

## ORIGINAL ARTICLE

# The Effects of Picture Exchange Communication System (PECS) in Occupational Therapy Sessions on Social and Communication Skills among Children with Autism Spectrum Disorder

Nurazrina Rhaman<sup>1,2</sup>, and Padma A. Rahman<sup>1\*</sup>

<sup>1</sup> Centre for Occupational Therapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

<sup>2</sup> Cemerlang Cendana Educational Centre, 43000 Kajang, Selangor, Malaysia

## ABSTRACT

**Introduction:** Occupational Therapy (OT) utilizes a variety of therapeutic approaches to improve the social communication skills of children with Autism Spectrum Disorder (ASD). There is a dearth of published research on the use of the Picture Exchange Communication System (PECS) during OT sessions. The current study sought to determine the impact of PECS during OT sessions on communication and social skills in children with ASD. **Materials and Methods:** A randomized control trial was conducted in four therapy centers within Kuala Lumpur. After baseline measurements were obtained, participants were allocated randomly to either the control (N = 15) group or intervention (N = 15). The intervention group received the PECS program in addition to OT sessions consisting of sensory-motor activities and functional, symbolic, and social play. In contrast, the control group received only OT sessions. Both the control and intervention groups completed the Vineland Adaptive Behavior Scale Third Edition III (VABS III) at baseline and after the fourth, eighth, and twelfth week of interventions. **Results:** A one-way repeated measures Analysis of Variance (ANOVA) was conducted to examine the effects of the PECS program on social and communication skills among children with ASD in control and intervention groups across four time points. The result revealed that children with ASD improve social and communication skills with an additional PECS in OT sessions. The intervention group's mean communication score improved significantly over time ( $p < 0.001$ ), and the scores were greater than the control group's across all time intervals. The intervention groups (mean = 79.65) recorded a significantly higher standard score of socialization compared to the control group (mean = 65.27). **Conclusion:** As a result, PECS in OT sessions is effective in enhancing communication and social skills in children with ASD. *Malaysian Journal of Medicine and Health Sciences (2025) 21(SUPP5): 49–56. doi:10.47836/mjmhs.21.s5.7*

**Keywords:** Picture Exchange Communication System (PECS), Communication skills, Social skills, Occupational Therapy (OT), Autism Spectrum Disorder (ASD)

## Corresponding Author:

Padma A. Rahman, PhD

E-mail: padma553@uitm.edu.my

Tel: + 03-32584392/ 4306

## INTRODUCTION

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines Autism Spectrum Disorder (ASD) as a neurodevelopmental disorder characterized by challenges with social interaction and social communication. This includes repetitive and restricted patterns in interests, behaviors, and activities. Note that ASD children have various difficulties, comprising limitations in social interaction, verbal communication, and repetitive behavioral patterns. Moreover, numerous research has proven that the key social communication abilities of behavior request, social contact, as well as

joint attention are challenging for children with ASD. These children have deficiencies in a number of skill areas when compared to children who are usually developing and kids with other developmental issues. Accordingly, social and communication difficulties are defining characteristics of children with ASD at all developmental stages (1).

Numerous interventions and therapies, such as the family-centered early intervention program (2) and Developmental, Individual-differences, & Relationship-based (DIR)/ Floortime (3), improve social communication in children with ASD, particularly expressive communication. Notably, the Picture Exchange Communication System (PECS) established by Bondy and Frost (4) is among them. Furthermore, PECS is one of the Augmentative and Alternative Communication (AAC) programs that assist children

with ASD in achieving functional communication skills. PECS is a visual communication technique used to assist individuals with ASD in communicating. Moreover, it involves using pictures or symbols to represent words or ideas and then exchanging these pictures with a communication partner to convey a message (4).

Individuals diagnosed with ASD or other communication problems have been discovered to benefit from PECS, which has been the subject of numerous studies (5-7) and has been demonstrated to be an effective intervention. PECS is frequently used in conjunction with other modes of communication, such as speech or sign language. In addition, it can be perceived as an effective method for developing functional communication skills and enhancing an individual's independence (8).

