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Effective ways of teaching children with Autism Spectrum Disorder in Inclusive Physical Education Setting

Ruben Arroyo
rarro1@brockport.edu

Effective ways of teaching children with Autism Spectrum Disorder in Inclusive Physical Education Setting

A Synthesis of the Research Literature

A Synthesis Project

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Ruben Antonio Arroyo Santiago

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Read and Approved by: Melanie Perreault .
Melanie Perreault, PhD

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Cathy Houston-Wilson 8/21/19

Dr. Cathy Houston-Wilson
Chairperson Department of Kinesiology, Sport Studies and Physical Education

ABSTRACT

The purpose of this synthesis is to provide effective teaching strategies for inclusion of students with autism in adapted physical education settings. To that end, a literature review produced a critical mass of 16 relevant articles identifying strategies such as prompting, video modeling, variable intensity prompting (i.e., flexible and most-to-least), antecedent-based intervention, peer tutoring and self-management. These strategies are further discussed to provide practical ways physical educators can use to include students with autism to general or adapted physical education settings. Based on gathered data, there is strong evidence supporting the benefits of variable intensity prompting strategies like most-to-least. Evidence also supports that antecedent-based methodology provides a solid starting point to develop interventions that can incorporate other teaching strategies. As an educator, using proper and effective teaching methods provides the opportunity to improve the students' quality of life.

Keywords: "Autism Spectrum Disorder", "Effective teaching strategies", "Effective methods", "Peer-tutoring", "Self-regulation strategies", "Task analysis", "Antecedent-based intervention" and "Adapted physical education".

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CHAPTER 1

INTRODUCTION

Throughout the years, there have been studies on the effects of physical activity on individuals with Autism Spectrum Disorder (ASD) (Sandt & Frey, 2005; Todd & Reid, 2006). In general terms, studies show that individuals with ASD demonstrate poor motor skills and social integration during the activities. Also, they often remain isolated and display repetitive movements. According to Sandt and Frey (2005), individuals with ASD show restricted, repetitive, and stereotypical patterns of behavior, interests, and activities, as well as qualitative impairments in social interaction and communication.

Considering current law requirements calling for inclusion and given the rising numbers of individuals with ASD, it is essential for educators to be prepared. At some point in their careers their diverse group of students will include individuals with ASD.

ASD is a neurodevelopmental disorder showing characteristics such as persistent deficit in oral communication and social interaction across multiple contexts (DSM-V, 2013). Individuals with ASD show difficulty exchanging ideas, thus, decreasing their opportunities to share interest, emotions and feelings. Communication deficit ranges from being verbal to nonverbal. Also, individuals avoid eye contact, have deficient body language or gesticulation, show hyper or hypoactivity to sensory input (e.g., indifference to pain, sensitivity to temperature, odors or touch) (DSM-V, 2013).

Individuals with ASD show restrictive and repetitive patterns of movement, sound and behavior. Their adherence to routines can lead to extreme distress reactions caused by small changes to such patterns. Such characteristic causes resistance to transitions and

highly restricted and fixated behaviors, for example, a strong attachment to an object. (DSM-V, 2013)

ASD symptoms must be present in the early developmental period and cause significant impairment in social, occupational, or another relevant functional area (DSM-V, 2013). There are three levels of severity (i.e., levels 1 to 3) depending on the amount of support required. Level 1 individuals require some support at socializing and show difficulties starting interactions. Level 2 individuals show a marked deficit in verbal and nonverbal communication with inflexibility changing established routines. Level 3 individuals show severe difficulty at social skills and strong inflexibility changing routines. Many individuals with ASD also have motor deficit including odd gait, clumsiness, and other abnormal motor traits (e.g., temporary slowing or freezing). Self-injury and disruptive or challenging behavior are common in children and adolescents with ASD. According to the CDC (2018), 1 in 59 children in the US have ASD and the condition prevails in males more than females (i.e., 4 to 1 ratio). Frequent comorbidities of students with ASD are intellectual impairment and structural language disorder (DSM-V, 2013).

Educators face many challenges in the classroom, including having students with ASD. Without proper teaching strategies, it would be difficult for students with ASD to learn (Obrusnikova & Dillon, 2011a, 2011b). Class structure and long waiting time for turns cause students to get distracted quickly and lose focus (Sandt & Frey, 2005; Todd & Reid, 2006). These factors favor lack of movement and lead to limited motor coordination, functional deficiencies, health-related issues, and hypokinetic diseases (Case & Yun, 2015). According to Case and Yun (2015), teachers of students with ASD

have difficulty supplying task instructions. Students with ASD do not understand the instructions and display little attention or direct focus to inappropriate tasks. Lack of understanding of instructions makes it challenging for students with ASD to develop new motor skills.

Physical activity benefits health, social, and individual aspects of life (Stanish et al., 2015). Also, exercising helps diminish anxiety and aids autoregulation by decreasing the disruptive time and engaging social skills (Stanish et al., 2015). Comparing Students with ASD with non-ASD students allows identification of barriers and gaps in acceptance that affect preference, enjoyment, and perspective of physical activity. Thus, opinion and preference of students with ASD must be considered before starting physical activity (Stanish et al., 2015).

The purpose of this synthesis is to answer the following question. "What are most appropriate strategies to teach the student with ASD in an adapted physical education setting?" It is the author's intent to find effective ways of teaching physical education to the ASD population and to engage and maintain their active participation in the classroom and after the intervention.

Rationale

An effective teacher uses proper teaching strategies to engage students with ASD and improve their physical performance inside and out of the physical education setting.

Operation Definitions

Physical Activity: is health-related and includes components such as cardiorespiratory endurance, body composition, muscular strength and endurance, and flexibility.

ASD: is a neurodevelopmental disorder that display unique characteristics such as repetitive movement patterns and stereotypical behavior while presenting limitation on daily living skills such as communication and social interaction.

Teaching strategies: is the structure, system, methods, techniques, procedures and processes that a teacher uses during instruction to assists students learning.

Adapted physical education: is an individualized program involving physical and motor fitness, fundamental motor skills and patterns, skills in aquatics and dance, and individual and group games and sports designed to meet the unique needs of individuals.

