

# ***The Effectiveness of Peer-Mediated Interventions and Applied Behavioural Analysis in Improving Autistic Individuals' Social Interaction: A Comparative Analysis***

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**Abstract:** Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterised by difficulties in social communication and interaction. To enhance the social functioning of individuals with ASD, various intervention strategies including Peer-Mediated Interventions (PMI) and Applied Behavioural Analysis-Based Interventions (ABA-BI), have been developed. This research article conducted a comprehensive comparative analysis by reviewing existing literature to assess PMI's and ABA-BI's effectiveness in improving social initiation, social understanding, and social responses in individuals with ASD. The findings revealed that PMI showed better results in improving the social initiation of autistic individuals, while ABA-BI demonstrated better outcomes in enhancing their social responses. However, there is limited research on the improvement outcomes related to social understanding in autistic individuals, and the long-term effects of these interventions were not examined. In addition, certain factors, including gender, cultural context, social context, and age group, may influence the relative effectiveness of these interventions. As is this, more research needs to be conducted to examine the influence of these factors on improving the social interaction ability of autistic individuals. Understanding these influences may help design tailored intervention strategies to optimise treatment outcomes.

**Keywords:** Autism Spectrum Disorder, Peer-Mediated Interventions, Applied Behavioural Analysis-Based Interventions

## **1. Introduction**

Autism Spectrum Disorder (ASD) refers to a neurodevelopmental condition diagnosed when individuals demonstrate challenges in social communication and/or engage in repetitive behaviours over an extended period [1]. The diagnosis and severity of ASD may cause significant disruptions to individuals' emotional, cognitive and social functioning. Impaired social functioning is one of the primary difficulties faced by autistic individuals, leading to challenges in forming and maintaining meaningful relationships. Study has revealed that autistic children tend to have less mutual friendships than typically-developed children [2]. Further research supported this finding, indicating that autistic children are less engaged with their peers at school [3], and have smaller social networks

[4]. This lack of social interaction abilities and the challenges autistic individuals face in social settings can lead to social anxiety and a preference for solitude [5].

To address these concerns, researchers and clinicians have developed various intervention strategies targeting the social deficits in individuals with ASD. Two prominent approaches are Peer-Mediated interventions (PMI) and Applied Behavioural Analysis-Based Interventions (ABA-BI), which have been identified as effective and valid in enhancing ASD's social interaction abilities [6,7]. Peer-Mediated Intervention (PMI) includes typically-developed peers supporting autistic individuals in their daily social context, especially at school; numerous studies have shown that PMI achieves positive outcomes for children [6]. Four key components of PMI were identified: peer training, where typically-developed peers are educated about ASD and taught strategies to support and involve autistic individuals in various social interactions [6]. Secondly, structured activities that promote the social skills of autistic individuals [6]. Thirdly, adult facilitation, where teachers or therapists provide guidance and support during social interactions to facilitate positive outcomes [6]. Finally, social skills training, where specific social skills are taught to autistic individuals through peer modelling, improves their ability to engage in reciprocal social interactions [6].

In comparison, ABA-BI utilises systematic behavioural-based principles to modify behaviours and enhance daily social communication skills in individuals with ASD [7]. The ABA-BI consists of three core components: behavioural assessment, where social functioning is measured to identify areas requiring intervention [7]. Secondly, behavioural modification involving targeted strategies and positive reinforcement to shape social behaviours [7]. Finally, prompting and fading, where support is gradually reduced as the individual becomes more proficient in social skills [7]. Several interventions are based on ABA-BI and share core features. These include Picture Exchange Communication System (PECS), Discrete Trial Training (DTT), and Social Skills Groups (SSGs) [8-10]. PECS is a structured program designed to help autistic children learn social skills that based on an exchange-based communication system commonly used in clinical and school settings [8]. DTT is an instructional approach that involves direct and systematic methods, where children repeatedly practice until they acquire specific skills, emphasising on breaking down skills into smaller elements and units [9]. Social skills groups (SSGs) are a type of intervention where three or more students, including those autistic individuals, are taught various social behaviors simultaneously [10]. Despite the variations in designs and performances, these interventions are consistent with ABA-BI principles and have shown effectiveness in enhancing eye contact and improving social initiation in children with ASD [7].

However, social interactions can be broken down into several components, such as social initiation (the motivation for social interaction), social understanding (the ability to comprehend other's emotions, social cues and rules), and social responses (the ability to respond appropriately during social interactions) [6], few studies have explored which component these two interventions improve most effectively. Moreover, the long-term impact of the treatment effect on autistic individuals remains unclear, as social complexity and demand for social interaction may increase with age. As is this, the primary objective of this research was to conduct a comparative analysis and assess the effectiveness of PMI and ABA-BI in enhancing different social interaction components in individuals with ASD. By utilising a comparative analysis method, this study aimed to provide valuable insights into the strengths and limitations of each intervention approach, ultimately contributing to a better understanding of how to support social skill development in autistic individuals.