Children diagnosed with ASD who struggle with social interactions and communication may benefit from Occupational Therapy (OT) as an effective form of intervention. Additionally, sensorimotor activities, also known as using sensory input and movement to enhance function, can be a beneficial component of OT for these children. These interventions involve using movement to improve function (9).

One of the most popular methods used to encourage self-regulation is sensory-motor intervention. Attempts to control, alter, or modify one's own behavior and emotions to suit the requirements of a situation are theoretically referred to as self-regulation. Meanwhile, a sensory-motor intervention enhances kids' capacity to control their arousal levels, leading to well-ordered behavior and enhancing social communication (10). In order to assist children in regulating their arousal levels and create a state of calm alertness best for learning and social interactions, these interventions frequently entail activities that provide various sensory inputs. Interestingly, this entails climbing the rock wall to reach the trapeze swing, swinging on the trapeze, falling down into the ball pit, and being prone to the net swing while pushing oneself with the upper extremities. At the same time, gross motor performance and motor planning challenges, including obstacle courses and rock wall climbing to obtain toys, will be incorporated by clinicians throughout the intervention program (11). By improving a child's ability to regulate their arousal levels, sensory-motor interventions can lead to more well-organized behavior. This includes improved attention and focus, as well as enhanced social communication. This is attributed to when children are better able to regulate their sensory processing. As a result, they are more able to engage in social interactions and communicate with others (11).

Occupational therapists must consider PECS as a part of a comprehensive early intervention program to promote positive social and communication skills (5). Note that a dearth of published research on employing PECS during OT sessions exists. Additionally, Charlop-

Christy et al. (12) proposed assessing the generalization of the intervention across clinic settings, the home, and the school. This is since only a limited study (13) has been conducted on how PECS can be translated into other settings. Therefore, the present research sought to determine the effects of using PECS during OT sessions on communication and social skills in children with ASD.

## MATERIALS AND METHODS

### Design, procedure, and the study sample

The present study, conducted in 2022, was a randomized control trial study conducted in four special needs centers located in Klang Valley. Participants were selected based on inclusion and exclusion criteria and ranged in age from four to six years old. To detect a significant difference at  $p < 0.05$  with a power of 0.85 and a small effect size of 0.27, twenty-four participants are required. Due to the 20% dropout rate observed in a prior study (14), a sample size of thirty is required to attain sufficient statistical power. Accordingly, fifteen individuals were assigned to each of the control and intervention groups in a ratio of 1:1.

This study included pre-test as well as post-test measurements of the outcome or dependent variables, comprising social skills and communication skills after the fourth, eighth, and twelfth weeks (Figure 1).

Participants for this study must have been referred to an OT service, be between the ages of 4 and 6 years old, and have been diagnosed with ASD at Level 1 (requiring support) or Level 2 (requiring substantial support), according to medical reports. They also demonstrated mastery of Phase I (How to Communicate) and Phase II (Distance and Persistence) of the PECS program and did not attend Speech-Language therapy. Moreover, Carr and Felce (15) highlighted that interventions used at the initial stages of development frequently produce positive outcomes. Aside from that, the participants had difficulty understanding personal space, could not recognize or regulate their emotions, were unaware of the rules or expectations, and had difficulty making, maintaining, or keeping friendships with peers. It is also noted that they were unable to empathize with others, had difficulty sharing or taking turns, and had limited verbalization and echolalia (immediate or delayed) (16). However, associated conditions like visual, hearing, and physical impairments and co-morbid medical conditions were excluded from this study since they did not fulfill the criteria for inclusion.

