

The importance and challenges of observing social interactions in autistic preschoolers during inclusive educational settings: A scoping review

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Abstract

Background and aims: A growing number of autistic children have access to inclusive education programs as early as kindergarten. However, little is known about how they actually participate in social interactions and develop their communicative skills according to the parameters of this environment. The aim of this article is to review observational studies on this topic and critically analyze their methodological choices by arguing on the aspects of communication skills noted in the observation grids. Disparities in the information collected depending on the method used have implications for understanding and supporting autistic children in an inclusive school environment.

Methods: Observational studies on social interactions of autistic preschoolers within inclusive preschool settings were scoped. The studies were analyzed according to the following parameters: aims of observation, method used for coding, communication partners considered (adults and peers), type of children's social engagement (initiatives and responses), diversity of communicative forms and communication functions, distinction and comparison of interactional contexts related to the activities, and whether changes linked to developmental variables are studied on an interindividual or longitudinal basis.

Results: Seventeen studies using the observation method in inclusive preschool settings were identified. Recording methods are mostly based on video recording. The coding grids mainly focus on autistic children while partners' behaviors (adults, peers) are often coded in less detail, thus providing little information on their dynamic role in the interactions. Overall, autistic children were found to initiate interactions much less often than they respond to it. The data generally distinguish the communicative forms used by children and indicate a predominance of nonverbal means at preschool level. However, a few studies coded communicative functions, whether they are addressed to children or produced by them. In addition, very few studies compare interactions across activity contexts. In addition, very few studies compare interactions across activity contexts. Results of some studies showed that children initiated interaction more frequently during free play than during work activity, but results are heterogeneous. Developmental trajectories in social skills seem to be associated with the severity of autism and language skills, but longitudinal designs are still rare.

Conclusions and implications: Direct and fine-grained observation in the classroom is a key source of information about how communication takes place in preschool-inclusive settings. The data, despite some methodological challenges, offer opportunities for better adjustment based on professional objectives. Our review highlights the importance of offering occasions for initiatives to autistic children and training of neurotypical peers to better interact with autistic children and promote verbal communication. Further observational studies are needed to use more microanalytic measures of the functional quality of social interactions in autistic children, including joint comparisons between partners (adults vs. peers) and across contexts (e.g., play vs. structured development) so that appropriate strategies can be proposed in inclusive preschool settings.

Keywords

Autism spectrum disorders, observation method, social skills, inclusive preschool education, naturalistic observation

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Introduction

As supported by the United Nations, inclusive education is a recommendation for all children including those with neurodevelopmental disorders (Watkins, 2014). Following this recommendation requires schools to adjust their systems of teaching and learning to meet the needs of all learners despite their diversity. It is well known that social understanding, interpersonal adaptation, and behavioral adjustments represent the main challenges in autism spectrum disorder (ASD) while being prerequisites for many school activities and learning strategies. Therefore, the implementation of inclusive education for autistic children requires a particular investment in supporting social skills with teachers and peers, beginning at the preschool level. This support must be closely accompanied by regular and appropriate assessments of their progress in sociocommunicative functioning within school settings. This narrative review critically analyzes the current direct observation methods used to study the social functioning of autistic children in inclusive preschool contexts. Our first objective is to identify the advantages and disadvantages of direct observation methods and to argue the case for aspects of observation grid analysis. The aspects observed in the communication influence the results obtained in the studies which in turn may influence decisions in supervision and pilot tools that could optimize the chances of successful implementation of an inclusive, but also appropriately individualized curriculum.

The degree of impairment or relative strength in fundamental early social skills, such as joint attention, imitation, shared social play, and nonverbal communication is associated with later language skills, theory of mind externalizing and internalizing behaviors, as well as academic success (Boonen et al., 2014; Charman, 2003; Charman et al., 2000; Dawson et al., 2004; Mundy, 2018; Toth et al., 2006; Vaughan Van Hecke et al., 2007). These impairments in social interactions and cognitive abilities may influence later school adjustment and performance, both socially and academically.

Even though autistic students face adaptive challenges when entering regular school programs, inclusive programs seem to have positive effects on language and intellectual development (Harris et al., 1991). Several author's analyses are in favor of inclusive placements, which seem to offer more positive benefits to autistic children than specialized settings when children have at least some competencies in expressive and receptive communication (Nahmias et al., 2014; Peetsma et al., 2001).

While the foregoing studies provide insight into the effectiveness of inclusive curriculums, they all use before-and-after comparisons on standardized measures to evaluate this effectiveness without showing how the effects of inclusion occur step by step. Ecological studies are needed to better understand how children interact and

progress in natural environments and how they adapt to variations in contextual constraints. Observing the course of the interactions during classroom activities such as play or learning is important to get fine-grained information about which parameters of this environment modulate the opportunities, forms, and functions of social behavior (Pellegrini, 2001).

Pioneering studies of social functioning (not just dysfunctions) of autistic children in their familiar environment date back to the 1980s. Wetherby (1986) and Loveland et al. (1988) constructed observation grids based on pragmatic theories of social skill development. These grids were designed to encode interactions by characterizing behaviors not only as initiatives or responses, or their forms, but also their functions. Adopting an ecological approach, they considered the diversity and dynamic reciprocity of communicative interpersonal intention and their contextual variations (e.g., agreeing/refusing, giving direct attention, requesting, providing information, and social turn taking) manifested by both children and their interlocutors. For example, Wetherby (1986) highlighted the fact that autistic children may use a heterogeneity of communication mechanisms and have a limited repertoire of functional communication, using noncommunicative acts such as echolalia to communicate. However, these studies focused on children who were videotaped at home in their family environment. They did not address the school environment, where the first years of integrated learning and social development take place outside the family. A study by Binns et al. (2022) showed that autistic preschoolers interact more with adults during gross motor activities than during symbolic play. These findings highlight the importance of considering the contexts and types of activities, but this study was not conducted in an education setting but in a laboratory.

