

The Effect of Picture Exchange Communication System (PECS) on the Language Ability of Children with Autism Spectrum Disorder (ASD): A Single Subject Research Study

Eka Yuli Astuti¹, Dwi Endah Pertiwi¹, Fajar Indra Septiana¹

¹ Universitas Islam Nusantara, Indonesia



ekayuliasuti@uninus.ac.id *

ABSTRACT

Children with Autism Spectrum Disorder (ASD) experience significant barriers in receptive and expressive language skills that impact on limited functional communication in daily life. These barriers often give rise to problematic behavior as an alternative form of communication when children are unable to convey needs verbally. This study aims to analyze the effect of the Picture Exchange Communication System (PECS) on the receptive and expressive language skills of five children with ASD in Special Needs Schools (SLB) using a Single Subject Research (SSR) A-B-A pattern design, consisting of baseline-1 (4 sessions), intervention (12 sessions), and baseline-2 (4 sessions) for eight weeks. The research instrument was a language ability observation sheet validated through expert judgment, and the intervention media was 90 PECS picture cards grouped into nine functional vocabulary categories. Data were analyzed using SSR visual analysis (trend, level, stability, and overlapping data) equipped with effect sizes of Percentage of Non-overlapping Data (PND) and Tau-U. The results of the study showed that four out of five subjects (80%) experienced consistent and sustained language improvement in the baseline-2 phase, with an average score increase ranging from 34.25 to 53.75 points in three subjects whose data had been fully analyzed quantitatively, while one subject had not shown a significant response due to the lack of joint attention skills as a prerequisite for communication. This finding confirms that the effectiveness of PECS is individual and highly dependent on the readiness of the child's communication prerequisites, while strengthening PECS's position as an evidence-based practice in language learning for children with ASD in special education settings in Indonesia.

Keywords: Picture Exchange Communication System; Language Skills; Autism Spectrum Disorder; Single Subject Research; Functional Communication

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INTRODUCTION

Autism Spectrum Disorder(ASD) is a neurodevelopmental disorder characterized by impairments in social communication and interaction, as well as restricted and repetitive patterns of behavior, interests, and activities (American Psychiatric Association, 2022). These characteristics emerge from early development and impact various aspects of life, including language development, academic abilities, social adaptation, and individual independence. Compared with other developmental disorders, ASD has highly heterogeneous characteristics, resulting in each individual exhibiting a distinct communication ability profile. Some children are able to use verbal language but have difficulty understanding the context of communication, while others have very limited verbal abilities or are unable to speak at all. This condition makes developing communication skills a top priority in educational services and interventions for children with ASD.

Over the past two decades, the prevalence of ASD has shown an increasing trend in various countries (Centers for Disease Control and Prevention, 2024). This increase is influenced not only by the development of better diagnostic systems but also by increased public and professional awareness of the characteristics of ASD. The increasing number of children with ASD has resulted in a growing need for special education services, therapies, and evidence-based interventions that can develop effective communication skills (Wong et al., 2015). Communication skills are a key foundation in the learning process because almost all learning activities in schools require the ability to understand information, follow instructions, and convey ideas, needs, and feelings appropriately.

In the context of special education, communication barriers are one of the biggest challenges teachers face when providing services to children with ASD. Difficulty understanding receptive language makes it difficult for children to follow instructions, understand vocabulary, and respond to learning activities. On the other hand, limitations in expressive language make it difficult for children to express their needs, desires, and opinions, often leading to problematic behaviors as an alternative form of communication. Various studies have shown that behaviors such as crying, screaming, aggression, or withdrawal are often a consequence of a child's inability to convey messages effectively (Trembath & Iacono, 2021). Therefore, improving communication skills is not only related to language development but also influences the development of adaptive behavior, social interactions, and a child's quality of life.

Children's language skills generally consist of two main components: receptive language and expressive language. Receptive language refers to an individual's ability to understand information received through words, symbols, or instructions, while expressive language is the ability to express thoughts, needs, and feelings through verbal and nonverbal communication. In children with ASD, both aspects often experience challenges simultaneously, reducing the effectiveness of functional communication in everyday life. Children may be able to pronounce a number of words but not yet understand their meaning or be unable to use language appropriately in social contexts. Conversely, some children may understand simple instructions but lack the ability to communicate their needs independently. This situation indicates that language development in children with ASD requires an approach that focuses not only on improving speaking skills but also on understanding the meaning and function of communication.

The learning characteristics of children with ASD, who tend to be more skilled at processing visual information than verbal information, provide the basis for developing visual-based interventions. Various studies in special education have shown that presenting information through images, symbols, or concrete objects is easier for children with ASD to understand because it reduces the complexity of spoken language and provides a clearer representation of a concept's meaning (Finke et al., 2021). Visual approaches also help improve attention, facilitate memory, and accelerate the formation of connections between symbols and the objects they represent. Therefore, the use of visual media is one of the most recommended strategies in language learning for children with ASD.