Screenings were held in therapeutic rooms equipped with chairs, a small desk, and familiar and unfamiliar toys and objects. The researcher provided the caregiver with the participants' preliminary form, which consisted of a Vocabulary Selection Worksheet. The following phase involves observing a participant in an unstructured

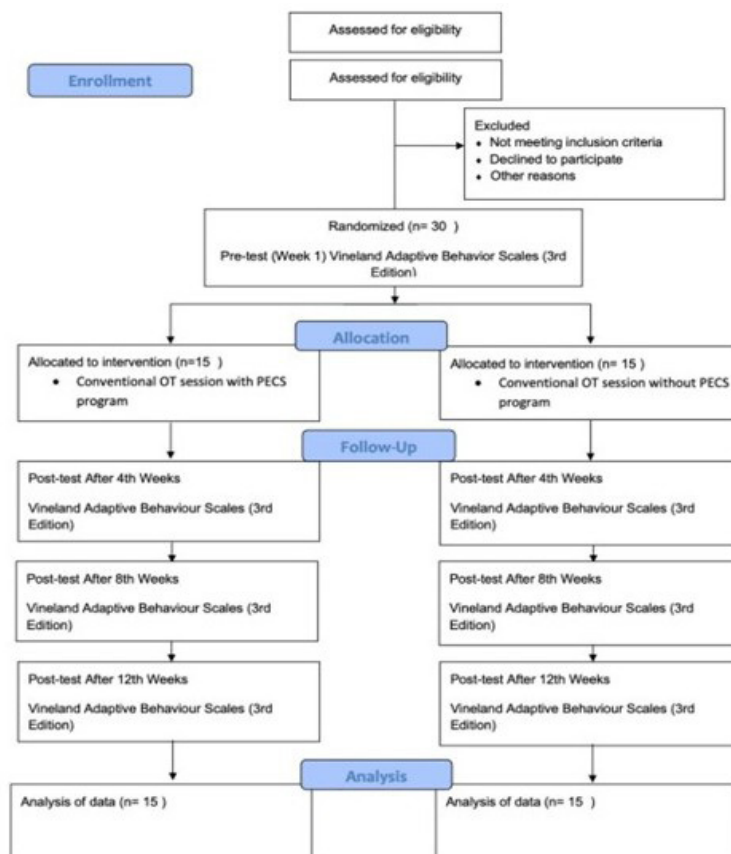


Fig. 1: Flow chart of the participant's enrollment, allocation, follow-up measure, and analysis

environment, followed by a formal reinforcer assessment employing reinforcer hierarchy. Phases I and II were implemented based on the PECS protocol in PECS Training Module (8).

### Measures

The Social and Communication Skills Challenges Checklist was utilized to assess the social communication skills difficulties of all participants. Participants were selected for this study due to their challenges in the areas of Social Interaction as well as Language and Communication. The instrument employed in this study was the Vineland Adaptive Behavior Scale III (VABS III). VABSIII was particularly employed to gather parent/teachers' reports of the child's communication and social abilities at home/school. Furthermore, the Cronbach's alpha for the Adaptive Behavior Composite (ABC) is excellent, 0.80 – 0.92 (17). Caregivers of the participants completed the Comprehensive Parents/ Caregivers Questionnaire of VABS III prior to the intervention and after four, eight, and twelve weeks of the intervention.

During the initial phase, raw scores are obtained from the data collected from the caregivers of participants. These scores represent the frequency of observed behaviors. The initial findings are subsequently converted into v-scale scores, domain scores, and an ABC score. Meanwhile, the v-scale scores display a mean value of 15 and a standard deviation of 3, whereas the domain

and ABC scores indicate a mean value of 100 and a standard deviation of 15. In addition, percentile scores are utilized to illustrate the comparative placement of an individual within a standardized sample, with a score of 50 being the average.

### Intervention and control groups

Both control and intervention groups' procedures participated in sensory-motor activities (10, 18) and were conducted in the Sensory Integration room or OT room. Participants were offered forty-five minutes to one-hour individual sessions with a frequency of once a week for twelve weeks.

