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# The what, where, who, why, which, and how of collaborative play involving autistic children in educational context: a contextual inquiry

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**Introduction:** In educational settings, autistic children often encounter barriers to engaging in collaborative play. Notably, play is an important component of a child's development, and its pedagogical significance has been rigorously researched. This study endeavored to understand the dynamics of collaborative play among autistic children across various learning contexts, examining usual methodologies, associated challenges, and potential technological constraints influencing the collaborative play among autistic children.

**Methods:** The study was conducted in two diverse environments, an inclusive international school and a center for children with disabilities, both located in Qatar, and both with a significant population of autistic children. The data was gathered through a series of 45 interviews with a diverse group of proxies, including therapists, teachers, and parents. Furthermore, 48 observation sessions were conducted with the autistic children in both settings. The data from the interviews and observation sessions were analyzed using inductive reasoning to perform a thematic analysis.

**Results:** The study elicited six key themes from the interviews, coined as '5 W-H', which encompassed the aspects of who (Actor), where (Location), what (Tool), why (Purpose), which (Sense), and how (Process) in terms of how collaborative play was conducted. From the observation sessions, another four themes were derived, which centered on collaborative play, potential for collaboration, coordinated activity, and collaborative activity.

**Discussion:** The findings of this study provide valuable insights into the practice of collaborative play among autistic children, serving as a useful resource to guide future research agenda and educational practices. Understanding these dynamics can aid in developing more effective educational strategies and technologies to enhance the collaborative learning experiences of autistic children.

## KEYWORDS

autism, autistic children, collaborative play, multisensory, collaboration, contextual inquiry

# 1 Introduction

The number of children diagnosed with autism has increased significantly in recent years, with approximately one in every 54 children being diagnosed with autism in the United States, in 2020 (Maenner et al., 2021). In Qatar, where this study took place, one in every 87 children is said to have been diagnosed with autism (Alshaban et al., 2019), at a time when the definition of autism continues to be up for debate (Kenny et al., 2016). According to the American Psychiatric Association, autism is a neurodevelopmental condition that causes difficulties with social interaction and communication, as well as restricted and repetitive behaviors, activities, and interests (Diagnostic and Statistical Manual of Mental Disorders: DSM-5™, 5th Ed., 2013). In this study, “autism” refers to the clinical diagnosis of autism spectrum disorder. Most of the autism community often views the term “disorder” as stigmatizing as it stresses the associated difficulties while deemphasizing its strengths (Kenny et al., 2016). It is always difficult and nuanced to choose the appropriate language representation and terms when speaking about autistic individuals (Kenny et al., 2016). Many studies discussed the different points of view of autism communities (Dunn and Andrews, 2015; Kenny et al., 2016; Bury et al., 2020). Yet, autism cannot be described in a way that is universally accepted. Thus, to respect the preferences of most autistic individuals, the identity-first language, “autistic person,” is used throughout this paper (Kenny et al., 2016).

Given the considerable increase in autism diagnoses, it is imperative to understand how this condition impacts various aspects of a child’s life, including their play behavior and developmental progress. Play is a crucial part of a child’s development, and its educational importance has been extensively studied (Besio and Carnesecchi, 2014; Weisberg et al., 2016; Gray, 2017; Besio, 2018). However, it is difficult to agree on a single definition of play, due to its complexity and significance (Sutton-Smith, 2009). As defined by Weisberg et al. (2013), play refers to any activity that is spontaneous, enjoyable, and does not have a specific purpose. Play can be considered an activity, as it is defined as a child’s free and independent activity (Smith and Roopnarine, 2018). Caillois (2001) views play as a pleasurable, self-chosen activity. Ruckenstein (1991) emphasizes on the play uniqueness, highlighting its separation from everyday life, its voluntary nature, and its temporary character. Brown (2009) adds more characteristics, describing play as seemingly purposeless, chosen freely, inherently appealing, timeless, self-forgetful, open to improvisation, and something people want to keep doing. Vygotsky (1967), who was one of the first scholar to approach and investigate play, highlighted the vital role of sociodramatic play, emphasizing its impact on children’s cognitive development and higher mental functions, such as inhibition. This occurs as children engage in play within the zone of proximal development, as detailed in Bodrova and Leong (2015) review. In contrast, Piaget (2013) viewed play as an inherently valuable activity, a mechanism through which infants assimilate the external world into their existing cognitive frameworks rather than a way to acquire new knowledge. Also, several studies (Elkonin, 2005; Kravtsova and Maximov, 2014; Polivanova, 2015) classified play according to three stages: the preparatory stage, play as a leading activity, and play as an activity. The first stage is when the child gets familiar with the concept of play and starts to explore and imitate. The second stage is when the child begins imaginative play, symbolic play, role play, play with rules, and collaborative play. The third stage is when the child starts to play

all types of games with rules, such as mobile games, table games, verbal play, and computer games.

There are numerous advantages to play. Children acquire knowledge and learn to think critically, recall information, and solve problems through play (Mabagala and Mabagala, 2007). Although there is several types of play (Lai et al., 2018; Kuhaneck et al., 2020), this paper focusses on social and collaborative play where both require interaction between two or more children (Whitman, 2018). Social play allows children to explore their physical and social environments (Whitman, 2018). While collaborative play improves a child’s ability to think before acting, empathize with other children’s perspectives, and develop negotiation skills. Hence, children develop skills through play, and adults have a significant role in supporting it by being mediators (Smith and Roopnarine, 2018). During play, children are exposed to alternative problem-solving and conflict-resolution strategies, which enhance their ability to collaborate and develop their role-taking skills (Whitman, 2018). Inclusive play follows the play concept where players are diverse in profile, it involves the physical, social, and emotional growth of the child who learns to play with others. As a result, the child can develop social skills, confidence, independence, and resilience during inclusive play by playing with other children (Wenger et al., 2021). All children benefit from inclusive play, especially autistic children, who often are unable to participate in physical play like other children (Whitman, 2018).