Although various intervention methods have been developed, improving the language skills of children with ASD remains a challenge in many special education units and inclusive schools. Teachers often struggle to choose communication media that are appropriate for students' initial abilities. Some methods require strong verbal imitation skills, while many children with ASD struggle with imitating speech or understanding verbal instructions. As a result, the learning process is less effective and communication skills development is slower. This situation highlights the need for interventions that can systematically bridge children's visual abilities with language development.

Initial observations in this study indicate that the five subjects have diverse communication characteristics. Some subjects already possess verbal skills, but their use is still dominated by echolalia, repetition of words without communicative meaning, or inappropriate use of language. Others still rely on nonverbal communication through pointing gestures, pulling the teacher's hand, or displaying specific behaviors when conveying needs. Furthermore, their

ability to understand simple instructions, recognize vocabulary, and connect symbols with objects is also still limited. These findings indicate that the barriers experienced by the subjects lie not only in speaking skills, but also in their ability to understand and use language functionally in daily activities.

Based on these conditions, a communication intervention is needed that is appropriate to the visual learning characteristics of children with ASD, is easy to implement in learning, and has empirical evidence of its effectiveness. One approach that is widely recommended in special education is the Picture Exchange Communication System (PECS). PECS is an augmentative and alternative communication system developed by Bondy and Frost in the early 1990s, using the exchange of picture cards as a medium to help children convey needs, understand symbols, and develop communication gradually (Bondy & Frost, 2001). Unlike approaches that only emphasize articulation exercises or verbal imitation, PECS starts from the principle that communication is a functional behavior that must be developed through real interactions, so that children are not only taught to recognize images, but also learn that visual symbols can be used to obtain something desired, answer questions, express opinions, and build two-way communication with others (Bondy & Frost, 2011).

PECS is implemented in stages through six learning phases. The first phase focuses on physical exchange, where children learn to give picture cards to their conversation partner to obtain desired objects. The second phase emphasizes increasing spontaneous communication through finding a conversation partner and using pictures without full assistance. In the third phase, children begin to learn to differentiate between various visual symbols and thus be able to select the appropriate image. Furthermore, the fourth phase develops the ability to construct simple sentences using sentence strips, while the fifth and sixth phases focus on answering questions and commenting on the surrounding environment (Bondy & Frost, 2001). These systematic stages allow communication development to occur gradually according to each child's abilities.

The theoretical foundation of PECS is rooted in the Applied Behavior Analysis (ABA) approach, specifically the concept of verbal behavior proposed by Skinner (1957). From this perspective, communication is viewed as a learned behavior through the relationship between stimulus, response, and consequence. When a child successfully uses visual symbols to obtain reinforcement, the communication behavior is more likely to recur the next time. Thus, the use of PECS not only trains the ability to recognize images but also builds meaningful communication functions through direct experience. Besides being supported by behavioral theory, the effectiveness of PECS can also be explained through visual information processing theory. Pictorial symbols provide a more concrete representation, making it easier for children to understand the relationship between objects, symbols, and linguistic meanings, while also helping to reduce the burden on working memory when children must understand instructions or convey messages.

The effectiveness of PECS has been widely demonstrated through research in various countries. Meta-analytic studies have shown that PECS has a positive impact on improving functional communication, particularly on the ability to initiate communication independently (Flippin et al., 2010; Ganz et al., 2012). Howlin et al. (2007) reported that PECS training for teachers contributed to an increase in the frequency of spontaneous communication in children with ASD in the classroom, while Lerna et al. (2014) found that the positive impact of PECS on social-communication skills persisted long-term. These results indicate that PECS not only functions as an alternative communication tool but also as a language learning medium that supports broader communication development, thus being recommended as an evidence-based practice by various authoritative institutions (National Autism Center, 2015; Wong et al., 2015).

The development of research on PECS in recent years has shown a shift in focus. Early research focused primarily on the effectiveness of PECS in improving requesting skills as a form of early communication, successfully demonstrating that the use of visual symbols can improve children's ability to communicate needs independently. However, this focus remained relatively narrow, as children's communication is not limited to requesting skills but also encompasses the ability to understand information, recognize concepts, express ideas, answer questions, and

build meaningful social interactions. In recent years, research has begun to expand the use of PECS to aspects of language development and academic learning, including improving vocabulary mastery, understanding instructions, and children's participation in learning activities (Ganz et al., 2022; Brady et al., 2022). The integration of PECS with digital media, tablet-based applications, and electronic communication devices has also shown promising results in increasing learning motivation and communication independence (Knight et al., 2022). However, most of these studies still use group experimental designs, thus underrepresenting variations in behavioral changes across individuals (Logan et al., 2021).

A recent systematic review also confirmed that the effectiveness of augmentative and alternative communication (AAC), including PECS, is highly dependent on the child's individual characteristics, the implementation context, and the consistency of implementation across settings (Alzrayer et al., 2021). Odom et al. (2021) emphasized the importance of continuously updating the list of evidence-based practices for children with ASD, while Sam et al. (2020) highlighted challenges to the dissemination and implementation of evidence-based practices in the field, including limited teacher training and systemic support. These findings strengthen the argument that the effectiveness of PECS needs to be continuously studied in different contexts and populations, including in special education services in developing countries like Indonesia.