A researcher conducting both intervention and control groups is an occupational therapist with substantial experience with ASD. About PECS, in particular, the researcher participated in two workshops provided by a professional consultant of Pyramid Educational Consultant, following the strictly stipulated format of the training manual. These workshops covered PECS basic and advanced training (8) and provided certification of attendance at the conclusion of each workshop. Additionally, the researcher also successfully completed and passed the PECS Level 1 examination.

Other than sensory-motor activities, which included jumping on the trampoline, climbing, gym ball, crawling/tunnel, scooter board, and balance beam, both the intervention and control groups received functional,

symbolic, and social play as an intervention (19). Moreover, the intervention group received additional PECS programs, which involved Phases III, IV, and V as per the PECS protocol.

Phase III, Picture Discrimination, is divided into Phase IIIA and Phase IIIB. In Phase IIIA, Simple Discrimination, the participant is required to discriminate between two picture symbols; one is the desired item, whereas another is the undesired item. Additionally, the participant needs to choose his or her preferred item correctly. During this phase, the participants were initially shown picture cards that depicted activities categorized into sensory-motor, pretend, and board game activities. These activities were then classified as preferred or non-preferred. Following this, in Phase IIIB, participants' understanding was evaluated by investigating their ability to associate the selected picture cards with the associated objects effectively. However, the same set of cards used in Phase IIIA was employed to maintain consistency between their actions and reported preferences.

Sentence structure, or Phase IV of the PECS protocol, comes next. The researcher gave the verbal model "I want" after the participant requested by turning over a sentence strip, utilizing a time delay, and labeling the desired objects. Then, the researcher returned the sentence strip and item to the participant.

In Phase V, also known as Responsive Requesting, the researcher introduced the verbal prompt "What do you want?" As Phase V intervention proceeds, a delay is placed between the verbal cue and the additional gestural prompt toward the visual symbol for "I want." The purpose of this phase is for the participant to be able to spontaneously and responsively request the item they like.

The final phase in this PECS protocol is Phase VI, Commenting. The PECS protocol's final phase enables the participant to respond to an interesting event or occurrence that results in social reinforcement. Table I briefly describes the six phases of the PECS program implemented in this study.

Both control and intervention groups received the intervention for twelve weeks with a duration of forty-five minutes to one hour.

**Statistical analysis**

The normality test was conducted using the Shapiro-Wilk statistic. The Shapiro-Wilk test for normality exhibited a non-significant result for the communication and socialization domains when p was more than 0.05. This indicates that standard scores for each week interval were normally distributed. Therefore, the parametric test was conducted.

Data collection and analysis are conducted to evaluate

**Table I: Brief description of the PECS phases implemented in the study**

Phase	Description
I Physical exchange of picture	The child is taught to initiate a conversation by presenting a communication partner with a picture of a desired object.
II Distance and persistence	The child is taught to acquire a picture from the PECS book, which had been relocated away from him, walk to the communicative partner, and persist in handing the picture to the communicative partner.
IIIA Simple discrimination	The child is taught to choose from all pictures on or in the PECS book, which begins with a highly preferred picture to a non-highly preferred one.
IIIB Discrimination between multiple pictures	The child is taught to demonstrate the correspondence between the picture and the chosen item.
IV Sentence structure	The child is taught to mix several symbols or words to form simple phrases.
V Responsive requesting	The child is taught to make a spontaneous and responsive request for the item that is his preference.
VI Commenting	The child is taught to respond to some interesting event or occurrence in the environment, resulting in social reinforcement.

the hypothesis or investigate the research questions. This includes determining the instrument's format, the data collection method, and the amount of data obtained (nominal, ordinal, interval). Statistical Package for Social Sciences (SPSS) was utilized to analyze the received data. A p-value of 0.05 demonstrates the existence of a significant difference if one exists. In addition, this study uses social and communication skills as dependent variables. Moreover, a one-way repeated measures Analysis of Variance (ANOVA) was performed to investigate the effects of the PECS program on social, communication, and daily living skills among children with ASD in the control and intervention groups at baseline, week four, week eight, and week twelve.

