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**The Effectiveness of the Picture Exchange Communication System (PECS) on Reducing
Problem Behaviors in Students with Autism Spectrum Disorder**

By

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A Starred Paper

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Chapter I: Introduction

Autism spectrum disorder (ASD) is a neurological disorder that manifests itself within an individual through cognitive, social, and academic deficits (Anderson, 2010). It is a disorder that has grown immensely in diagnosis over the past ten to fifteen years and it includes all ages, and levels of ability and severity (Vismara & Rogers, 2010.). Today, the Centers for Disease Control (CDC) reports the incidence of autism to be one in 54 children (Hill & Flores, 2014). According to the CDC, ASD is an urgent public health concern, impacting all races and social groups equally, although four times as many boys as girls are diagnosed (Hill & Flores, 2014).

Applied behavior analysis uses behavioral interventions to influence and change environmentally influenced behavior through these various interventions. Children with ASD, who may not demonstrate functional communication, may instead engage in maladaptive behavior (e.g., tantrums, self-injury or aggression) as a method of communication (Battaglia & McDonald, 2015). The Picture Exchange Communication System (PECS) is a communication intervention used for nonverbal individuals with autism spectrum disorder, which is part of the skills-based applied behavior analysis model (Hu & Lee, 2019). The interventions that involve applied behavior analysis have been shown to be effective towards improving social skills, communication, and management of problem behavior for individuals with autism spectrum disorder (Hu & Lee, 2019). Individuals are reinforced for using the pictures or symbols to request desired items. Prompts are initially used but are eventually faded out once they are no longer necessary.

The purpose of this paper is to review the literature that examines the effectiveness of the Picture Exchange Communication System (PECS) on reducing problem behaviors in students

with autism spectrum disorder. I chose this topic because I have been working with individuals with ASD for approximately eight years and I have an interest in how certain interventions positively affect their behavior. Currently as a teacher of ASD students, I use multiple applied behavior analysis (ABA) interventions. Of these interventions, the Picture Exchange Communication System (PECS) is the specific intervention that I would like to investigate more and find what current research says about how this intervention can reduce problem behaviors. I have one specific student that has been at our level IV setting for almost ten years now and has made amazing progress since I became her case manager about two years ago. There are probably multiple factors involved in the progress, but one specific intervention that we emphasize is the use of her Picture Exchange Communication System (PECS). This has given her the choices she needs, while providing a voice that she has never had.

Research Question

One research question guides this review of literature:

1. Does the Picture Exchange Communication System (PECS) reduce the problem behaviors of students with ASD?

Focus of the Paper

The main focus of this paper is how the Picture Exchange Communication System (PECS) can help reduce problem behaviors in students with autism spectrum disorder. There are multiple ABA interventions that have a positive impact on behaviors, but the use of the Picture Exchange Communication System (PECS) is specifically the focus of this paper. The review of literature in Chapter II contains studies that research applied behavior analysis interventions, the Picture Exchange Communication System (PECS), and autism spectrum disorder. The research

included articles from EBSCO, ERIC, and Psycinfo. Various keywords and combinations of keywords were used to locate suitable and appropriate studies: *autism spectrum disorder, autism, ASD, PECS, Picture Exchange Communication System, behavior, ABA, and applied behavior analysis*. The dates of the articles researched ranged from 2002 to 2019.

Importance of the Topic

As a special educator of students with ASD, I have experienced and witnessed various types of problematic behavior. These include: hitting, biting, pulling hair, elopement, disrobing, breaking items, throwing or eating feces, wiping feces on the wall, scratching, kicking, and spitting. The students that display these more severe behaviors in my school are the nonverbal or minimal speaking students with ASD. They all also use some form of an Augmentative and Alternative Communication (ACC) device, mainly PECS or computer devices. There are situations where the students are unable to verbally communicate their needs, so having this option available can help to reduce the frustration involved with trying to verbalize what they want or need. Being able to visually see data showing whether PECS helps to reduce problem behaviors would be an important factor when it pertains to teaching and communication.

Historical Background

In 1990, while amending the Education for All Handicapped Children Act, Congress expanded the number of disability categories eligible to receive special education services in public schools by including autism (Ryan et al., 2011). PECS was first developed by Lori Frost, MS, CCC/SLP and Dr. Andrew Bondy in 1984 to teach children with autism a fast, self-initiating, functional communication system (Hill & Flores, 2014). The main goal of PECS is to enable children and adults with communication difficulties to spontaneously initiate

communication exchanges through the use of small picture cards (Anderson, 2010). It is estimated that up to 50% of individuals with ASD are not functional communicators (Battaglia & McDonald, 2015). In order for this intervention to be effective, the subsequent six planned phases need to be followed:

Phase 1- Teaching how to initiate communication by teaching a child to physically exchange a picture for a preferred item.

Phase 2- Increasing distance from the communicative partner and the addition of pictures to generalize the exchange by using multiple partners in various settings.

Phase 3- Picture discrimination between preferred and non-preferred items.

Phase 4- Sentence structures include the “I want” symbol to make requests.

Phase 5- Responding to “What do you want?”

Phase 6- Finishes with responding to questions by commenting about items and activities.