CHAPTER 2

METHODS

Search Procedure

Research strategy for the present work consisted of a literature search on "autism", "effective teaching", "effective methods" using the EBSCO databases. Search keywords were "Autism Spectrum Disorder", "effective teaching, "effective teaching strategies", "effective teaching methods", "physical activity", "inclusion", "physical education setting", and "sports". Combining keywords made the search more specific and narrowed down results. This search provided 1,571 articles using "effective teaching methods" as primary keyword, "Autism Spectrum Disorder" as second and "physical education" as third.

Separate searches produced 98 and 14,428 with keywords "antecedent-based intervention" and "task-analysis", respectively. Adding "autism" to the later search dropped hits to 164 articles. Searching for "peer-tutoring" yielded 737 hits that reduced to 9 when adding "autism".

A literature search of the Sports Medicine and Education Index using keyword "individuals with Autism Spectrum Disorder in physical education" resulted in 327 articles. Changing the keyword to "inclusion" resulted in 250 articles. Additional 33 articles resulted from using different terms. Yet, most of the articles obtained from the Index had already appeared on previous EBSCO searches. used the ancestry method to find classical and fundamental work in the field. After reading the articles, the search continued by tracking the references list of articles for more information. On each search, hits were screened to identify relevant articles.

Inclusion Criteria

The search for articles was specific to physical activity and physical education setting. EBSCO supplied most of the information found. This pool of literature was further screened to select articles dealing with "adapted physical education" and "physical education" settings. Search time range was 2000 to 2019 for updated data.

Search was exclusively among scholarly or peer reviewed articles in English and Spanish. Articles used for critical mass included quantitative and qualitative studies that answer or could lead to the answer of the problem statement. On the end, critical mass contained 16 on teaching strategies for students with ASD.

Data Analysis

Data extraction started by summarizing relevant information of each article in an article grid (see Appendix). Then, a coding table (see Appendix) was used to sort ideas by topic. These tools helped separating articles and ideas by relevant topics. Since, each article had essential information on effective teaching, the tools helped organize specific information of articles.

CHAPTER 3

RESULTS

Critical mass data analysis allowed identification of several science-based strategies used to teach students with ASD. Some tools focused on improving behavioral and socials skills while other strived to improve psychomotor performance. The following sections present findings in greater detail.

Antecedent-based Intervention

According to Stichter, Randolph, Kay & Gage (2009), antecedent-based intervention is an old-process of structural analysis recognized as a necessary and under-investigated method that is often used as a tool to increase or decrease behaviors of students with ASD. Behavior problems are some of the challenges teachers face when teaching students with ASD. Antecedent-based intervention provides a way to address such behaviors. An antecedent-based intervention is when, using structural analysis, a teacher builds the evaluation process on how the student behaves at certain time; finding the cause and a way to address it. A study by Stichter et al. (2009), evaluated students with ASD, of the same age group (i.e., 7-8 years old) as their peers, that spent at least half of the time in general education setting and presented behaviors of concern to teachers. The setting was an elementary suburban school from the Midwest. Researchers designed a three-phase intervention: baseline, structural analysis, and intervention. During the baseline, participants engaged in inappropriate behavior (e.g., pinching, grabbing, knocking down) towards their peers and self-stimulatory behaviors like pervasive talking and noise making. Others engaged in visual self-stimulatory behaviors such as watching fans and spinning materials and vocal stimulation like making noises, washing machine

sound, and perseverative talk. Considered variables were proximity, previous exposure and high structure. After the intervention, participant improved their behavior (i.e., diminishing the inappropriate and increasing the appropriate), gave the hand to peers, and engaged more in class. By having a structured schedule, they receive the necessary breaks for self-stimulation. When structuring a schedule, is vital to describe the steps students must follow as this help them organize themselves.

According to Pokorski and colleagues (2019) antecedent-based interventions produces consistent results in students with ASD, regardless of age, abilities or behavioral challenge. These researchers used antecedent-based interventions to compare sensory-based intervention (SBI) (i.e., headphones) and physical exercise as specific strategies to improve behavior. SBI is commonly used to improve sensory disfunction of children with ASD (Pokorski et al., 2019). Their study was done primary with preschool children (4 years of age) with ASD using intervention schedules, token board, and visual representations of choice. It must be noted that antecedent-based intervention is not merely a strategy, but a strategical way to combine or incorporate strategies to change stereotypy behaviors. The SBI intervention considered the use or no-use of a headphone on behavior performance. Data showed 50% engagement in stereotypy behavior without headphones versus 33% while wearing the headphones during a visual choice selection task with verbal prompts. There was no difference in performance when not offered a choice. The physical exercise intervention compared performance on three gross-motor activities. Results showed improvement from a baseline of 45% to 73% after the intervention.

Peer-Tutoring

The intent of peer tutoring is the successful inclusion of students with a variety of disabilities, in this case, students with ASD. According to Barfield, Hannigan and Lieberman (1998), peer-tutoring benefits the tutor and the tutee by enhancing the instructional environment. Also, it is a teaching strategy that increases instruction on one-on-one basis with student with disabilities at level 1 and level 2.

According to Ward and Ayvazo (2006), social integration of individuals with ASD is essential to build interpersonal relationships. Their study included individuals with ASD and typically developing peer tutors at catching a ball. Instead of focusing on learning time of students, researchers focused measurements on the development of social skills and the impact of peer tutors on performance. The task was age-appropriate for students and consisted of two critical elements: (1) self-tossing a ball thrown from below the waist using both hands, and (2) catching it. Peer tutors received a 30-minute training session prior to beginning of the intervention. A second 10-minutes refresher session started with a teacher provided short discussion on the value of teamwork and cooperation. Participants of the study were K-8 students from a charter school specialized in including students with ASD. Classroom included 1 to 3 students ages 5 to 7 diagnosed with ASD and 8 to 10 typically developing students. Study baseline was the whole-group direct instruction, were the teachers gave verbal instructions and demonstrations to all the class followed by students' performance and teachers' feedback to each student. There were two interventions. For the first intervention, denominated class-wide peer tutoring-1 (CWPT-1), typically developing students paired with students with ASD. During CWPT-1, student with ASD responded to the command of their peers while music played. Peer

students resembled a teacher of the same age who supplied instructions to perform and praised the tutee for correct execution. The intervention increased performance of students with ASD compared to the baseline and slightly improved performance of tutors. During the second phase (CWPT-2), peer tutors focused on their own performance and modelled the task (instead of providing instructions and feedback) while a different music played. Performance of students with ASD and peer tutors improved significantly during CWPT-2 (Ward and Ayvazo, 2006).