**RESULTS**

All thirty participants completed twelve weeks of intervention and underwent the final analysis. Table II presents the demographic information of the participants. The mean age of participants in the intervention group was 5.22 (0.606) years, while the mean age in the control group was 4.94 (0.652). At the same time, early implementation of PECS can significantly improve communication skills, positively impacting the child's overall development and quality of life (20).

Table III provides the difference in mean of the standard score of the communication within a group based on time. The post hoc test using Bonferroni recorded a significant difference in both groups between different time intervals except in the OT group. However, there was no significant difference in the standard score of the

communication between baseline vs. week four.

**Table II: The Demographic Distribution of the Participants**

Variables	Mean (SD)	Total n (%)
Age	5.08 (0.64)	
<b>Gender</b>		
Girl		8 (26.7)
Boy		22 (73.3)
<b>Location</b>		
Center A		15 (50.0)
Center B		10 (33.3)
Center C		1 (3.3)
Center D		4 (13.3)
<b>Ethnicity</b>		
Malay		20 (66.7)
Chinese		6 (20.0)
Indian		3 (10.0)
Others		1 (3.3)
<b>Group</b>		
OT with PECS	5.22 (0.606)	15 (50.0)
OT	4.94 (0.652)	15 (50.0)

**Table III: The difference in the standard score of the communication between and within the group based/regardless of time**

Time	OT + PECS		OT	
	Mean Difference (95% CI)	p-value	Mean Difference (95% CI)	p-value
Baseline vs. week four	-3.93 (-5.26, -2.61)	< 0.001	-0.93 (-2.38, 0.52)	0.411
Baseline vs. week eight	-9.27 (-12.34, -6.19)	< 0.001	-4.87 (-6.90, -2.84)	< 0.001
Baseline vs. week twelve	-16.60 (-20.91, -12.29)	< 0.001	-8.40 (-11.52, -5.28)	< 0.001
Week four vs. week eight	-5.33 (-8.80, -1.87)	0.002	-3.93 (-5.38, -2.48)	< 0.001
Week four vs. week twelve	-12.67 (-16.94, -8.39)	< 0.001	-7.47 (-10.31, -4.63)	< 0.001
Week eight vs. week twelve	-7.33 (-9.97, -4.69)	< 0.001	-3.53 (-5.69, -1.38)	0.001

According to Table IV, there is a significant difference in the mean of the standard score of the communication between OT with PECS and OT group based on time ( $p < 0.001$ ). The PECS with the OT group (mean = 76.12) recorded a significantly higher standard communication score than the OT group (mean = 61.02). In addition, OT with the PECS group recorded a significantly higher standard score of communication means compared to the OT group across different time intervals.

**Table IV: Total Mean Score of the Standard Score of the Communication between the group**

Time	OT+PECS (n = 15)		OT (n = 15)		p-value
	Mean (sd)	Total mean score	Mean (sd)	Total mean score	
Baseline	68.67 (13.227)		57.47 (8.442)		
Week four	72.60 (12.949)		58.40 (8.700)		
Week eight	77.93 (11.158)	76.12	62.33 (8.525)	61	< 0.001
Week twelve	85.27 (11.272)		65.87 (8.132)		

The result obtained from the analysis is summarized in Table V. There was a significant difference in the mean of the standard score of the socialization within OT with PECS and OT based on time ( $p < 0.001$ ). The post hoc test using Bonferroni recorded significant differences in both groups between different time intervals except in the OT group. However, there was no significant difference in the standard score of socialization between baseline vs. week four. Moreover, there was a significant difference in the mean of the standard score of the socialization between OT with PECS and OT group regardless of time ( $p < 0.001$ ).