During the play with autistic children, common instructional prompts such as, “Try stacking the blocks this way,” are often utilized with positive intentions. The aim is to direct the child towards what is traditionally perceived as “appropriate play,” with the ultimate goal of supporting and guiding the play. This approach is grounded in the long-held belief that play is a central element in a child’s developmental process, providing a conduit for acquiring essential skills and knowledge. However, it is crucial to reassess this approach, emphasizing the importance of autistic play, which can be conceptualized as a phenomenon characterized by difficulties, differences, and strengths (Gillespie-Lynch et al., 2017; Dwyer, 2022), and the validation of unique play behaviors. By embracing the strengths and interests of autistic children, an environment should be created that enhances their intrinsic motivation to engage in play (Dwyer, 2022). Traditional play paradigms often highlight collaborative play as developmental benchmarks for neurotypical children (González-Sala et al., 2021), yet it is important to recognize and respect the diverse ways in which autistic children express themselves through play. Therefore, the responsibility falls on educators and clinicians to adopt an inclusive and affirming approach to play interactions with autistic children. Engaging with them in activities that resonate with their interests provides a foundation for language development and social interaction. For instance, if a child finds joy in spinning objects, practitioners should join in this activity rather than redirecting them to more conventionally accepted play behaviors. This approach not only fosters a supportive environment but also encourages language and social development in alignment with the child’s natural tendencies. The neurodiversity viewpoint on autism acknowledges that autistic play has challenges and strengths (Dwyer, 2022). To investigate autistic play from this perspective, it is important to adopt a balanced approach and use neutral or positive terminology (Gillespie-Lynch et al., 2017). This is crucial because deficit-focused language used by professionals and researchers can perpetuate stigma and marginalization of autistic individuals

(Gibson et al., 2011). However, there is a limited amount of research focusing on understanding autistic play from a neurodiversity-informed standpoint. Some studies have moved away from a deficit-focused approach emphasizing the need to understand the challenges and distinctions of autistic play to better support it. For example, Conn (2015) examined autistic autobiographies and identified patterns of joyful early play experiences.

The presence of autistic children in inclusive educational environments is on the rise (Lindsay et al., 2013) where these children frequently engage with their neurotypical peers (O’Keeffe and McNally, 2023). Even though inclusive education seeks to grant autistic children sufficient opportunities to join with neurotypical peers, studies indicate that mainstream educational environments often struggle with these integrations (Humphrey and Symes, 2013; Lindsay et al., 2013; Lai et al., 2020; Linimayr et al., 2023). Play emerges as a natural mechanism to support social communication and facilitate the inclusion of autistic children in regular educational frameworks (O’Keeffe and McNally, 2023). Within the school setting, peer interactions during play, shared interests, and the foundation of friendships are helpful in learning. The benefits of positive peer relationships during childhood enhanced academic outcomes, enriched linguistic capabilities, and an improved life quality (Carter et al., 2010; Rotheram-Fuller et al., 2010). Specific to classroom contexts, research suggests that autistic children often experience diminished friendship quality and increased social isolation when compared with their neurotypical peers (Chamberlain et al., 2007). Importantly, as these children progress to later elementary grades, their participation in peer social engagements might disappear, emphasizing the crucial nature of support during these developmental stages (Rotheram-Fuller et al., 2010).

Generally, toys have been regarded as crucial tools to support play. A toy is an artifact to facilitate play and its positive effects (Zagalo and Branco, 2015). It is meant to stimulate children’s feelings and senses, enrich their imagination, enhance their evaluation and application skills, and support their physical, cognitive, social, and emotional development (Hall et al., 2022). Recent studies have explored how children play with toys (Møller, 2015; Trawick-Smith et al., 2015). Interactive technologies, robotics, and mechatronic toys have recently gained attention as potential tools for enhancing the social skills of autistic children (Shaer and Hornecker, 2010). The effectiveness of mechanical and technological devices in engaging children has been identified as a critical factor. While technology can be difficult to define, it generally includes elements of purpose, function, and benefits (Brey, 2009; Carroll, 2017). Research shows that integrating technology into teaching improves children’s learning (Khowaja et al., 2020). Consequently, technology-based approaches have been increasingly adopted to support autistic individuals during learning and play (Hijab et al., 2022). Researchers and therapists should, however, evaluate each approach case-by-case, since there is no one-size-fits-all approach for autistic individuals.

Several studies have explored the context of play in autistic children (Marwick et al., 2022), but only a few have examined collaborative play (Nonnis and Bryan-Kinns, 2019, 2021). Accordingly, this study aimed to understand the best practices, issues, and barriers associated with collaborative play in autistic children. In pursuit of this objective, a contextual inquiry was conducted at both a local center for children with disabilities and an inclusive school in Qatar. The subsequent sections of this paper are organized as follows: firstly,

detailing the methodologies and materials employed in this inquiry, then presenting the findings and analysis derived from semi-structured interviews and observations. Toward reaching, the conclusion of the paper by deliberating upon the outcomes of the contextual inquiry.