Communication is important for children with ASD. In another study, Thiemman-Bourque, McGuff and Goldstein (2017) used peer tutoring to teach students with ASD how to use a Speech-Generating Device (SGD). According to these researchers, SGD can facilitate direct learning as opposed to being a mere translating machine. Peer tutoring can build social skills by enabling interaction between classmates during different activity settings. Benefits of the intervention also impacted the typically developed peer tutors since they engaged more at the task by receiving a more focused attention. The study by Thiemann-Bourque et al. (2017) combined the evidence-based practices of peer-mediation and SGD to evaluate their effect on students with ASD. The study takes place at a preschool classroom with 4-year-old students diagnosed with severe ASD and non-verbal or minimal verbal skills (defined as less than 20 spontaneous words) (Thiemann-Bourque et al., 2017). Students also received 90 minutes of speech-language therapy per week. The baseline of the study consisted in introducing the SGD to the setting of the student with ASD as another item in the classroom. For the intervention, normally developing peers were trained on the use of the SGD and exposed to the subjects. Communication was measured by coding and frequency count in 6-minute intervals. The

intervention improved prompted and spontaneous communication in both, the student with ASD and the typically developing peer.

Prompting Strategies

Most-to-least prompting has proven to be a useful technique for improving performance of individuals with ASD (Yilmaz et al., 2010). The authors used the intervention in conjunction with the Halliwick's swimming program on children with ASD. The study starts by offering many prompts (i.e., physical prompts and verbal prompts) while directing the student throughout the desired movement and the whole task. Prompting then reduces to verbal and modeling prompts to give the student a hint of what is supposed to do without any physical guidance. At the end of the intervention, with only verbal cues prevails as the only prompt given. Authors successfully demonstrated the impact of most-to-least prompting and commented on the goodness of Halliwick's swimming program. They observed considerable improvement in as little as three interventions.

Blair, Weiss, and Ahearn (2018) compared the effectiveness between most-to-least physical prompting and most-to-least vocal prompting. The study included two 12-year-old participants, one diagnosed with ASD and the other with Pervasive Developmental Disorder. Prior to the study, participants were screened for minimum skills on the procedures that included following two-step directives with prepositional phrases, colors and shapes. There were 30 possible responses per training session. Edible prompting was the reinforcement used each time participant performed correctly. During initial sessions, the therapist used the verb "help" to refer to the intervention of guiding with physical prompt. Later, the expression "do it together" replaced "help" and physical

prompting gradually reduced to a minimum. This way Blair, Weiss and Ahearn (2018) can discern the impact of physical and verbal prompting. Each prompting had 5 levels, starting with the strongest and fading towards the least strong prompts. Physical prompting started with hand-over-hand, grabbing the object with the participant, and transitioned to forearm guidance. Verbal prompting started with a whole sentence, such as “Put the green stick in the red hole”, and decreased the amount of words after each session working the way towards independence (Blair et al., 2018).

Leaf et al. (2016), performed a comparison between most-to-least prompting and flexible prompt fading to teach students with ASD using pictures. For most-to-least prompting, the teacher placed pictures in front of students and said the names of the images. Students should repeat the names. As sessions progressed, verbal prompts reduced. Economy tokens were used as reinforcements by allowing 30 seconds of play with their favorite toy (or other task preferred task) when the student correctly identified the six images of the intervention. During the flexible prompt intervention, the teacher provides praised for good performance and corrective feedback otherwise. The key difference between prompting strategies is that most-to-least provides decreasing amount of the same information while flexible prompting depends on the performance. Towards the end of the study, participants mastered the skills. One participant achieved 97% using most-to-least prompting and 90% with the flexible prompting. The other subject reached 94% with most-to-least prompting and 98% with flexible (Leaf et al., 2016). Most-to-least prompting is effective for teaching students with and without ASD.

A study by Dieringer et al. (2017) used participants diagnosed with ASD from an elementary school ages of 6 to11 and engaged them in physical activities via music,

prompting and modeling; common strategies to teach students with ASD. Individuals with ASD often require motivation to engage in different activities, including physical activities. It has been shown that students with ASD have deficits in gross motor skills and coordination (Dieringer et al., 2017). For the first part of the intervention, the teacher asked students to listen to the music and follow its instructions. Then, played music with instructions guiding students to perform exercise. For the second part, the teacher asked to listen to the music and follow her lead. Then, played the music and demonstrated the exercise. Results showed that modeling increased participant engagement on the physical activity. Furthermore, the behavior generalized to new songs.

A study by Pennington et al. (2018) time to response is important for the learning process of students. Knowing if students answer correctly let educators know if learning occurred. Response time to prompting varies depending on the received input and how it's processed. The study requires students diagnosed with ASD and moderate intellectual disability, ages 7 to 12, evaluated response time to least prompting. As part of the study, there were edible reinforcers and other tangibles students preferred. The intervention consisted of one-on-one interactions using picture cards and frames containing sentences with a missing word in the middle (e.g., The____is). Students fill the spaces in the frames with pictures from the word bank based of the question made by the teacher. The teachers measure response time between question and answers to a maximum of 10 seconds per frame. For the baseline portion of the study, students received prompting even if they did not respond. For the intervention portion, students received a prompt followed by a tangible item or praise when responding to the communication. Results showed improvement as response time decrease by the end.

Self-Management

According to Zantinge et al. (2017), self-regulation is a behavior strategy for students with ASD who show impulsivity, self-aggression, anxiety and aggressiveness towards others. It is considered a key strategy to address problematic emotional behaviors in individuals with ASD that must be introduced at young age to prevent future rampage.