Indeed, the majority of studies assessing the impact of inclusive education on autistic children use standardized methods before and after the inclusive curriculum to evaluate children's competencies but rarely collect direct observational data about in situ sociocommunicative functioning throughout the schooling process. Collecting data from multiple methods, such as standardized tests, parent and teacher interviews, and observations of students in natural settings, allows for more representative findings (Koegel et al., 2012). Because the collection and coding of observational data can be expensive and time consuming, it is important to carefully examine the methods and findings of previous research to highlight their relevance and limitations, as well as their potential implications for educational practices in inclusive settings.

Present study

A detailed analysis of how autistic children interact and communicate in classroom activities may be particularly

useful for professionals working in inclusive settings. This type of research is likely to provide guidelines for educational adaptations based on objective evaluations with the necessary rigor and distance. Despite the number of studies evaluating social interactions in inclusive school settings, whether in routine inclusive practice or to evaluate more specific interventions, no review to date has examined the variety and suitability of methods for collecting observational data. In observational studies, the quality of the observations will influence what is known about the way autistic children interact and develop social skills in school contexts and about the impact of intervention programs on their sociocommunicative development. Examining the quality of prompts or responses provides additional information about how children indicate their acceptance or refusal according to the nature and developmental complexity of the social intentions involved, and how interventions can be delivered to improve the quality of communication. To what extent do observational studies to date provide fine-grained information about how autistic children interact and communicate with adults and peers in the classroom? How is social communication recorded and social behavior coded to capture the dynamics of social interaction in inclusive preschool programs? These are important questions to address when attempting to evaluate the benefits of inclusive education programs and the need for curriculum adjustments. Therefore, the main aim of our review is to analyze studies that use direct observation to characterize the frequency and quality of social interactions that autistic children engage in with their different partners in inclusive preschool settings, using a series of questions as a framework:

- (a) What are the researchers' main goals in using this observational method (characterizing specificities of autistic children's functioning in the preschool environment? Assessing the impact of a specific intervention in this context?)
- (b) What methods are used to record social interactions and what are the advantages of each method?
- (c) How are the interactional dynamics of social behaviors with the child's different school partners (adults/peers) analyzed?
- (d) What place is given in the recording and coding system to the quality of social interactions such as social engagement (initiatives and responses), communicative forms, and function?
- (e) Which situations are selected for observation and is the child's variability of sociocommunicative functioning compared across contexts?
- (f) Finally, what is the place for longitudinal designed studies and what are the developmental variations or changes in social skills during the preschool period?

Methods

Search procedures and inclusion criteria

To include studies in this review, we conducted systematic searches in three online databases: Google Scholar, PsychINFO, and PubPsych. Searches were restrained to peer-reviewed articles written in English. The combination of key words used was "'ASD OR autism,' AND 'observation' OR 'naturalistic method' OR 'ecological observation' AND 'social skills' OR 'social interaction' OR 'social communication,' AND 'preschool classroom' OR 'preschoolers in classroom,' OR 'kindergarten.'" Following this step, some references were included manually from bibliographies of key articles. There were no restrictions placed on the year of publication or the publication type. Our review research took place within the period of May 2019 to March 2022.

Studies meeting the above requirement were included on the basis of the following criteria: (1) they were empirical studies using the direct observation method; (2) they evaluated social interactions in inclusive preschool programs (with or without testing a specific intervention in this context); and (3) the participants were children with an ASD diagnosis, from preschool to early school age (or at least one subgroup of children is aged 2–6). We identified 17,800 sources, of which 36 studies were read in their entirety, 11 articles were removed due to context (children were filmed in a laboratory, therapy room, specialized settings, or home) and eight were removed due to the age criteria not being met. Finally, a total of 17 studies were selected and reviewed. Only studies using systematic observation were included.

Reviewing procedures

The identified studies were evaluated according to several features related to methodological rigor, quality, and breadth of measurement. The first parameter relates to the characteristics of the participants, such as gender, age, severity of autism, and county in which the study took place. Autism severity and developmental quotient level are important to consider because social skills and social motivation are related to autism severity and to cognitive and to communication age (Charman, 2003; Hilton et al., 2007). The second parameter related to the authors' main purpose of using the observation method. In some studies, the aim is to characterize autistic children's social functioning in a preschool environment, with or without comparing them with their typical peers. Other studies employ this method to evaluate a particular intervention program. The next parameter focuses on the method used to record behavior, as using video or live coding in the field does not allow for the same reliability controls or coding accuracy. The subsequent parameters refer to how the target concepts were operationalized in the observation grid used in the study. Since the definition and assessment of sociocommunicative

behaviors in autistic individuals are heterogeneous (Matson & Wilkins, 2007; Tajik-Parvinchi et al., 2021), their transposition in a grid may vary substantially across studies therefore leading to different results regarding the quantitative and qualitative aspects of interactions between autistic children and their partners during preschool classroom activities. Thus, we noted whether the coding focused only on the children's target social behaviors or also on the behaviors of social partners (adults or peers) and, thus, on the dynamic context of interactions.