**Table V: The difference in the standard score of the socialization between and within the group based/regardless of time**

Time	OT + PECS		OT	
	Mean Difference (95% CI)	p-value	Mean Difference (95% CI)	p-value
Baseline vs. week four	-3.33 (-5.22, -1.45)	0.001	-1.67 (-3.55, 0.22)	0.101
Baseline vs. week eight	-8.07 (-12.30, -3.84)	< 0.001	-5.00 (-7.70, -2.31)	< 0.001
Baseline vs. week twelve	-13.60 (-17.36, -9.84)	< 0.001	-8.80 (-12.53, -5.07)	< 0.001
Week four vs. week eight	-4.73 (-9.06, -0.41)	0.028	-3.33 (-5.38, -1.29)	0.001
Week four vs. week twelve	-10.27 (-13.59, -6.94)	< 0.001	-7.13 (-10.17, -4.10)	< 0.001
Week eight vs. week twelve	-5.53 (-10.92, -0.14)	0.042	-3.80 (-6.35, -1.26)	0.003

For socialization, as provided in Table VI, OT with the PECS group (mean = 79.65) recorded a significantly higher standard score of socialization compared to the OT group (mean = 65.27). Yet, there was no significant difference in the mean of the standard score of the socialization between the OT with the PECS group and the OT group based on time ( $p = 0.064$ ).

**Table VI: Total Mean Score of the Standard Score of the Socialization between the group**

Time	OT+PECS (n = 15)		OT (n = 15)		p-value
	Mean (sd)	Total mean score	Mean (sd)	Total mean score	
Baseline	73.40 (10.979)		61.40 (7.229)		
Week four	76.73 (9.932)		63.07 (7.045)		
Week eight	81.47 (10.908)	79.65	66.40 (7.376)	65.27	0.064
Week twelve	87.00 (8.272)		70.20 (7.858)		

## DISCUSSION

The purpose of the current study was to assess how employing PECS during OT sessions affected the social and communication skills of ASD children. According to our knowledge, this research was the first one to assess in Malaysia how well employing PECS during OT sessions improved the communication and social skills of ASD children.

A group of ASD children who received OT sessions combined with PECS was contrasted with a different group who received only OT sessions. Notably, group comparison performed on formalized test scores regardless of time indicates that the group receiving OT sessions with PECS acquired significantly higher communication scores than the OT group. Furthermore, OT with the PECS group also reported significantly higher mean communication standard scores than the OT group across all time intervals. The use of PECS was associated with significant improvements in communication skills such as requesting, commenting, and labeling (21). In addition, the study by Preston and Carter (22) provided substantial evidence for the efficacy of PECS as an intervention for enhancing communication skills in ASD children with limited or no speech.

PECS provides a structured and visual system for communication that may be personalized to the child's individual needs as well as abilities. This can improve their engagement and participation in therapy sessions and improve their ability to communicate their needs and wants. Moreover, implementing PECS in therapy sessions can promote generalized communication skills across various settings and communication partners. This can be a crucial step toward improving overall social and communication abilities.

However, the post hoc test using Bonferroni recorded significant differences in both groups between different time intervals except in the OT group. Yet, there was no significant difference in the standard score of the communication and socialization domains between baseline and week four. Hence, this suggests that the treatment or intervention did not significantly affect that particular outcome measure during that time interval.

OT sessions can also provide opportunities for ASD children to practice utilizing PECS in various functional contexts, including play, self-care activities, and community activities. Accordingly, this can improve their ability to use PECS to communicate efficiently in everyday settings, greatly impacting their social and emotional health.

This study is significant as it reveals that the use of PECS in OT sessions improves social and communication skills, enables more structured and supported communication, and increases motivation and involvement in therapy. The "physical exchange" in a PECS protocol could increase children's desire to interact with a social partner since it would be triggered first by the children's desire. This desire is to achieve a concrete goal through social interaction and only then by the children's desire to share and experience objects with a social partner (23). Furthermore, Novak and Honan conducted a thorough systematic review to evaluate the efficacy of pediatric OT interventions, including the PECS. Thus, this intervention was discovered to earn a strong

recommendation for implementation, suggesting a high level of evidence-based support (24).