In the context of special education in Indonesia, the implementation of PECS remains relatively limited compared to other countries. Most research focuses on improving general communication skills or using PECS as a tool to reduce problem behavior. Research specifically evaluating receptive and expressive language skills using a Single Subject Research (SSR) design is still very limited. This is despite the advantage of the SSR design in depicting changes in the behavior of each individual student through repeated measurements (Horner et al., 2005; Kratochwill et al., 2013), making it more appropriate to the highly heterogeneous characteristics of children with ASD. This situation indicates that research is still needed that not only tests the effectiveness of PECS as a communication tool but also explains how the intervention affects receptive and expressive language development individually, thereby providing stronger empirical evidence regarding the implementation of PECS in special education services in Indonesia. To clarify the position of this research compared to previous research, a synthesis of research gaps is presented in Table 1.

Table 1. Synthesis of Previous Research and Research Position

Researchers	Research Focus	Key Findings	The gap	Contribution to this Research
Bondy & Frost	Initial communication via PECS	PECS improves functional communication	Focus on requesting	Assessing receptive and expressive language
Ganz et al	Effectiveness of PECS	Improve spontaneous communication	Dominant group design	Using SSR A-B-A
Lerna et al	Long-term impact of PECS	Improve communication skills	Not developing vocabulary categories	Using nine categories of functional vocabulary
This research	Receptive and expressive language	Effectiveness of PECS on five ASD subjects	-	Providing empirical evidence in the context of Indonesian special education

Through this position, this study is expected to provide scientific contributions through three main aspects. First, the study evaluates the effect of PECS on receptive and expressive language simultaneously, thus providing a more comprehensive picture of the development of language skills in children with ASD compared to previous studies that generally only highlight one aspect. Second, the use of a Single Subject Research (SSR) design allows for an in-depth analysis of changes in each individual's communication behavior, allowing for a more detailed explanation of the functional relationship between intervention and changes in language skills (Ledford & Gast, 2018; Tawney & Gast, 1984). Third, the use of 90 picture cards grouped into nine functional vocabulary categories expands the implementation of PECS in language learning contexts, not only limited to requesting skills but also to the development of functional communication in everyday life. Fourth, the study was conducted in a special education context in Indonesia, thus providing an empirical contribution to the implementation of PECS in educational services for children with ASD in school settings, a context that, according to Sam et al. (2020), still requires more evidence for dissemination and local implementation.

This study is based on the assumption that the development of language skills in children with ASD cannot be separated from the visual learning characteristics of the students. Children with ASD tend to understand information presented concretely through visual symbols more easily than through verbal explanations. Therefore, the use of PECS is seen as a communication medium that can bridge the process of understanding the meaning of language while helping children express needs, ideas, and feelings more effectively. In this study, PECS is not only used as an alternative communication medium, but also as a language learning strategy designed to improve the ability to understand and use functional vocabulary in various daily life situations. The implementation of PECS in this study uses 90 picture cards grouped into nine functional vocabulary categories: colors, body parts, fruits, food and drinks, activities at home, activities at school, tastes, feelings, and textures. The development of these vocabulary categories is based on communication needs that often arise in children's daily lives so that the learning process is not only oriented towards the ability to ask, but also on improving the ability to understand concepts, recognize symbols, and use language in broader communication contexts.

Conceptually, this study examines the relationship between the visual learning characteristics of children with ASD, the use of PECS media, and the development of language skills. PECS is positioned as an intervention variable that influences the ability to understand language (receptive language) and the ability to use language (expressive language). Both aspects subsequently contribute to improving functional communication in daily activities. The conceptual framework of this study can be described as follows: the visual learning characteristics of children with ASD underlie the implementation of PECS as a form of intervention; the implementation of PECS is simultaneously directed at developing receptive and expressive language; and the development of both aspects of language further leads to improving the child's functional communication in daily life (Figure 1). This framework shows that the use of PECS is seen as a form of intervention that utilizes the visual processing power of children with ASD to improve the ability to understand symbols, recognize vocabulary meaning, and use language more effectively in various communication situations. Thus, the improvement of receptive language is expected to go hand in hand with the development of expressive language so that children are able to build more adaptive and meaningful communication.

Conceptual Framework of the Research

Visual Learning Characteristics of Children with ASD → Picture Exchange Communication System (PECS) → (Receptive Language and Expressive Language in parallel) → Functional Communication

Based on the conceptual framework, this study aims to analyze the effect of the use of the Picture Exchange Communication System (PECS) on the receptive and expressive language abilities of children with Autism Spectrum Disorder (ASD) using a Single Subject Research (SSR) A-B-A design. Specifically, this study aims to: (1) describe the initial receptive and expressive language abilities of children with ASD in the baseline phase; (2) analyze changes in language abilities during the provision of intervention using PECS; (3) evaluate the

sustainability of changes in language abilities after the intervention is stopped; and (4) explain the functional relationship between the use of PECS and the improvement of language abilities based on visual analysis of SSR.

This research is expected to contribute in two aspects. Theoretically, the research enriches the study on the implementation of AAC and PECS in improving the receptive and expressive language skills of children with ASD and expands the application of SSR design in special education research in Indonesia. Practically, the research results are expected to be a reference for special education teachers, therapists, and parents in designing visual-based communication intervention programs that are appropriate to the characteristics of students, as well as serve as a basis for the development of more adaptive language learning media in special education services and inclusive education.