We then examined how the quality of social skills was analyzed. Some studies mainly count the number of initiations and responses, while others distinguish between communicative forms and/or functions of interactions. Indeed, simply counting the number of social exchanges and even noting their modality (such as verbal vs. nonverbal communication) can only provide a limited picture of children's skills, vulnerabilities, and potential development over time. Forms of communication are mentioned when the observation grid includes different aspects of the means of communication. Communicative forms can be speech, vocalization, motor acts, gestures, picture exchange, gazing, or pointing. Regarding the function of communication, it refers to the intention of social exchange. Some communicative functions relate to basic behavior regulation such as requesting an object or action, while others aim at social sharing up to the sharing of mental attitudes such as requesting information or commenting. Examining the extent to which the coding system differentiates these functions is an important issue for the informative quality of the results. In addition, because kindergarten includes a variety of situations with social demands (e.g., classroom, recess, and lunch), we examined whether the observational studies included comparisons across school contexts. We also examined whether studies that focused on classrooms compared the quality of interactions in activities that may have different effects on children's social engagement, such as free play, adult-directed activities, or routine activities. Finally, we examined whether the studies took into account children's developmental trajectories and variables. Our initial interest was in longitudinal studies, but due to their scarcity, we also included cross-sectional and short-term studies. The aim was to highlight the parameters of sociocommunicative skills that vary over time or with developmental levels in autistic preschoolers. Criteria for considering improvement in social functioning included improvements in initiations and responses, forms of communication, and diversification of functions.

Results

Characteristics of participants

Participants were preschoolers with a diagnosis of autism attending inclusive curriculums. In total, there were 687

participants (Table 1), with the number of girls not always clearly specified (≈ 116). Participants ranged in age from 30 to 120 months. In some studies, participants were older than 6 years, but only data from preschool groups was considered. The studies were conducted in different countries, with a substantial part coming from the United States (seven in 17 studies) (see Table 1). It is obvious that studies were conducted in developed countries where the educative inclusion of autistic children is a national strategy. Information on the severity of autism among participants and the source of this assessment was heterogeneous across studies. Four out of 17 studies did not mention clinical severity. Among the others, 12 studies used standardized scales (CARS or ADOS), but six of these studies did not specify the results. Six studies provided the degree of severity, with children presenting severe autism in two studies, moderate autism or high functioning profiles in four studies, and different levels of severity in one study (see Table 1).

With regard to developmental level, here again, the information was based on a diversity of tools or unspecified. In three studies, the participants had no developmental delay. In five studies, mental age was not mentioned (four of these studies also failed to mention the severity of ASD). Seven studies provided developmental data showing a developmental delay, and in one study (Chiang & Lin, 2008) five of the participants had a developmental delay, three others they did not had, and finally six participants were not evaluated (see Table 1).

Table 2 summarizes the parameters systematically analyzed and reviewed in each study.

Aims of researchers in using the observation method

In the majority of studies (12 out of 17), observations were conducted in inclusive programs without supplementary intervention (see in Table 2). These studies were designed to understand how autistic children interact with peers and adults. Regarding the purpose of the observation, in five studies the observation was done to evaluate an intervention method, mostly based on social skills. The purpose of the observation and the comparison of different groups of children are discussed with more detail in the next sections.

Recording method

Observing social interactions in schools involves making choices on where and how to collect the relevant behaviors. The primary decision to be made is whether to videotape the interactions or to code live on-site. Each method has potential advantages and disadvantages in terms of the quality and reliability of information collected, and it also has practical constraints (e.g., authorizations for filming minors, the cost of coding time, etc.). Most studies reviewed used a videotaped recording method (14 out of 17), with one study using vocal recording and sensors for movements

Table 1. Characteristics of participants' intervention programs in the included studies.

Included studies	Country	Total n (n female)	Mean age in months	Severity of ASD	Developmental measures
Anderson et al. (2004)	New Zealand	10 (1)	64.2	Severe ASD (CARS $M = 40.6$)	Developmental delay (WISC-III: 28–86)
Bauminger-Zviely et al. (2017)	Israel	G1: 21 (1) G2: 30(3)	59.38 54.83	High functioning ASD	No developmental delay (Mullen's scale: 108)
Bauminger-Zviely and Shefer (2021)	Israel	50 (9)	54.28	Moderate (ADOS $M = 6.86$)	No developmental delay (Mullens scale: 97.17)
Boyd et al. (2011)	USA	8 (2)	58.88	Moderate (CARS: $M = 30.06$)	Not mentioned
Chiang and Lin (2008)	Australia and Taiwan	Preschool age group = 14 (not mentioned)	31–72	Severe and Moderate (CARS > 37 and CARS < 37))	5 with developmental delay, 3 without developmental delay, and 6 not evaluated. (ABI scale)
Clifford et al. (2010)	UK	41 (3)	45.2	Severe (ADOS: $M = 14.8$)	Developmental delay (nonverbal Mullen scale: 27.5)
Fasano et al. (2021)	USA	56 (22)	50.14	Not mentioned	Not mentioned
Gutierrez et al. (2007)	USA	3 (1)	56	Not mentioned	Not mentioned
Hume et al. (2019)	USA	53 (12)	47.52	ADOS used; results not mentioned	Developmental delay (Mullen scale = 65.53)
Jamero (2019)	Philippines	9 (1)	26.6	Not mentioned	Not mentioned
Kaale et al. (2014)	Norway	G1 : 34(8) G2 : 27(5)	47.6 50.3	ADOS used; results not mentioned	Developmental delay (Mullen scale: 25.6)
Kamps et al. (2015)	USA	95 (15)	69.6	Moderate (CARS: 32.7)	No developmental delay (PPVT-4: 87.5; VABS communication: 86.7)
Kemp et al. (2013)	Australia	11 (not mentioned)	46.03	Not mentioned	Not mentioned
McGee et al. (1997)	USA	64 (3)	39–52	CARS used; results not mentioned	Developmental delay (63% of ASD students are nonverbal)
Pasco et al. (2008)	UK	91 (10)	82 (but range = 3.11–10.2)	ADOS used; results not mentioned	Developmental delay (Nonverbal mental quotient Mullen's scale = 31.8)
Rice et al. (2016)	USA	G1:10 (2) G2:10 (0) GR10 (3)	30 42 54	CARS used; results not mentioned	Developmental delay (Stanford-Binet Intelligence Scale 4: 29–32; 40–43; 53–55)
Westman Andersson et al. (2013)	Sweden	40 (9)	40	ADOS used; results not mentioned	WPPSI-R and VABS; results mentioned
		Total $N = 687$ (Female ≈ 116 ; 16.89%)			