## 2. Method

### 2.1. Research Design

This article adopts a comparative analysis research design, which involves reviewing and analysing existing literature on PMI and ABA-BI in the context of ASD social functioning improvement. The systematic review approach is used to identify and select relevant studies for inclusion and exclusion.

### 2.2. Search Strategy

In July 2023, a comprehensive search was carried out by referring to three databases, namely APA PsycInfo (Ovid), Scopus (Elsevier), and Web of Science core collection. The search covered the years 2012 to 2023 and included articles from the fields of psychology, psychiatry, and medicine. For the Peer-Mediated Intervention (PMI) group, the keyword search terms focused on three areas: autism (using terms like Asperger\* or Autism\*), social interaction (including terms like social skills, social engagement, or social functioning), and peer-mediated intervention (using the term peer\*). For the Applied Behavioral Analysis-Based Intervention (ABA-BI) group, the keyword search terms also covered three areas: autism (using terms like Asperger\* or Autism\*), social interaction (including terms like social skills, social engagement, or social functioning), and applied behavioral analysis-based interventions (using the term ABA\*).

Out of a total of 131 studies identified through the keyword search, only four studies for Peer-Mediated Interventions (PMI) and four studies for Applied Behavioral Analysis-Based Interventions (ABA-BI) met the specific inclusion and exclusion criteria outlined below:

1. The studies employed an experimental group design and were randomized control trials (RCTs).
2. The participants in the studies were of any age and diagnosed with ASD.
3. The studies focused on a PMI with a primary outcome related to a specific social interaction skill, such as social initiation, understanding, or responses, and take a peer-training as a component of the PMI. Alternatively, the studies examined an ABA-BI with a primary outcome related to a social interaction skill.
4. The studies were published in the English language.
5. The studies were conducted between the years 2012 and 2023.

### 2.3. Comparative Components

These two interventions were compared based on their effectiveness in improving autistic individuals' social interaction ability across three domains: social initiation, social understanding and social response. Several characteristics of the studies, including the age, gender, ASD severity and intervention context, were also compared to evaluate these treatments' effectiveness in enhancing the social interaction ability of individuals with ASD symptom. For comparisons, the primary demographic background of selected PMI and ABA-BI were summarised as Participants Textual Summary (see below). In contrast, the details of both interventions' implementation were constructed in Table 1 following the textual comparison. In addition, the comparison outcomes of both interventions were constructed in Table 2 following Table 1.

#### Participants Textual Summary

##### PMI:

Eight males and three females aged 8-17 years from America [11].

80 males and 15 females aged 5-6 years from America [12].

54 males and six females aged an average of 8 years from America [13].

48 males and seven females aged 4-12 years from China [14].

**ABA-BI:**

17 males and one female aged an average of 38.78 months from Italy [15].

54 males and seven females from America aged an average of 3.75 years from America [16].

15 participants aged an average of 4 years and ten months from America (no gender reported) [10].

16 males and ten females aged 6-11 years from Italy [17].

Table 1: Implementation Details.

PMI			
Author	Peers and Characteristics	Experimental Procedures	Treatment Period
Corbett et al. (2012)	11 peers, who had prior experience working with individuals suffering from ASD, were selected. The matching of peers to participants was influenced by the severity of the participants' symptoms.	The school theatre hosted a two-week afternoon camp that featured a range of activities. On Day 1, the activities included circle time introductions, mock auditions, ice breakers, theatre games, and imaginative play. Then each individual was assigned a specific role. From Day 3 to 10, the interactive theatre games decreased, and more emphasis was placed on role-playing, character development, and rehearsing. On Day 11-12, rehearsals were conducted, and on Day 13-14, the camp culminated with the final performance.	Two weeks; 4h/day
Kamps et al. (2014)	4-6 peers per target child; Selected based on good attendance, social skills, and willingness to participate	Classroom sessions at school involved age-appropriate table-top activities and non-treatment social probes. These programs take place outside of the classroom and comprise three distinct activities.	2 years; 25-30min sessions; 3*/week
Kasari et al. (2012)	Three typical peers nominated by teachers based on appropriateness and social network salience	Peers were taught how to interact with children facing social difficulties on the school playground.	6 weeks; 20 minutes each and 2* /week
Zhang et al. (2022)	16 children aged 4-12 meeting specific criteria including enthusiastic, patient, voluntary, with good social skills	Peers used peer modelling, tutoring, and reinforcement strategies to improve autistic children's social interaction skills.	2 months; 40 minutes per session; 3*/week
ABA-BI			
Author	Experimental Procedures		Treatment Period

Table 1: (continued).