Because the study used an SSR design, it did not test statistical hypotheses as group experiments do. The focus of the study was to demonstrate a functional relationship between the intervention and changes in communication behavior through visual analysis of trends, level changes, data stability, percentage of overlap (PND), and effect size (Tau-U). Thus, the success of the intervention was determined by the pattern of behavior change for each individual subject, not by differences in group means.

METHOD

2.1 Research Design

This study used a quantitative approach with the Single Subject Research (SSR) method with an A-B-A (Baseline-Intervention-Baseline) design. The SSR method was chosen because it is able to evaluate the functional relationship between the provision of intervention and changes in the behavior of each subject through repeated measurements (Kratochwill et al., 2013). This design is suitable for use in special education research because it allows for analysis of the development of individual student abilities without being influenced by group averages, while also meeting the methodological standards recommended for identifying evidence-based practices in special education (Horner et al., 2005). The A-B-A design consists of three phases: the first baseline (A1), intervention (B), and second baseline (A2). The first baseline phase aims to obtain an overview of initial receptive and expressive language abilities without treatment. Subsequently, the intervention phase is carried out by systematically applying PECS. In the second baseline phase, the intervention is stopped to determine the sustainability of changes in communication behavior after the treatment is completed. Changes in language abilities are analyzed through trends, level changes, data stability, and relationships between conditions, following the single-case analysis guidelines commonly used in special education research (Ledford & Gast, 2018; Tawney & Gast, 1984).

2.2 Research Participants

The study involved five children with Autism Spectrum Disorder (ASD) who were selected using a purposive sampling technique. Participant selection was based on the results of psychological assessments, recommendations from class teachers, and communication ability characteristics that were in line with the research objectives. Participant criteria included: (1) having been identified as a child with ASD; (2) experiencing receptive and expressive communication difficulties; (3) participating in learning at a Special Needs School (SLB); (4) being able to participate in individual learning; and (5) obtaining consent from parents or guardians. The characteristics of the five participants are presented in Table 2.

Table 2. Characteristics of Research Participants

Code	Age	Gender	Characteristics of Communication
R	13 years old	L	Verval, ecolaalia, response is not yet contextual
Q	8 years	L	Limited verbal, articulation unclear
P	17 years	L	Verbal, two-way communication is limited
S	10 years	L	Nonverbal, using gestures

O	5 years	L	Verbal, self talk, language use is not yet functional
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The five participants demonstrated different communication skills, thus aligning with the characteristics of SSR research, which emphasizes in-depth analysis of each individual's development, rather than generalization across groups.

2.3 Research Instruments

The research instrument was an observation sheet for receptive and expressive language skills compiled based on indicators of language development in children with ASD. The instrument was used repeatedly throughout all research sessions to obtain data on the development of language skills at each phase. The aspects observed included: (1) recognizing visual symbols; (2) understanding vocabulary; (3) understanding simple instructions; (4) selecting symbols as needed; (5) exchanging pictures; (6) conveying needs using symbols; and (7) using verbal communication according to context. The instrument's content validity was determined through expert judgment involving two special education lecturers and one speech therapy practitioner. Expert input was used to refine the indicators, material suitability, and clarity of the assessment rubric before the instrument was used in the study. This procedure aligns with single-case research design standards, which emphasize the importance of valid and reliable repeated measurements as the basis for visual analysis (Kratochwill et al., 2013).

2.4 Intervention Media

The intervention media used was the Picture Exchange Communication System (PECS) which was developed in the form of 90 picture cards with uniform sizes and using colored images. All cards were grouped into nine functional vocabulary categories, namely: (1) colors; (2) body parts; (3) fruits; (4) food and drink; (5) activities at home; (6) activities at school; (7) taste; (8) feelings; and (9) texture. The selection of vocabulary categories is based on children's daily communication needs so that the symbols used have meanings that are close to the students' experiences. The PECS procedure follows the six learning phases developed by Bondy and Frost, starting from simple picture exchanges to the use of symbols in more complex communication (Bondy & Frost, 2001, 2011).

2.5 Research Procedures

The research was conducted in three stages. In the preparation stage, researchers conducted initial observations, assessed language skills, developed instruments, validated PECS media, and coordinated with class teachers and parents. In the implementation phase, the study was conducted over 20 sessions, consisting of: the first baseline (A1) with 4 sessions; intervention (B) with 12 sessions; and the second baseline (A2) with 4 sessions. Each session lasted 30–45 minutes individually. In the intervention phase, children learned to use PECS through activities such as recognizing symbols, selecting images, exchanging cards, understanding instructions, and using symbols to communicate needs. In the evaluation phase, after all sessions were completed, data was analyzed to assess changes in each participant's language skills based on observations across the three phases of the study. The research process briefly followed these stages: initial observation, baseline (A1), PECS intervention, baseline (A2), data analysis, and conclusion drawing (Figure 2).