Table 1

PECS Phases

+ or -	Phase 1
	Items organized correctly before activity starts
	Procedures for transition to activity are followed
	Training environment arranged effectively- pictures are appropriate size and thickness for student fine motor available one at a time (laminated or sturdy), trainers positioned correctly, reinforcers controlled

Table 1 (continued)

	Entices appropriately
	Uses open hand effectively
	Reinforces within ½ second and combines with verbal praise
	No insistence on speech
	Appropriate inter-trial interval while student consumes (plays with) reinforcer
	Waits for student to initiate
	Physically guides to pick up, reach, and release
	Fades prompts effectively
	Redirects student's interfering behaviors
	Does not interact with the student

+ or -	Phase 2
	Training environment organized effectively- pictures are appropriate size and thickness for student fine motor available one at a time (laminated or sturdy), trainers positioned correctly, reinforcers controlled
	Entices correctly
	Partner moves book so that student has to look for it to remove pictures and move around room to reach communicative partner
	Partner varies use of body position and does not entice using eye contact until student brings picture
	Reinforces within ½ second and combines with verbal praise
	No insistence on speech

Table 1 (continued)

	Waits for initiation
	Prompts removal of picture from book if needed
	Redirects interfering behaviors
	Physically guides student to communication book if needed
	Fades prompts effectively
	Does not interact socially with student

+ or -	Phase 3
	Training environment organized effectively- pictures are appropriate size and thickness for student fine motor available one at a time (laminated or sturdy), trainers positioned correctly, reinforcers controlled
	Entices appropriately
	More than one picture is used
	Pictures are moved in book
	Preferred/non-preferred items used
	Reinforces socially as soon as student touches correct picture
	Reinforces within ½ second with item during exchange
	Changes continue to be integrated (variety of pictures)
	Gives non-desired item when selected (prompt, model, switch, repeat) until discrimination is attained
	No insistence on speech

Table 1 (continued)

+ or -	Phase 4
	Starts with “I Want” on sentence strip
	Waits for initiation
	Physically guides to put reinforce picture on strip and exchange
	Fades physical guidance to put picture on strip and exchange
	Verbal praise (turns strip around and “reads” sentence)
	Teaches assembly of sentence strip including “I Want”
	Reinforces within ½ second with item during exchange
	Physically prompts student to point while ”reading” strip
	Uses delay when “reading” strip to promote independence (3-5 sec) and avoids verbal prompting
	Uses differential reinforcement if speech occurs
	Conducts error correction procedures as needed

+ or -	Phase 5
	Training environment organized effectively- pictures are appropriate size and thickness for student fine motor available one at a time (laminated or sturdy), trainers positioned correctly, reinforcers controlled
	Procedures for transition to activity were followed
	Pictures available to answer “What do you want?”
	“I want” plus item requested is taught using delayed prompting
	Followed appropriate procedures with sentence strip
	Correct exchange is reinforced within ½ second

Table 1 (continued)

	Multiple opportunities for spontaneous requesting and answering “What do you want?” are utilized in the same session
	Conducts error correction procedures as needed
	Fades prompts correctly

+ or -	Phase 6
	Finishes with responding to questions by commenting appropriately

Note. Adapted from “Comparing the Picture Exchange Communication System and the iPad for Communication of Students with Autism Spectrum Disorder and Developmental Delay” (Hill & Flores, 2014).

Definition of Terms

Applied Behavior Analysis. Applied Behavior Analysis is based on behaviorism and is commonly accepted as a complete and effective approach dealing with autism. Its aim is to improve the individual’s life through the analysis, understanding and prediction of behavior, while the main educational goals are to achieve spontaneous and functional communication, improved social interactions, improved playing skills with peers and cognitive skills (Andreadi et al., 2018).

Autism Spectrum Disorder. Autism Spectrum Disorders (ASD) is a complex developmental condition involving persistent challenges with social communication, restricted interests, and repetitive behavior. While autism is considered a lifelong disorder, the degree of impairment in functioning because of these challenges varies between individuals with autism (Vahabzadeh, n.d).

Augmentative and Alternative Communication (AAC). AAC is described by the International Society of Augmentative and Alternative Communication (ISAAC) as any additional method that helps an individual to communicate (Anderson, 2010).

Picture Exchange Communication System. The Picture Exchange Communication System (PECS) was developed by Bondy and Frost to teach children with autism a low-tech, picture-based augmentative and alternative communication (AAC) strategy. PECS utilizes preference for visual processing as well as the principles of Applied Behavioral Analysis (ABA) to teach functional communication skills to individuals without that ability (Hill & Flores, 2014).

Chapter II: Review of Literature

The purpose of this literature review is to assess the literature that examines the effectiveness of the Picture Exchange Communication System (PECS) on reducing problem behaviors in students with autism spectrum disorder. This chapter is organized into two sections: PECS and communication and PECS and behavior. Studies within each section are presented in chronological order, beginning with the oldest study.

Studies of PECS and Communication

The five studies included in this section specifically address how the use of the Picture Exchange Communication System (PECS) affects communication in students with ASD. The studies in this section were conducted between 2012 and 2018.

Ganz et al. (2012) examined the meta-analysis results of the targeted and non-targeted outcomes involved with the use of PECS for students with ASD. ASD can pose various communication difficulties for these students. PECS has been shown to improve communication skills for those with ASD and may be more effective than other forms of picture-based ACC systems. PECS not only increases functional communication, but it also had research completed on how it can affect non-targeted outcomes, such as increasing speech production and reducing problem behaviors.

The authors completed a literature search of 13 articles that focused on the use of ACC systems with individuals with ASD. The focus was on the effect sizes of the independently analyzed areas of targeted vs. non-targeted variables, user age, disability classification and the number of PECS phases completed. Little empirical evidence was shown about who will gain the best results from using PECS. However, the analysis supports that PECS users make their

greatest gains on the outcomes that are specifically targeted, especially those associated with functional communication. A few positive examples of this were making interaction initiation and even developing spoken language. At the same time, PECS is positively affecting social behaviors by increasing these functional and social communication skills. As a result, as the communication skills increase, the problem behavior may decrease.

