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Preschool-based Interventions to Promote Peer Interactions of Children with Autism

A Systematic Literature Review from 2010-2022.

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ABSTRACT

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Autism often makes children struggle to interact with peers, including initiating, responding, and maintaining social interactions in social settings. They may frequently miss opportunities to engage with peers; they get alienated and tend to appear outside peer activities, restricting opportunities for developing relationships. The time that a child spends in preschool and with peers is crucial for their social skills to develop. Over time, their peers will have a more significant influence on them. This systematic literature review aimed to describe the preschool-based intervention for children with Autism to increase their peer interaction. The search was conducted using three databases (ERIC, PsycINFO, and Web of Science), and seven studies were then selected that met predefined inclusion criteria. The current review includes different interventions such as Peer-mediated intervention, preferred Activities with Peer Support, iPod Touch™, Technology as Communication Devices, and Peer-Mediated LEGO® Play intervention. The seven selected articles conducted an intervention to improve peer interaction of children with Autism. The majority of the reviewed studies found that peer interaction interventions improved the social interaction of children with Autism. As the limitation of the study, the lack of research focusing on preschool-based children with autism spectrum disorders and the interventions available to them were highlighted.

Keywords: Pre-school based Intervention, Peer interaction, Autism spectrum disorder

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1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impaired social communication, limited interests, and repetitive activities (American Psychiatric Association, 2013). One of the most prominent characteristics of Autism, according to the American Psychiatric Association (2013), is a significant lack of social and communication skills and stereotyped and repetitive activities. These Autism features frequently influence children's engagement in daily activities (Stagnitti & Cooper, 2009). Despite living in an inclusive setting, many children with Autism commonly feel social isolation from peers and do not engage in reciprocal interactions (Rotheram-Fuller et al., 2010).

Social difficulties in children with Autism hurt their relationships with peers, making inclusion difficult and complex for educators. Literature supports that the social challenges of students with Autism are the prominent aspect of their disease (Barnett, 2018). When children with Autism begin an interaction, their communication efforts may appear strange to peers because of their unusual social behavior patterns, resulting in misunderstandings and disputes (Prizant & Wetherby, 2005). Difficulties in children's communication and their incapacity to understand the social signs of their peers limit the development of interactions between them (Godin et al., 2017). There is much concern about the lack of social interaction, which has a direct impact on quality of life (Kaale et al ., 2012) and can put autistic children at risk of social isolation (Strain & Schwartz, 2001) and lack of friendship and loneliness (Kasari et al.,2010).

All the reasons listed above indicate that preschool-based interventions that promote social interaction are important for this group of children regardless of the contents of the intervention. To support social interactions for children with Autism, it is vital to take advantage of inclusion and improve social interaction for children with Autism. Such interventions may also begin at a young age to promote participation and acceptance later in life (Hu & Lee, 2018).

2. Background

This thesis topic requires that some terms and contents be clarified to be treated in a differentiated manner.

2.1 Autism Spectrum Disorder

Autism Spectrum Disorder is a severe neurodevelopmental disorder that affects one in every 160 children worldwide (Atladottir et al., 2014). Autism spectrum disorder defined as persistent deficits in social communication and social interaction across multiple contexts, with restricted

and repetitive behaviors and interests (American Psychiatric Association, 2013). Autism symptoms vary from moderate to severe, with each student presenting diverse and distinct disorder characteristics. The word spectrum is used because the symptoms and their intensities vary from person to person, generally impairing everyday functioning (APA, 2013).
The first symptoms appear around the second year of life. They typically involve a language development delay accompanied by a lack of interest in social interactions, odd play, and communication patterns (APA, 2013). Many people with Autism have other challenges, such as linguistic, intellectual, and motor difficulties. They may also engage in self-injury and difficult or disruptive conduct, particularly during childhood and adolescence (APA, 2013).

Hence, persons with Autism may avoid social connections with peers and adults, making it even more challenging to engage in everyday social interactions (Boudreau & Harvey, 2013)**.** It is worth noting that problems in social belongingness follow persons with Autism during their lives as they age. As a result, many problems from regular social interactions may continue to increase. Because Boudreau and Harvey (2013) investigate the continuously extensive influence of social impairments on persons with Autism over a person's lifetime, they emphasize the need to implement successful evidence-based strategies early in a child's development.

Children with Autism spectrum disorder usually struggle to interact with others and may intentionally avoid social situations. As children with Autism frequently miss opportunities to interact with peers, they get alienated and forced outside of peer activities, restricting opportunities for developing relationships (Cotugno, 2009). Once children start their preschool years, their peer group will have a pivotal effect on their social competence development and participation, and this influence develops over time (Rubin et al., 2009). However, for children with Autism, low interest in and ability to communicate with peers (and adults) are identifying characteristics (Odom, 2019).

2.2 Peer interaction

During early childhood, positive peer interactions provide the foundation for developing friendships, which are fundamental for social development, participation, and well-being. Children who can use language to begin and reply to peers suggest activities, take turns, share, use items, and manage arguments with peers are more likely to build healthy peer relationships (Stanton-Chapman et al., 2008). Social contact amongst peers is an integral part of the learning

experience for all students in today's schools. Teachers utilize peer interaction as an opportunity to discuss educational topics, engage students, and develop a school environment (Sutton et al., 2019).

Improvement in social functioning, mainly how to teach skills required in interacting with peers, is one area that frequently has to be focused on children with Autism (American Psychiatric Association, 2013). Compared with their typically developing peers, children with Autism spend less time in social interactions (Kasari et al., 2010). Many studies of school-aged children with Autism have demonstrated that children with Autism experience unusual patterns of interaction, with little mutual friendships, less engagement with peers, and belonging to thinner social networks (Chang & Locke, 2016).

Children with Autism often have difficulty interacting with others, including initiating, responding to, and maintaining social interactions (SY, Cui , & Parrila , 2011). Since they have deficits, they are often considered non-preferred play partners by their typically developing peers (Rotheram-Fuller et al., 2010). These social challenges can severely influence interactions between children with Autism and their peers, making inclusion in school settings challenging for teachers. The lack of social skills further impairs the development of positive relationships with peers during the school years (Laushey & Heflin, 2000).

