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Undergraduate

Establishing a Standardized Measurement Tool for children with ASD for use in PECS research

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### **Abstract**

Children diagnosed with Autism Spectrum Disorders (ASD) face a variety of challenges such as the inability to communicate verbally. The Picture Exchange Communication System is an early intervention program that has shown to increase the verbal communication skills of some children with ASD. However, how PECS increases verbal communication in some children with ASD is unknown. To understand how PECS leads to verbal communication in some children with ASD, researchers must use a consistent set of reliable measures with specific groups of children with ASD. This literature review analyzed the three most frequently used standardized measurement tools used to assess children with ASD in PECS research; Vineland Adaptive Behavior Scales (VABS), Autism Diagnostic Observation Schedule (ADOS), and the Childhood Autism Rating Scale (CARS). VABS is a measure which can determine intellectual disability. VABS should be used with children that begin PECS without any verbal skills. ADOS is a measure used to support an ASD diagnosis. ADOS should be used with all children that are placed in the PECS program, with low functioning to high functioning ASD. CARS can retrospectively measure the abilities of a child with ASD. CARS should be used with children with ASD that begin using PECS at a later age.

*Key words:* Autism Spectrum Disorder, Vineland Adaptive Behavior Scales, Autism Diagnostic Observation Schedule, Childhood Autism Rating Scale, Standardized Measurement Tool, Picture Exchange Communication System, Verbal Communication.

## Introduction

Children diagnosed with Autism Spectrum Disorder (ASD) face a variety of challenges such as deficits in verbal communication, social interaction, and repetitive patterns of behavior and interests (American Psychiatric Association, 2013). One of the earliest deficits in children with ASD, noticed especially by parents and caregivers, is the inability to communicate verbally. This lack of verbal communication by children with ASD often leads to frustration, self-injurious behavior, and aggression towards others; a series of challenges that can negatively affect the child's overall quality of life (Ben, and Zachor, 2011). However, ASD diagnoses can be given as early as 12 to 18 months of age with early intervention leading to better life outcomes (Daniels, and Mandell, 2014; Barbaro, and Dissanayake, 2012).

To facilitate communication for children with ASD, Bondy and Frost (1994) developed the Picture Exchange Communication System (PECS), an Augmentative and Alternative Communication program (AAC) used in early intervention. PECS is a picture based communication system divided into 6 phases (see appendix A). In their study, Bondy and Frost (1994) found that out of the 66 children that used the PECS program for one year, 59% acquired verbal speech as their main form of communication (p. 13). In addition, a meta-analysis looking into the effectiveness of PECS found the program to be useful in reducing the disruptive behaviors of children with ASD (Sulzer-Azaroff, Hoffman, Horton, Bondy, & Frost, 2009). Since this discovery by Bondy and Frost (1994), PECS has been one of the most widely used communication systems to aid the development of communication skills in children on the autism spectrum.

However, despite the wide implementation of PECS and the significantly favorable results yielded by research on PECS, the relationship between the PECS program and increased

verbal communication has not been established (Jurgens, Anderson, & Moore, 2009; Pasco, & Tohill, 2011; Greenberg, Tomaino, & Charlop, 2014). To determine how PECS leads to verbal communication in some children with ASD, researchers must measure the characteristics of the children using a reliable standardized measurement tool. (Flippin, Reszka, & Watson, 2010). For instance, assessing a child's verbal skills prior to and after implementing PECS determines what verbal characteristics in children with ASD lead to more successful outcomes with PECS (Ganz, Lashley, & Rispoli, 2010; Flippin et al. 2010). In addition, using the most reliable measure or set of measures consistently in PECS research, makes comparing the results of large groups of studies more clear. Thus, making the relationship between PECS and verbal communication easier to determine.

Given that the skills and abilities of children with ASD fall on a continuum of the disorder from low functioning to high functioning (Venker, Ray-Subramaniam, Bolt, & Weismer, 2013), research on PECS should also be administered using a large pool of participants that would fall within the same category of the ASD diagnosis (e.g., severe, moderate, high functioning). Examining children that fall within specific ASD categories, in PECS research, would make it easier to determine how PECS increases (or does not increase) verbal communication in some children with ASD.

There are currently a wide variety of measures used in PECS research. Some examples are; the Autism Diagnostic Interview-Revised (Lord, Risi, Dilavore, Shulman, Thurm, & Pickles, 2006), the Autism Diagnostic Observation Schedule (Ganz et al. 2010; Lerna, Esposito, Conson, Russo, & Massagli, 2012), the Psycho-Educational Profile-Revised (Osborne and Reed, 2008), and the Gilliam Autism Rating Scale (Osborne and Reed, 2008). However, using an inconsistent set of measures in PECS research yields a variation of results, making large groups of studies

difficult to compare to one another. However, the measures most frequently used in PECS research are editions of the Vineland Adaptive Behavior Scales (VABS) (Perry and Factor, 1989), the Autism Diagnostic Observation Schedule (ADOS) (Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Rutter, 2000), and the Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980).