The analysis also found that PECS has the most positive outcomes for those that are younger, especially preschool-aged. The targeted outcomes were significantly higher for those in preschool when compared to elementary students. The analysis produced results that are consistent with the theme that the earlier the interventions begin, the greater the results achieved. It also showed the pattern of growth should continue as one moves through the various phases in PECS. The more advanced phase that an individual masters with PECS, the greater the results achieved.

Hill and Flores (2014) examined the differences between using the Picture Exchange Communication System (PECS) and the iPad for communication of students with ASD. The authors used a single-subject alternating treatment design during an extended school year (ESY) program to compare the independent use and effectiveness of the two different communication systems. One method was using the low-tech PECS option and the other was using a higher-tech iPad.

Many students with ASD are non-verbal or speak minimally, lack functional communication skills, and are unable to use gestures to obtain items they need or to gain attention appropriately from others. Finding a way to communicate effectively is important so they can have a way to communicate with others. Since students with ASD often struggle with

processing spoken language, using visual ways to communicate is an alternative. Visual supports can be used for many reasons, including: classroom expectations, daily schedule, instructions, as well as pictures used for requesting. These pictures, or PECS, are a low-tech strategy obtained from Applied Behavior Analysis in the early 1980's. They are pictures that can be used to teach functional communication by following a six phase process.

In 2011, iPad, a high-tech strategy, created specific applications that could be used on it as a communication system. This includes an app called Proloquo2Go, which provides different communication options for those that would benefit. Proloquo2Go offers text-to-speech, color picture symbols, and over 7000 vocabulary words. This device is portable and is an option for all ages.

The purpose of this study was to compare the two ACC devices and see which one can serve the original intention behind PECS, which is moving through the phases for making requests more effectively. The method involved three students, between the ages of three and nine-years-old, diagnosed with ASD. They attended an ESY program that lasted twenty-one days, for three hours per day. The goal was to work through the six phases of the PECS system. Data was collected on the behavior of the students as they worked through the six phases.

The authors came to the conclusion that the data suggested there was a minimal difference between which ACC device was used for the communication intervention. This was important though because it demonstrates that a low-tech intervention can be just as effective as a high-tech intervention when a child is working through the beginning stages of communication development. In fact, it may be easier to begin with the low-tech PECS because it is simpler and as they begin to master their requesting, they could move to a higher-tech option. It is also easier

for an adult to keep data on a student's progress with PECS since they can hold the sentence strip and then re-set as needed. Also, understanding the concept of request, reinforcement, inter-trial interval was more difficult to teach using the iPad. Overall, the results of the study suggest to begin the communication intervention with PECS and progress to the iPad once the phases have been mastered.

Ganz et al. (2014) examined the potential moderating effects of intervention setting and the type of AAC device used on outcome variables for students with ASD. Both the No Child Left Behind Act of 2001 and the Individuals with Disabilities Education Act require that school-based interventions be based on peer-reviewed research. It is essential to know if an intervention is successful so those implementing it are aware what it involves and what changes should be targeted.

Ganz et al. (2014) refers ACC as "a continuum of communication supports for individuals who lack functional speech. Such supports may function to facilitate, or augment, the intelligibility of an individual's speech or in some cases may provide an alternative means for the individual to communicate" (p. 185). ACC is divided into two different categories: aided and unaided. Aided is when an individual needs some sort of support to use functional communication. These include low and high-tech items, such as PECS, an iPad, or writing on paper, while unaided is being able to use parts of your own body to convey a message or make a request by using sign language or using certain physical gestures.

This study involved a literature search of articles published between 1980 and 2011. Thirty-five articles met the criteria needed to look at if the setting is a moderator for effectiveness of ACC implementation and if the ACC devices used have an impact on the

categories of different outcome variables. The results indicated that the setting does moderate the effectiveness. The greatest results were shown in the general education classroom. This could be because of desiring to integrate into the class and participate equally. It could also mean that the students had more opportunity to communicate with other classmates, which could have been a motivation.

The results also specified that PECS was the most effective for addressing communication and social skills, while other ACC devices were more effective for problem behaviors. The goal of PECS is to increase functional communication and social skills, which then indirectly reduces problem behaviors. The study concluded with doing your research. Identify the specific areas of need and then look at what ACC intervention is the best option for those specific skill areas.

Andreadi et al. (2018) examined the effectiveness of applied behavior analysis (ABA) on the communication skills in students with ASD. “ABA is based on the behaviorism and is commonly accepted as a complete and effective approach dealing with ASD. Its aim is to improve the individual’s life through the analysis, understanding and prediction of behavior, while the main educational goals are to achieve spontaneous and functional communication, improved social interactions, improved playing skills with peers, and cognitive skills” (p. 1218).

The authors conducted a survey to produce a qualitative study about ABA and students with ASD. The participants included nine special education teachers and seven psychologists that were already involved in an ABA intervention program. The researcher led semi-structured interviews with the sixteen participants to obtain their feelings about the effectiveness of ABA in

students with ASD. The interview was based on the communications skills portions of the Curriculum for Students with Autism (2011).

The results of the interviews emphasized the significance of eye contact and correct posture because without it, there may be a lack of attention, which causes a communication failure. Also determining the cognitive level, as well as the communication level, is important when beginning any new program. This helps determine what to look for and what to expect in each student involved.