2.3 Preschool as a part of early childhood education

Over the last few decades, early childhood education, care, and development have become increasingly important. The term preschool refers to a specific area of early childhood education. Most children now take advantage of childcare services before entering school, and participation among younger children has also increased sharply (UNESCO,2007). The purpose of preschool is to ease the transition between kindergarten and school by emphasizing play-based learning. Preschool development is divided into three categories by the National Research Council (2000): cognitive abilities, school readiness, and social and emotional development. Those areas focus on improving language and social skills.

Positive interactions with peers are an essential social ability that is typically learned during childhood. However, observational studies indicate that children with Autism interact with peers less frequently than typical children, have poorer quality interactions with peers, spend more time in aimless play, and maintain a greater physical distance from peers (Bass & Mulick, 2007). Children with Autism are increasingly being included in early childhood education classrooms, where interaction with others is an important developmental goal. Facilitating the

development of peer interaction skills in Autism children incorporated into preschools and childcare facilities is thus an essential goal (Rotheram-Fuller, 2010).

2.4 Interventions

The goal of interventions for children in need is to help them, and their families function effectively. It is critical to help and aid them to face their challenges as effectively as possible (Lollar, Hartzell, & Evans, 2012). Interventions can either support a child's positive functioning or reduce hazards that may harm a child's development. Interventions should, in general, give a holistic perspective of the child, taking into consideration the child's many risks and strengths on both an individual and environmental level (Masten, 2001).

In children with Autism, the lack of direct interaction and peer and professional training can contribute to social isolation. Thus, one of the critical goals of psychological and communication intervention research has been to develop effective techniques to improve social interaction skills in natural contexts (Koegel et al, 2012) In these natural environments, inclusive schools with everyday opportunities to interact with typically developing peer models are common.

The development of a child is determined by the child's features and behavior, as well as interactions within the environment. Bronfenbrenner's bio-ecological model (Bronfenbrenner, 1994) is one example of how to look at the various systems that exist, from microsystem to macrosystem, that directly and indirectly impact the child's development. Intervention can be carried out at many system levels to support the child's growth and learning.

3. Theoretical framework

3.1 The bio-ecological model of Human Development: Bronfenbrenner

For a comprehensive look at the factors that impact child development, the bio-ecological model proposed by psychologist Uri Bronfenbrenner provides a good overview of the subject. The bio-ecological theory of development emphasizes the effect of the environment on an individual's development, in addition to biology (Bronfenbrenner & Morris, 2006). The bio-ecological approach (Bronfenbrenner & Morris, 2006) describes peer interaction as a fundamental process related to human development. It is characterized by the "progression of mutually complicated reciprocal interactions" over a prolonged period". Depending on the

frequency and duration of interactions, the impact of these processes on development can differ significantly (Bronfenbrenner, 2001).

Bronfenbrenner (1994) described ecological systems around a child to create a theory of the interaction of the child's development inside their environment. The systems are named microsystem, mesosystem, exosystem, and macrosystem. The microsystem is the child's closest setting. It involves daily interactions between the person in the center and persons in their immediate surroundings, such as parents, peers, and teachers (Bronfenbrenner, 1994). These interactions are essential for a child's cognitive and emotional development (Swick & Williams, 2006).

The mesosystem is defined as the interaction between various components of the microsystems, in which the child is actively participating. According to Bronfenbrenner, the exosystem indirectly influences the child since it does not participate, for example, in financial troubles within the family, parental job loss, or parental educational background, all of which may harm the child but do not directly engage it. The macrosystem consists of social and political institutions, institutional systems, and cultural values that influence the child's development environment. It functions similarly to a cultural orientation framework for the child (Bronfenbrenner, 1994). Bronfenbrenner then describes the chronosystem, which is another aspect that affects development. It depicts not only the developing child's but also its environmental system's temporal change or stability (Bronfenbrenner & Morris, 2006). Hence, Bronfenbrenner's model enables us to learn about preschool children, their resources, and the fundamental connections between environmental elements and the child. This approach expands on the focus on obstacles and facilitators to children's (communication) growth, involvement, and well-being.

4. Study Rationale

Interactions between children of the same age become important in preschool and continue to be so throughout their lives. These interactions serve as the foundation for building social connections, which are an important aspect of the quality of life for people with and without disabilities (Bass & Mulick, 2007). Children who struggle with peer connections in preschool are more likely to develop social isolation, depression, and poor school performance in the long run. Early childhood is a vital time to acquire social skills such as the ability to interact positively with peers. Therefore, helping children with Autism who are integrated into

childcare centers and preschools to develop peer interaction skills is an important objective (Rotheram-Fuller, 2010).

5. Aim and Research Questions

The systematic literature review aims to describe the preschool-based intervention for children with Autism to increase their peer interaction. The study will be aided by the research question presented below, based on the PIO (Participants, Intervention, Outcome) framework, Table 1.

1. What are the available intervention programs for promoting peer interaction for children with Autism in the preschool setting?

2. What is the effectiveness of preschool-based interventions aimed at promoting peer interaction for children with Autism?

Table 1

PIO framework

PIO	
Population	Preschool-age Children with Autism
Intervention	Preschool-based intervention/ Early Childhood Intervention
Outcome	Peer interaction/peer relationship/peer communication/peer participation

6. Method

A systematic literature review was conducted to meet the aim of this study and answer the research questions.

6.1 Systematic Literature Review

Jesson et al. (2011) defined a systematic literature review as a research method to examine existing literature based on a specific question. The search strategies should be based on inclusion and exclusion criteria for determining which articles should be included in the search. It means the process needs to be clear and transparent to be replicated in the future (Jesson et al., 2011).