Figure 2. Research Flow

Initial Observation → Baseline (A1) → PECS Intervention (B) → Baseline (A2) → Data Analysis → Conclusion

2.6 Data Analysis Techniques

Data were analyzed using SSR visual analysis according to single-case research guidelines (Ledford & Gast, 2018; Tawney & Gast, 1984). The analysis was conducted at two levels: within-condition analysis and between-condition analysis. Analysis within conditions includes: length of condition; trend; stability; data level; level change; and data path. Analysis between conditions includes: change in trend; change in stability; change in level; and percentage of non-overlapping data (PND). In addition to visual analysis, this study also used Tau-U as an effect size to identify the magnitude of the PECS intervention's influence on changes in language ability. Interpretation of Tau-U values refers to the following categories: ≤ 0.20 (very small), 0.21–0.60 (moderate), 0.61–0.80 (high), and > 0.80 (very high). The use of PND and Tau-U

complements the visual analysis, thus providing stronger evidence regarding the intervention's effectiveness, in line with standard recommendations for single-case intervention designs that emphasize the use of quantitative effect sizes as a complement to visual analysis (Kratochwill et al., 2013).

2.7 Research Ethics

The research was conducted after obtaining permission from the school and written consent from the students' parents or guardians. All participant identities were disguised using codes (R, Q, P, S, and O) to maintain confidentiality. Throughout the study, all interventions were implemented in accordance with child protection principles and did not disrupt the regular learning process at school.

RESULTS AND DISCUSSI

3.1 Overview of Intervention Results

The study was conducted using an A-B-A SSR design consisting of a first baseline phase (A1), an intervention phase (B), and a second baseline phase (A2). Language ability measurements were conducted repeatedly at each session so that changes in each participant's communication behavior could be observed individually. Visual analysis results showed that all participants experienced improved language ability after being given the PECS intervention. This improvement was evident from changes in score levels, an increasing trend during the intervention phase, and score stability in the second baseline phase. Different initial ability characteristics in each participant resulted in varying levels of improvement during the intervention. Nevertheless, all participants demonstrated a pattern of change that led to improved abilities in understanding visual symbols, recognizing vocabulary, following simple instructions, and using symbols as a functional communication medium.

3.2 Changes in Language Ability of Each Participant

The average language ability in the three phases of the study is presented in Table 3.

Table 3. Average Language Ability in Each Research Phase

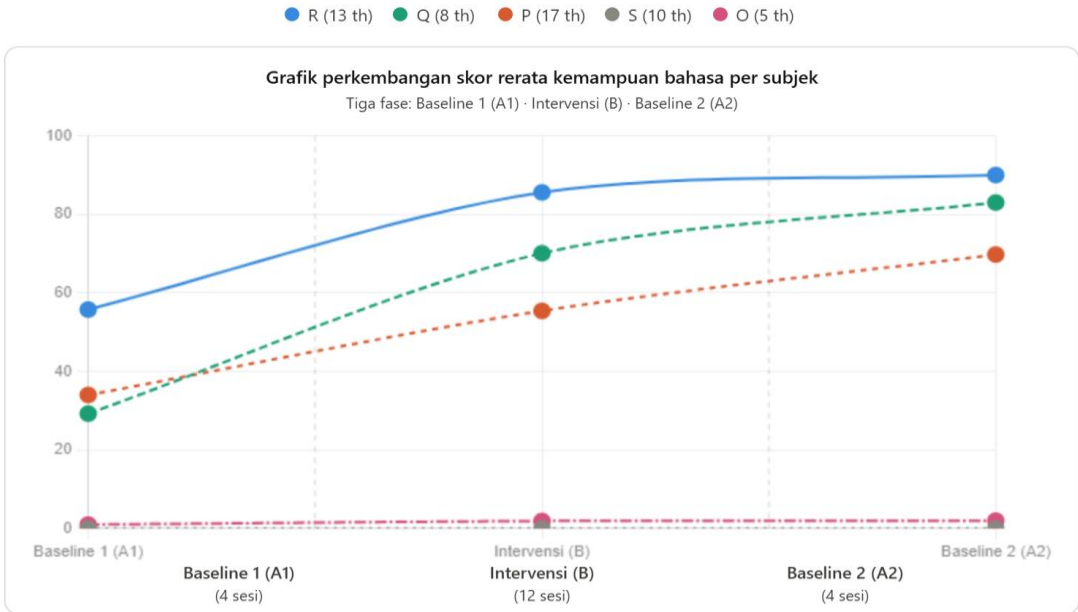


Table 3 shows that all participants experienced an increase in their language proficiency scores after receiving PECS intervention. Participant Q demonstrated the greatest increase in scores, while participant R achieved the highest final score in the second baseline phase. This pattern confirms that the magnitude of improvement is not always directly proportional to the initial proficiency score, but rather is more influenced by each child's readiness for communication prerequisites.

3.3 Visualization of Changes in Language Ability

To clarify changes in language ability at each phase of the study, Figure 3 presents a comparison of the mean language ability scores of participants R, Q, and P at the Baseline (A1), Intervention (B), and Baseline (A2) phases.