(Fasano et al., 2021); and two studies used live behavioral recording systems on paper sheets and or a hand timer (Table 2). Among 14 studies used filmed observations, eight studies coded intentions of communicative acts, and four analyzed timing or duration of behaviors. Research that did not use video recording collected more targeted behavioral frequencies focused on certain dimensions of communication (e.g., initiations, or vocalizations), but necessarily captured a more limited range of communication parameters. For instance, Gutierrez et al. (2007) noted in the data sheets the forms of initiations by autistic children toward peers and vice versa. Bauminger-Zviely

and Shefer (2021) qualified social interactions with a more detailed manual coding scale, but their categories mixed aspects of form, function, and frequency, making it impossible to analyze them independently. Finally, Fasano et al. (2021) used automated systems of recorded movements and vocalizations between peers in the classroom to track child's orientation, proximity with peers. Authors put sensors in each corner of the classroom and children wore tags that indicated their location and orientation. Despite the precision and objectivity of these measurements, they did not inform us about the content of interactive exchanges.

Table 2. Characteristics of included studies.

Included studies	Testing a specific intervention?	Recording method	% of double-coded videos	% of interobserver agreement	Scope of child's interactive partners	Partners' behaviors coded?		Initiatives and/or responses	Forms	Communicative functions	Context comparisons	Longitudinal/follow-up design
						Adults	Peers					
Anderson et al. (2004)	No	Video	10%	80%–100% (M = 91.7%)	Adults and peers	Yes	Yes	Distinguished	Yes	Yes	No	No
Bauminger-Zviely et al. (2017)	No	Video	25%	M = 86%	Peers	No	Yes	Distinguished	No	No	No	No
Bauminger-Zviely and Shefer (2021)	No	Real-time coding (hand sheet)	25%	Kappa: 64.7%–100%	Peers	No	Yes	Distinguished	Yes	Yes	No	No
Boyd et al. (2011)	No	Video	23–30%	Formula $A/(A+D)$ % 50–100%	Peers	No	No	Distinguished	No	No	No	No
Chiang and Lin (2008)	No	Videos	23%	Intraclass correlation coefficient and Kappa: 0.91–1	Adults and peers	No	No	Distinguished	Yes	Yes	No	No
Clifford et al. (2010)	Yes	Video	50%	Intraclass correlation coefficient = 0.50–1	Adults and peers	No	No	Distinguished	Yes	Yes	No	No
Fasano et al. (2021)	No	Audio	5% (of audios)	Kappa = 0.71 (M = 86%)	Peers	No	Yes	Confounded	Yes	No	No	Longitudinal (2–5 months) ^a
Gutierrez et al. (2007)	Yes	Real-time coding (hand timer and paper data sheets)	33%	Formula : $A/(A+D)$ % 53%–82% (M = 70%)	Adults and peers	Yes	Yes	Focus on initiatives	Yes	No	No	No
Hume et al. (2019)	Yes	Video	20%	Kappa = 0.79–0.92	Adults and peers	Yes	No	Confounded	No	No	Daily living vs creative arts vs large motor vs circle time vs manipulative play vs pretend play	No

(continued)

Table 2. Continued.

Included studies	Testing a specific intervention?	Recording method	% of videos coded	% of interobserver agreement	Scope of child's interactive partners	Partners' behaviors? (not only child's)	Social engagement: Initiatives and/or Responses	Communication functions	Context comparisons	Longitudinal follow-up design
Jamero (2019)	No	Video	Double-coded all videos	No information for agreement	Adults and peers	No	Distinguished	No	No	No
Kaale et al. (2014)	Yes	Video	18%	Intraclass correlation coefficient 0.67–0.75	Adults	No	Focus on initiatives	Yes	No	Follow-up ^b (12 months)
Kamps et al. (2015)	Yes	Video	23% of	Kappa: 0%–100%	Peers	No	Distinguished	No	No	Follow-up ^b (6 months)
Kemp et al. (2013)	No	Video	22.66%	Kappa = .76–0.77	Adults and peers	No	Confounded	Yes	Free play, vs lunch vs circle	No
McGee et al. (1997)	No	Video	30%	Kappa = 0.79	Adults and peers	No	Confounded	Yes	Free play vs routines vs group activity	No
Pasco et al. (2008)	No	Video	22%	Intraclass correlation coefficient range: 0.59–0.96	Adults and peers	No	Distinguished	Yes	No	No
Rice et al. (2016)	No	Video	15%	Kappa: 51.4%–100%	Adults and peers	No	Distinguished	No	Yes	No
Westman Andersson et al. (2013)	No	Video	25%	Kappa = 0.82–1	Adults	Yes	Distinguished	Yes	No	No

^aLongitudinal design = repeated observations in the classroom without the aim of evaluation of a specific program; ^bfollow-up = observation to evaluate an intervention program at different times over the year (2–4 times).