Non-compliance is not a criterion to diagnose ASD, but it may occur. Individuals with ASD often need improvement in social skills to effectively interact with peers. Self-management training can develop social skills of students with ASD (Liu, Moore, & Anderson, 2015).

According to Liu et al. (2015), self-management training is a teaching strategy that has being researched as a behavior intervention procedure for student with ASD. When individuals with ASD get aroused, their nervous system receives mixed the signal and cause lack of control over their emotions (Zantinge et al., 2017). Applying self-management skills can help them to achieve successful outcomes during social interactions (Liu, Moore, & Anderson, 2015).

The study by Liu et al. (2015) measure the heart rate of children with and without ASD to show that arousal affects the psychophysiological response and leads to frustration. Zantinge et al. (2017) worked on students with ASD, age 9, and train them on self-management skills to improve disruptive behaviors towards family, including siblings, and school peers. Before addressing target behaviors, investigators first specifically described what needed change and the strategy to enable it.

Liu and colleagues (2015), observed the behavior of participants during 20-minutes and recorded events to differentiate positive behaviors to reinforce and

inappropriate behavior to be addressed. The self-management intervention of the study resulted in behavior improvements on interruptions (30% to 86 during maintenance stage), asking the opinion (28% to 92% during follow up), and proper greetings to unfamiliar adults (49% to 93%). In other words, intervention worked.

Zantinge and colleagues (2017) compared heartrate and arousal during social interactions and the effect of autoregulation. The study included 27 children with ASD and 44 typically developing children. Observations included intellect, inhibition, cognitive flexibility, self-control and language. Emotional experience was collected, using video and direct observations of students, between 30-120 seconds. Physiological arousal was measured by placing electrodes on the top-center chest area to record the time and frequency of the heart changes. There was no difference between the heartrate of children groups during the baseline period. However, frustration increased the heartrate of students with ASD in comparison to their peers.

When teaching self-regulation strategies such as constructiveness, venting and avoidance, children with ASD engaged less in constructive strategy and engaged more in venting and avoidance as preferred self-management skills. Student with ASD show less self-control skills than their peers in the control group. When executing mental flexibility, children with ASD show more problems at inhibitory control (mean=35.2, SD=6.2) and mental flexibility (mean=20.5, SD=5.4) compared to the control group on inhibitory (mean=24.3, SD=4.5) and cognitive flexibility (mean=13.5, SD=3.4). Investigators suggest that a correlation exists between behavior dysregulation in children with ASD and lowered IQ and language skills.

Picture and Video Comparison at Teaching

Pushkarenko et al. (2016), conducted in a pilot study to examine the effectiveness of a pictographic activity schedule intervention within a structured aquatic setting. Participants attended for three months to a class of 10 to 12 students with different disabilities. The observation period was about 13 weeks, which divided the swimming sections to 30-40 minutes dividing them in: warm-up activity from 5-10, the swimming section from 15-25 and concluding with free time to complete the section. During the research, participants started with a high percentage of class interruptions. The intervention demonstrated how to use the pictographic schedule and introduced students with ASD to aquatic settings. Authors stressed the importance of engaging students in the task and leaving no room for the student to get distracted or engage in inappropriate behavior.

Bittner et al. (2018), used evidence-based teaching methods (i.e., video modeling and picture task cards) to educate students with ASD. Children with ASD who participated in the study were identified as level 1 and level 2 ages 5-9 years. The study concluded that both teaching techniques are equally effective in educating children with ASD and depended on the student's ability to process the images. Authors suggested that the skill to be taught must have a high level of proficiency so that it can be imitated to the maximum providing an opportunity for improvement in motor prowess. Besides, the student must recognize the meaning of the image, thus, pre-teaching should take place. Kellens et al. (2018), compared the effectiveness of statics pictures versus video prompting to teach life skills to children with ASD level 3 according to the DSM-V criteria for ASD. The materials used were skill-based static pictures in task analysis and

video made by the teachers performing the task. Results varied according to the participant and the ability to process information to complete the skill but improved in all instances.

CHAPTER 4

DISCUSSION

Reviewed literature helped identify several teaching strategies that have proven effective addressing behavioral issues, improving psychomotor performance and developing social skills. None of those studies claim interventions to be easy, but all of them showed to be successful when properly applied. The following sections of this manuscript summarize key learnings gathered from evaluation of the identified critical mass.

Structure Settings Improve Behaviors

Antecedent-based interventions is a behavior management strategy for student with ASD. It is an evidence-based practice that allows incorporation of diverse strategies for effective teaching (Pokorski et al., 2019). Having a structured environtment is key to the success of the antecedent-based interventions. This facilitates marking events as they occur. After identifying and describing the behavior to be addressed, the next step is to determine the action to be implemented by the teacher. Examples of actions include token economy, most-to-least prompting and Positive Behavior Intervention Support (Pokorski et al., 2019; Stichter et al, 2009). Evidence shows that implementation of antecedent-based interventions by a structural analysis successfully changes behavior. In order to measure the change, it is key is to establish a baseline of target behaviors (Stichter et al., 2019).

Peer Involvement Causes Positive Effects

Students with ASD demonstrate characteristics such as lack of communication and social skills but peer-mediated interventions provide exposure for students to develop the necessary skills for communication efficiently (Ward and Ayvazo, 2006). Engaging peer-tutoring helps them practice and develop social skills (Thiemann-Bourque et al., 2017; Ward and Ayvazo, 2006). Peer-tutoring benefits, not only the student receiving tutoring or tutee, but the tutor student as well. Engaging them in social interaction, alone or with tools like SGDs, increases the opportunity to communicate with peer of the same age (Thiemann-Bourque et al., 2017; Ward & Ayvazo, 2006). For example, children who participated in the study by Thiemann-Bourque et al. (2017) learned to use the SGD within 2 to 3 hours and communication and social interaction rates increased.

Pre-teaching the tutor has proven to increase effectiveness of peer-tutoring in physical education settings (Ward & Ayvazo, 2006). Though results may vary depending on the students' understanding and social skills, there are benefits for both students. Finally, results show that peer-tutoring leads to improve performance compared to whole-group instruction (Ward & Ayvazo, 2006).