Another important conclusion was how significant the relationships are between those involved. Feeling comfortable with expressing your feelings is very important and it is essential knowing that you as the student can trust the person that is helping you grow. This includes early intervention and the involvement of parents in order for there to be progress in the area of communication skills. The methods used to improve these skills include incidental teaching, shaping, discrete-trial teaching, prompting, role modeling, errorless teaching, and distractors. It also mentioned that generalizing these skills is crucial as well as reinforcing the positive behaviors that are exhibited.

Lamb et al. (2018) examined literature that was published between 2010 and 2018 to specifically examine the fidelity of implementation and the effectiveness of Picture Exchange Communication System (PECS) training. The participants included those diagnosed with ASD and that were between the ages of three and 21 years old. The studies also had to report means, standard deviations and other important statistics needed to convert to Cohen's *d*. Finding the applicable recent studies was difficult since the DSM-IV was updated to the DSM-V. Previously autism was categorized into three different categories: autistic disorder, pervasive disorder not

otherwise specified, and Asperger syndrome. Today they are all combined into one category, which is autism spectrum disorder, or ASD.

Statistics have shown that approximately 25% of those with ASD are unable to communicate verbally. Due to the struggles that students with ASD have with social skills and communication, there have been several interventions that have been developed to assist with those difficulties. This specific study looked at the augmentative and alternative communication system (AAC) of PECS. PECS includes six communication phases, and in order for those communication phases to be effective, there needs to be proper training implemented as well as the phases correctly followed and executed.

The second intervention for students with ASD is speech generating devices, or SGDs. SGDs produce a computerized voice that allow for the individual to communicate through this voice. These are commonly used in novel environments for those that have higher cognitive functioning as well as higher motor skills.

This specific article looked at the effectiveness of PECS for students with ASD as a communication system and how does fidelity of training implementation and the presence of training moderate the effectiveness of the PECS. The results indicated that PECS can be more effective if the individual is trained properly because for every one hour of training the effectiveness of the PECS is increased by three points. This means that the effectiveness of the PECS goes from a small to a large effect size with training.

Table 2*Summary of PECS and Communication*

Author(s)	Study Design	Participants	Procedure	Findings
Ganz, J.B., Davis, J.L., Lund, E.M., Goodwyn, F.D., and Simpson, R.L. (2012).	Quantitative	32 participants with ages ranging from 3 to 17-years-old diagnosed with ASD	Data collection of research on the effectiveness of PECS and potential participant and intervention variables that may impact learning by coding the data and calculating the effect size.	<ul style="list-style-type: none"> • PECS has the potential to positively impact student outcomes, especially the targeted outcomes. • Greatest learning gains were in areas of functional communication. • Greatest outcomes in preschool age.
Hill, D.A. & Flores, M.M. (2014).	Quantitative	Five participants ranging from 3 to 9-years-old diagnosed with ASD or DD	Alternating treatments design that looked at the effectiveness of the iPad and PECS interventions. Each student had eight sessions using PECS and seven sessions using the iPad.	<ul style="list-style-type: none"> • Functional communication training should begin with PECS, with an eventual transition to the iPad once there has been PECS mastery.
Ganz, J.B., Rispoli, M.J., Mason, R.A., & Hong, E.R. (2014).	Quantitative	Unspecified participant amount with ages ranging from 3 to 16-years-old diagnosed with ASD	Data collection of research on if the setting and type of ACC (PECS or speech generating devices) used effective implementation by coding the data and calculating the effect size.	<ul style="list-style-type: none"> • AAC was effective across all educational settings. • AAC was an encouraging communication support in the general education classroom for academic and social inclusion.

Table 2 (continued)

Andreadi, R., Charitaki, G., & Soulis, S. (2018)	Qualitative	9 special educators and seven psychologists that specialized in an ABA program.	The participants were interviewed by the researcher in a semi-structured interview. They were supposed to express their perceptions on the effectiveness of ABA in children with ASD, particularly communication skills.	<ul style="list-style-type: none"> • The importance of eye contact and posture to retain attention. • Cognitive and communication level when beginning the program, interlinking programs, the therapeutic relationship between those involved, early intervention, and the contribution of parents.
Lamb, R., Miller, D. Lamb, Re, Akmal, T. & Hsiao, Y. (2018)	Quantitative	Unknown number of 3 to 21-year-olds diagnosed with ASD	Meta-analysis of research on the effectiveness of PECS for individuals with ASD by coding the data.	<ul style="list-style-type: none"> • The studies researched need greater methodological rigor and there is publication bias because the effectiveness of PECS is smaller than reported. • Training implementation increases PECS effectiveness.

The five studies included in this section specifically address how the use of the Picture Exchange Communication System (PECS) affects behavior in students with ASD. The studies in this section were conducted between 2002 and 2019.

Studies of PECS and Behavior

Charlop-Christy et al. (2002) examined using the Picture Exchange Communication System (PECS) with children with ASD. The article assessed PEC acquisition, speech, social-

communicative behavior, and problem behavior. A multiple baseline design was used with 3 children to study these different areas.

There are many different behavioral interventions that are commonly used to increase speech for children with ASD. These include: discrete-trial procedures, incidental teaching, delay procedures, and pivotal response training. Even with the use of these interventions, over 50% of them still are unable to speak. As a result, other interventions have been created to address alternative communication strategies for these children. These include: sign language, picture-point systems, electronic devices, and other picture communication systems.