In all studies, coders were trained before starting observations and there was a measurement of intercoder agreement between at least two observers, on a minimum of 10% of the observations. Two studies did not report the number of double-coded videos. Interobserver reliability was determined using three different methods: Kappa statistics ($n=9$), intraclass correlation coefficient (ICC, $n=3$), or simple percentage of intercoder agreement ($n=2$). Finally, three studies mentioned that interobserver agreement was established, without informing on the method used (see Table 2). In the majority of papers (11 out of 17), values of intercoder reliability were distinguished for the different behaviors but six studies only reported a global average value of agreement. The lowest or most variable intercoder agreements were found among communication forms (ICC range between 0.52 and 0.99); functions (ICC between 0.34 and 1); complex social behaviors (Kappa agreement range =0.53–1) and social games (Kappa agreement =0.77).

Scope of child's interactive partner

Interactions with adults. Regarding children's social partners at school, 10 studies analyzed interactions with peers and adults (Anderson et al., 2004; Chiang & Lin, 2008; Clifford et al., 2010; Gutierrez et al., 2007; Hume et al., 2019; Jamero, 2019; Kemp et al., 2013; McGee et al., 1997; Pasco et al., 2008; Rice et al., 2016), five studies focused only on interactions with peers, and two studies focused only on interactions with adults (Kaale et al., 2014; Westman Andersson et al., 2013) (Table 2). Concerning interactions with adults and peers, children with typical development interacted more often with adults during teacher-led activity and more often with peers during free situations (Booren et al., 2012). However, in our review, when both interlocutors were considered, autistic children generally found to interact less often with peers than with adults, with peer interactions representing 3%–30% of their interactions in classrooms (Anderson et al., 2004; Chiang & Lin, 2008; Clifford et al., 2010; Hume et al., 2019; Pasco et al., 2008; Rice et al., 2016). A current interpretation is that adults are better than peers at adapting communication strategies to children's special needs, although this difference in partners' adjustment is not always empirically explored (see the following section). Among adult partners, interactions with teachers were more often observed than interactions with other professionals, such as support/assistant workers (Clifford et al., 2010). Again, taking into consideration communication partner (peers and adults) of autistic preschoolers is important, since differences in professionals' training and awareness of the disorder, as well as their familiarity with each child's interests and functioning, are likely to influence the occasions and modalities of social communication.

Consideration of adult's behaviors in the coding system. Since social interaction is a result of an exchange between at least two people, the behaviors of both interlocutors should ideally be analyzed. However, coding grids are often child-centered. Even though coding children's responses to adults presupposes an initiative on their part, information lacks precise modalities of solicitations and contributions to the sequence unfolding, the adjustments of children over time, and, therefore, the conditions that may favor their social engagement. Among the 17 studies reviewed, only four included an observational grid coding that also focused on adults' behaviors toward autistic children (Table 2). Using Ballard's (1981) grid, Anderson et al. (2004) analyzed adults' initiations during play sessions, in which the children interacted with adults and peers. The higher frequency of interactions with adults than with peers was attributed to the fact that more interactions with adults were initiated by adults. They also found that more nonverbal interactions were produced when interactions were initiated by adults. However, among five studies evaluating a particular intervention, only two of them analyze adults' behaviors. Thus, adults' behaviors were rarely analyzed in their contribution to social interactions of autistic children in school settings whether in the context of a testing a specific intervention or not.

Interactions between peers. The majority of the studies focused on interactions between peers, as this type of interaction is a major issue in inclusive educational settings. Fifteen papers out of 17 coded social interactions between peers (Table 2). Five of these studies focused only on analyzing peer interactions without comparing interactions with adults (Bauminger-Zviely & Shefer, 2021; Bauminger-Zviely et al., 2017; Boyd et al., 2011; Fasano et al., 2021; Kamps et al., 2015). In nine studies, peer's behaviors are also coded (see Table 2). However, when coding peer social skills, the focus was primarily on comparing skills between neurotypical or children with developmental delay and autistic children, rather than analyzing the dynamic social interaction itself. Concerning interactions with typical peers, both autistic children and typical peers rarely initiated mutual interactions (0–4%) (Gutierrez et al., 2007). Interactions between autistic children and children with developmental delay were also scarce (Anderson et al., 2004). Overall, the studies indicate that social interactions between autistic preschoolers and peers were scarce, unless when they were supported.

Quality of interactions

Social engagement: initiations and responses. Initiation and response rates are basic indicators of social engagement that were frequently used (12 out of 17 papers), but their analysis varied across studies. Two studies focused only

on initiations and spontaneous communication (Gutierrez et al., 2007; Kaale et al., 2014) (Table 2), because it was the targeted measure for evaluating the effectiveness of an intervention. Studies also varied on the fineness of analysis with respect to interaction partners, behavioral function context, and behavioral change over time.