Lerna et al. (2012)	The revised PECS (ABA-BI) was conducted for the experimental group, whereas the revised Conventional Language Therapy (CLT) was used for the control group [15].	6 months; 30-min for each session; 3*/week
Howard et al. (2014)	The revised Intensive Behavioural Analytic Treatment (IBT) (ABA-BI) was conducted on 29 participants as an experimental group at school, home and clinical settings [16]. The rest 32 participants were equally assigned to the autism education classroom (AP) and generic educational programming group as controlled groups, respectively (GP).	Three years; 25-40 hours per week with multiple sessions for IBT; 25-30 hours/week for the AP; and 15 hours for the GP.
Leaf et al. (2017)	Revised SSGs (ABA-BI) that include four assessment periods were conducted for 8 participants as an experimental group at kindergarten [10]. Each assessment period consisted of 2 2 hours group probe sessions and one community probe session. The other 7 participants were assigned as a controlled group.	32 sessions over four assessment periods. Each group probe session was 2 hours, and each community probe was 20 minutes.
Hamdan et al. (2018)	A revised DTT (ABA-BI) was conducted for 13 participants as the experimental group, while others were assigned as a controlled group at school [17]. Each session was 35 minutes and consisted of preparation (5 minutes), program principle-based training (20 minutes) and differentiated training in various contexts for skills' generalisation (10 minutes).	3 months; 35 minutes each session; 3*/week

Table 2: Treatment Outcomes.

Author	PMI		
	Social initiation	Social understanding	Social responses
Corbett et al. (2012)	Increased active involvement with peers	Significant improvement in face stimuli perception and interpreting the social meaning when engaging with others.	No significant improvement of eye contact.
Kamps et al. (2014)	Significantly increased initiation for peer engagement at school	Not measured	No significant differences observed between groups concerning social responses and communication.

Table 2: (continued).

Kasari et al. (2012)	Increased playground engagement initiation and time	Not measured	Not measured
Zhang et al. (2022)	Children with mild to moderate ASD exhibited an increase in social motivation, but those with severe ASD did not show the same increase.	Not measured	Social responsiveness increased in children with mild and moderate ASD, but no significant differences were observed between the experimental and control groups of children with severe ASD.
<b>ABA-BI</b>			
<b>Author</b>	<b>Social initiation</b>	<b>Social understanding</b>	<b>Social responses</b>
Lerna et al. (2012)	Increased social initiation and social help request	Not measured	Increased joint attention and cooperative playability, but no eye contact
Howard et al. (2014)	Not measured	Increased receptive language skills and non-verbal understanding; effects maintained after a three years follow-up	Increased expressive language skills, adaptive skills and non-verbal communication skills; effects maintained after a three years follow-up
Leaf et al. (2017)	Significantly increased social initiation and the tendency to ask for help	No measured	Improved social behaviours, including cooperation, joint attention and turn taking
Hamda et al. (2018)	Not measured	Significantly increased abilities to understand facial expressions and tones of voice.	Increased social imitation ability, but long-term effect was not found.

### 3. Result

#### 3.1. Study Characteristics

According to the result, most participants in both intervention programs were dominantly males, and most interventions were conducted at schools or clinical settings (see Participants Textual Summary & Table 1). Also, most of the participants' ages in both intervention programs were around six and from Western culture (see Participants Textual Summary).

#### 3.2. Peer-Mediated Intervention (PMI)

The result demonstrated that all the selected PMI is effective in enhancing the social initiation domain of autistic individuals' social interaction abilities compared to other domains (see Table 2). However, its effectiveness is not applied to the social responses domain as several PMI showed insignificant results [11,12,14]. The effectiveness of PMI in improving autistic individuals' social understanding remains unclear as only one study found significant improvement in autistic individuals' face stimuli perception and interpretation of the social meaning after intervention [11]. None of the studies have

documented the long-term effects of PMI in improving ASD social interaction ability across three domains (see Table 2).

### **3.3. Applied Behaviour Analysis-Based Intervention (ABA-BI)**

The selected ABA-BI were all effective in improving the social responses domain of autistic individuals' social interaction ability, compared to two other domains (see Table 2). However, the effectiveness of ABA-BI in improving social initiation and social understanding domains is not apparent as only two studies suggested increased social initiation of autistic individuals after the intervention [10,15], two studies reported increased social understanding of autistic individuals after the intervention [16,17], respectively. Further research may be needed to test the effectiveness of ABA-BI in promoting the social initiation and social understanding of autistic individuals. Only one study by reported the long-term effect of the intervention after a three years follow-up (see Table 2) [16].