6.2 Search Strategy

The process of searching for this systematic literature review was conducted in January 2022 through electronic databases. The databases ERIC, PsycINFO, and Web of Science were utilized. These databases were chosen since they provide reliable sources of peer-reviewed, scientific articles in the fields of social science, education, and psychology. The search term utilized in all databases includes Boolean operators (OR, AND) to combine the search phrases and organize the delimitation. (Search words used in each database can be found in Appendix A). Three filters were used across all datasets to reach the desired findings: 1) language (English), 2) peer-reviewed only, and 3) publication date (2012-2022). Furthermore, the references of selected publications were checked to ensure that all relevant scientific material was reviewed. A search protocol was created in Excel to document the procedure, including the name of each database, the keywords ["Peer interaction" OR "Peer relationship" OR "Peer Acceptance" OR "Peer participation" OR "Peer communication" (Topic) and "autism" OR "autism spectrum disorder" OR "asd" OR "Preschool" OR "Preschool Children" OR "preschoolers" (All Fields) and "Intervention" OR "Early intervention" OR "Preschool-based intervention" OR "Early Childhood education" OR "Preschool education" OR "Early Childhood interventio"] , and the number of results received (see Appendix A).

6.3 Selection Criteria

Predetermined inclusion and exclusion criteria based on the aim, research questions, and PIO of the study guided the selection of articles. The selection criteria were formed using the PIO framework and are shown in Table 1. The present study aimed to identify interventions used to promote peer interaction for children with autism in the preschool setting. Those involved were only children diagnosed with Autism or at risk of Autism who attended mainstream or inclusive preschools. Research investigating intervention studies that included special support provided by teachers within the preschool context with the purpose of improving peer interaction for children in a preschool setting were included. Thus, articles investigating interventions implemented by medical professionals, therapists, or caregivers were beyond the focus of this study and hence, they were excluded. Finally, articles published in peer-review journals between 2010 and 2022 were included, when written in the English language. The inclusion and exclusion criteria are shown in Appendix B.

6.4 Selection Process

At first, the total number of the articles retrieved from Eric, PsycINFO, Web of Science, and through screening references 'Handsearching' was 303, which were imported to EndNote. A total of 49 duplicates were identified through this process. The remaining articles (n=254) were screened. The screening procedure was divided into two sections. The papers were initially screened on a title and abstract level before moving to a full-text screening procedure. The selecting process is depicted using a flow chart graphic (Figure 1).

6.4.1 Title and Abstract Screening

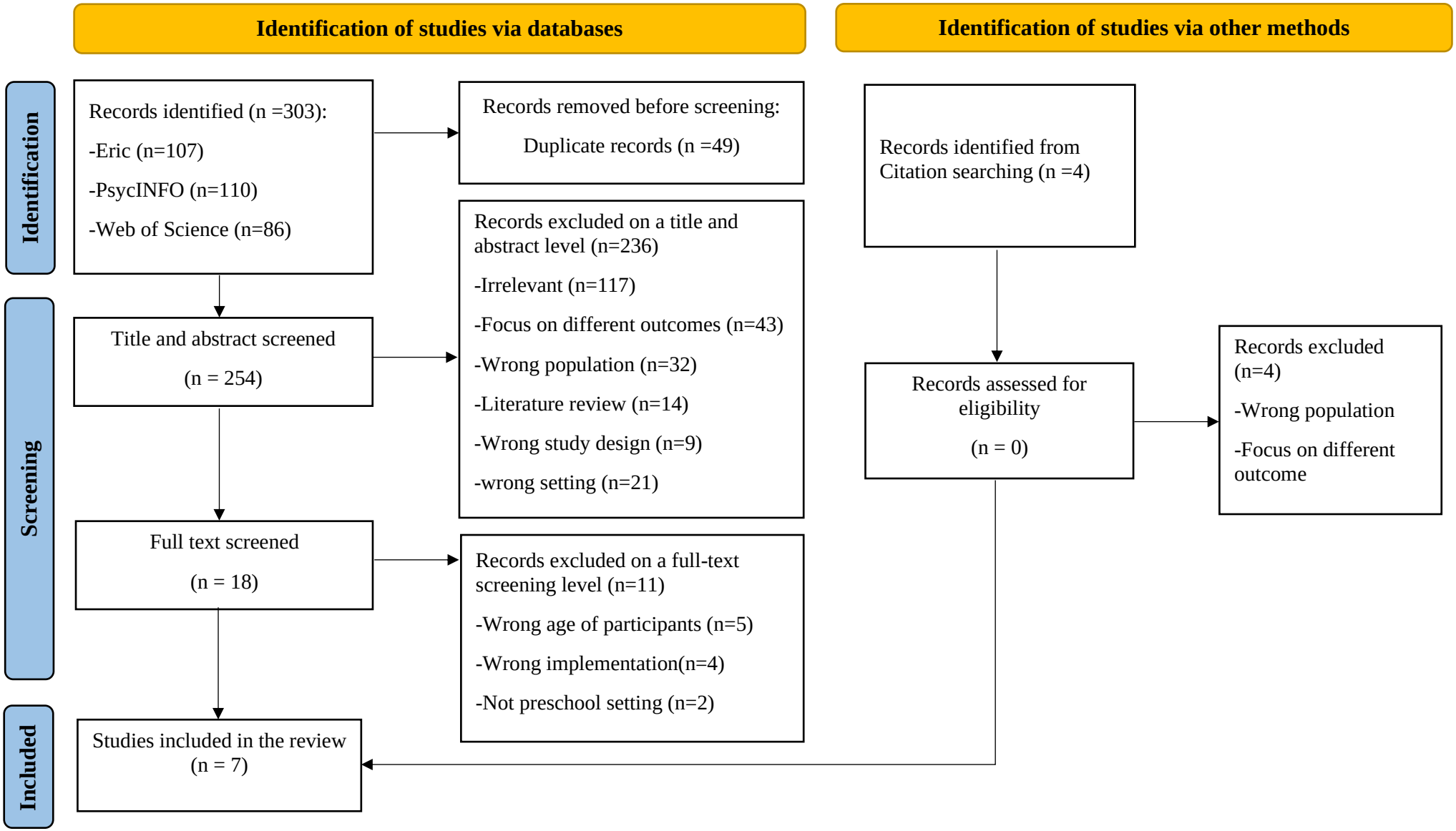
After removing duplicates, 254 studies remained for the title and abstract screening. A total of 236 studies were excluded concerning specific inclusion criteria. The majority of the studies were not relevant to the aim of the present study. A significant number of research focused on different outcomes, such as social skills or school achievement. Other studies were focusing on the wrong population or parents' involvement in the intervention process. (See Figure 1). Overall, 18 studies remained for full-text screening.