## 2 Materials and methods

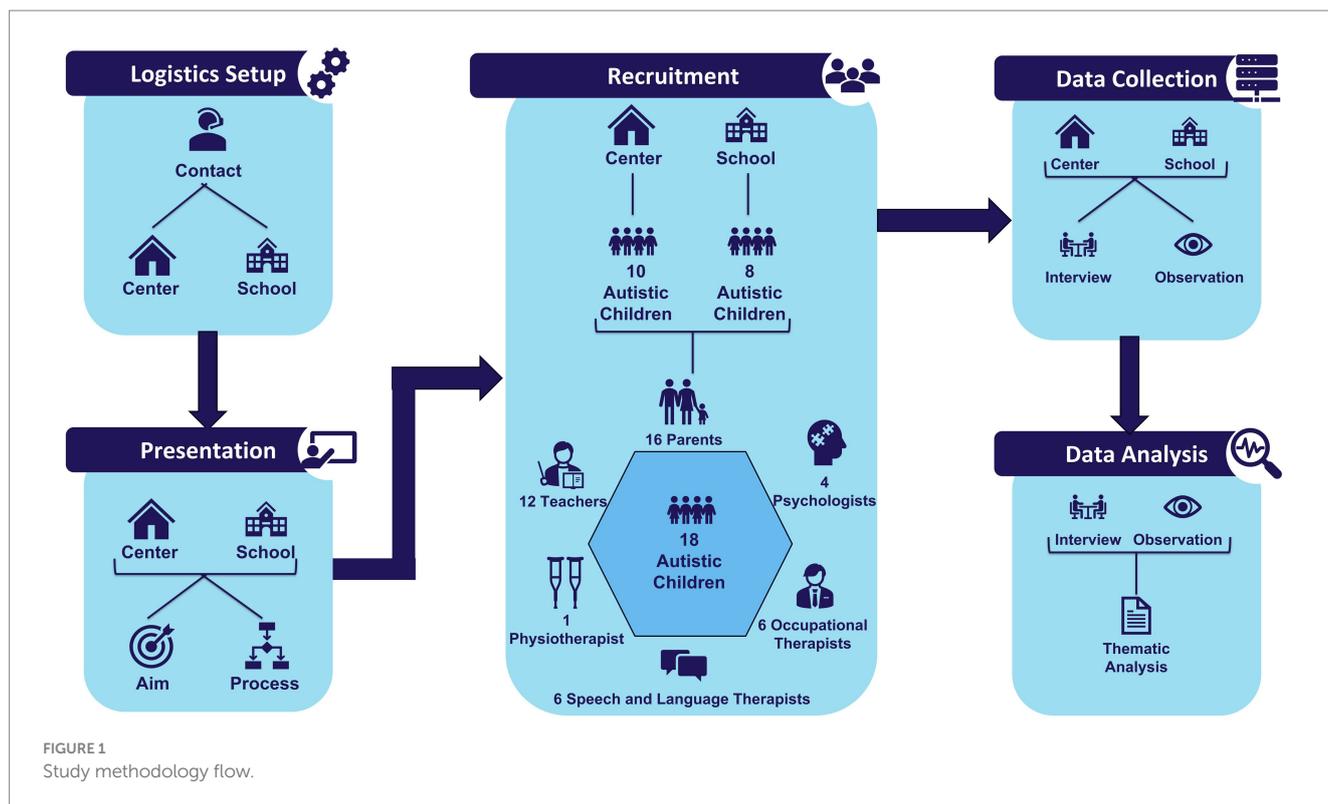
### 2.1 Overview

This study is a component of a broader project aimed at developing, co-designing, and evaluating a multisensory tool that supports collaborative social play among autistic [Project ID: NPRP13S-0108-200027] (Hijab and Al-Thani, 2022). This work employed a human-centered methodology, leveraging the principles of co-design (Druin et al., 1998; Sanders and Stappers, 2008). In order to conduct the co-design, it is imperative to study the population, and the action of play in educational settings. This paper presents the findings of the project’s initial phase. Therefore, a contextual inquiry technique is employed. Contextual inquiry is a qualitative method of data collection that involves observing participants in environments where they feel most comfortable, to acquire relevant data (Holtzblatt and Beyer, 1997). In a contextual inquiry conducted in classrooms (Holtzblatt and Beyer, 1997), tools and technologies used by autistic children for collaborative play were examined. The study design consists of conducting a contextual inquiry in a center and the school (refer to Figure 1). In which, 18 children were selected, interviews with their surroundings were conducted, and children during their center and school schedule were observed in which they mentioned to have collaboration. Behavioral patterns were observed, and both challenges and opportunities were identified. Semi-structured interviews and observational sessions served as data collection methods. The collected data were analyzed using thematic analysis (Clarke and Braun, 2017). Authors 1 and 3 carried out 22 interviews with teachers and therapists, and eight with parents, accumulating approximately 16 h, then conducted 22 observation sessions. Author 2 performed 15 interviews with teachers and parents spending over 4 h in total and observed 26 sessions. Subsequent sections will present details about participant recruitment, profiling, and the methods used for data collection and analysis.

### 2.2 Study locations

The study of this work was held in two locations located in Qatar: a center for children with disabilities and an inclusive school. The center is for children with disabilities where 80% of the children were diagnosed with Autism. The school is a mainstream institution committed to fostering inclusivity. The school implements a tiered system designed to accommodate diverse needs and ensure an inclusive environment for all its students.

At the center, various specialists assessed children using distinct tools. Psychologists used the Childhood Autism Rating Scale (Schopler et al., 1980) to distinguish autistic children from those with developmental delays and an observational assessment to identify behavioral challenges. Teachers employed the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP)



(Sundberg, 2008) to establish language goals for autistic children. Occupational therapists utilized the Functional Independence Measure (Wong et al., 2010) to assess the necessary support for daily motor and cognitive tasks, while Speech and Language Therapists evaluated verbal ability and the use of Picture Exchange Communication Symbols (PECS) (Klein and Zimbleman, 1990).

Contrastingly, the inclusive school, catering to autistic and neurotypical children, relied on parental documents for diagnosis and needs, avoiding in-school assessments. The school adopted a multi-tiered system, in line with Sansosti's suggestion (Sansosti, 2010), emphasizing evidence-based interventions for academic, behavioral, and social/emotional needs. The study observed seven students from tier 3, providing concentrated, personalized support, and one from tier 1, offering broad instructional support. There were no students from tier 2, which is meant for targeted aid to address skill gaps. The school's curriculum was customized according to individual students' abilities and needs.