Guide and Encourage Proper Behaviors

Prompting has proven to be one of the most effective teaching techniques, particularly when applied under a variable intensity scheme such as most-to-least prompting. Prompting increases the opportunity to engaging students in the appropriate behaviors. According to Yilmaz et al. (2010), "is an errorless technique that starts with the strongest prompt for the student to respond correctly".

Prompting can take many forms as a teaching strategy. Dieringer et al. (2017) showed that music prompting alone did not improve behavior but blending it with physical prompting increased student response. Utilizing the music prompt in combination with modeling benefits the student and gives teachers another element to address behaviors in class. Since students with ASD are sensitive to over or under stimulation (DSM-V, 2013), combining prompts might prove useful to certain students who need stimulation and guidance to perform in physical education settings.

Varying the intensity of prompts is effective when intervening students with ASD. The most implemented technique to teach students with ASD is most-to-least prompting (Blair et al, 2018; Leaf et al., 2016; Yilmaz et al, 2010). Most-to-least prompting is effective and leads towards independence of movement.

Flexible prompting is another strategy of proven effectiveness. It is less invasive than most-to-least and can be corrective feedback or praise depending on student performance (Leaf et al., 2016). Flexible prompting is better suited to teach students individually. It is also key to wait for the student response to supply the correct prompt. This method of reinforcing behaviors with different stimulus increases proper behaviors and has proven to last after the intervention (Yilmaz et al., 2010).

Verbal prompting was consistently used in all studies; proving to be widely used and effective with students of different disability levels and ages. It is regarded as the least strong prompt to improve the psychomotor domain. When used with variable intensity prompting, it helps student engagement of the cognitive domain, thus, improving information retainment and interpretation (Pennington et al., 2018).

Teach How to Channel Emotions

According to Zantinge and colleagues (2017), emotional behavior can be expressed in different ways such as tantrums, aggressive emotions towards one-self or other, including signs of anxiety and irritability. One necessary skill teachers and parents can provide to student with ASD is self-management. It help individuals to handle stress and channel energy towards an appropriate behavior to improve social skills (Liu et al, 2015; Zantinge et al., 2017).

The support team, particularly from parents and teachers, is important to improve the social skills of student with ASD during the daily interactions with society. Ways of implementing self-management include self-recording, self-monitoring, parent-managed reinforcement, and video modelling of social skills (Liu, et al., 2015). Video modeling allows behavior imitation, but how information is processed will determine its success. Parent involvement in the intervention reduces stress and increases quality time with the child and improves understanding of the situation (Liu et al., 2015). It is important to teach children with ASD how to deal with emotions and arousal needs since early age. Teaching self-regulation strategies help level emotions and improve engagement.

Use Technology to Model Expected Behaviors

Effective implementation of video modelling requires understanding of how student interpret visual stimulus as it refers to delayed imitation of actions and delayed matching accuracy. This requires pre-testing with DTMS to determine how much students interpret and to understand their ability to take reference from a video or picture (MacDonald et al., 2015). Delayed object to picture matching capacity is a prerequisite skill for successful video modelling implementation (Tereshko et al., 2009).

Segmenting the video (i.e., video prompting) is more effective than a continuous video modelling. Shortening the video interaction and maintaining focus on desired behaviors helps the student to engage. MacDonald et al. (2015) suggests benefits comes from shorter time to get distracted and shorter time between observation and execution; conditions teachers should strive for when implementing video or picture prompting.

Self-management and video modelling have been successfully applied to discrimination training with the goal of improving social skills. Results showed improvement in all target areas that lasted after the intervention and generalized to other areas (Pushkarenko et al., 2016). Bittner et al. (2018) use video modeling and picture prompts and both proved them to be effective teaching strategy for students with ASD. The tools provide students a variety of stimulus (i.e., from the static picture to the dynamic image in video modeling) that can be used in schools and other settings.

The used of schedules (a form of visual prompt) as part of structured teaching (TEACCH model) help avoid inappropriate behavior and engaged in proper ones (Yilmaz et al., 2010). Following schedules reduces inappropriate response time (IRT) as it provides a structured environment that eases transitions and decreases uncertainty. Schedules help maintain and generalize behaviors after the intervention period (Yilmaz et al., 2010).

Comparison of visual prompts to video prompts found no significant difference in motor performance. Both improved performances significantly. Observed difference appeared to relate to “whether or not the participant was having a good day and was willing to work”, however, some students expressed preference for video prompting (Blagrave, 2017, p. 21). Visual cues can be used with words or pictures demonstrate

performance. Children with ASD used picture cards to construct simple sentences and develop their cognitive domain; showing an improvement that lasted after intervention (Todd and Reid, 2006).

Conclusion

The purpose of this synthesis was to provide effective teaching strategies for educators at including individuals with ASD in inclusive physical education settings. Literature suggest that there is a need for teachers to be educated and trained on how to effectively include students with ASD in inclusive educational settings. Evidence of the selected and analyzed studies reveal various effective teaching strategies for educating children with ASD within adapted physical education settings. The most effective teaching methods are most-to-least prompting, picture prompting and video modeling. Most-to-least prompting can help teachers at the beginning for teaching the correct way with an errorless teaching strategy going from a strong prompt and decreasing through the improvement of the student to a least strong prompt. Picture prompting can assist teacher when the student knows the information of the picture, also on daily basis the student can identify the task at hand when is break down in a task analysis. Video modeling can further help teacher by demonstrating how the task should be done correctly, also this strategy to be effective keep the level of the task done at the video at a mastery level at least 70% (preferably upper) for benefit of the student.

Teaching strategies must be adapted to the processing capacity of individuals. These strategies apply on and off the school setting, thus, being appropriate for daily use of activities at home. Exposing children with ASD to these tools has proven to be beneficial for individual's motor and social development. The strategies presented at the

synthesis are evidence-based that support the education and inclusion of student with ASD at physical education settings improving on the different aspects that benefits the students (physical, social, and cognitive).