6.4.2 Full-text Screening

The remaining 18 articles were screened on the full-text level, and according to predetermined inclusion and exclusion criteria, 11 studies were excluded. In total, 7 studies remained for quality assessment and data extraction. The flow chart (Figure 1) shows exclusion reasons on the full-text level for excluded studies.

Figure 1

Flow Chart Diagram (Page et al., 2021)



6.5 Data Extraction

The first category was article information, including authors, year of publication, title, journal, country, study aim and rationale, research questions, study design, measures used, and ethical consideration. The second category contained participants (number of participants, dropout, sampling characteristics) while the study design, as well as the data collection, were also included in the protocol. The type of intervention, time frame, and duration were all mentioned in the following category, and finally, outcomes, results, study limitations, ethical considerations, and conclusion were reported. A summary of this protocol is presented in Appendix C.

6.6 Quality Assessment

Quality assessment is used to evaluate the methodological quality and validity of studies (Jesson, 2011). To assess the quality of the research, the checklist "Critical Review Form – Quantitative Studies" developed by Law et al. (1998) was utilized. (See Appendix D). Questions were answered during the viewing of the articles. The checklist contained eleven items with one question each that could be answered with "yes," "can't tell," and "no". The questions were graded on a scale of 0% percent to 100%. "Yes" is marked with a green color and 100%, "can't say" with an orange color and 50%, and "no" with a red color and 0%. Following that, the percentage points from each research were summed together and ranked as "Low" (50 percent), "Medium" (50-80 percent), and "High" (>80 percent) quality. Five articles were evaluated to be high quality, and two articles were assessed to be medium quality. Table 2 provides an overview of the quality assessment results.

Table 2

Overview of the quality score

Reference	Total score in %	Level of quality
Dueñas et al. (2020)	100	high
Katz et al. (2013)	77.2	medium
Xiaoyi Hu et al. (2021)	86.3	high
Mancil et al. (2016)	81.8	high
Kamps et al. (2014)	100	high
Xiaoyi Hu et al. (2018)	72.7	medium
Katz et al. (2015)	90.9	high

Note: Overall level of quality - 100-80%= high; 79%-50% moderate; 49%-0%= low

6.7 Data Analysis

The data extraction protocol was used to analyze and report key information found in the selected articles. All seven studies were re-screened in detail to identify and extract valuable information to answer the research question properly and ensure that all relevant data were included. Descriptions of intervention programs were analyzed to address the first study question. To answer the second study question, the outcomes of the intervention programs were analyzed and classified into several categories.

6.8 Ethical Consideration

A systematic literature review does not demand the direct collecting of sensitive or private data from participants, and hence, in general, ethical issues are not emphasized. However, it is necessary to critically reflect on the quality of studies, results, the researcher's perspective, biases, provided information, and outcomes. Furthermore, the selection and analysis of the included papers should be structured in a way that assures transparency and objectivity (Arksey & O'Malley, 2005). Thus, the author mustn't be influenced by personal opinions or preconceptions that may distort existing data, resulting in a low-quality study (Arksey & O'Malley, 2005).

It is important to consider ethical principles and obtain informed consent from participants. When researchers are conducting research on children with disabilities, they must ensure that children's rights are protected and that all requirements are met before consent is given (Bond Sutton et al., 2003). The quality assessment considered ethical methods, and all chosen studies were examined to check if ethical protocols were followed and if an ethics board or committee had authorized the study. Six studies took ethical considerations into account. This involves approval from the review board and informed consent from the children's caregivers or participants. However, one study made no mention of ethical problems.

7. Results

Seven articles were included in the final analysis based on the inclusion and exclusion criteria, the study purpose, and the research question.

7.1 Overview of included articles

All studies used a quantitative study design and focused on interventions that promote peer interaction for children with Autism. The articles were peer-reviewed and published between 2013 and 2021. Each study was assigned an identity number (IN) to make referencing easier. Table 3 shows an overview of included studies. Five studies were considered as having high quality (1, 3, 4, 5, 7) and two medium quality (2, 6). Out of the seven studies, three were set in the USA (1, 4, 5), two in Canada(2, 7), and two in China(3, 6). Considering the researched questions and aim, the selected studies evaluated either (1) preschool-based interventions for children with Autism and (2) the effect of preschool-based interventions on the social interactions of preschoolers with Autism and their typically developing peers. The participants in all articles consisted of children with Autism and their typically developing peers. All studies are about children in preschool-aged between 3-6 years old.

Table 3

Overview of included studies

IN	Author (Year)	Title	Participants	Country	Aim of the study	Study design (Quantitative/Qualitative, Mixed)
1	Dueñas et al., (2020)	Effects of a multicomponent peer-mediated intervention on social communication of preschoolers with Autism	children with Autism (n=3); typically developing peers (n=3)	USA	Examines the effects of a multicomponent, peer-mediated intervention on the social communication behaviors of children with Autism and their typical peers in inclusive preschool classrooms.	Quantitative, multiple probe design
2	Katz et al. (2013)	Peer-mediated intervention for preschoolers with Autism implemented in the early childhood education setting	children with Autism (n=3); typically developing peers (n=3)	Canada	Investigate the effects of peer intervention on the social interactions of children with Autism.	Quantitative, multiple-baseline design
3	Xiaoyi Hu et al., (2021)	Combining preferred activities with peer support to increase social interactions between preschoolers with Autism and typically developing peers	children with Autism (n=2); typically developing peers (n=6)	China	Evaluated the effects of using preferred activities with peer support on the social interactions of preschoolers with Autism and their typically developing peers.	Quantitative, multiple probe design
4	Mancil et al. (2016)	Effects of iPod touch™ technology as communication devices on peer social interactions across environments	children with Autism (n=3); peers are chosen for the study were picked randomly from each child's classroom	USA	Evaluate the use of the iPod Touch™ as a speech-generated device (SGD) for functional communication training (FCT).	Quantitative, experimental Design
5	Kamps et al. (2014)	A Comprehensive peer network intervention to improve social communication of children with Autism	children with Autism (n=97); Four to six neuro-typical peers were recruited from each focus child's general education classrooms or a classroom within one grade	USA	Examine the effects of a peer network intervention that included peer mediation and direct instruction for kindergarten and first-grade children with Autism.	Quantitative, randomized controlled trial
6	Xiaoyi Hu et al.,(2018)	Using Peer-mediated LEGO® play intervention to improve social interactions for Chinese children with Autism in an inclusive setting	children with Autism (n=3); typically developing peers (n=3)	China	Examine the effects of a peer-mediated LEGO® play intervention on improving social skills for children with Autism in an inclusive preschool.	Quantitative, multiple probe design
7	Katz & Girolametto (2015)	Peer-mediated intervention for preschoolers with Autism: Effects on responses and initiations	children with Autism (n=3); typically developing peers (n=9)	Canada	Investigates the effects of the peer-mediated intervention on the responses and initiations of preschoolers with Autism	Quantitative, multiple baseline design