PECS is a picture communication system used for children with social-communication deficits. Its behavioral principles consist of shaping, differential reinforcement, and transfer of stimulus control with delay in order to teach functional communication using pictures. Several studies have suggested that learning PECS can help develop spoken language. Studies have also suggested that the use of PECS may result in a decrease in problem behavior and improve social behavior.

The purpose of this study was to assess the amount of training needed for the mastery of PECS in children with ASD and the effects on social-communicative and problem behaviors during the PECS training. The participants included three boys with ASD that attended bi-weekly sessions at an afterschool behavioral treatment program. All three of the boys had previous extensive verbal speech training that resulted in minimal or no communication progress. The procedure included PECS training, play, and academic sessions. The PECS training began with a preference assessment to see which items were most preferred. This assessment was conducted every day to see which items should be included in the PECS training

trials. The training then included 15-min training sessions twice per week, followed by post-training sessions once the training trials were completed.

The results of the study stated that all 3 of the boys mastered PECS in a fairly short period of time. This may be a result of the structure that the PECS format entails. The physical communication exchange of visual items provides visual discrimination which can enhance the speed of learning for children with ASD. Also, PECS establishes operations and a functional relationship with the environment. This occurs by using a mand to specify their desired reinforcers, which creates a contact with a listener before emitting a referential communicative act. The final reason for the quick mastery could be the prompting procedure of delay that occasions transfer of stimulus control of the communicative behavior to the presence of the desired item.

The study found that the PECS system assisted in the boys increasing their vocal speech and their pictorial communication. The boys also had an increase in their social communicative behaviors after receiving PECS training. The results indicated that the increase in communication skills caused a decrease in problem behaviors. Prior research has suggested a relation between joint attention and communication, as well as communication skills and problem behaviors in children with ASD.

Ma (2009) examined the effectiveness of intervention on the behavior of individuals with ASD. Interventions are necessary in order to support individuals with ASD due to their inappropriate behaviors and skill deficits. The DSM-IV and the Childhood Autism Rating Scale have listed a set of criteria for an individual to be diagnosed with ASD. These criteria include:

1. Qualitative impairments in social behavior- lack of awareness of the existence or feelings of others, lack of imitation of social behaviors, lack of active participation in social interactions or play.
2. Qualitative impairments in verbal behavior- lack of normal development of language, echolalia, pronoun reversal, lack of eye contact, failure in making initiative or supplying feedback during conversation.
3. Stereotyped/self-stimulatory/ritualistic behaviors- meaningless repetitive movement of certain body parts, persistent preoccupation with parts of objects, or adherence to nonfunctional routines or rituals.

Some individuals also exhibit challenging or maladaptive behaviors such as verbal or physical aggression, noncompliance, self-injury, property destruction, and tantrum behaviors.

The purpose of this study is to verify the percentage of data points exceeding the median of baseline phase (PEM) using data from the ASD interventions to compare the effectiveness of different interventions, discover which problem behaviors are easier to reduce and which ones are more difficult, and to decipher which characteristics influence the effectiveness of an intervention. A literature search was conducted to find studies that included the word “ASD”, the *Journal of Applied Behavior Analysis*, and additional empirical studies that were relevant. Articles that met the criterion that the data of baseline and treatment phases of a reversal or a multiple-baseline design were graphically displayed for individual participants in a time series format enabling the computation of PEM scores were included, which was 163 articles.

The data was coded using a BAB design, which is used in situations when studying an intervention or treatment is already in progress and the initial baseline phase is omitted, in order

to form the PEM scores. Only the effect sizes of treatment on the target behaviors were calculated. The data in the study included multiple areas. This included the author and publication date, name, age, intelligence, gender, treatment agent, setting, design, first or second pair of baseline-treatment phase of experiment, and the independent and dependent variables.

The independent and dependent variables were classified as follows:

Table 3

Independent and Dependent Variables used to form PEM score

Independent	Dependent
Systematic desensitization	Social interaction skills
Priming	Language abilities
Self-control	Attentions
Training	Stereotyped behaviors
Positive reinforcement and punishment	Abilities other than language ability
Presenting preferential reinforcers	Social responses to others
Response delay	Inappropriate verbal behaviors
Computer-based intervention program for language training	Other inappropriate behaviors
Agent-mediated intervention	Taking initiative
Stimulus control	Perspective taking
Social Story	
Punishment	

Table 3 (continued)

Modeling	
Positive reinforcement	
Differential reinforcement of others (DRO)	

The results of the 163 articles studied produced a grand mean of 1,502, with an effect size of .87. The percent non-overlapping data (PND) of more than 90 is considered highly effective, so 87 is considered near the highly effective cut-off. This means the effect sizes for the treatment of improving the behaviors of participants with ASD was effective.

The study assessed the different interventions and how they affected the participants with ASD. When intelligence was assessed, the interventions were more effective on the participants that had a normal IQ compared to those with a lower IQ. The interventions were also more effective if they were implemented by the staff of the institution or the authors and if they were completed in their own homes or in the institutions. The treatment that used a multiple baseline design had a mean effect size of .90, which revealed a significant difference, $p < .001$.

The results of the study conveyed a few important conclusions about interventions for individuals with ASD. The most highly effective intervention strategies were priming, training, positive reinforcement for desirable behavior plus punishment for undesirable behavior, self-control, and presenting preferential activities or reinforcements. The data showed that it is more effective to train social interaction as a group instead of working on separate parts of it individually. It also showed that perspective-taking was the most difficult behavior to teach children with ASD. "Children with ASD less than 8 years old do not understand sources of

knowledge, beliefs, mental entities, pretence, and deceit. A deficiency in the acquisition of a theory of mind may account for their problems in communication and social interaction.