This literature review explored the strengths and downfalls of the VABS, ADOS, and CARS measures and proposes that the Vineland Adaptive Behavior Scales (VABS) should be used to assess children that begin the PECS program with no verbal skills, who may have a comorbid diagnosis of intellectual disability; the Autism Diagnostic Observation Schedule (ADOS), paired with the Autism Diagnostic Interview-Revised (ADI-R), should be widely implemented with all ASD populations in PECS research; and the Childhood Autism Rating Scale (CARS) should be implemented with children that begin the PECS program at a later age, with or without verbal communication skills at baseline. In addition, before this literature review, research comparing the three measures had not been completed.

### **Methods**

Peer-reviewed empirical studies from the last 20 years, in which the VABS, ADOS, and CARS measures were used to assess children with Autism Spectrum Disorder (ASD) were analyzed. An Exception were three articles; one which dated back to 1980 which describes the Childhood Autism Rating Scale (CARS), an article from 1989 which describes the Vineland Adaptive Behavior Scales (VABS), and Bondy and Frost's 1994 article which established PECS as augmentative and alternative form of communication for children on the autism spectrum. In addition, articles in which the VABS, ADOS, and CARS measures were used to assess children with ASD, which did not include research on PECS, were also examined to understand the

functions and uses of the measures. Some examples are research that aimed to determine the long term outcomes of an ASD diagnosis, early intervention outcomes, language outcomes, and social communication outcomes. Articles that described the measures and their validity were also examined. Emphasis was placed on research from the last ten years to encompass the most recent findings. The articles were obtained from Psych Info, Psych Articles, SAGE Journals, and PubMed. Key terms used in search of articles were: ‘Vineland Adaptive Behavior Scales’, ‘Autism Diagnostic Observation Schedule’, ‘Childhood Autism Rating Scale’, ‘Picture Exchange Communication System’, and ‘verbal communication’.

### **Vineland Adaptive Behavior Scales**

The Vineland Adaptive Behavior Scales (VABS) is a reliable measure of day-to-day personal and social skills (adaptive behavior) required for self-sufficiency. VABS can be used to assess individuals from birth to adults. The assessment is made through a semi-structured interview with the parent or caregiver of the child by a psychologist or trained professional. It includes 5 domains and various subdomains (Perry and Factor, 1989). The first three domains are always assessed and include; communication, daily living, and socialization skills. The fourth domain assesses motor skills in children younger than 6 years of age. The fifth domain is optional, where severity of maladaptive behavior is recorded in children 5 years of age and older (Perry and Factor, 1989; Paul, Miles, Cicchetti, Sparrow, Klin, Volkmar, Coflin, & Booker, 2004). In addition, the Vineland Adaptive Behavior Scales is a good measure of intellectual disability (Perry, Flanagan, Geier, & Freeman, 2009).

Considering that children with ASD have a wide variance of skills and abilities, researchers should focus on grouping the participants of studies on PECS, based on the developmental level and skill set of the children. For example, researchers can focus on assessing

a group of children with low functioning ASD. There is a high comorbidity rate of Autism Spectrum Disorders with intellectual disability (Matson and Shoemaker, 2009). Research has also found that intellectual disability is a significant factor in the outcomes of verbal communication (Kjellmer, Hedvall, Fernell, Gilberg, & Norrelgen, 2012). Since intellectual disability is often comorbid with ASD, and having no verbal skills can be a sign of intellectual disability, the Vineland Adaptive Behavior Scales should be used to assess children that begin the PECS program with no verbal skills who may have a comorbid diagnosis of intellectual disability. Using this strategy could help researchers understand how PECS affects children with lower levels of intellectual ability. In addition, the Vineland Adaptive Behavior Scales offers a detailed source of clinical information on the child being assessed which can be used to determine special needs and educational placement (Perry et al. 1989; Yang, Paynter, & Gilmore, 2016).