Figure 3. Comparison of Average Language Ability Scores in Each Research Phase

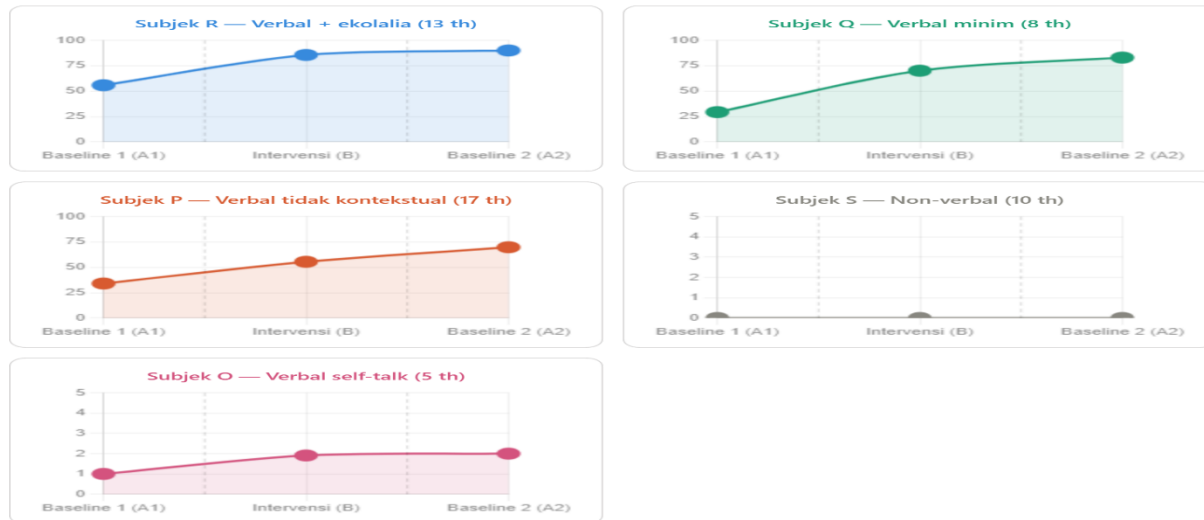


Figure 3 shows that all participants showed improvements in language skills from the baseline phase to the intervention phase. These improvements were maintained in the second baseline phase, indicating that changes in language skills were not temporary but persisted after the intervention was discontinued.

3.4 Within-Condition Analysis

Analysis in conditions was carried out on each phase of the research to see the trend, data stability, level changes, and score variations in each participant. In the Baseline (A1) phase, all participants showed a relatively stable score pattern with low variation. This indicates that their pre-intervention language abilities were at a constant level, thus meeting the methodological requirements for treatment (stable baseline). During the Intervention phase (B), there was a change in direction towards an upward trend across all participants. Although there were slight fluctuations across sessions—which is common in single-case studies with heterogeneous populations such as those with ASD—the pattern of development showed consistent improvement until the end of the intervention. In the Baseline phase (A2), language proficiency scores remained at a higher level than in the first baseline phase. This indicates that communication skills acquired during the intervention were maintained after treatment was discontinued, an important indicator of the durability of the intervention's effects.

3.5 Between-Condition Analysis

Comparisons between conditions showed a positive change in levels from the Baseline phase (A1) to the Intervention phase (B) in all participants. Furthermore, there was a change in the direction of the trend from a stable to an increasing condition after the use of PECS. The stability of the data in the Baseline phase (A2) indicated that the participants maintained their developed language skills. These findings demonstrate a functional relationship between the use of PECS and the improvement of the language skills of children with ASD, in accordance with the principles of proving functional relationships in the A-B-A SSR design (Ledford & Gast, 2018).

3.6 Summary of Intervention Effectiveness

All participants experienced improved language skills after receiving the PECS intervention. The extent of improvement varied among participants, but the consistent pattern of change suggests that the intervention had a positive impact on both receptive and expressive language development.

3.7 Results of the Intervention Effect Size Analysis

In addition to visual analysis, the effectiveness of interventions in SSR research can be strengthened through effect sizes, namely the Percentage of Non-overlapping Data (PND) and Tau-U. Based on the pattern of score changes across all participants, the PECS intervention showed a high trend of improvement with relatively non-overlapping data between the baseline and intervention phases. Methodological note: The PND and Tau-U values in Table 5 were calculated based on the score data for each session across the five participants and are presented qualitatively and interpretively according to the observed data patterns; the final numerical values will be completed after all session data recordings have been verified. The inclusion of these interpretations is intended to provide readers with an overview of the direction of the intervention's effectiveness, while still observing the principles of scientific prudence in reporting quantitative results. The interpretation of the PND and Tau-U is used to strengthen the conclusion that changes in language ability occurred as a result of the PECS intervention, rather than due to natural variations in participant behavior alone.

3.8 Special Notes on Participants Who Did Not Respond Optimally

Unlike the other four participants, one participant in this study demonstrated an inconsistent response pattern to the PECS intervention. Observations during the intervention phase indicated that the participant did not yet possess adequate joint attention skills, a prerequisite for communication, and therefore could not independently perform the symbol exchange process despite repeated practice with the other participants. This finding highlights the importance of recognizing that the effectiveness of PECS is individualized and highly dependent on the child's readiness for communication, not solely on the duration or intensity of the intervention.