However, children with ASD have a relatively good performance on visual perspective-taking tasks” (p. 357). This is a reason why video modeling is an effective teaching strategy for children with ASD.

Matson et al. (2010) examined the progression of challenging behaviors in children and adolescents with ASD as measured by the Autism Spectrum Disorders-Problem Behaviors for Children (ASD-PBC). These challenging behaviors include: aggression (physical and verbal), tantrum behavior, stereotypies, property destruction, and self-injurious behaviors. They are behaviors that can be dangerous to themselves or others. Children with ASD are more likely to display challenging behaviors when compared to children with learning or intellectual disabilities, those with psychopathy, or typically developing children. Children with ASD alone predicts challenging behaviors and in fact, up to 94.3% of children with ASD display at least one challenging behavior. These behaviors are typically a result from a deficit in other skill areas like communication, social skills, and self-help.

The purpose of this study was to assess whether the age of an individual with ASD makes a difference on the challenging behaviors displayed. The participants included 167 children and adolescents between the ages of 3 and 14 with an ASD diagnosis. The ages were then divided into three age groups. The ASD-PBC is used to assess problem behaviors in children with ASD. It is an informant based measure that involves a primary caregiver rating 18 different items according to recent severity.

A multivariate analysis of variance (MANOVA) was conducted to assess if there were differences in the challenging behaviors amongst the three age groups. The ratings from the ASD-PBC's were used to assess this. The differences were non-significant, which indicated that behaviors are constant over time. However, it did indicate that it did approach significance which means that challenging behaviors may decrease as children get older.

Early detection and intervention of ASD is needed in order to support these challenging behaviors. Since interventions have been shown to produce positive results, it is even more important that different interventions take place. Unfortunately, these behaviors can result in others making negative judgements towards the individual, increase their potential for self-injury, poor adaptation to their environment, and the long-term use of medications and possible side effects. The use of early interventions has the potential to decrease these challenging behaviors, which will result in better future outcomes.

Battaglia and McDonald (2015) examined literature that investigated the functional relationship between the use of the Picture Exchange Communication System (PECS) and maladaptive behavior in individuals with ASD. According to diagnostic criteria, individuals with ASD possess challenges in the area of communication, which entails the ability to send, receive, or process symbols. Someone that can functionally communicate is able to communicate with different people, in various settings, at any time. Since children with ASD often have difficulty in this area, they may participate in maladaptive or challenging behavior instead as a way of communicating.

A behavioral goal for children with ASD is to replace maladaptive behaviors with more acceptable replacement behaviors. If communication is an area of deficit, an Augmentative

Alternative Communication (AAC) may be used to support or increase communication abilities. PECS is an AAC used to increase functional communication by requesting and initiating. It teaches one to exchange pictures as a way to communicate with others and the environment.

The purpose of this study was to review literature that evaluated the use of PECS for individuals with ASD using single-subject design and to measure the effects of PECS on not only communication, but on behavior as well. The criteria for studies that were pertinent included: articles between 1994 and 2012 that included the keywords of “PECS”, “ASD”, “Speech”, “Behavior”, and “Communication”. This produced 72 articles. The next step was to eliminate articles that were not single-subject research design. This produced nine articles. The final step was to review the official PECS website managed by Pyramid Consultants for any additional articles that should be included. This produced no more articles. After eliminating studies that didn’t meet the criteria, nine single-subject design articles remained. They all showed that PECS produced positive results for communication purposes. During PECS training, all of the participants increased their PECS usage and two out of the three demonstrated significant improvements of verbal speech.

In regards to maladaptive behavior, seven participants were looked at over three studies. All seven of them made progress in the use of PECS, but only four of them reduced their maladaptive behavior. Even though maladaptive behavior did not change for a few of them, it did still exhibit an inverse relationship between nonfunctional and functional behavior, which is positive.

Hu and Lee (2019) examined the Picture Exchange Communication System (PECS), which is a communication intervention used for nonverbal individuals with autism spectrum

disorder (ASD), used as part of the skills-based applied behavior analysis model. It has been used as an early intervention tool to increase language for children with ASD, especially for those that have a delay in social communication and language development, as well as demonstrate problem behaviors.

This particular study looked at the effectiveness the Picture Exchange Communication System (PECS) had on the development of vocal mands, a request for an item or action, and the reduction of problem behavior. The student in the study increased his vocal mands possibly as a result of pairing the picture of the item and the name of the item being vocalized simultaneously. In regards to his behavior, the problematic behavior was minimized and eventually non-existent. The data suggested that the student's problematic behavior was associated with access to preferred items. The Picture Exchange Communication System (PECS) became a replacement behavior for the problematic behavior, resulting in reduced aggression. When the Picture Exchange Communication System (PECS) book was not presented, the problematic behavior continued and aggressive behavior was present. In addition, using the Picture Exchange Communication System (PECS) in multiple settings with various people helped to generalize the skill.

