equipment, the sound of feet and balls on the gym floor, the smell of sweat. Students could have difficulty filtering that all out and challenging behaviors could be observed. As educators we must realize that the behavior is occurring due to the environment.

The third research question was, how can physical educators be better prepared teaching to students with ASD? The results of the literature highlighted a need for professional development and getting to know the students with ASD. Sortwell et al. (2024) findings reported a hyposensitive student could appear under-responsive, and they could be characterized as the student is “not listening”. However, a PE teacher's responsibility is to control the environment and modify activities to adjust the sensory experiences for students with ASD. The acronym to assist physical education teachers Sortwell et al. (2024) came up with is CLASH: C-contact, L-light, A-area, S-sound, and H- heating, ventilation, air conditioning. Planning ahead of time and incorporating modification of lessons will help physical education teachers and other educators be more prepared and provide a safe environment. Bassette et al. (2020) reported video-based instruction helps students with ASD learn. Skill levels of all participants in the study increased their levels of independence after intervention. The videos may increase the response effort needed to teach skills and/or be ineffective in meeting the needs of people with moderate to

severe developmental disabilities without requiring the presence of a person to prompt them. Orhan et al. (2024) reported that educators face frequent behavioral problems during lessons, which they are not adequately trained to handle. The finding concluded that educators working with individuals who have ASD generally lack sufficient knowledge and pedagogical education specific to special needs. There is a need for specialized undergraduate and graduate programs to train educators in APE for ASD.

Recommendations for Future Research

In reviewing the data based on sensory input for students with ASD in physical education the following limitations were noted regarding the studies under review. A significant limitation is that physical educators lacked specialized training in APE for ASD. The gap in training can impact the safety and well-being of both students and educators. Another limitation was that studies were limited to physical educators working in public schools or higher education. Results may not be the same as if studies were broadened to special day schools or private schools. Special day schools could potentially have different findings as it is not an integrated setting with peers that do not have disabilities. The last limitation is a study collected data on effective PE programs and lesson practices for children with ASD, but there is still a lack of comprehensive, evidence-based guidelines and the struggles that the physical education teachers face.

Based on these limitations and other insights related to the literature the following recommendations for future research should be considered:

1. In order to make the findings more generalizable, future studies should collect data from special education day schools and private schools.
2. Future studies should focus on collecting data from physical education teachers' perspectives regarding team and individual sports in PE. Studies comparing and

analyzing team versus individual sports in PE for students with ASD can aid in providing guidance through different units.

3. Future studies should focus on socialization skills with peers with and without a disability amongst students with ASD.
4. Future research ideas should collect data on the educational background of physical education teachers and their APE knowledge to decrease the gap of training provided for PE teachers.

Summary

The purpose of this literature review was to determine the educational implications of stimulant identification in students with autism. By focusing on variables such as autism, physical education, sensory processing, a data-based search was conducted resulting in the selection of 10 relevant articles. These articles were carefully analyzed to systematically determine the educational implications of stimulant identification in students with ASD. Research revealed there are specific sensory groups within individuals who have ASD and identified a significant gap in the training and knowledge of physical education teachers in how to best support students with ASD.

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APPENDIX A- ARTICLE GRID

The Role of Sensory Input for ASD in Physical Education Williams

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/ Recommendatio
Penny Lamb, Dianna Firbank, David Aldous	Capturing the World of Physical Education through the Eyes of Children with Autism Spectrum Disorder	Sport, Education, and Society	To explore the pupil's perspective of having autism spectrum disorder.	Data collection: Case study Small, rural, secondary school (ages 11-16 years of age) in Eastern England. The researchers worked with 5 group of pupils (four males, 1 female). Participants used pseudonyms: Robert (16), Danny (15), Alex (15), Joe (14), and Josie (12). Photo-elicitation-pupils used iPads to take photos related to their experiences in PE. Auto-driving-pupils took photos and had unstructured interviews explaining their photos. Interviews were recorded using an app on the iPad.	Qualitative research Bourdieu's framework provided a lens for understanding social behavior and structures. Manual thematic analysis Coding process through the usage of color coding for clarity.	4 main themes- PE changing room PE corridor PE office PE activities The themes highlighted the importance of physical spaces and the experiences for an individual with ASD.	Individuals with AS education and each and management of the chaos in the loc emotional well-bei It is crucial that tea through informed a environment they a Physical education importance of ensu adopts expectations distress.