In a case-study assessing 4 children, Greenberg, Tomaino, and Charlop (2014), used VABS to measure the verbal abilities of children before beginning research on PECS. Two of the children, ages 4-5 years old, were completely nonverbal before beginning PECS (p. 37). The other two children, ages 7-8 years old, could imitate some words using vocalizations (e.g., word approximations such as “buh” for ball) (p. 37). The study found that children who were able to imitate words prior to starting the PECS program had higher outcomes in vocalizations after completing the PECS treatment (p. 42). However, the increase in vocalizations were sounds non related to the items the children were requesting (such as “duh” for book) (p.48). Although the researchers used children of different ages, the sample was too small to generalize results to a larger population. In addition, the authors did not mention the intellectual level of the children,



which warrants further research on the relationship between the PECS program and increased verbal communication.

Moreover, considering that intellectual disability may affect the verbal outcomes of children with ASD, further research on the PECS program should be done using an exclusive pool of children with ASD and a comorbid diagnosis of intellectual disability. Implementing research on PECS, using children with a comorbid diagnosis of ASD and intellectual disability would be useful in determining how PECS affects the verbal outcomes of children with a comorbid ASD and intellectual disability diagnosis. Furthermore, allowing clinicians to determine what early intervention programs would be most useful for children with ASD depending on their intellectual level.

### **Autism Diagnostic Observation Schedule**

The Autism Diagnostic Observation Schedule is a reliable standardized measurement tool that can be used to support a diagnoses of Autism Spectrum Disorder. Assessments using the Autism Diagnostic Observation Schedule (ADOS) are made via a semi-structured observation conducted by a trained professional. ADOS consists of three domains measuring communication, social interaction, and play skills (or imaginative use of materials), with a higher score indicating higher severity of ASD (Gray, Tonge, Sweeney, 2008; Lord, 2010). ADOS can be administered in children from 2 years of age to adulthood. In addition, ADOS includes four modules which can be used on individuals based on their characteristics such as developmental and language levels, from nonverbal to verbal skills (Lord, 2010).

The Autism Diagnostic Observation Schedule (ADOS) is an effective measure to use in PECS research since the observational setting allows the trained professional to gather the

child's characteristics in a natural environment. However, one disadvantage is that ADOS does not take into account parent or caregiver feedback. In this case, researchers have suggested pairing ADOS with the Autism Diagnostic Interview-Revised (Lord, 2010) a measure that is administered specifically for parent and caregiver feedback to gain a more thorough picture of the child with ASD (Lord et al. 2006; Lord, 2010). Gathering as much information on a child's characteristics for research on PECS is important because it allows researchers to understand how PECS is effective with some populations versus others, based on the level of the children's skills. Thus, pairing ADOS a measure completed by a professional, with ADI-R a measure completed with parent feedback; yields complete information on the skills and characteristics of the children with ASD being assessed in PECS research.

Moreover, the Autism Diagnostic Observation Schedule (ADOS) should be used with all children with ASD, in PECS research. ADOS offers researchers a clear picture of the child's abilities from low functioning autism to high functioning autism (Gray et al. 2008). In their study, which aimed to establish the validity of ADOS, Gray, Tonge, & Sweeney (2008) measured the abilities and characteristics of children clinically diagnosed with Pervasive Developmental Disorder Not Otherwise Specified (PDD NOS) (a milder form of autism, now classified under ASD), Autism (a more severe form of autism, now classified under ASD), and Non-Autism children. Where the highest scores were indicative of a more severe ASD diagnosis, the authors found that children with Autism consistently had the highest scores, followed by children with PDD-NOS and the lowest scores found in non-autism children, establishing clinical agreement that ADOS is a reliable and valid measurement tool (p. 664).

In addition, a study using ADOS to analyze the trajectories of individuals with autism, Gotham, Pickles, and Lord (2012) found that the diagnosis of ASD in individuals remained

consistent; again, establishing ADOS as a reliable measure (p. 1283). Thus, given that ADOS is used to assist a diagnosis of autism and is a good measure to establish the baseline characteristics of children with ASD; ADOS should be used in PECS research with all children with ASD to determine how PECS affects the verbal abilities of children with ASD, prior to and after the PECS program is implemented.

### **Childhood Autism Rating Scales**

The Childhood Autism Rating Scale (CARS) is a reliable standardized measurement tool that measures the severity of the autism symptomology by assessing children on a variety of skills (Geier, Kern, & Geier, 2013). Evaluations made with CARS are assessed in an observational setting by a trained professional (Schopler, Reichler, DeVellis, & Daly, 1980). CARS assesses individuals with ASD using 15 scales that measure various skills such as; imitation, adaption to change, verbal communication, nonverbal communication, intellectual consistency, and global impression, which is an overall commentary on the child's ability. In addition, CARS allows psychologists and trained professionals to measure the skills of children with ASD, retrospectively (Schopler et al. 1980).