In terms of co-founding factors, the individual's age, cognitive abilities, and severity of social impairment may influence the PECS' effectiveness in improving social skills. Note that the nature and intensity of the intervention may play a role, as well as the individual's interest and motivation to engage in social interactions. Moreover, the level of support and involvement of parents and caregivers may also be crucial factors.

In addition, it is essential to emphasize that the impact of these factors might vary considerably in various contexts. This comprises schools, households, and therapeutic settings, each presenting different interactions and barriers. Nevertheless, to assess the effectiveness of the intervention, this study was conducted exclusively during OT sessions. Throughout the entire study, careful attention was given to maintaining several environmental and contextual aspects, including the level of structure, the relationship between the therapist and child, and the intensity and frequency of the intervention. As Carrī et al. (13) highlighted, while PECS training is intended to promote generalization beyond the training environment, it is crucial to consider the specific communicative partner and the context in which communication occurs. This is necessary to ensure that initial spontaneous attempts at PECS requesting are appropriately reinforced and supported in new contexts. In conclusion, it is crucial to note that while PECS may not significantly impact social skills for some individuals, it can still be a valuable tool for improving communication skills and overall quality of life.

## LIMITATIONS AND FUTURE DIRECTIONS

A limitation of this study was the higher baseline scores observed in the intervention group compared to the control group. While our repeated measures analysis accounted for changes over time, future studies should aim for larger sample sizes and consider stratified randomization to ensure more equivalent groups at baseline. This would help to minimize potential biases arising from initial group differences. Other than that, randomized control trials with large sample sizes are recommended for future research.

## CONCLUSION

The present findings demonstrated a strong impact of PECS on the social and communicative skills of ASD children. However, it is essential to emphasize that the effectiveness of PECS in OT sessions may depend on various conditions. This includes the child's individual needs and capabilities, the therapist's expertise and experience, and the carer's involvement and level of parental support.

## ACKNOWLEDGEMENTS

This work was supported by Geran Dana UiTM Selangor (DUCS 2.0) (600-UITMSEL (p1.5/4)(026/2020).

## COMPETING INTEREST

The authors declare that they have no competing interests.

## ETHICAL CLEARANCE

This research was approved by the Research Ethics Committee at Universiti Teknologi MARA (UiTM) (REC/09/2021(MR/812)). The consent of participants was obtained from volunteers. Participants' anonymity and the acquired data remained confidential.