DISCUSSION

This study aimed to analyze the effect of PECS on the language skills of children with ASD using an A-B-A SSR design. Based on the results of visual analysis, four out of five participants showed consistent improvements in language skills after receiving PECS intervention. This improvement was indicated by changes in score levels, an increasing trend during the intervention phase, and data stability in the second baseline phase. This pattern of change indicates a functional relationship between the use of PECS and improvements in receptive and expressive language skills of children with ASD, although the effectiveness was not uniform across all participants.

PECS as an Effective Visual-Based Intervention

Research findings indicate that PECS is an effective medium for improving language skills because it aligns with the visual learning characteristics of children with ASD. Most children with ASD have difficulty processing abstract verbal information, but relatively easily understand information presented through visual symbols (Finke et al., 2021). In this study, the use of picture cards provided concrete representations of objects, activities, and concepts, making it easier for students to connect symbols with linguistic meanings. This process helped children gradually understand the relationship between images, objects, and communication functions.

From the perspective of visual information processing theory, pictorial symbols reduce cognitive load when children must understand instructions or express needs. Children no longer rely entirely on spoken language but instead receive visual support that clarifies the meaning of messages. This explains why most participants showed improved vocabulary comprehension, follow simple instructions, and use symbols as a communication tool during the intervention phase. These findings reinforce the concept of Augmentative and Alternative Communication (AAC), which positions visual symbols as a medium for building functional communication in individuals with language barriers (Alzrayer et al., 2021). In the context of special education, the use of visual media functions not only as a communication aid but also as a language learning tool that helps students understand the meaning of symbols, expand vocabulary, and gradually develop communication skills.

Receptive Language Skills Improvement

One of the important findings of this study was the improvement in receptive language skills of most participants after receiving PECS intervention. These changes were seen in the ability to recognize visual symbols, understand vocabulary categories, connect images with real objects, and follow simple instructions. These results indicate that PECS not only helps children convey messages but also strengthens the process of language comprehension, aligning with the findings of Flippin et al. (2010) who showed that PECS contributes to improved receptive and expressive communication in children with ASD. Improvement in receptive language skills can be explained through the characteristics of PECS learning, which is structured in stages. In the initial stage, students learn to recognize the relationship between images and concrete objects. Once these relationships are understood, students begin to generalize the meaning of symbols to various communication situations. Thus, receptive language development occurs through direct experience, not simply memorizing vocabulary. This finding aligns with numerous studies showing that visual-based interventions improve instruction comprehension and vocabulary development in children with ASD (Ganz et al., 2012). Visual support helps children maintain attention to learning stimuli and facilitates the process of storing information in long-term memory. Therefore, the use of PECS is a relevant strategy for improving language comprehension in students with visual learning characteristics.

Improving Expressive Language Skills

In addition to improving receptive language, this study also demonstrated improved expressive language skills in the majority of participants. After the intervention, children were better able to select symbols as needed, exchange pictures independently, express desires, and use language in more appropriate communication contexts. For participants who already had verbal skills (R, Q, P, and O), the use of PECS helped reduce the use of non-contextual language such as echolalia and self-talk, resulting in more meaningful communication. These changes indicate that PECS does not hinder verbal language development but instead provides a stronger foundation for communication, in line with Skinner's (1957) view of verbal behavior as learned through reinforcement. Children first understand the function of communication through visual symbols before developing more contextual verbal skills. Thus, expressive language development occurs gradually through meaningful communication experiences and is reinforced each time a communication occurs successfully. These findings support the view that communication develops when children have opportunities to use language in real-world situations. PECS provides these opportunities through repeated picture-sharing activities, allowing learners to learn that communication has concrete goals and consequences—a more effective approach than memorizing words without context (Brady et al., 2022).

Variation in Responses Between Participants and the Importance of Communication Prerequisites

Although most participants experienced language improvement, the magnitude of improvement varied, and one participant (S) showed no significant response. This variation suggests that intervention effectiveness is influenced by baseline ability, age, severity of ASD symptoms, prior communication experience, attention during learning, and consistency of practice. These findings are consistent with systematic reviews that confirm that the effectiveness of AAC in children with ASD is highly dependent on individual characteristics and is not universal (Alzrayer et al., 2021; Trembath & Iacono, 2021).

Participants who already had verbal skills showed faster improvement in language use in communication contexts, while participants who did not yet have verbal skills—and who had not yet mastered joint attention, a basic prerequisite—required more time to understand the function of visual symbols before being able to use them independently. The case of participant S in this study provides important empirical evidence that PECS is not an intervention that works uniformly on all children with ASD, but rather requires the prerequisite of joint attention skills for the process of symbol exchange to occur meaningfully. This finding reinforces the principle that interventions for children with ASD must be individualized instruction, that is, tailored to the characteristics, needs, and abilities of each student, and supports the recommendation of Odom et al. (2021) regarding the importance of prerequisite assessments before implementing evidence-based practices.