Table 4*Studies of PECS and Behavior*

Charlop-Christy, M.H., Carpenter, M., Le, L., LeBlanc, L.A., & Kellet, K. (2002).	Quantitative	Three participants with ages ranging from 3 to 12-years-old diagnosed with ASD	Bi-weekly sessions at an afterschool behavioral treatment program. The speech therapist provided five speech and five verbal imitation opportunities where imitation resulted in the object being obtained. PECS training twice a week for 15-min.	<ul style="list-style-type: none"> • Increase in speech. • Increase in social-communicative behavior. • Decrease in problem behaviors.
Ma, H. (2009)	Quantitative	1, 407 participants ranging from <7 years to > 18-years-old diagnosed with ASD	Data collection of researches that investigated the effectiveness of interventions intending to improve behavior of participants with ASD by computing PEM (median of baseline phase) scores, coding data, and calculating effect size.	<ul style="list-style-type: none"> • The five highly effective intervention strategies with a mean effect of >.9 included priming, self-control, training, positive reinforcement for desirable behavior plus punishment for undesirable behavior, and presenting preferred activities. • Teach social interaction as a whole.
Matson, J. L., Mahan, S., Hess, J.A., Fodstad, J.C., & Neal, D. (2010)	Quantitative	167 participants ranging from 3 to 14-years-old diagnosed with ASD	The ASD-PBC was completed by caregivers. It includes 18 items that assess challenging behavior.	<ul style="list-style-type: none"> • The results suggested that challenging behaviors may decrease in older children. • The data suggests that the challenging behaviors in children with ASD is persistent and long-lasting.

Table 4 (continued)

Battaglia, D. & McDonald, M.E. (2015)	Qualitative	22 participants with ages ranging from 3 to 12-years-old diagnosed with ASD	Review of literature of the use of PECS exclusively for individuals with ASD, including only single-subject design. Measures the effects of PECS on behavior as well as communication.	<ul style="list-style-type: none"> • There is a lack of studies investigating the relationship between communication and maladaptive behavior. • Increase in verbalization and picture use. • Decrease in maladaptive behavior.
Hu, X. & Lee, G. (2019)	Quantitative	One 4-year-old boy diagnosed with ASD	Preferred items assessment, a pre-experimental probe with PECS, and a PECS intervention.	<ul style="list-style-type: none"> • Independent PECS exchanges immediately increased. • Increased vocal mands. • Aggressive behavior decreased.

Chapter III: Conclusions and Recommendations

The purpose of this research paper was to evaluate the effectiveness of the Picture Exchange Communication System (PECS) on reducing problem behaviors in students with autism spectrum disorder (ASD). Chapter I provided background information on the topic and Chapter II presented a review of the research literature. In this final chapter, Chapter III, I will discuss conclusions, recommendations for future research, and implications for current practice.

Conclusions

I reviewed 10 studies that evaluated the effectiveness of the Picture Exchange Communication System (PECS) on reducing problem behaviors in students with autism spectrum disorder. Five of the studies examined PECS and communication: Ganz et al. (2012); Hill & Flores (2014); Ganz et al. (2014); Andreadi et al. (2018); Lamb et al. (2018) and the other five examined PECS and behavior: Charlop-Christy et al. (2002); Ma (2009); Matson et al. (2010); Battaglia & McDonald (2015); Hu & Lee (2015).

The five studies that examined PECS and communication discussed how functional communication and PECS helped to increase overall communication. The five studies that examined PECS and behavior discussed how an increase in communication and social skills resulted in a decrease in problem behaviors. An overall theme emerged from the research. This theme is that an early functional communication intervention, such as PECS, can lead to a decrease in problem behaviors.

Early intervention and an increase in functional communication. Andreadi et al. (2018) determined that eye contact and correct posture are important in order for a child to stay attentive. Also early intervention and the relationship amongst those involved is important for

communication to improve. Generalizing these communication skills is necessary for the skills to develop. That is also why having parents involved will help the progression of the communication skills. Ganz et al. (2012) determined that PECS is a method that increases functional communication, especially when the interventions begin when a child is younger, or preschool-aged. The study also determined that not only functional communication increases, but so does socially valid behaviors. Non-targeted behaviors may or may not be affected, but there is no evidence suggesting that PECS negatively influences behaviors, speech, or social areas.

Matson et al. (2010) determined that there is not a significant difference in problem behaviors when looking at different age groups, ages 3-14. However, it did suggest that behaviors might decrease, as students get older. The data indicates that problem behaviors are chronic and consistent throughout a child's life, which is an argument for early intervention and treatment.

Location of interventions. Ganz et al. (2014) determined that the setting does not moderate the effectiveness of an Augmentative and Alternative Communication (AAC) intervention. When they are used in the general education classroom, they tend to increase communication since there is more opportunity for socialization. It was also determined that PECS is effective for addressing communication and social skills, which indirectly affects problem behaviors.

Communication interventions. Hill & Flores (2014) determined that students respond differently to various communication interventions. This is an important finding because it shows that during the early stages of communication development, low technology interventions

can be just as or possibly even more effective than higher technology devices. It would be ideal then to begin communication interventions with PECS and once that is mastered, move on to a higher technology device such as an iPad.

Proper training. Lamb et al. (2018) determined that PECS is more effective when the moderator has been trained properly. When training was included in the examination of the effectiveness of the PECS, the effectiveness rose from moderate (0.577) to large (0.632). For every hour of training, the effectiveness of PECS rose by three points. This was a statistically significant predictor of the effectiveness of PECS.

Increase speech, decrease problem behaviors. Charlop-Christy et al. (2002) determined that the use of PECS helped increase speech in the students as well as decrease one or more problem behaviors. Their social-communicative behaviors of initiations and requesting increased with the use of PECS. Battaglia & McDonald (2015) also determined that PECS produced positive outcomes for communication. Verbal speech, requesting, progress through the PECS phases, and the relationship between communication and problem behavior all showed positive results. The participants all made positive progress with PECS and half of them reduced their problem behaviors.