## 2.3 Participants and recruitment

Ten autistic children were recruited through the center and eight through the school. After receiving ethical approval from the Research Board of the Qatar Biomedical Research Institute, the researchers independently presented the project's aims and contextual inquiry methodology to the center's and the school's therapists and teachers. During the presentation, the researchers informed the attendees to support the study by recruiting autistic children aged between ages 7 and 12. The center ensured that all children who participated in the study had been assessed similarly. The center and the school handled the assessment files for the researchers. As from

now, for the purpose of coding, "C" and "S" letters prior the participant code refer to the center and school, respectively. To fulfill the ethical requirements, the children were assigned codes ranging from C1 to C18, such as C1 for child 1 and C2 for child 2. As shown in the table, ten children in the center coded from C-C1 to C-C10 and eight children in the school coded from S-C11 to S-C18. Similarly, codes were assigned to all interviewees: SLT for speech and language therapists, OT for occupational therapists, T for teachers, PS for psychologists, PT for physiotherapists, and P for parents. In this paper, C-SLT1 refers to the speech and language therapist from the center and S-T9, refers to the teacher from the school. The center and the school collected parental consent forms and confirmed the parents' availability for interviews. Table 1 summarizes the demographic information of the 18 autistic children. For each child, several interviews took place. This included interviewing the child's parent, teacher(s), and therapist(s) directly involved in providing services to each child. Across the two institutions, interviewees were 16 parents, 12 teachers, six SLT, four PS, six OT, and one PT. Two parents could not participate in the interview; hence, in total, 45 semi-structured interviews were conducted.

## 2.4 Data collection

### 2.4.1 Interview

The parents, teachers, and therapists were interviewed individually to understand the current practices, challenges, and experiences of engaging autistic children in collaborative play. Before conducting the interviews, written consents were obtained through the center and the school. Details on the interview duration for each interviewee group are presented in Table 2. The interviews began with gathering

TABLE 1 Autistic children's information.

	Child	Gender	Age	Verbal/non-verbal	Challenges
<i>Center - C</i>					
	C-C1	M	12	Verbal	None
	C-C2	F	7	Verbal	None
	C-C3	M	11	Non-verbal	None
	C-C4	M	11	Verbal	None
	C-C5	M	9	Verbal	Wheelchair user
	C-C6	M	7	Non-verbal	None
	C-C7	M	10	Verbal	None
	C-C8	M	11	Verbal	None
	C-C9	M	11	Verbal	None
	C-C10	M	10	Verbal	None
<i>School - S</i>					
	S-C11	M	7	Verbal	None
	S-C12	M	12	Verbal	ADHD
	S-C13	F	9	Verbal	Auditory Loss
	S-C14	M	11	Verbal	None
	S-C15	F	8	Verbal	None
	S-C16	M	8	Verbal	None
	S-C17	M	8	Verbal	None
	S-C18	M	11	Verbal	ADHD
Min			7		
Max			12		
Average			9.61		

TABLE 2 Total duration of the interviews.

Role	Number of Interviewees	Total	Average
Teacher	12	6:12:34	0:31:03
Psychologist	4	2:24:26	0:36:07
Occupational therapist	6	2:49:27	0:28:15
Speech and language therapist	6	3:38:00	0:36:20
Physiotherapists	1	0:28:54	0:28:54
Parents	16	5:43:11	0:21:27
Total	45	21:16:32	

demographic information about the interviewees and general information about collaborative play and the use of technology. Then there were questions about tools and technologies used by the children, and their collaborative play experiences. Moreover, excluding the parents, the interviewees were asked about the therapy plans and the pedagogical strategies they employ with the children. [Appendices A, B](#) in [Supplementary material](#) provide demographic information of specialists and parents, respectively.

#### 2.4.2 Observation

Following the semi-structured interviews, observation sessions were conducted at the center and school. The center and the school were asked to select sessions that involved collaborative play. These

sessions manifested in the form of educational classes, a collaborative gathering, or scheduled breaks. The school sessions were noticeably different from those at the center shown in [Table 3](#).

Approximately three random sessions per child were selected and observed. A total of 20 observation sessions conducted at the center entailed sports, reading, art, music, lunch, and interactive floor projection sessions. The sport session started with warming up, followed by different physical activities. The reading session occurred in the library, where teachers read stories about daily activities. During the art session, the children sat at a U-shaped table and painted under the guidance of the teacher. In the music session, a song was played, followed by guided activities. In the interactive floor projection session, a variety of games were projected on the ground,

TABLE 3 Total duration of the observation sessions.

Location	Session	Total recorded duration
<i>Center</i>		07:33:06
	Music	00:40:12
	Art	01:50:54
	Sport	01:05:14
	Interactive Floor Projector	00:47:46
	Launch	01:55:39
	Library	00:31:00
	Free Play	00:42:21
<i>School</i>		10:07:03
	IPC	1:44:33
	Adventure Playground	00:57:32
	Sensory Room	00:44:46
	Trampoline Room	01:04:37
	Break (Snack)	01:15:48
	Lunch	02:24:06
	PE	00:56:41
	Music	00:59:00

and motion sensors detected the children's movements and allowed them to interact with the projections. The sessions were video recorded, yielding a total of 7 h and 33 min that were carefully analyzed. Table 2 presents the duration of recorded observations for each session. Medical reasons kept C-C5 away from these sessions. Toward the end of observing the selected sessions, the researchers suggested adding two free play sessions to the study. These had not been considered previously because the suggested classes did not involve collaborative instances and were guided by mediators. The free play sessions involved nine children divided into two groups. No adult guidance was provided as the children were left to do as they pleased in a room full of different toys. Throughout the study, two cameras were used during the observation sessions, one was handheld by one researcher, and one was mounted on a tripod. Two researchers took notes.