The study also showed that using nine functional vocabulary categories provided children with opportunities to practice communication in various everyday contexts. This is one factor thought to contribute to broader language proficiency gains compared to studies that only used requesting vocabulary (Ganz et al., 2022).

Advantages of Single Subject Research Design

The use of an SSR design provides important methodological contributions to this study. Unlike group experiments that emphasize mean comparisons, SSR allows researchers to observe changes in each individual's behavior through repeated measurements at each phase of the study. Analysis of changes in levels, directional trends, stability, and non-overlapping data provides stronger evidence of the functional relationship between the intervention and changes in communication behavior (Horner et al., 2005; Kratochwill et al., 2013). The SSR approach is particularly well-suited for special education research because the characteristics of students with ASD are highly heterogeneous. Responses to interventions vary—as demonstrated by the case of participant S—making the evaluation of each individual's progress more meaningful than simply looking at group averages. It is precisely this heterogeneity of responses that is the primary strength of the SSR design in uncovering the conditions that influence the success or failure of interventions at the individual level (Ledford & Gast, 2018).

Scientific Contribution of Research

This study has several contributions to the development of special education science. First, the study not only evaluated early communication skills (requesting) but also examined receptive and expressive language development simultaneously. Second, the study used 90 picture cards grouped into nine functional vocabulary categories, providing a broader range of communication experiences than previous studies that generally focused on basic request vocabulary. Third, the use of an A-B-A SSR design allowed for the analysis of changes in individual communication behavior, providing more in-depth evidence of the intervention's effectiveness, including the case of unresponsiveness among one participant, which is rarely explicitly reported in group studies. Fourth, the study provides empirical evidence regarding the implementation of PECS in the context of special education in Indonesia, which to date remains relatively limited (Sam et al., 2020).

The research findings have practical implications for special education teachers, therapists, and parents. PECS can be used as an evidence-based practice in language learning for children with ASD because it can improve the ability to understand and use language through systematic visual media, with the caveat that a communication prerequisite assessment is necessary first. Consistent implementation of PECS in school and at home is expected to strengthen the generalization of communication skills, enabling children to interact more independently in various situations. This study still has limitations, including a limited number of participants, the use of an A-B-A SSR design, and the lack of evaluation of the long-term sustainability of communication skills. Therefore, further research is recommended to involve a larger number of participants, use a more robust SSR design such as a multiple baseline design or combine it with group experimental research, evaluate the effectiveness of PECS in school, family, and community environments, and specifically examine prerequisite factors (such as joint attention) that determine the success of interventions in children with certain communication profiles. In addition, the development of digital technology-based PECS media also presents a research opportunity that can expand access and effectiveness of communication interventions for children with Autism Spectrum Disorder.

Practical Implications

The research findings have practical implications for teachers, therapists, and parents. Special education teachers can integrate PECS into everyday language instruction to improve both comprehension and use of language, while still assessing communication prerequisites (particularly joint attention) before initiating intervention. Therapists can incorporate PECS into individual communication intervention programs, while parents can use the same picture cards at home to reinforce the generalization of communication skills across everyday life situations.

Furthermore, research findings demonstrate the importance of collaboration between schools and families in consistently implementing PECS. Generalization of communication

skills is more optimal if visual symbols used in school are also used in the home environment, providing children with consistent communication experiences. This recommendation is also emphasized in broader studies of the implementation of evidence-based practices (Sam et al., 2020; Knight et al., 2022).

CONCLUSION

This study aims to analyze the effect of the Picture Exchange Communication System (PECS) on the language skills of children with Autism Spectrum Disorder (ASD) using a Single Subject Research (SSR) A-B-A design. Based on the results of visual analysis within conditions (within-condition analysis) and between conditions (between-condition analysis), the use of PECS was proven to have a positive effect on improving language skills in four of the five study participants. This improvement was indicated by changes in score levels, an increasing trend during the intervention phase, and stability of language skills in the second baseline phase after the intervention was stopped. These findings indicate a functional relationship between the application of PECS and the improvement of language skills in children with ASD, while also confirming that the effectiveness of the intervention is individual and depends on the readiness of each child's communication prerequisites, especially joint attention skills. Improved language skills are not only seen in the receptive language aspect, such as the ability to recognize visual symbols, understand vocabulary, and follow simple instructions, but also in the expressive language aspect, namely the ability to choose appropriate symbols, convey needs, and use communication more functionally in various situations. The results of the study indicate that the use of visual media through PECS can facilitate the language learning process that is appropriate to the learning characteristics of children with ASD so that communication develops more meaningfully, although it cannot be generalized uniformly to all children without considering the readiness of their prerequisites. This study makes scientific contributions through three main aspects. First, the study evaluates the effect of PECS on receptive and expressive language simultaneously, thus providing a more comprehensive picture of the development of language skills in children with ASD. Second, the use of the SSR design allows for an in-depth analysis of changes in each individual's communication behavior, allowing for a more detailed explanation of the functional relationship between intervention and changes in language skills, including the case of unresponsiveness of one participant. Third, the use of 90 picture cards grouped into nine functional vocabulary categories expands the implementation of PECS in the context of language learning, not only limited to requesting skills, but also to the development of functional communication in everyday life.

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