Note: IN = Identification number

7.2 Interventions for promoting peer interaction for children with Autism

This section aims to address the first research question by providing information on interventions for promoting peer interaction among preschoolers with autism spectrum disorder.

7.2.1 Description of the interventions

The seven selected articles conducted an intervention to improve peer interaction of children with Autism. Despite their differing intervention, all followed a defined aim or purpose that guided taken actions and interventions. All of them used interventions intended to improve the peer interaction of children with Autism with their peers. One article has more aims, such as improving children's responses and initiations to their peers during the intervention [7]. The duration of the intervention varied amongst programs, with the shortest being 4 weeks [7] and the longest being 14 weeks [6]. The duration of the other interventions was around 5-6 weeks. Sessions were scheduled two to four times each week. Furthermore, the frequency and length of the sessions were very comparable, lasting around 20-30 minutes each. Table 4 contains further information on the interventions under consideration.

Study number [1] looks at a multicomponent Peer Mediated Intervention to train typically developing children to react to children with Autism independently during pretend play activities and multi-exemplar video modeling to encourage unscripted initiations of children with Autism. Through Peer Mediated Intervention, typically developing peers are taught how to initiate social interactions and respond to children with Autism in natural settings. Study number [2] also investigated the effects of peer intervention on the social interactions of children with Autism. In peer-mediated intervention studies, typically developing children were trained to engage children with Autism in positive and prolonged social exchanges. Peer interventionists are taught to direct particular social techniques such as invitations to play, offer of assistance, offer to share, and displays of affection to children with Autism in such research. Study number [3] used two interventions (i.e., preferred interest activity and preferred interest activity with peer supports) to investigate the effects of a preferred activity with peer support intervention package on the social behavior of preschoolers with Autism and their typically developing peers.

The iPod Touch TM was employed as a Speech Generated Device (SGD) in study number [4] for Functional Communication Training (FCT). The study’s aims were to evaluate the effects

of generalizing and maintaining acquired communication repertoires and social initiations with peers.

Study number [1] will look at the efficacy of a complete peer network intervention, which includes peer training and direct teaching, on the social communication of young children with moderate to high functioning Autism. The LEGO® play intervention was embedded in LEGO® construction activities is designed to Improve Social Interactions among young children in the 6th study. The last research, like the second, employed peer-mediated intervention to explore the effects of the intervention on replies, initiations, and peer interaction.

Table 4

Description of the interventions

Reference	Intervention	Duration	Frequency of sessions	Session Length
1	Multicomponent Peer-mediated Intervention	5 weeks	Four times per week (n=15)	Two 4-min play sessions, 20 min apart
2	Peer-mediated Intervention	5 weeks	Weekly session (n=12)	Around 20 min, two 10-min
3	1.Preferred activity Intervention, 2. Peer support Intervention	5 weeks	Four times per week (n = 5–8)	Peer training session (20–30 min), 15-min play session
4	iPod Touch™ Technology as Communication Devices	6 weeks	Twice a week (n=11)	30 minutes
5	Comprehensive Peer Network Intervention	6 months	Three times per week (n= 47-50)	Around 25 to 30 min
6	Peer-mediated LEGO® play Intervention	14 weeks	Twice a week (n= 28-31)	Around 40 min
7	Peer-mediated Intervention	4 weeks	Three times per week (n= 12)	Around 20 minutes

7.3 Outcomes of interventions

Even though all of the studies included in this paper aim to improve peer interaction between children with autism and their peers.

The seven included studies had peer interaction as one of their outcome measures, which were measured using various scales or indices. The study conducted by Dueñas et al. (2020) had outcome measures frequencies of unscripted verbalization as one of their outcome measures.

The researchers were curious whether children with Autism began to deviate from scripts over time. Social Initiations and Replies were an outcome variable in five articles (1,3,5,6,7), which were used to describe children with Autism's social initiations and responses during baseline, intervention, maintenance, and generalization.

Table 5

Outcomes of interventions

Reference	Peer Social interaction	Social Initiations and Responses	Unscripted Verbalizations	Positive effect of the intervention
1	☑	☑	☑	☑
2	☑			☑
3	☑	☑		☑
4	☑			☑
5	☑	☑		☑
6	☑	☑		☑
7	☑	☑		☑

7.4 Effect of preschool-based interventions on child's peer interaction

To answer the second question of this study, the present section examines the effectiveness of the interventions on the peer interaction of children with Autism.

Based on the study by Dueñas et al. (2020), the multicomponent PMI increased social communication exchanges between children with Autism and typically developing peers. The multicomponent intervention had an immediate effect on social communication exchanges for this dyad. The overall social communication exchange level was significantly above baseline and averaged 10 social communication exchanges (range: 4–16).

Katz et al. (2013) examined the effectiveness of a peer-mediated social intervention in preschoolers with autism, and their findings were significant and encouraging. Primarily, the intervention enhanced social engagement among children with autism. In particular, the three children with Autism significantly increased their interactions with two typically developing peers during play sessions. Furthermore, these gains were maintained in a maintenance test

held 4 to 5 weeks after the end of the intervention. The current study found that children with Autism experienced longer and more sustained extended interactions. The effectiveness of the intervention was investigated via visual inspection of the data and calculation of the percentage of nonoverlapping data points (PND), as described by Scruggs and Mastropieri (1998). Result showed that during the play sessions, the number of extended interactions increased significantly over baseline.