As for the school, a total of 26 observation sessions were conducted. Similarly, the school was asked to highlight collaborative play sessions in the curriculum. The classroom was set up with rectangular desks so children could sit next to each other, which naturally afforded collaboration. The school recommended that the following sessions to be observed: Physical Exercise (PE), Trampoline Room, Adventure Playground, Sensory Room, Music, The International Primary Curriculum (IPC), Break, and Lunch time. In the PE session children were learning how to swim together, under the guidance of the coach. The Trampoline Room session offered children the opportunity to jump together. Adventure Playground session was a play area that includes climbing frames and activity towers. During sensory sessions, children interact with projected images on the floor in rooms equipped with projectors. Every music session aimed to teach how to play an instrument and try it out. The IPC sessions start from the early years of school to enable the children to learn about the world, cultivate personal qualities, and build an international mindset. Furthermore,

two sessions were observed outside of the pre-scheduled sessions and were not included in the analysis to better understand how sessions are conducted in different ways and how children interact with different sessions. Medical reasons prevented S-C14 from participating in the observation sessions. The video recordings at the school, which amounted to 7 h and 7 min, were collected as shown in Table 2.

### 2.4.3 Data processing and analysis

All the interviews were recorded using two voice recorders and transcribed manually following the approved instructions (Poland Blake, 1995; McNulty, 2012) shown in Table 3.

The transcripts were then revised for accuracy before being uploaded into ATLAS.ti, a software used for qualitative data analysis (Soratto et al., 2020). For the analysis of interview data, a comprehensive thematic approach (Braun and Clarke, 2006) was employed, which resulted in the formation of the 5W-H model themes. Researchers immersed themselves in the data, instituted codes (sub-themes), and developed main themes and sub-themes through inductive reasoning. Generation of preliminary codes facilitated categorization of conceptually similar patterns across multiple datasets (Braun and Clarke, 2006). Weekly meetings were convened by the authors to continuously refine the coding system, leading to the consolidation of sub-themes into main themes. The codebook corresponding to this process is available in Appendix C in Supplementary material.

Data derived from observation sessions were analyzed using thematic analysis, resulting in distinct themes, as shown in Table 4. Videos and notes from these sessions have been uploaded to ATLAS.ti, and four main themes have guided the analysis: collaborative play, coordinated activity, potential for collaboration, and collaborative activity. The videos were diligently coded within these themes, yielding a comprehensive analysis of what was observed (Table 5).

TABLE 4 Transcription instructions.

Situation	Instruction	Example
Missing Dialog	...	...And after this we had to give him the toy
Emphasis on a word or sentence	Underline	Child said I want this toy
Emotion (anger, humor, sadness...)	(Emotion)	(Laughing) You know
Shouting	CAPITAL LETTERS IN BOLD	... and the child said I WANT THIS TOY
Empty brackets indicate the inability to hear what was said	()	We use a tool () it is responsible for transcription
Elapsed time in silence in seconds	(#)	Yeah (2) it is a good question
Left brackets indicate the point at which another's talk overlaps a current speaker's talk	[	A: quite a [while B: [yeah

TABLE 5 Observation session themes.

	Collaborative play	Coordinated activity	Potential for collaboration play	Collaborative activity
Awareness	Yes	No	No	Yes
Communication	Yes	No	Yes	No
Coordination	Yes	Yes	Yes	Yes

#### 2.4.3.1 Collaborative play

Collaborative Play requires a common aim between the players, as well as awareness, coordination, and communication (Dillenbourg, 1999; Gutwin and Greenberg, 2002). Awareness encompasses knowledge of others' actions within a collaborative setting. Coordination involves ensuring that activities are carried out in the correct order, at the appropriate time, and in compliance with the task's constraints including division of labor. Communication is also a significant pillar in collaborative play, as several types of joint activities demand the concerted effort of two or more individuals (Gutwin and Greenberg, 2002). While dialog and gestures play a significant role in collaboration, conversations are the dominant mode of communication in most groups (Gutwin and Greenberg, 2002).

#### 2.4.3.2 Coordinated activity

Instances of Coordinated Activity were coded during analysis when coordination was the only feature in the recording. Typically, specialists were coordinating structured activities, aimed at benefiting autistic children. Their roles encompassed the design and guidance of interactions to enhance educational experiences and social growth.

#### 2.4.3.3 Potential for collaboration

The Potential for Collaboration theme refers to various individual or coordinated activities that could be promoted as collaborative play. If the same activity possibly included collaboration characteristics, the action was coded as having the potential for collaboration. In other words, if the children played with a teacher or professional mediator. Yet, the children appear not to be aware of each other's actions as they are only following rules and the guidance of the mediator who holds their hands while the children have no eye contact with each other. Such activity was coded as having potential for collaboration, even if the collaboration did not materialize in the given context.

#### 2.4.3.4 Collaborative activity

Collaborative Activity encompasses the idea of collaboration, emphasizing the importance of working together towards a common goal. It involves fostering a sense of awareness among the individuals involved, while excluding direct communication as a defining factor. To improve group performance in an activity, it is often highlighted that awareness of individual and group member activities is an important aspect (Dourish and Bellotti, 1992). According to (Gaver et al., 1992), "focused collaboration activity" demands heightened awareness among users who closely collaborate. However, when labor is distributed or collaborators do not share a common goal, the need for mutual awareness becomes less significant. Nevertheless, Gaver highlights that even in such scenarios, providing minimal awareness information can enhance the performance of collaborators.

## 3 Results

### 3.1 Semi-structured interviews

Interviews were held with 12 teachers, four PS, six OT, six SLT, and one PT involved in the study. Only 16 parents were interviewed as two parents, C-P4 and C-P10, were unable to participate due to personal reasons. Due to the complexity of collaborative play, it was critical to identify factors impacting its effectiveness. Initial analysis of interview responses led to the creation of the 5 W-H model to examine factors influencing collaborative play. Six main themes, shown in Figure 2, were discerned, addressing the questions of who (actors), where (location), why (purpose), what (type of technology), which (senses), and how (process). Figure 2 displays these themes.