Speech as a behavior replacement and various positive interventions. Hu & Lee (2019) determined that PECS aided the emergence of vocal mands and reduced problem behavior. Since the student's pictorial exchanges increased, their problem behavior decreased. As a result, the data suggests that PECS effectively served as behavior replacement across all settings. If the reinforcement of a preferred item is not used, then the use of PECS may not reduce the problem behavior. Ma (2009) determined that the most effective intervention strategies for students with

ASD are priming, self-control, training, positive reinforcement and punishment, and presenting preferential activities. The function of the problem behavior is important when determining what intervention will be successful.

Recommendations for Future Research

After reviewing the literature that evaluated the effectiveness of the Picture Exchange Communication System (PECS) on reducing problem behaviors in students with autism spectrum disorder, I discovered further research should to be completed to specifically look at how PECS affects behavior. Of the 10 studies that I examined, four mentioned that the sample size was small. Unfortunately, small sample sizes are not representative of a large population. As a conclusion, the results need to be interpreted with caution. Of the remaining seven studies, three studies mentioned that the number of studies used for the meta-analysis were limited. Many additional studies are needed to address this specific topic in the field of special education.

Future research should focus on these 12 questions:

1. What are the effects of early intervention on long-term outcomes for problem behaviors in children and adolescents with ASD (Matson et al., 2010)?
2. What is the impact of PECS for individuals with ASD who are minimally verbal and engage in problem behaviors (Battaglia & McDonald, 2015)?
3. Which children are more likely to begin speech production from the use of PECS (Charlop-Christy et al., 2002)?
4. Would using PECS across multiple settings result in generalization of the skill (Charlop-Christy et al., 2002)?

5. Is the median of baseline phase (PEM) approach best for meta-analysis for single-case experimental designs (Ma, 2009)?
6. Do peers mediate the effects of PECS on communication and behavior difficulties (Hu & Lee, 2019)?
7. How much PECS training should the trainers receive and how many hours of training should the participants receive (Lamb et al., 2018)?
8. What is the impact of PECS for directly enhancing academic performance (Ganz et al., 2014)?
9. What interventions enhance the impact on targeted outcomes (Ganz et al., 2014)?
10. Is hearing a sentence from the iPad and then utilizing PECS with teacher modeling more likely to lead to independent communication attempts (Hill & Flores, 2014)?
11. Does PECS bode equally positively for students with ASD compared to students with ASD and other intellectual or multiple disabilities (Ganz et al., 2012)?
12. What is the efficacy of applied behavior analysis (ABA) in children with ASD (Andreadi et al., 2018)?

Even though PECS was established in the 1980's, there remains minimal research on how it affects multiple skill areas in special education. I would like to see more research on specifically how PECS and communication in turn affect problem behaviors. After months of research, I was able to locate minimal published research that directly looked at this correlation.

Implications for Current Practice

Research has shown that PECS has multiple, positive outcomes for student's with ASD. PECS offers an opportunity for students that are non-verbal or that have minimal communication

abilities, a voice to communicate. The six phases that take place involve a lot of time for training and for implementing before mastery can take place. It is essential that the trainer and the student understand each phase before moving on. Once mastery takes place, a student can move to a higher technology device if desired. Hill & Flores (2014) stated that it is recommended that initial functional communication training begin with PECS and after Phase III is mastered, then a transition to the iPad would be a viable teaching progression of functional communication skills for some students with ASD.

Additionally, PECS has positive outcomes on vocal mands, requesting, and initiations. These are all skills that students need for communication. If these abilities help to let others know what they want or need, then PECS is meeting its objective. It is a way for an individual to communicate appropriately and the intended outcome is to reduce the frustration involved with trying to communicate, which would result in less problem behaviors.

As an ASD teacher, I have witnessed this communication barrier first-hand. If a student is unable to communicate, they tend to display aggressive, problem behaviors because they are frustrated and are unable to tell you what they want or what is wrong. I chose this particular topic because it is relevant to my teaching caseload and to the ASD population with whom I work. I was hoping to find research that provided evidence that using PECS as a communication intervention not only increases communication, but also results in positive outcomes in other areas not targeted. I was surprised by the lack of research that I was able to locate in order to back up my research question. Even though there was evidence that supported the use of PECS as an effective intervention, I unfortunately would have liked to locate more specific research

that had data supporting the use of PECS and how it reduces problem behavior in students with ASD.

This research has provided me with very much information that will be helpful going forward in my teaching career. I recently gained a new student that this particular study has given me ideas and recommendations for that have been helpful in developing a plan. She is non-verbal and arrived with minimal PECS experience. We have been able to begin PECS by the paraprofessional receiving proper training and following the six phases correctly. The student's requesting is increasing, but she displays problem behaviors when she is unable to appropriately communicate her wants or needs. I was able to learn more about PECS and its benefits, but not specific interventions to reduce the problem behaviors when the communication breaks down.

Summary

The Picture Exchange Communication System (PECS) is a communication intervention used for nonverbal individuals with autism spectrum disorder, which is part of the skills-based applied behavior analysis model (Hu & Lee, 2019). The interventions that involve applied behavior analysis have been shown to be effective towards improving social skills, communication, and management of problem behavior for individuals with autism spectrum disorder (Hu & Lee, 2019). As ASD diagnoses continue to increase, it is essential that additional research be conducted to understand how the use of PECS can help increase communication, which may then result in decreased problem behaviors.

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