While this synthesis had demonstrated that some teaching strategies (most to least prompting, video prompting and video modeling) can help teachers effectively include students with ASD in inclusive settings, future studies should focus on antecedent-based intervention and how it can be implemented in different settings. This because it is another teaching strategy that works on the behavior of the students and the education, also can be blended with another strategy as well. Also, further research is needed on the application of picture and video modeling to teach different motor tasks. This because by broadening the base of the complexity and difference in motor task can be investigated for discerning the difference and how to implement it at other related setting (family, playground and leisure activity). Finally, peer-tutoring and family involvement should be taken in consideration for the success of any teach the strategy because they are the people that spend most time with students with ASD and know better for references at help with engagement.

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APPENDIX A - CODING TABLE

Category	Detail
Age groups	• 3 to 12[1] • 4 to 6[2] • 5 to 9[3] • 9[4] • 11 to 17[5] • 12 to 14[6] • 9[7] • 7 and 8[8] • 4.5 to 4.7[9] • 7 to 12[10] • 6 to 11[11] • 6 to 7[12] • 8[13] • 12[14] • 4.5[15]
Video modeling	• Both, delayed imitation of actions and delayed matching accuracy correlate with video modeling performance. Thus, the success of video modeling can be easily assessed by testing for DTMS.[1] • Segmented video modeling (video prompting) is more effective than video modelling. Authors suggests benefits comes from shorter time to get distracted and shorter time between observation and execution. Conclude that delayed object to picture matching is a prerequisite for successful video modelling.[2] • Successfully used self-management and video modelling for discrimination training with the goal of improving social skills. Results showed improvement in all target areas that lasted after the intervention and generalized to other areas.[7]
Visual or verbal cues (prompts)	• Picture task card and video prompting were equally effective improving motor performance. [3] • Used schedules as part of structured teaching (TEACCH model). Structured teaching is designed to educate ASD students and avoid inappropriate behavior. Schedules can reduce inappropriate response time (IRT). This effect varies by individual. Schedules also help generalize behaviors as IRT also reduced outside the intervention setting. Effects lasted after intervention period.[5] • Compared visual picture prompts to video prompts and found no significant difference in terms of final motor performance. They concluded both are equally effective, since performance improved significantly. Authors commented that individual differences appeared be related to “whether or not the participant was having a good day and was willing to work”. Students expressed preference for video prompting.[6]

	• Used prompting and visual cues to teach writing. Children with ASD learned to use a software package to construct simple sentences. Improvement lasted after intervention ended.[10]
Music prompting	• Music prompting alone did not improve gross motor task completion (GMTC). Combining prompting and modelling caused a slight improvement. No behavior generalization observed.[11]
Variable intensity prompting (most-to-least, flexible prompt fading)	• Use of Halliwick's swimming program with most-to-least prompting drastically improved students' performance. Trainers reported that students enjoyed the activity and improved their social and communication skills. Changes lasted after intervention. Authors commented on the goodness of Halliwick's method.[4] • Compared mot-to-least prompting to flexible prompt fading and found them to be equally effective in sustained behavior after the intervention. Flexible prompt fading required fewer sessions to teach skill.[12] • Compared physical versus verbal prompting using the most-to-least strategy. Results showed that both strategies were effective. One of the two subjects improved more with vocal prompting.[14]
Self - management	• Successfully used self-management (self-recording, self-monitoring and parent-managed reinforcement) and video modelling for discrimination training with the goal of improving social skills. Results showed improvement in all target areas that lasted after the intervention and generalized to other areas. Findings agreed with earlier literature on self-management.[7] • Self-management can improve behavior.[16]
Structural analysis (antecedent-based interventions)	• Successfully used structural analysis to determine antecedent variables in a school setting and design intervention packages to influence subsequent behaviors. Findings agreed with earlier literature on structural analysis. Authors also noted the importance of benchmarking targeted behaviors across settings based on typical peer data.[8] • Developed antecedent-based interventions to compare sensory-based (headphone) and physical exercise to improve behavior.[15]
Peer-mediated interventions	• Trained children without ASD to use a speech generating device (SGD) and paired them with children with ASD (non-verbal). Target children learned to use the SGD within 2 to 3 hours and communication rates increased.[9] • Used peer tutoring in a physical education setting. While children without ASD had varied results, children with ASD improved skills. Instruction with peers lead to improved performance compared to whole-group instruction.[13]

Notes:
1 MacDonald et al., 2015
2 Tereshko et al., 2009

3 Bittner et al., 2018
4 Yilmaz et al., 2010
5 Pushkarenko et al., 2016
6 Kellems et al., 2017
7 Liu et al., 2015
8 Stichter et al., 2009
9 Thiemann-Bourque et al., 2017
10 Pennington et al., 2018
11 Dieringer et al., 2017
12 Leaf et al., 2016
13 Ward and Ayvazo, 2006
14 Blair et al., 2018
15 Pokorski et al., 2019
16 Zantinge et al., 2017