#### 3.1.1 Actors (who? – W1)

Actors' themes answer "who" participated in the collaborative play. Five sub-themes were explored: family, strangers, players,

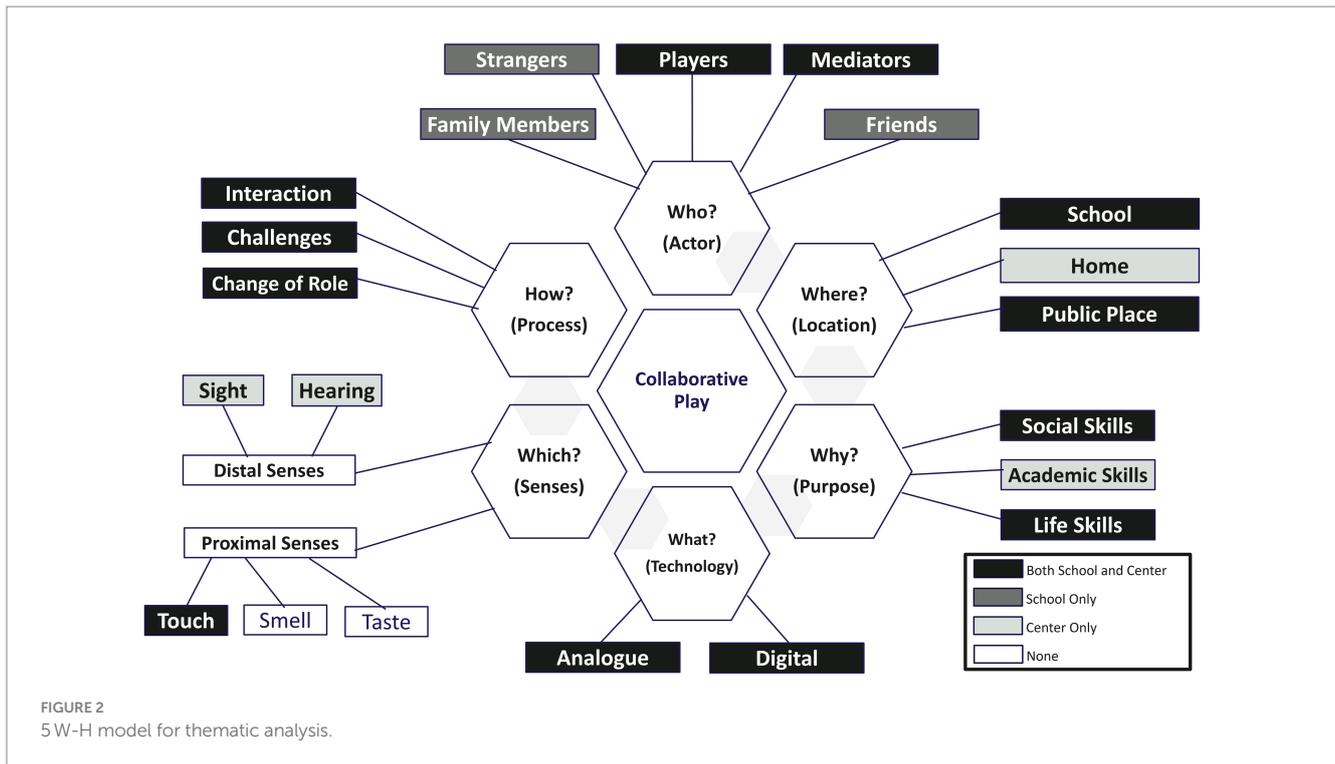


FIGURE 2  
5 W-H model for thematic analysis.

mediators, and friends. The school interviews revealed all sub-themes; however, the center interviews did not reveal family members, friends, or strangers. Each sub-theme is defined in the code book.

“Players” sub-theme (C-43, S-40 times) comprised children and participants in the collaborative play activity. The psychologists discussed a collaborative play held in class that focused on turn-taking in which the players took turns:

“...Collaborative activities can happen in the classroom; for example, you give the child a task to color a part of a picture, and then his friends complete the same task. Another example is making a string of beads where children cooperate to make a full string of beads...”  
– C-PS4.

“Mediators” (C-6, S-11 times) refers to the people facilitating interaction between children within a group (Smith and Roopnarine, 2018). For example, C-T2 describes his role in a collaborative activity as follows:

“...I guide him by telling him where to place the ball according to its color, what number he should hold, and where to go ...” – C-T2.

The sub-theme “friends” (S-2 times) refers to a person who is drawn to people of the same age and is drawn to “ones in which people visited, went out together, discussed shared past times, and participated in an organization together (Policarpo, 2015). For example, S-P16 discussed a collaborative activity previously held with his autistic child S-C16 and his friends.

“...He is interested in Pokémon cards, and he is exchanging in with his friends in school.” – S-P16.

“Family Member” (S-6 times) refers to a group of people united by ties of marriage, blood, or adoption (Burgess, 1952). S-12 gives an example of S-C12 playing engages with his sisters:

“When he is in a good mood, he plays with his sisters by engaging with them.” – S-P12.

“Strangers” (S-3 times) refers to someone who does not have a close relationship with someone and does not maintain membership with one another (Harman, 2011). S-P16 discusses a collaborative play with strangers in a public place held with S-C16:

“At the moment, he would be fine if he plays with any other kids around him.” – S-P16.

### 3.1.2 Location (where? – W2)

According to the interviewees, collaborative play occurred in four main places. “School” was mentioned by interviewees in both the center and the school. However, home and public space were found only in center and community space was found only in interviews of the school. “School” (C-6, S-14 times) was mentioned by the teachers and therapists. C-PS4 talked about the sessions where the collaborative play occurred:

“... collaborative activities happen in sport session or maybe inside the classroom ...” – C-PS4.