As stated above, mutual interactions between peers were relatively rare, but when they did occur, they were no more often initiated by nonautistic peers than by autistic children (Boyd et al., 2011; Gutierrez et al., 2007; Kaale et al., 2014), and autistic children and typical peers initiated interactions equally (Anderson et al., 2004). By contrast, in child–adult interactions, the rate of adult initiatives was much higher than that of child initiatives, with children participating mostly as “responders” (Anderson et al., 2004).

Regarding verbal initiations, Bauminger-Zviely et al. (2017) compared communication between autistic children and those with typical development. Autistic children evoked fewer requestives than children with typical development. In two studies, initiation rates were specifically analyzed during joint attention and joint engagement episodes (Kaale et al., 2014; Rice et al., 2016;). Rice et al. (2016) found that autistic children responded more to joint attention than they initiated the joint orientation of attention. However, after a preschool program focused on joint attention and joint engagement, improvements in the initiation of joint attention with peers were achieved (Kaale et al., 2014).

Initiative and response rates were sometimes differentiated according to context. Clifford et al. (2010) showed that initiations and noninteractive behaviors occurred equally in free play and in organized activity, but responses were more frequent during organized activity.

Communicative forms

Coding the diversity of communication forms is important, especially for young children, who may use a variety of means to express intention (e.g., verbal and nonverbal, conventional, symbolic, iconic). They may also use more or less rich combinations of these means. In 11 studies, children’s communicative forms were coded (Table 2), although with a diversity of criteria for their categorization. Chiang and Lin (2008) compared different communication aids, by analyzing verbal communication and used a taxonomy adjusted to the repertoire of compensatory modalities in atypical children, for example coding separately speech, aided augmentative communication (e.g., pictures, photographs, and word cards), and unaided communication (e.g., gestures and sign language). Anderson et al. (2004) distinguished between verbal and nonverbal interactions, and Gutierrez et al. (2007) separated forms into vocalizations, gestures, and physical communication. Westman Andersson et al. (2013) extended their categories to

include nonverbal forms of communication such as vocalization, pointing, gestures, unusual eye contact, facial expression, and joint attention. Clifford et al. (2010) differentiated among verbal forms, between single words and phrases, and among gaze, gaze switch, and follow gaze/point. Pasco et al.’s (2008) grid contains the same forms including also a new form, sign gestures.

Because of this coding diversity, the results do not report with the same accuracy how communication forms are used by children in the preschool context. McGee et al. (1997) showed that verbalization is less frequent in autistic children than in children with typical development, but Fasano et al. (2021) found that vocalizations did not differ in quantity between autistic children and those with developmental delay or typical development. Moreover, children generally vocalized more toward those who previously vocalized toward them (Fasano et al., 2021), and they communicated primarily through physical means, such as pushing or touching (Gutierrez et al., 2007). Some forms of communication were found to vary according to the context, with eye gaze being more frequent during structured activity than in free play (Clifford et al., 2010). However, only two studies considered how communicative forms vary according to the social partner. Anderson et al. (2004) found that autistic children communicated with adults mostly by nonverbal means, and Chiang and Lin (2008) found that children are more inclined to use unaided augmentative alternative communication (gestures and signs) with both adults and peers than aided augmentative alternative communication.

Communication functions

Approximately half of the studies reviewed (nine out of 17) included specific coding of communicative functions, that is the interpersonal intention of communicative acts, independently of their forms (see Table 2). The proportion was similar among noninterventional studies (five out of 10) and interventional studies (four out of 7) With respect to the classification of functions, modes of categorizing intentions varied across studies. Rice et al. (2016) distinguished the aims of joint attention and joint engagement as social versus instrumental functions since attempts to orient another person’s attention may have a social sharing intention but may also be intended to regulate behavior (e.g., requesting objects or actions). Other main categories used in the studies were request, comment, reject, and greet (Chiang & Lin, 2008; Pasco et al., 2008). In other observation grids, intentions were classified as behavior regulation, requesting object or action, refusal/protest, compliance, social interaction, showing off attention, acknowledgment, joint attention, commenting, sharing attention, and requesting information (Boyd et al., 2011; Clifford et al., 2010).

Results showed that autistic children attending preschool-inclusive contexts initiated few joint attentional states at the age of two. At the age of four, initiations increased but essentially for instrumental intentions (Rice et al., 2016). Moreover, across functions, requesting and rejecting were more common than comments or greetings (Chiang & Lin, 2008). Common requests were often made for obtaining objects, but they also included engaging in social routines or drawing attention to oneself (Boyd et al., 2011). Autistic children were more likely to play alone than in groups on a reciprocal basis (Jamero, 2019). Finally, Bauminger-Zviely et al. (2017) conducted a functional analysis of the children's utterances and found that autistic children presented more difficulties in assertive communication than those with typical development; however, assertives were more frequent when autistic children communicated with friends than with nonfriends. Finally, none of the studies compared the use of communicative functions between different interlocutors (i.e., adults or peers).

Context comparisons

Although the global scope of sampled situations considered for analysis covered a variety of school situations (e.g., play, work, lunch), very few studies conducted systematic comparisons of social interactions and communication between different kinds of preschool situations (Table 2). Activities proposed at preschool indeed present a variety of structural constraints and interpersonal aims (learning, social, sensory-motor play, etc.). Free play is an unstructured situation where children might have opportunities to initiate and lead interactions; however, structured activities can be easier for autistic children as free situations can provoke anxiety due to unpredictable events or frustration related to less regulated exchanges. In 16 out of 17 studies, social interactions were coded during free play and 11 of them observation took also place in structured activities. In addition, six studies included recess (snack) and lunch time. Yet, only two studies of 17 examined whether social interactions and communication might vary between different activities. Finally, in two studies, the situations in which children were filmed were not identified.