Since the Childhood Autism Rating Scale (CARS) assesses the severity of autism symptomology and the child's skills retrospectively, it should be used in PECS research with children with ASD who begin the PECS program at a later age with or without any verbal skills. Children that start early intervention programs such as PECS, at a later age (6-8 years old) may have some verbal skills while others may not; none the less, having minimal verbal skills before starting the PECS program plays an important role in increased verbal communication (Greenberg et al. 2014; Gordon, Pasco, McElduff, Wade, Howlin, & Charman, 2011).

In addition, children that begin PECS at a later age may acquire verbal speech at a different rate than children who begin PECS at a younger age (Greenberg et al. 2014). CARS is an effective measure to use with children that begin the PECS program at a later age because it measures specific skills that have been implicated to lead to greater verbal outcomes of children with ASD who used PECS as an early intervention program. For example, CARS measures the degree to which a child with ASD is able to imitate others' use of phrases (Schopler et al. 1980). The ability to imitate others' use of phrases has been correlated with a greater verbal communication outcome (Greenberg et al. 2014).

Furthermore, in a study conducted by Yokoyama, Naoi, and Yamamoto (2006) the researchers found that PECS was effective in increasing the use of vocalizations, such as word approximations, in children including those with severely minimal vocal repertoires (p. 502). The researchers used CARS to assess the children's verbal abilities prior to and after implementing PECS; demonstrating the usefulness of a standardized measurement tool to assess verbal skills of children in order to understand how PECS aids in verbal communication. Thus, conducting research on PECS with a pool of children who begin PECS at a later age, can yield results to answer how PECS affects children that begin the PECS program at a later age with a variation of skills such as verbal imitation.

### **Discussion**

Since individuals diagnosed with ASD have a wide variation of skills and abilities from severe disability to high functioning characteristics, research on PECS should be done with specific target groups of children based on the severity of their ASD diagnosis. In addition, research on PECS that assesses children using the same set of measures, consistently, would

yield comparable results that could be used to determine how PECS leads to verbal communication in some children with ASD.

The Vineland Adaptive Behavior Scales is a good measure of intellectual disability. Since there is a significant comorbidity rate of ASD with intellectual disability and intellectual disability is a significant factor in the outcomes of verbal communication, the Vineland Adaptive Behavior Scales should be used to assess children that begin the PECS program with no verbal skills, who may have a comorbid diagnosis of intellectual disability.

The Autism Diagnostic Observation Schedule is a good measure of overall characteristics of a child with ASD. ADOS is used to assess children with ASD to support an ASD diagnosis. When paired with the Autism Diagnostic Interview-Revised (a parent interview) ADOS would be a good measure to use with all children that begin the PECS program, at any age, regardless of their ASD diagnosis since specific modules are used for children with ASD, who have specific developmental and language levels.

The Childhood Autism Rating Scale is a good measure of autism symptomology. It allows the trained professional assessing the child with ASD to create an overall image of the child's abilities. CARS would be a good measure to use with children that begin the PECS program at a later age because it can measure the child's characteristics, retrospectively. In addition, children who begin the PECS program at a later age may have a variation of verbal skills at baseline. CARS is a good measure to use with children on the PECS program to determine what verbal characteristics lead to better outcomes with the PECS program.

This literature review focused on the Vineland Adaptive Behavior Scales (VABS), the Autism Diagnostic Observation Schedule (ADOS), and the Childhood Autism Rating Scale

(CARS) measures; and their use in research on the PECS program, autism, and verbal outcomes.

Further research should be done on the wide variety of deficits of children with ASD, such as repetitive behavior, stereotypical behavior, aggression, and disruptive behaviors and the relationship between those deficits and their effect on verbal communication.

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Appendix A:

### **Picture Exchange Communication System**

PECS is a picture based communication system through which a non-verbal or minimally verbal child with ASD learns to communicate their needs by exchanging a picture of a desired item with a communicative partner (teacher, parent, caregiver, etc) to obtain the item. It is divided into 6 phases. The first phase introduces the child to PECS and relies heavily on adult physical prompting. The second phase introduces distance, where the child is expected to walk to the adult and exchange a picture for a desired item. The third phase teaches the child to discriminate between two or more pictures (Bondy and Frost, 1994, pp. 3-6). By the fourth phase, the child learns to form simple sentences such as “I want cookie”. In phases 1 through 4 the communicative partners do not use verbal cues to prompt the child. In phase five, the communicative partners begin using verbal cues such as “what do you want?” to teach the child to respond to a verbal prompt. The sixth and final phase teaches the child to comment on verbal cues and engage in conversational communication (Bondy and Frost, 1994, pp. 7-10).