However, “homes” and “public places” were highlighted by the parents. The home-based (C-2 times) collaborative play took place with family members either inside the house or in the backyard:

“...In the backyard, we have three trampolines that the children jump on, so the children gather jump and laugh...” – C-P2.

“Public places” (C-3, S-2 times) mainly included the park, swimming pools and community space too (MacQueen et al., 2001). The parents discussed taking their children to a public place and trying to get them engaged in collaborative activities with other children or with family members:

“I’ve put him in a mixed playgroup in support group out of school. S-C14 goes once a week to a life skills group that is Neurodiverse...” – S-P14.

### 3.1.3 Purpose (why? – W3)

The interviewees explained why the children play collaboratively. In an educational setting, play is often a means of practicing skills. Interview analysis produced three skills: social, academic, and daily living. During the interviews with the center, all skills were noted, but the “academic skills” sub-theme did not appear in the school. The “social skills” (C-37, S-18 times) included many skills such as social initiations, social greetings, conversational rules and social communication (Gillis and Butler, 2007). Mainly, the teachers and therapists used collaborative play to enhance turn-taking and the communication skills of autistic children:

“Collaborative play activities teach the children to wait for their turns and to follow the rules; for example, they teach them to raise their hands and not to answer without permission...” – C-T6.

“Academic skills” (C-14 times) are often part of the educational curriculum (Jordan, 2013). Teachers use PECS in collaborative play to enhance the academic skills of autistic children:

“...For example, matching pictures game, where we put the pictures on a table or the floor, and the child has to match these pictures to the other pictures placed on the wall. Or we can have a competition between the children. Or matching colors, where we put colored balls on the floor and group them according to their colors...” – C-T7.

Lastly, “daily living skills” (C-11, S-2 times), such as toileting and other personal care activities that are required to support independence (Bennett and Dukes, 2014). The teachers and therapists mentioned the use of collaborative play to support the children’s independence:

“...We teach them if they sneeze to do it in their arm when they yawn to go like this; we teach them to throw their papers away in the garbage after lunch...” – S-T11.

### 3.1.4 Type of technology (what? – W4)

According to the literature, technology can be categorized into “analog” and “digital media.” Both categories appeared in the analysis of interviews in both locations. “Analog media” (C-102, S-20 times), encompasses everything uninfluenced by computer-based media and generally articulates design visualization by freehand or manual

manipulation (Caldwell and Woodward, 2012). The therapists and teachers gave examples of tools used in activities. For instance:

“If I have a plate and a spoon, we pretend to eat and feed the doll. We also act as we are drinking from the cup, covering the doll with a cover if it sleeps, or letting the baby walk or run. All these are functional aspects...” – C-SLT1.

However, in “digital media” (C-15, S-4 times), Human-Computer Interaction is usually achieved through computer-aided software or virtual reality tools. Thus, “digital media” refers to any interaction mediated by a computing device (Caldwell and Woodward, 2012). The teachers mentioned the use of iPads and smartboards:

“... We use often iPads, we also use interactive whiteboards, so in which again, they can play the games by turn taking...” – S-T12.

### 3.1.5 Sense (which? – W5)

This theme has two main sub-themes: “distal” and “proximal” senses. The “distal senses” included sight (C-5 times) and hearing (C-6 times) (Korsmeyer, 2019) that appeared in both locations. The therapists and teachers frequently mentioned these two senses. For example:

“... I use is visual sense the most, because visual communication is important for them...” – C-SLT2.

Touch, smell, and taste are “proximal senses” (Korsmeyer, 2019). Teachers and therapists in both locations mainly focused on touch (C-9, S-2 times), and no interviewee mentioned any collaborative play activity involving taste or smell. For example, teachers and parents discussed the usage of tangible and sensory toys during collaborative play activities:

“...During the sensory story, we give the children tools to interact with; for example, we give them a rabbit and snake shape to touch and feel how the rabbit is smooth and the snake is tall...” – C-T1.

### 3.1.6 Process (how – H)

This theme highlighted the process of collaboration which appeared in both locations. It included the “interaction” between the players, the “challenges” the autistic children face during play, and the “change in roles.” This role change often happens as an attempt to address the challenges during collaborative play. While the children are engaging in collaborative play activity, adults interact (C-39, S-15 times) by guiding them through instructions that include encouragement:

“...He engages with his younger sister until he gets fed up with her because she’s loud, so he tells her to be quiet and walks away. Then with encouragement, he gets back...” – S-P14.

The “challenges” (C-16, S-3 times) that the interviewees highlighted were related to the initiation and willingness to participate and interact in play:

“...Their play is random and unstructured... Also, some autistic children cannot make a specific collaborative activity due to their skills restriction...” – C-PS3.

The “change in role” (C-5, S-6 times) occurred when the teacher, as a mediator, played with the child and constructed a collaborative play environment:

“For example, they had to share the boat where they sat. I’m the treasurer, or they say I am the sea Monster, and they take turns.” - S-T13.