The research carried out by Xiaoyi Hu et al. (2021) was the first study to examine the impact of an intervention package consisting of a preferred activity and peer support on preschoolers with Autism and their typically developing peers. Results revealed that Both intervention conditions successfully increased initiations, responses, and social play in children with Autism. With the implementation of Intervention 1 and 2, the peers' social interaction behaviors increased quite significantly from the baseline (Tau-U = .92; p = .00 for Yaoyao's peers and Tau-U = .94; p = .00 for Baobao's peers).

Likewise, the study by Mancil et al. (2016) (IN 4) concluded that the iPod Touch™ promotes higher peer interactions. The overall peer social engagement duration was most significant for the iPod Touch™ condition. Within two weeks, the participants were able to use the iPod TouchTM AAC device efficiently. All participants started initiating and responding to each other more frequently. Peer interaction increased in magnitude during the iPod Touch™ condition, with interactions lasting an average of 7 minutes (range, 5–9 minutes per 30-minute session). The generalization duration average and ranges were higher than during the initial intervention and maintenance conditions conducted prior to the generalization data.

Effects of a comprehensive 2-year peer network intervention clearly show that children enrolled in the peer networks intervention grew more in initiations to peers during non-treatment social probes and during generalization probes in natural settings than participants in the comparison group. During treatment sessions children showed more increases in total communication to peers the longer they were in the peer networks. Result showed the mean scores over the two-year time period for initiations, responses, and total communications with peers. Significant differences were noted for the experimental group for growth over time (from the beginning of Kindergarten through the end of First grade) compared to the control group for initiations to peers during non-treatment social probes (b = 0.022; SE = 0.010; p = .033; see Fig. 1 top panel), but not for responses (b = -0.007; SE = 0.009; p = .482; see Table 4) or total communication (b = 0.010; SE = 0.007; p\.164). The results also indicate that the total number

of communicative acts was significantly affected by the length of time in the peer networks intervention. These results suggest that children with Autism are more likely to engage in more communicative acts the longer they are in the peer network intervention (IN 5).

Study results by Xiaoyi Hu et al. (2018) (IN 6) indicated that all three children with Autism responded and initiated social interactions more frequently after completing the intervention. There appears to be a functional relationship between peer-mediated LEGO® intervention and the social interactions of children with Autism. Results showed that, during baseline, social initiations and responses were at a low level but significantly increased under the intervention conditions with an ascending trend for all three children. Peers delivered a steady level of prompts with a gradual descending trend throughout each intervention session. Among the children with ASD, the peer-mediated LEGO® intervention clearly had a positive effect on social interactions.

As part of the analysis, Katz & Girolametto (2015) (IN 7) examined a child's responses and initiations across play contexts of playdough and block play (10 minutes each). The effectiveness of the intervention was examined by comparing the children's participation in the different phases of data collection, that is, during baseline, during the last three implementation sessions, and during the maintenance sessions. Following the intervention, all three target children demonstrated improvements in their responses and initiations to their peers during the intervention. Furthermore, they maintained these gains four weeks later and generalized their initiation and response skills to an untrained peer.

8. Discussion

A total of seven articles studied different interventions aimed to improve these aspects, and the findings suggest that support programs for children with Autism are effective in enhancing social interaction.

8.1 Reflection on findings

The current review includes different interventions such as Peer-mediated intervention, preferred Activities with Peer Support, iPod Touch™ Technology as Communication Devices, and Peer-Mediated LEGO® Play intervention. Regardless of the differences in their activities, they all followed a defined goal or purpose that led their actions and interventions. They all applied the intervention to improve peer interaction between children with Autism and their peers. All of the studies included in this paper aim to improve peer interaction between children

with autism and their peers. Moreover, research conducted by Dueñas et al. (2020) (IN1) had as one of their outcome measures frequencies of unscripted verbalization. The researcher attempts to see whether children with Autism started straying from scripting over time.

8.2 Discussion in Relation to interventions

The current review includes different interventions such as Peer-mediated intervention, preferred Activities with Peer Support, iPod Touch™ Technology as Communication Devices, and Peer-Mediated LEGO® Play intervention. Regardless of the differences in their activities, they all followed a defined goal or purpose that led their actions and interventions. They all applied the intervention to improve peer interaction between children with Autism and their peers.

In peer-mediated intervention, typically developing children are trained to engage children with Autism in positive and prolonged social interactions. Moreover, peer interventionists are instructed to direct specific social skills such as invites to play, offering support, requests to cooperate, and sympathy to children with Autism. Peer Mediated Intervention methods must be technically friendly for peer implementation. The activities chosen should be age- and developmentally appropriate for all children involved. In addition to having instructional goals, routine and play activities should also be entertaining and engaging to children.

The research included in this review revealed statistically significant findings for peer interaction. Peer-mediated intervention significantly enhanced social engagement among children with autism. The effectiveness of the intervention was examined by comparing the children's participation in the different phases of data collection, that is, during baseline, during the last three lamentation sessions, and during the maintenance sessions. In addition, all target children demonstrated improvements in their responses and initiations to their peers during the intervention. Through the PMI multi-component program, social communication exchanges between typically developing peers and children with Autism increased with minimal adult involvement during play sessions.

Findings from current studies are in the line with previous research which indicated social skill interventions combining peer support strategies (Hu & Lee, 2018) and the children with ASD's preferred interests and activities (Watkins et al., 2019) are effective for improving social interactions among preschoolers with ASD and their typically developing peers. It is conceivable that engaging in preferred activities enhances an ASD child's desire to engage in social interactions, play with others, and participate in group activities, leading to an increase

in social behavior. (Koegel R. L., 2006). In comparison to baseline play sessions, the preferred activity procedures were beneficial in improving interaction and involvement in social play between the child with ASD and typically developing peers. This is also in line with previous research that showed that by incorporating preferred activities of children with ASD into activities and modeling behavior, socialization with peers can be improved (Watkins et al, 2019).

Increased interaction duration also confirmed previous studies finding that used peer interventions to improve children's social interaction abilities (Banda et al., 2010; Keen et al., 2001). There have been very few studies on the length of extended interactions (Conroy et al., 2007; Nelson, 2007). The finding in the current studies which showed that children with ASD increased the length of their interactions is significant because it reflected the quality of children's interactions that are maintained over time.