In play situations, autistic children engaged less in group play than in social nonplay activities, or parallel and simple play (Jamero, 2019). Kemp et al. (2013) compared free time, group activities, and routines. Their findings showed that autistic children demonstrated more active engagement during routines and free play, and more passive engagement during group activities. Finally, Hume (2019) compared different activities such as creative arts, preacademic activities, motor activities, group activities, manipulative play, and pretend play. Results showed that interactions were more likely to happen during pretend play and motor

activities than at other times. In sum, although some studies include communicative function coding, only two of them took into consideration the diversity of environmental parameters within school settings and activities that may influence the use and range of social communicative functions.

Development of social skills and consideration of developmental variables

Only one out of the 17 studies used a longitudinal design (Fasano et al., 2021) following children monthly from 2 to 5 months. Nevertheless, the results did not show a significant evolution of social skills over time and finally authors did not present longitudinal results in their article. Two studies included a follow-up plan to assess factors affecting the effects of intervention programs. Follow-up studies used pre- and postassessment with an interval of 6–12 months (Table 2). The results of these follow-up studies were analyzed with respect to the evolution of social interactions during inclusive programs, revealing a diversity of devices to support social communication and of criteria to assess these changes. The criteria of change taken into account were the increase of initiations as well as the duration of the interaction or joint engagement. Interventions focused on social interactions and socialization were found to increase the initiation of joint attention (Kaale et al., 2014) as well as the duration of interaction between peers (Kamps et al., 2015). However, none of the studies followed preschoolers for more than 12 months and in both studies, a specific intervention is tested focused on social skills. Further studies are needed to better understand the evolution of responses, the degree of combination of communicative forms of interaction, and the diversification of communicative functions. Since their development might be slower than that of typical children, and progress at different rates, information regarding the developmental trajectories of social communication in young autistic children in preschool settings is still lacking over a longer period of time.

When it comes to taking interindividual differences into account, which clinical or developmental dimensions have been linked to which direct measures of social functioning at school? Severity of autism, language, and cognitive abilities have been reported as moderators of children's frequency of communicative exchanges in the classroom. Thus, receptive and expressive communication levels were correlated with the rate of vocalization to peers (Fasano et al., 2021). Severity of autism was negatively correlated with the frequency of peer interactions (Chiang & Lin, 2008). Moreover, a higher level of verbal IQ in high functioning children with autism correlated with more verbal abilities during interactions with peers (Bauminger-Zviely et al., 2017). Once again, the impact of distinctive clinical or developmental profiles on children's social functioning at preschool was mainly explored through measures of social or

verbal exchange rates. Information is lacking on possible differences in terms of coordination of communication resources or the use of more advanced interpersonal functions.

To conclude, when developmental questions were examined, only the quantity of interactions was presented, and it was measured in terms of the frequency of initiations or the amount of interaction time between peers and adults. Analyses conducted in these studies rarely used developmental models to consider how children may progress in their combination of forms or in the diversification of interaction intentions (the sole exception was the study by Rice et al., 2016.) No information was provided on the way adult partners themselves might change their communicative behaviors toward children over time. Thus, more longitudinal studies are needed to understand how the quality of communication, in terms of forms, functions, and reciprocal exchange dynamics, develops over time.

Conclusion

The purpose of this paper was to provide an overview of studies examining social interactions and communication skills of autistic children, using an observation method in inclusive preschool settings. The evaluation of the methodology used for observational studies is an essential step when we critically analyze the results of social interactions in autistic children at preschool. Recommendations proposed for enhancing social skills in autistic children depend also on the methodology that collects and analyzes results.

Overall, there is considerable heterogeneity in the size of the samples (from three to over 50 subjects) but also in the number and degree of detail of the behaviors recorded, which are both elements that can lead to variations in the results.

Concerning the recording of observed behaviors, most of the studies reviewed used a videotaped recording method to analyze social interactions. This method is time consuming, requiring the researcher to review the scenes several times to code the various parameters of interactions, even though coding software has contributed to reducing the time cost. Filming in school is a rigorous way to obtain information about social spontaneous interactions, especially when involving atypical children. Behaviors that could have been unnoticed or considered noncommunicative at first may, when observed in detail by video, turn out to be communicative acts (Wetherby & Prutting, 1984). Similarly, this method can detect certain sequential articulations between behaviors or temporal shifts that are sometimes undetectable by the naked eye in real time. These detections are important because in autistic children, irregularities in the speed of behavioral response and adjustment to rapid flows have been observed (Gepner & Féron, 2009).