2. Jihyun Lee Justin Haegele	Understanding Challenging Behaviors of Students with Autism Spectrum Disorder	JOPERD	To understand why the behaviors are occurring and strategies to minimize the behaviors for individuals with ASD in Physical Education.	Table 1. Strategies to Minimize Challenging Behaviors of Students	Qualitative research	PE is the among the most challenging educational context for students with ASD because of considerable stimuli existing in the gym. Three reasons for what cause challenging behaviors- Sensory overload Aversive or over-focused sensory inputs The teacher not knowing the function of the behavior	Challenging behavi reasons why. It is in each child is unique differently. Sensory overload- Sensory over-respo responsivity, and se modulation issues. PE teachers must be overloading while t The gym could be c pieces of equipmen on the gym floor, th could have difficult challenging behavio

3. Laura Bassette, Shannon Titus-Dieringer, Kim Zoder-Martell, McKenzie Cremeans	The use of Video-based Instruction to Promote Independent Performance of Physical Activity Skills in Students with Developmental Disabilities in a School and Community Setting	Psychology in the schools	To explore video-prompting and video-based intervention works for students with developmental disabilities.	Three participants were recruited through a convenience sample from a local high school between 14 and 22. The participants had to have eligibility for special education services of moderate to severe developmental disabilities, and recommendations from a teacher that they would benefit from functional PA instruction. Pre-assessment Baseline Intervention phase VP-YMCA phase VM-YMCA phase Social validity questionnaire Interobserver agreement	Quantitative research An Apple iPad Mini was used to create videos, an EB Pro app was developed to help facilitate PA in people with ASD. Video based intervention- Video prompting (VP) Video-based intervention (VBI)	Three participants Ben, Rob, and Ivan showed an initial delay in independence during the teaching trials at school, but their independence increased over time. Ben showed immediate improvement and acquired all steps independently after viewing the video prompting. Rob struggled at first but improved over time. His independence increased during the intervention. Ivan displayed variable performances throughout the study, however engagement improved when edible incentives were introduced. Rob-Intervention mastered the circuit after 53 sessions averaging 80.6% independence.	The customization could identify the a environmental featu walking circuit. Themes of the study Skills- All participa independence after Motivational strateg to improve Ivan's e needed that incentiv The videos may inc needed to teach skil meeting the needs o severe DD without person to prompt th

						Ivan mastered the circuit after 110 sessions, averaging 64.7% independence. Ben achieved 100% independence immediately upon starting intervention and mastered the circuit in 42 sessions.	
4. Andrew Sortwell Batian Carter-Thuillier, Ferman Konukman, Kate O'Brien, Soukaina Hattabi, and Kevin Trimble	Planning and Pedagogical Considerations for Teaching Children with Autism Spectrum Disorder in Physical Education	Kinesiology Review	To address challenges and sensory stimuli associated with ASD and to suggest ways on how to effectively create a physical education curriculum.	Table 1- PE unit recommendations Table 2- Sensory stimuli recommendations Table 3- strategies to improve self-regulation	Qualitative research	Effective PE program lessons can improve physical skills. To create a supportive environment teaching requires special preparation and teaching strategies.	PE teachers must cr for individuals with more likely to enco experiences, often a difficulties, which r the environment. A hypersensitive or easily distracted by A hyposensitive stu responsive, and the student is "not liste control of supportin adjust the sensory e CLASH (Table 2) C- Contact L- Light A- Area S- Sound H- Heating, ventilat

5. Kristi Menear and William Neumeier	Promoting Physical Activity for Students with Autism Spectrum Disorder: Barriers, Benefits, and Strategies for Sucess	JOPERD	To identify the barriers, benefits and strategies related to physical education and to explore how to adapt the curriculum and teaching practices.	Reports indicate that overweight, obesity, and inactivity occur at higher rates in individuals with ASD. The majority of children with ASD display weaknesses in posture, movement, and strength. The lack of motor coordination can be frustrating for a child with ASD as they struggle to keep up with their peers in physical activity.	Qualitative research	Poor or delated motor skills The demand of social understanding in some environments Strategies for success- Use social stories Prepare the environment Adapt the curriculum and teaching practices	Research in ASD ar behavioral improve Physical activity int that a jogging exerc maladaptive behavi minutes following t research with exerc claim that exercise in the short term for
6. Anne Kirby, Virginia Dickie, and Grace Baranek	Sensory Experiences of Children with Autism Spectrum Disorder: In their own words	Autism: The International Journal of Research and practice	To explain autism spectrum disorder in the first-person perspective.	Ages 2-12 years recruited through clinics, parent groups, schools, and state registry with a diagnosis of ASD 12 participants who were diagnosed with ASD Parent questionnaires about sensory experiences Observational assessments used to derive non-verbal mental age Parent in-depth qualitative interviews about child's sensory experiences	Qualitative methods Repeated reading and discussion of the transcripts among the research team. Coding procedures	Three themes- Normalizing- the children frequently framed that they either felt or wanted to feel “normal”. Storytelling- the children used storytelling techniques to share their experiences. Describing responses- the children frequently characterized a sensory experience by the reaction they had to it.	In the study, it is de children with ASD experiences. Children of the stud experiences through included strategies, reactions, and fear. Challenges of the st children’s focus, dis and interpreting the and discussion had gestures.