In this study, video modeling is used to teach typically developing peers how to respond to children with ASD in order to promote social initiations. In addition, a multi-component PMI that includes video modeling shows promise for teaching children with ASD how to initiate relationships with other children. The current study found that children with ASD and typically developing peers interacted more during play sessions after participating in the multicomponent PMI. In addition, children with ASD increased their social initiations toward their typically developing peers. In contrast to previous research, children with ASD displayed more social initiations but less positive responses to social interactions (Dueñas et al., 2019; MacDonald et al., 2009).

As part of current review, LEGO® play intervention was incorporated into LEGO® construction activities to improve social interactions among young children. LEGO® play is highly structured, predictable, and systematic, and many children, particularly those with Autism, enjoy it. For example, constructing a LEGO® model is an easy and natural way to reinforce what the child has learned. The study was the first attempt to assess how a peer-mediated LEGO® play intervention affected preschool children with ASD's social initiations and social reactions during group play in an inclusive environment. The study's findings supported earlier research (Katz & Girolametto, 2013) showing that PMIs enhanced social connections for children with ASD in inclusive environments. Likewise, this study used structured LEGO® construction activities in a small group setting, similar to previous studies (Legoff, 2006). While in previous studies the therapist played a more directive role, the adult

in the current study assisted the children in choosing their preferred LEGO® models and transitioning to a different role with another task model. The intervention was also conducted in a natural setting, a regular preschool where other children were present, rather than a clinical setting with relatively strict parameters. The study provided evidence of the effectiveness of the peer-mediated LEGO® intervention in enhancing social connections for preschoolers with ASD in an inclusive setting.

The current study's findings are in line with earlier research that have showed improvements in reactions after participating in peer-mediated interventions (Kalyva &Avramides, 2005, 2005;McGrath et al., 2003). As a result of the intervention, the children with ASD increased the frequency of their responses and initiates to untrained peers. It is considered important for an intervention to generalize acquired skills (Timler et al., 2007). In fact, this type of intervention aims to make sure that the target children can employ their newly acquired skills in their natural social context and not just with a small group of trained peers. Since the target children generalized their responses and initiated play with untrained peers, peer-mediated intervention may be an effective strategy for improving such play skills with a variety of play partners.

8.3 Discussion in Relation to Bronfenbrenner bio-ecological model:

The interventions in all studies were implemented in preschool classrooms, a natural context. The bio-ecological theory of development emphasizes that the environment plays a significant role in an individual's development, in addition to biology (Bronfenbrenner & Morris, 2006). A person and their environment affect each other in both directions. In terms of child development, the combination and efficiency of different elements are comparatively crucial (Bronfenbrenner & Morris, 2006).

The microsystem includes the interpersonal relationship of the child, and it is the immediate environment of the developing person where direct manipulation and face-to-face communication can occur (Bronfenbrenner, 1994). According to the bio-ecological model, one of the child's microsystems is a preschool setting where consists of peers, teachers, and other workers and Support provided within teachers and peers in preschool is located on the *Micro level.* That includes children’s *participation* in peer interaction, Social Initiations and Responses, and student-teacher interactions.

Preschool is the perfect setting because it is at an early age. It is a micro-context with enduring social relations, and there is a great potential to change behavior and function, as the study results indicate. In preschool, preschool teachers play an essential role. The social interaction between peers in preschool is an important component of learning. Teachers can discuss educational topics, engage students, and build a supportive school climate through peer interaction. Hence, it is crucial to know how they can adjust the environment to provide appropriate support to improve peer interactions in the classroom. Peer interactions also play a vital role in the learning process as they are members of the child's closest environment. Children learn how to work together and communicate during preschool, and they gain insight into themselves and others.

The included studies stated that peers had an essential role in the intervention and peer-based intervention is effective in promoting peer interaction for children with Autism.

8.4 Methodological considerations, study limitations

8.4.1 Methodological considerations

In this systematic review, all processes were reported in detail, enhancing transparency and allowing the study to be replicated by another researcher. The study, however, has some methodological limitations.

First, it is essential to note that only one researcher carried out the research for a short time. Typically, these sorts of studies need more time to be completed adequately. Despite discussions with another researcher regarding the selection of articles, the study and quality assessment were conducted by one researcher.

Another methodological limitation was that the author screened the papers based on title, abstract, and full text, which might have resulted in the removal of publications that fit the inclusion criteria. On the other hand, peer-reviewed literature may enhance the accuracy of a study. The use of predefined inclusion and exclusion criteria may have resulted in missing valuable content. Some relevant studies may have been eliminated after being evaluated at the title-abstract level (Jesson, 2011).

Furthermore, the method of data extraction was developed by the author. Several modifications were made to it during its development due to feedback received, but it was not adequately validated. However, since all the shown results information is contained within the protocol, it appears to be a good design.

8.4.2 Study limitations

This study has several limitations that need to be considered when generalizing its findings. The first is the sample size (n=7), which is a limited number of articles were included to address the study topic. This is due to a lack of research in the field. A larger sample would have enabled stronger and substantiated conclusions. The population of the studies included also presented some limitations. The majority of the studies selected had a small number of participants.

Following that, two of the seven articles were written by the same research groups, with the same first and second authors, Esther Katz, and Luigi Girolametto. Both studies investigated the effectiveness of Peer mediated intervention in goal setting, but they had different aims, and they used different samples and study designs. Evidently, choosing research from similar research groups can undermine the reliability of the results. In spite of this, both articles were included due to the restricted literature in this field.

Final point: there is a risk of methodological limitations here, and the selected articles can be viewed as a limitation. Quality assessment was conducted using the checklist "Critical Review Form - Quantitative Studies" developed by Law et al. (1998). In some cases, the quality of the articles isn't flawless (see Quality Assessment), and not all articles have been reviewed by ethics committees.