APPENDIX B - SYNTHESIS ARTICLE GRID

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Bittner, M., Myers, D., Silliman-French, L., & Nichols, D. (2018).	Effectiveness of instructional strategies on the motor performance of children with autism spectrum disorder.	PALAESTRA	The purpose of this study was to evaluate the effects of a 40-minute physical education class provided twice a week for six months on the performance of motor skills in 37 children with autism spectrum disorder (ASD) aged 5 to 12 years.	37 students from 5-12 years were assess by the TGMD-2 with a pre and post test and the intervention for 6 month 2 a week the class.	The data was analyzed by a t-test to determine the changes or if it remains the same or if the student remained at the average.	All the student demonstrated some improvement at all the items of the test.	Use more time at the week for exposure.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Josephine Blagrave (2017)	Experiences of children with autism spectrum disorders in adapted physical education	European Journal of Adapted Physical Activity	The purpose of the study is to find their description on how they view the adapted physical education class	Data was collected by 10 participants with ASD through drawings, the observation of the researchers and an interview. The data was collected in two weeks.	The drawings were analyzed using the methods described by Kalvaitis and Monhardt. The method described if it was negative, positive and neutral. The interviews were transcribed to verbatim for each individual. A second level coding was conducted to explore the theme of the drawings.	6 students demonstrated to like the interview and 7 enjoy that they were interviewed.	Broad the base.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Bryan J. Blair, Julie S. Weiss, & William H. Ahearn (2018)	A comparison of task analysis training procedures.	Education and treatment of children	The purpose of the study is comparing effectiveness most-to-least prompting physical and verbal prompt	Participant started with a pre-test to see if they were eligible by showing verbal communication, the edible preference assessment the data was collected by a multi-element design training session using tinker toys to construct using prompt fading of both prompting.	The data was analyzing by observation and time measuring between each prompt for more than 45 session and measure the mean and central tendency measurement	Both prompt fading approach proves the effectiveness towards the independence of the skills showing mastery of the skills taught in the intervention one participant demonstrated how vocal prompt works better and the other preferred the physical prompt.	For future studies using the vocal prompt for further investigation in motor task.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Shannon Titus Dieringer, Kimberly Zoder-Martell, David L. Porretta, Angela Bricker, & Jaclyn Kabazie, (2017).	Increasing physical activity in children with autism through music, prompting, and modeling	Psychology in the Schools	The purpose of the study is evaluating music, prompting and modeling to increase gross motor task completion in physical activity setting	Instructional session in an unused empty classroom using video cameras, music track, speakers, and beanbags during the sections for the procedures to pass. Baseline first then music instructions followed by prompting and modeling.	The data was analyzed separately to have the measure of each by the central tendency and the use of a coding table and the intervention graph.	The findings of the study suggested that prompting and modeling benefitted the individuals with developing skills repertoires. Also, the music with lyrical instruction can be beneficial when incorporated into the programs even though they could not increase on-task behavior.	Future research should focus on how music with instructional lyrics could engage more students with ASD.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Ryan O. Kellems, Kaitlyn Frandsen, Teresa A. Cardon, Katie Knight & Margaret Andersen (2017)	Effectiveness of static pictures vs. video prompting for teaching functional life skills to students with autism spectrum disorders	Preventing School Failure: Alternative Education for Children and Youth	The purpose of the study is to compare the effectiveness in learning for student with autism spectrum disorder at functional life skills.	The sample is composed by three teenager (ages from12-15) students with ASD. The intervention was done with different task such as throwing a ball overhand, walking backward, performing jumping jacks, washing a mirror, cutting a banana, and brushing teeth.	The Interobserver agreement was analyzed with the following equation: number of agreements/ number of agreements-number of disagreements X .100. And was collected across 70% of all phases.	At the results the both interventions demonstrated to be effective, but the static picture proves to be more effective on one student. The video intervention proves to be efficient right on time.	Broad the samples.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Justin B. Leaf, Jeremy A. Leaf, Aditt Alcalay, Alyne Kassardjian, Kathleen Tsuji, Stephanie Dale, Daniel Ravid, Mitchell Taubman, John McEachin, & Ronald Leaf, (2016)	Comparison of most-to-least prompting to flexible prompt fading for children with autism spectrum disorder.	Exceptionality	The purpose of the study is to compare the effectiveness of two kind of prompts most-to-least and flexible prompt fading with children with ASD.	Using a parallel treatment design nested into a multiple probe design, researchers taught each participant how to expressively label six pictures with most-to-least prompting and six pictures with flexible prompt fading. The researchers evaluated effectiveness, maintenance, efficiency, and performance across both prompting conditions and across all participants.	The data was analyzed by using probes of the different session and comparison between the session for getting the mean and range from each prompt.	Findings shows that the students learned all the skills taught and most-to-least prompting and flexible prompting showed to be an effective teaching technique and result in skills acquisition for individuals with ASD.	Future reference use the flexible prompt with condition of corrective feedback.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Yadan Liu, Dennis W. Moore, & Angelika Anderson, (2015)	Improving social skills in a child with autism spectrum disorder through self-management training	Behavior Change	The purpose of the study is to effects a partially parent-implemented self-management intervention incorporating video-modelling to distinguished the training improve social skills in children with ASD	A multiple baseline across behavior design no interruption, asking for opinions, and appropriately greeting unfamiliar adults was used to assess the effects of the intervention.	The data was analyzed with statistics central tendencies measurement with graphics observation was critical.	The intervention proves to be effective of antecedent-based intervention.	Use goal setting, self-evaluation self-reinforcement while understanding of the appliance of self-management process with children with ASD.
Rebecca P. F. MacDonald, Chata A. Dickson, Meaghan Martineau, and William H. Aheam (2015)	Prerequisite Skills That Support Learning through Video Modeling	EDUCATION AND TREATMENT OF CHILDREN	The purpose of this study was to evaluate the relationship between tasks that require delayed discriminations such as delayed imitation and delayed matching to sample on acquisition of skills using video modeling	Twenty-nine participants with an ASD diagnosis were assessed on different task inside of a small therapy room at the school and each participant were assign three videos for assessment.	The researcher conducted various regression to evaluate the variables	The study shows an increase in 69 % of each task.	Broad the base.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Robert Pennington, Allison Flick, & Kendra Smith Wehr, (2018).	The use of response prompting and frames for teaching sentence writing to students with moderate intellectual disability.	Focus on Autism and Other Developmental Disabilities	The purpose of the study of effects of response prompting strategies and the frames on sentence writing for three participants.	The interventionist used a concurrent multiple probe across behaviors design to evaluate the efficacy of the intervention package and posttest probes to assess generalized responding to untrained stimulation. During intervention, the teacher taught two students to construct sentences using selection-based software and another to generate handwritten responses across three different writing frames.	The data was analyzed after coding the intervention to understanding the discrepancy between the responses.	The study finds that is suggested that the participant had a stronger requesting than labeling repertoire after the study.	Is recommended to evaluate the effects of preintervention vocal repertoire and motivational variables on the effectiveness of the instructional packages.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Elizabeth A. Pokorski, Erin E. Barton, Jennifer R. Ledford, Abby L. Taylor, Elisabeth Johnson, & Heather K. Winters, (2019).	Comparison of antecedent activities for increasing engagement in a preschool child with ASD during a small group activity	Education and Training in Autism and Developmental Disabilities	The purpose of the study is to compare effectiveness between two setting one with headphone and no headphone, and three structured antecedent activities.	The two comparison of headphones and antecedent intervention conducted different times at the day during six-weeks, two sessions a day. The comparison was made with a small group to measure the difference with the control group.	The data was analyzed with time measurement and coding the time every 10s until finishing the whole time. It was used the interobservers agreements by randomly selecting session of the behaviors and conditions using point-by-point method.	At the first comparison the engagement of behavioral stereotypy was higher. But when the group was smaller and headphones in use the stereotypy rose in compare to the motor task the stereotypy dropped. During the second engaging in any type of antecedent of physical activity might increase engagement and decrease the stereotypy.	The study of sensory-based needs further investigation.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Kyle Pushkarenko, Gregory Reid and Veronica Smith (2016)	Effects of Enhanced Structure in an Aquatics Environment for Three Boys with Autism Spectrum Disorders: A Pilot Study	Journal on Developmental Disabilities	The purpose of the pilot study was to examine the effects of pictographic activity schedule implementation within a structured aquatic environment for individuals diagnosed with autism spectrum disorder (ASD).	The sample is three students with developmental disabilities primarily with ASD from ages 11-17 years. The student was taken to participate form aquatic weekly at a pool center included with another 12 different students. the observation took 13 weeks of time span and the students were following a schedule in pictures. The activity last from 30-40 minutes.	Part of the data were coded using a modified version of Siedentop and colleague's ALT-PE systematic observation instrument where behaviours were scored in 6-second intervals. Other with ALT-PE instrument at the .90 and .92 level. The agreement ranged from 80-97% and have a mean of 90%.	The three of the students demonstrated a drop of inappropriate behavior with the teachers' intervention.	Use of variability of weeks.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Janine P. Stichter, Jena K. Randolph, Denise Kay, & Nicholas Gage, (2009).	The use of structural analysis to develop antecedent-based interventions for students with autism	Journal of Autism & Developmental Disorders	The purpose of the study extends the literature for antecedent-based intervention with students with ASD and how it affects their communication and social skills.	Students with ASD passed through an inclusion criterion for the study, then passed through the intervention with baselin, intervention and follow-up with maintenance. A social skill interview form was completed by persons in charge of the students.	The data was analyzed by observation and the use of structural analysis that promotes prosocial adaptive behavior. the use of mean agreement and Kappa coefficient was also used.	The structural analysis has proved to be a consistent technique with antecedent analysis for the targeted behaviors.	Future replication at other motor skills and enhance the definition of participants definitions.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Lisa Tereshko, Rebecca MacDonald, William H. Ahearn (2010)	Strategies for teaching children with autism to imitate response chains using video modeling	Research in Autism Spectrum Disorders	The purpose of the study is to compare how student with ASD respond using the video modeling.	The sample is 4 students with ASD that are part of early intensive behavioral intervention (EIBI) that offered 5 days per week, 6h per day of individualized programming using the principles of applied behavior analysis. The participants are study in base of their background. Using various test to determine the present level of performance.	Agreements were use as part of the observations most than half agree on the pre-assess and students ranged from 90-100% of the agreement.	Students display 80-100 % of benefit at imitating the video.	Use different videos.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
Kathy S. Thiemann-Bourque, Sarah McGuff, & Howard Goldstein, (2017)	Training peer partners to use a speech-generating device with classmates with autism spectrum disorder: exploring communication outcomes across preschool contexts.	Journal of Speech, Language, and Hearing Research	The purpose of the study is to compare how students with ASD be included better by using Speech-generator device or with peer tutoring	Effects were examined using a multiple probe design across 3 children with ASD and limited to no verbal skills. Three peers without disabilities were taught to Stay, Play, and Talk using a GoTalk 4+ and paired with classmate with ASD in classroom social activities.	Measures included rates of communication acts, communication mode and function, reciprocity, and engagement with peers. Observation was part of the study and see what was the upward trend for students with ASD.	Future reference for researching for facilitating greater communication and social engagement with peer.	
Phillip Ward, & Shiri Ayvazo, (2006).	Classwide peer tutoring in physical education: assessing the effects with kindergartners with autism.	Adapted Physical Activity Quarterly	The purpose of the study is for develop evidence-based for including students with ASD at kindergartners via peer-tutoring.	A single subject withdrawal design assessed the effect of peer-tutoring on total catches and correct catches in the class.	The data was analyzed by using motor task criteria and coding table after observing.	It shows that it was not successful because of how students performed the total catches but did shows improvement in the criteria of the skills.	More studies to include students with ASD using peer-tutoring.