When it comes to coding and quantifying social behaviors, the most commonly used basic measures are children-centered, counting their frequency of participation

in social interactions. A consensual result highlighted by this measurement is that autistic children interacted more with adults than with peers in the classroom (Anderson et al., 2004; Chiang & Lin, 2008; Pasco et al., 2008). But beyond this quantitative observation, the analysis highlights the importance of considering not only the social skills of autistic children but also their interlocutor's behaviors (adults or peers) that, in most cases are not sufficiently precisely coded, especially on more qualitative dimensions of forms or functions. In addition, exchange opportunities should be studied not only bidirectionally (autistic child with an adult vs. with a peer), but also triangularly. For example, Gutierrez et al. (2007) show that adults *rarely* mediated interactions between peers. Concerning respective contributions in the dynamics of interactions, adults' initiatives were more frequent than child initiatives, and children mostly responded to initiations (Anderson et al., 2004). Autistic children rarely initiated interactions with peers; however, nonautistic peers initiated also rarely interactions with autistic children (Boyd et al., 2011; Gutierrez et al., 2007; Kaale et al., 2014). This finding underscores the need to focus on social skills training and adult mediation in inclusive contexts to help autistic children and their typical peers initiate interactions and play together.

Although some studies have coded forms or functions of communication, there is no consensus on how autistic children use both forms and functions of communication in different educational activities. However, it would be important to determine, in further research, which activity contexts are more likely to support which types of social intentions. In addition, it would be interesting to investigate which forms and combinations of forms of communication can be used by children and how professionals can help children to combine different forms. Free contexts may facilitate more spontaneous exchanges with a social sharing intention and specific educational techniques used in certain programs may constrain interactions to a specific range of forms and functions. Furthermore, while alternative/augmentative communication techniques are relatively easy to use, they primarily serve instrumental intentions and are more difficult to use for social sharing goals. While O'Keeffe and McNally (2023) highlighted the importance of play-based interventions to promote communication and social interactions between peers in inclusive programs, the authors emphasized the heterogeneity of methods to measure social skills in play situations and the difficulty of drawing any firm conclusions regarding the benefits of play-based interventions. Concerning longitudinal aspects, only a few papers studied evolution over time following children for less than 12 months. However, those that did show that the number of initiations increased (Kaale et al., 2014) as well as the duration of interaction between peers (Kamps et al., 2015). Finally, social skills are associated with language development (Fasano et al., 2021).

Limitations

In this review, social skills were analyzed only in preschool settings. It is possible that at school there is less space for spontaneous communication than in other environments and less focus, especially by adults, on social interaction than on communication for instrumental purposes. Moreover, communication between peers is less supported in the classroom than communication with adults.

Implications for practice and research

Despite these limitations, this review suggests that certain adjustments in inclusive preschool programs could be made to foster the conditions for social communication of autistic children with their preschool social partners. A recurring finding in the studies reviewed is that autistic preschoolers rarely initiate interaction with peers (Gutierrez et al., 2007; McGee et al., 1997) and they interact more with adults than with peers. This finding highlights the need for supporting and facilitating interaction between autistic children and their peers where and when the autistic child desires this. There is also a need for learning neurotypical peers how to communicate and how to engage with autistic children during play activities. Interactions between autistic peers and their neurotypical peers are very scarce and both children should be assisted to enjoy together the social interactions. Autistic children tend to initiate interactions more frequently during free play than during work time (Clifford et al., 2010) therefore, more free play situations need to be offered, with an adult mediation that gradually fades. Preschool programs may vary according to the different cultures and ages of schooling, but usually, academic goals are the main priority and socialization is an indirect outcome. However autistic children need specific guidance in social abilities. Studies also showed the need for more support during play to help children engage in play (Rice et al., 2016). Concerning communicative forms, physical forms were mostly observed (Gutierrez et al., 2007). It follows that teachers should work more on gestural and verbal forms of communication and to encourage their use, including peers. More research in educational programs should also be conducted on the conditions supporting the development of coordination of forms of communication and their associations with academic progress. Delehanty and Wetherby (2022), in home observations, found lower coordination of communicative forms in children with autism than in typical development and other developmental delays, and the degree of coordination between gesture and speech was a predictor of later social and language skills. Regarding the function of communication, instrumental intentions such as requests or refusals (e.g., for objects or attention) were mostly

observed (Boyd et al., 2011; Clifford et al., 2010). Although the mastery of these functions is necessary for academic and autonomous learning, it seems important to scaffold a wide range of communicative intentions within inclusive preschool settings, especially the functions that autistic children have difficulty in developing spontaneously: social sharing communication, such as sharing attention or comments and interpersonal sharing through play (e.g., reciprocal imitation games, teasing, etc.). These functions need to be considered both in the educational objectives and in the tools assessing the children's progress.

Finally, despite our initial desire to target longitudinal studies, their rarity led us to extend the analysis to include single-time design studies. We highlight the need for more longitudinal studies to capture changes in communication.

Direct observation methods can be useful tools in research as well as in educational programs. However, fine-grained longitudinal analysis in social communication needs to be used to better understand the development of reciprocal communication of autistic children and to make appropriate adjustments to programs that aim to enhance social interactions for social inclusion, beginning at the preschool level. In educational settings, observation can be complementary to indirect assessment tools, such as behaviors reported by parents or professionals through a questionnaire. Expanding the repertoire of assessment tools might allow for more objective findings as well as more precise ratings of interactive behaviors across different types of activities.

Direct observation methods can also be used to regulate educational practices. Recorded observation can be used as video feedback for professionals and a tool for collective reflection. A fine-grained analysis of the social behaviors of autistic children and of social partners can be used to adjust educational strategies to match the communicative profile of each child. By using video feedback, educators and teachers can gain competency and efficiency in their practice. Moreover, observation methods can be used to offer more opportunities for children to initiate social contact and provide better support to peer interactions. Finally, an observation grid focused on the function of communication can be a tool for more targeted training on the quality of social interactions through the sharing of social and mental goals between autistic children and peers or adults.

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