7. Brad Weiner and Michelle Grenier	Sensory Balancing Strategies for Students with Autism Spectrum Disorder	JOPERD	To examine strategies to incorporate sensory based activities into Physical Education.	More than 90% of children with ASD possess hypo or hypersensitivity to sensory stimuli 30 total students and 4 students diagnosed with ASD in Mr. Garcia's class	Qualitative research Sensory systems- Tactile Auditory Visual Proprioceptive Vestibular (Table 1)	Mr. Garcia felt better prepared to develop a learning environment that was designed to meet the unique needs of each student.	The strategies inclu Picture schedule bo directional picture c (stop, sit, stand, list first-then board wit given immediately completion of their
8. Katy Unwin, Georgina Powell, and Catherine RG Jones	The use of Multi-Sensory Environments with Autistic Children: Exploring the Effect of Having Control of Sensory Changes	Autism: The International Journal of Research and practice	To explore ways to integrate sensory needs into physical education.	41 autistic children aged 4-12 years (8 female, 33 male) Autism diagnosis was confirmed through the laboratory administered Autism Diagnostic Observation Schedule. Recruited through the Wales Autism Research Centre's Facebook page and recruitment register. For inclusion the child had to be aged 4-11 years (one participant turned 12 before testing), with a clinical diagnosis of autism, no diagnosis of another developmental disorder, and no significant hearing, visual, or mobility differences. First MSE use Active- Change or Passive-Change condition	Quantitative research Videos of the sessions were coded using ELAN software and then exported into SPSS. Coded by primary and secondary coder. Correlations were calculated on 25% of videos that were double correlated.	Providing control of sensory needs led to a significant decrease in RMB's, sensory behaviors, activity levels, stereotyped speech, and vocalizations.	The study highlight sensory needs (MS reduce disruptive b attention creating a environment. RMBs were both fe the Active-Change Passive-Change co

				Assessment 1- ADOS-2 or cognitive ability Assessment 2- ADOS-2 or cognitive ability Second MSE use- Active-Change or Passive-Change condition Free-play MSE use			
9. Girija Kadlaskar, Pin-Hsun Mao, Ana-Maria Iosif, David Amaral, Christine Wu Nordahl, and Meghan Miller	Patterns on Sensory Processing in Young Children with Autism: Differences in autism characteristics, adaptive skills, and attentional problems	Autism: The International Journal of Research and practice	To investigate the sensory processing differences in individuals with ASD.	383 Participants- 217 had SSP data with 211 having SSP data between the aged 2 and 4 years, 144 had development quotient scores below 70. Participants were enrolled in either the Autism Phenome Project (APP) study or the Girls with Autism—Imaging of Neurodevelopment (GAIN) study. The Short Sensory Profile (SSP)- 38 item parent-report questionnaire Mullen Scales of Early Learning (MSEL)- standardized measure of verbal and nonverbal development The Autism Diagnostic Observation Schedule-Generic (ADOS-G/ADOS-2)	Quantitative methods focusing on participants in each identified sensory class to the numerical data of percentages.	Distinct sensory classes- the parents questionnaires reported patterns with a mix of hypo-reactivity and hyper-activity to sensory stimuli. Intervention- Teaching coping strategies for overwhelming sensory environments could help address sensory symptoms that impact daily functioning.	It is important to id processing patterns patterns. It will help intervention strateg sensory-related cha

				Social Responsiveness Scale- 2nd Vineland Adaptive Behavior Scales- 2nd (VABS-2) Childhood Behavior Checklist, Ages 1.5-5 (CBCL)			
10. Bekir Erhan Orhan, Aydin Karaçam, Yuni Astuti	Exploring Educators' Preparedness and Program Implementation in Adapted Physical Education Classes for Individuals with Autism Spectrum Disorder	Journal of Physical Education and Sport	To explore where teachers need extra support when teaching students with disabilities.	The study group consists of 27 educators (19 women, 8 men) ages ranging from 23 to 36 years and most started their careers working with individuals with special needs. A personal information form and semi-structured interview form were used to collect data. Drafted questions were formulated based on the literature review. Each interview spanned 30-45 minutes.	Qualitative research Audio recordings occurred and were translated into plain text.	There are no specialized APE departments in Turkish universities and educators often lack necessary training. Educators face frequent behavioral problems during lessons, which they are not adequately trained to handle. Despite the lack of formal training, educators reported positive responses from ASD individuals and their families.	Educators working ASD generally lack pedagogical educat There is a need for graduate programs ASD.