## **4. Discussion and Suggestion**

The comparative analysis revealed that PMI was associated with better improvements in social initiation for autistic individuals compared to other social domains. In comparison, ABA-BI demonstrated significant improvements in social response compared to other social domains (see Table 2). These findings may suggest that combining both interventions in further research could enhance social initiation and response for autistic individuals, leading to more effective treatment outcomes. However, it is worth noting that limited research has assessed the effectiveness of PMI and ABA-BI interventions in improving the social understanding domain of autistic individuals (see Table 2). Future studies should explore this aspect further. Additionally, few studies have investigated these interventions as the social demand and complexity may increase as autistic individuals age. It would be beneficial for research to examine whether these improvements persist over time and influence the quality of their daily social interactions.

Moreover, certain factors may influence the relative effectiveness of these interventions. Firstly, the studies predominantly included male autistic participants (see Participants Textual Summary). As a result, the effectiveness of these interventions may not be generalisable to both males and females, leading to biased intervention results. Existing research indicated that autistic females demonstrate better social communication skills, increased social initiation and more advanced language abilities than autistic males [18,19]. Studies also showed that female autistic individuals are more skilled at camouflaging their social difficulties by imitating their peer's behaviours, adopting social scripts and suppressing their natural autistic traits [20]. Such symptom presentations can lead to late or underdiagnosis of ASD in girls according to current diagnosis tools [21]. As is this, the observed improvements in female autistic individuals after the intervention may be influenced by the placebo effect, as they already possess better social interaction abilities compared to male autistic individuals prior to the intervention. To address this, future studies should aim to recruit a more gender-diverse group of participants to reduce the likelihood of biased testing results. Alternatively, researchers should investigate whether the intervention has similar effects on both male and female autistic individuals. If significant gender differences in intervention effectiveness are found, tailored versions of these interventions may need to be developed specifically for female autistic individuals.

Furthermore, it is essential to acknowledge that most participants and interventions in the study were from a Western cultural context. As a result, the effectiveness of both PMI and ABA-BI may not necessarily apply to different cultural contexts. An evident illustration of this cultural variation can be observed in the interpretation of eye contact. For example, in East Asian cultures, extended eye contact might be perceived as aggressive toward others [22]. As a result, although PMI [e.g.,

11,12] and ABA-BI programs [10,16] have shown promising benefits for autistic children in Western cultures, it is important to conduct further investigations before generalizing these conclusions to other cultural settings. This may suggest the need for more studies to be conducted in different cultural contexts or to ensure a balanced representation of participants from various cultures to thoroughly examine the effectiveness of these interventions across different cultural contexts.

In addition, it is crucial to consider that the improvement in social interaction abilities observed in these autistic individuals during the interventions may not extend to other social contexts, such as work environments. This limitation arises as most of the interventions were utilised on campus (see Table 1), with only one study conducted in various settings [16]. Studies have demonstrated that autistic individuals may tend to fixate on using learned social skills, specifically in the settings where they were taught, without recognising their applicability in different contexts [7]. To address this, future research should explore and assess the transferability of the improvement outcomes of social interaction abilities in autistic individuals across various social contexts. Also, most participants in the studies were around six years old (see Participants Textual Summary). Therefore, the effectiveness of these interventions for different age groups remains unclear. To obtain a better understanding, future research should investigate the effectiveness of these interventions on diverse age groups, such as kindergarten, primary, and high school ages. If the interventions are found to be more effective at an early age, it would be beneficial to specify and target these interventions towards that particular age group to optimise the treatment benefits.

## 5. Conclusion

In conclusion, this study utilised a comparative analysis method to assess the effectiveness of PMI and ABA-BI in enhancing the social initiation, social understanding, and social responses of individuals with ASD. The findings indicated that PMI led to better outcomes in improving the social initiation of autistic individuals, while ABA-BI showed more promising results in enhancing their social responses. These results may suggest combining both interventions for more comprehensive treatment outcomes in improving the overall social interaction ability of autistic individuals. However, both interventions' effectiveness in enhancing the social understanding domain of autistic individuals remains uncertain. Therefore, further research is necessary to thoroughly examine and validate the effectiveness of PMI and ABA-BI in this specific area. Additionally, it is essential to consider certain factors such as gender ratio, cultural context, social context and participants' age as they might impact the generalisability of the interventions' effectiveness. To enhance treatment outcomes, future studies should conduct more research to assess the influence of these factors and provide tailored interventions that fulfill specified needs of autistic individuals.

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