8.5 Practical Implications

Despite numerous limitations, the results of this systematic review indicate the importance of preschool-based intervention for children with Autism. The first major implication of the results is that after a brief intervention, children with Autism were found to have increased and maintained their peer interactions. One of the core deficits in Autism is social interaction impairment, and the children's gains in responses and, in particular, initiations address this deficit. These findings were satisfied, and children with autism who interact with their peers more frequently receive more social and language feedback. (Katz & Girolametto, 2015). For children with Autism, increasing peer initiations outside of adult-directed, small group activities is a significant achievement. The findings support previous research that shows that social skills interventions for young children improve specific abilities and may encourage generalization (Kamps, et al., 2014). These interventions, which use peers as a resource, also allow children with Autism to form strong peer interactions from an early age. Children with Autism and their typically developing peers may benefit from preferred activities and peer

assistance to establish and maintain interaction. This intervention is straightforward to administer and fits into the daily routines of regular preschool settings.

8.6 Future research

There are several implications for future research based on the findings of this systematic review. According to these studies, the program had a positive short-term effect on children's extended interaction with peers. Future research should include short- and long-term follow-up sessions to assess the intervention's maintenance effect. The interventions were carried out by trained researchers; the authors emphasized the importance of training school personnel to carry out the interventions in order to improve generalization in future research. Hence, future studies may benefit from engaging all the target children's caregivers. This may support generalizing strategies across adults and contexts within the early childhood education setting. In addition, this intervention model may be further developed with the parents because they are well suited to implement play sessions with the target child's siblings and peers at home. It would also be beneficial to repeat this intervention with more children with Autism to increase generalizability.

9. Conclusion

Several interventions, such as Peer Mediated Intervention, LEGO® play intervention, preferred interest activity and preferred interest activity with peer supports, and iPod Touch Technology as Communication Devices, have been identified in various research. All of the reviewed studies found that peer interaction interventions improved the social interaction of children with autism. Interactions, initiations, and responses to their typically developing peers, in particular, increased considerably. As a result, increasing child initiations to peers outside of adult-directed, small group activities is a considerable achievement for children with Autism. Facilitating the development of peer interaction skills in Children with Autism incorporated into preschools and childcare facilities is thus an essential goal.

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11. Appendix

Appendix A: Table of Final Searches in Each Database

Database	Search words	Limits	Results
PsychINFO	noft("Peer interaction" OR "Peer relationship" OR "Peer Acceptance" OR "Peer participation" OR "Peer communication") AND noft("autism" OR "autism spectrum disorder" OR "asd" OR "Preschool" OR "Preschool Children" OR "preschoolers") AND noft("Intervention" OR "Early intervention" OR "Preschool-based intervention" OR "Early Childhood education" OR "Preschool education" OR "Early Childhood intervention") AND la.exact("ENG") AND pd(20100101-20221231) AND PEER(yes)	Publication date: 2010 – 2022 Source type: Peer Reviewed Journal Language: English	110
Eric	noft('early intervention in preschool' OR 'Early Childhood Education OR 'preschool education' OR 'early Childhood intervention' OR preschoolers OR preschool OR 'preschool-based intervention') AND noft(autism OR 'Autism spectrum disorder') AND noft('peer interaction' OR 'peer relation' OR 'peer participation' OR 'peer communication' OR 'peer acceptance') AND PEER(yes) AND stype.exact("Scholarly Journals") AND la.exact("ENG") AND pd(20100101-20221231) AND PEER(yes)	Publication date: 2010 - 2022 Source type: Peer Reviewed Journal Language: English	107
Web of Science	"Peer interaction" OR "Peer relationship" OR "Peer Acceptance" OR "Peer participation" OR "Peer communication" (Topic) and "autism" OR "autism spectrum disorder" OR "asd" OR "Preschool" OR "Preschool Children" OR "preschoolers" (All Fields) and "Intervention" OR "Early intervention" OR "Preschool-based intervention" OR "Early Childhood education" OR "Preschool education" OR "Early Childhood intervention" (All Fields) and Articles (Document Types) and English (Languages) and 2010-2022 (Publication Years)	Publication date: 2010 – 2022 Source type: Peer Reviewed Journal Language: English	86

Appendix B: Inclusion and exclusion criteria

	Inclusion criteria	**Exclusion criteria**
Population	Children diagnosed or at risk for Autism attending mainstream or inclusive preschool, Children diagnosed or at risk for autism in preschool age.	Parents of children with disabilities, Adults with disabilities, Children in special preschools, Typically developing children, Children with other disorders
Intervention	Interventions that focus on peer interaction promotion, Interventions or programs provided within the preschool setting	Medical care, psychiatric care, Interventions conducted by health professionals or therapists, Parents implement interventions
Outcome	Peer interaction/peer communication of children with Autism	Studies focus on risk factors; studies exclusively examine the engagement of children in daily activities with family and adults, social skills, social competence
Study design	Quantitative and qualitative studies, Mixed methods, Case studies	Literature reviews, Systematic reviews
Publication Type	Peer-reviewed scientific research articles or doctoral thesis, Publication 2010-2022, Language: English	Books or book chapters, reports, Conference papers

Appendix C: Data Extraction Protocol

Paper identification	Author Year Title Journal Country Study aim Research question
Participants	Number of participants Drop out Sampling characteristics Age Gender (male/female) Recruitment
Intervention	Type of intervention Time frame/duration Intensity of intervention
Research design	Qualitative Quantitative Mixed
Data collection	Interviews Observations Questionnaire
Outcome	Outcome Data analysis Ethics Results Conclusion Limitations

Appendix D: Quality Assessment (Quantitative)

Identification of paper	Author Title Journal Country Publication year
Was the purpose stated clearly?	Yes/No/ Cannot tell
Does the study apply to your aim and research questions?	Yes/No/ Cannot tell
Was relevant background literature reviewed?	Yes/No/ Cannot tell
Was the research design appropriate for the study questions?	Yes/No/ Cannot tell
Was the sample described in detail?	Yes/No/ Cannot tell
Was sample size justified?	Yes/No/ Cannot tell
Was the sample informed about the study? Was informed consent obtained?	Yes/No/ Cannot tell
Were the results reported in terms of statistical significance?	Yes/No/ Cannot tell
Was the analysis of results appropriate?	Yes/No/ Cannot tell
Were the results statistically significant (i.e., p<.05)?	Yes/No/ Cannot tell
Was an appropriate conclusion given according to the study methods and results?	Yes/No/ Cannot tell
Score on the quality assessment protocol:	