## REFERENCES

1. McDougall F, Willgoss T, Hwang S, Bolognani F, Murtagh L, Anagnostou E, et al. Development of a patient-centered conceptual model of the impact of living with autism spectrum disorder. *Autism*. 2018; 22(8):953-969
2. Park HI, Park HY, Yoo E, Han A, & Galeoto G. Impact of Family-Centered Early Intervention in Infants with Autism Spectrum Disorder: A Single-Subject Design. *Occupational Therapy International*. 2020:1-7
3. Reis HIS, Preira APS, Almeida LS Intervention effects on communication skills and sensory regulation on children with ASD. *Journal of Occupational Therapy, Schools and Early Intervention*. 2018; 11(3):346–359.
4. Bondy AS, Frost LA. The Picture Exchange Communication System. *Focus on Autism and Other Developmental Disabilities*. 1994; 9(3):1–19.
5. Alli A, Abdoola S, Mupawose A. Parents' journey into the world of autism. *SAJCH South African Journal of Child Health*. 2015; 9(3):81-84.
6. Barker RM, Akaba S, Brady NC, Thiemann-Bourque K. Support for AAC Use in Preschool, and Growth in Language for Young Children with Developmental Disabilities. *AAC: Augmentative and Alternative Communication*. 2013; 29(4):334-346.
7. McDonald ME, Battaglia D, Kean M. Using Fixed Interval-Based Prompting to Increase a Student's Initiation of the Picture Exchange Communication System. *Behavioral Development Bulletin*. 2015; 20(2):265–275.
8. Frost LA, Bondy AS. PECS: The picture exchange communication system training manual. 2nd Ed. Cherry Hill, NJ: Pyramid Educational Consultants. 2002.
9. Tanner K, Hand BN, O'Toole G, Lane AE. Effectiveness of interventions to improve social participation, play, leisure, and restricted and repetitive behaviors in people with autism spectrum disorder: A systematic review. *American Journal of Occupational Therapy*. 2015; 69(5):6905180010p1-6905180010p12
10. Schaaf RC, Hunt J, Benevides T. Occupational therapy using sensory integration to improve participation of a child with autism: A case report. *American Journal of Occupational Therapy*. 2012; 66(5):547-555.
11. Schaaf RC, Benevides T, Mailloux Z, Faller P, Hunt J, Van Hooydonk E, et al. An intervention for sensory difficulties in children with autism: A randomized trial. *Journal of Autism and Developmental Disorders*. 2014; 44(7):1493–1506.
12. Charlop-Christy MH, Carpenter M, Le L, LeBlanc LA, Kellet K. Using the picture exchange communication system (PECS) with children with autism: assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis*. 2002; 35(3):213-231.
13. Carr AJM, Le Grice B, Blampied NM, Walker D. Picture Exchange Communication (PECS) training for young children: Does training transfer at school and to home? *Behaviour Change*. 2009; 26(1):54-65.
14. Pickles A, Le Couteur A, Leadbitter K, Salomone E, Cole-Fletcher R, Tobin H, et al. Parent-mediated social communication therapy for young children with autism (PACT): Long-term follow-up of a randomized controlled trial. *The Lancet*. 2016; 388(10059):2501-2509.
15. Carr D, Felce J. The effects of PECS teaching to Phase III on the communicative interactions between children with autism and their teachers. *Journal of autism and developmental disorders*. 2007; 37(4):724-737.
16. Plymouth City Council. Social Communication Difficulties Checklist [Internet]. Plymouth.gov.uk. 2015 [cited 2020 Apr 12]. Available from: <https://www.plymouth.gov.uk/sites/default/files/SocialCommunicationDifficultiesChecklist.docx>
17. Sparrow SS, Cicchetti DV, Saulnier CA. *Vineland Adaptive Behavior Scale*. 3rd Ed. San Antonio, TX: Pearson. 2016.
18. Hong CS, Rumford H. *Sensory Motor Activities for Early Development: A Practical Resource*. 2nd ed. London, England: Taylor & Francis. 2020.
19. Spitzer SL. Play in Children with Autism: Structure and Experience. In: Parham LD, Fazio LS, eds. *Play in Occupational Therapy for Children*. 2nd Ed. New York, USA: Mosby. 2008:351-374.
20. Ganz JB, Simpson RL. Effects on Communicative Requesting and Speech Development of the Picture Exchange Communication System in Children with Characteristics of Autism. *Journal of Autism and Developmental Disorders*, 2004; 34:395-409.
21. Flippin M, Reszka S, Watson LR. Effectiveness of the picture exchange communication system (PECS) on communication and speech for children with autism spectrum disorders: A meta-analysis. *American Journal of Speech-Language Pathology*.

- 2010; 19(2):178–195.
22. Preston D, Carter M. A review of the efficacy of the picture exchange communication system intervention. *Journal of autism and developmental disorders*. 2009; 39(10):1471–1486.
  23. Lerna A, Esposito D, Conson M, Russo L, Massagli A. Social-communicative effects of the Picture Exchange Communication System (PECS) in Autism Spectrum Disorders. *International Journal of Language and Communication Disorders*. 2012; 47(5):609–617.
  24. Novak I, Honan I. Effectiveness of paediatric occupational therapy for children with disabilities: A systematic review. *Australian Occupational Therapy Journal*. 2019; 66(3):258-273.