Authors	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Recommendations
İlkerYilmaz, Ferman Konukman, Binyamin Birkan, & Mehmet Yanardağ, (2010).	Effects of most to least prompting on teaching simple progression swimming skill for children with autism.	Education and Training in Autism and Developmental Disabilities	The purpose of the study is to see the effects of most-to-least prompt for progression swimming for children with ASD	The study was design of 10-week session with a baseline to provide strong prompt at start to follow to a prompt fade to verbal prompt to maintains the effects after the	It was analyzed to determine the effectiveness of the prompts by recording and coding each time of the session	The study finds that most to least proves to be an effective teaching technique for students with ASD at teaching swimming.	Search for effective teaching at different motor task.
Gemma Zantinge, Sophie van Rijn, Lex Stockmann, & Hanna Swaab, (2017).	Physiological arousal and emotion regulation strategies in young children with autism spectrum disorders	Journal of Autism Developmental Disorder	The purpose of the study is compared the arousal and emotion between students with ASD and typically developmental students	This study included 27 children with ASD (25 boys) and 44 typically developing children (35 boys), Heart rate was continuously measured, and emotion strategies were coded, during a locked-box task.	The data were coded from the locked-box and analyzed the baseline, intervention and the follow-up of the task. Using t-test with the variables for understanding the correlation between them.	After the intervention went down it show that after putting headphones decrease the arousal from the from students with ASD, with the other part of motor task decreasing the inappropriate behavior and increase the focus.	Look another age range for seen the difference.