### 3.2 Observation

Observation sessions targeted children’s collaborative play, to understand their social interactions and pinpoint any needed support. These observations offer crucial insights into social development and collaboration, informing the study’s potential applications and implications. The observations were reported separately for the center and school to represent session diversity. During the observation sessions, C-C5 and S-C14 were absent due to medical reasons. Figures 3, 4 illustrate the theme distribution for the center and school, respectively. The

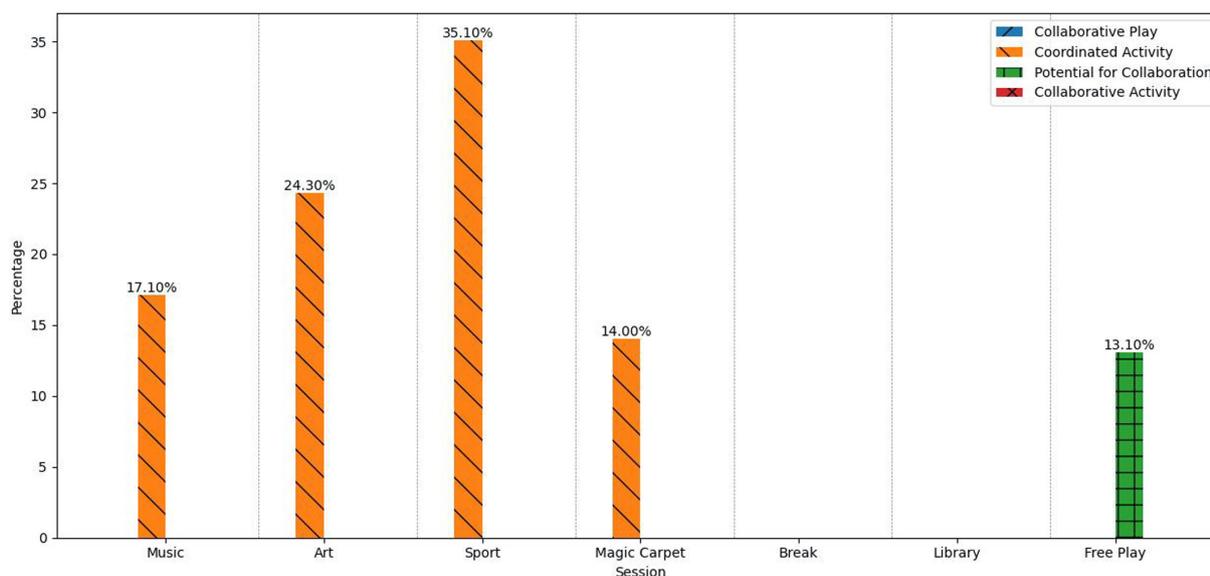


FIGURE 3 Distribution of the themes for the observation sessions in center.

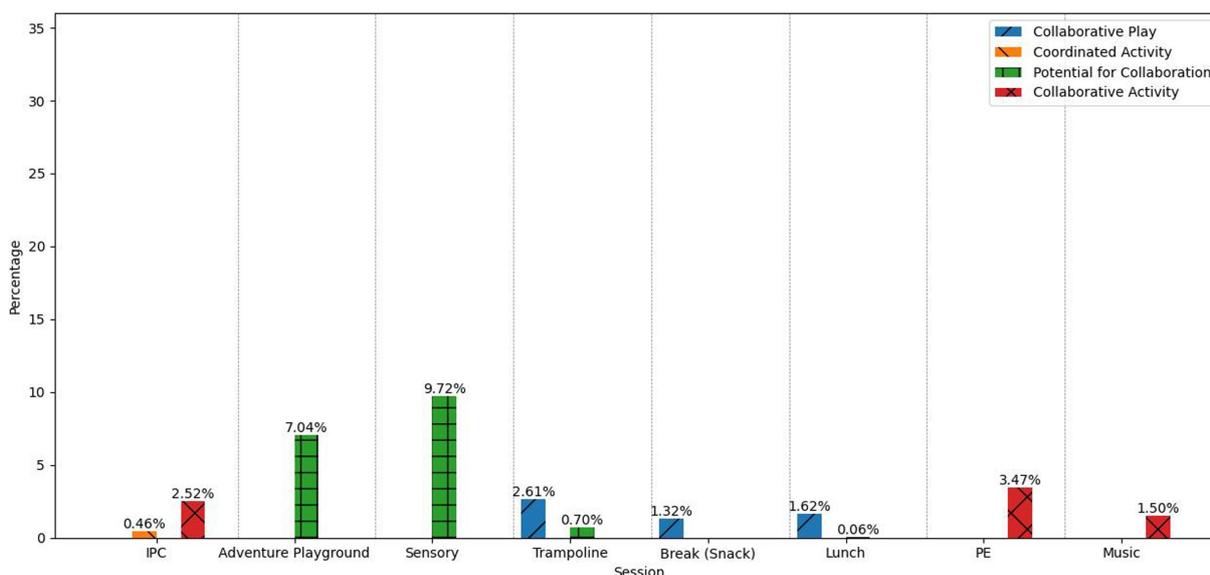


FIGURE 4 Distribution of the themes for the observation sessions in school.

figures display the proportion of time each theme was present in the total observed duration of the session.

### 3.2.1 Collaborative play

Collaborative Play occurs when awareness, coordination, and communication are present. At the center, no instances of collaborative play were observed; however, Collaborative Play was witnessed in the school during trampoline, break, and lunch sessions. In the Trampoline session (2.61%), S-C17 watched her peer jump around in circles with her on the trampoline, and they coordinated and followed each other's rhythms. She seemed to be aware of the child on the trampoline, as they both were running around in circles. In addition, they were both not jumping, but when S- C17 started bouncing, the other child also started jumping, and when one of them fell, the other stopped jumping and fell as well, so here it shows that they are aware. Finally, S- C17 continues to jump while making eye contact with another child. During the break (1.32%), S- C16 and his friends were laughing and playing as he attempted to pour juice into their mouths without them touching the straw as a challenge play where they laughed and collaborated to reach this goal. The Collaborative Play occurred in lunch sessions (1.62%) when S- C16 exchanged and discussed Pokémon cards with his friend, played in the football area after that, and embraced and cheered whenever a goal was scored.

### 3.2.2 Coordinated activity

The instances classified as coordinated activities in the videos indicate that children were having coordination with each other only in the absence of awareness and communication. At the center, only 14% of the total observed time was coded under coordinated activity. There was no coordinated activity during lunch and reading sessions as presented in Figure 3. During the lunch session, the children were seated individually to have their meals, and there was no socialization or interaction between the peers. Similarly, during the reading sessions, the children sat quietly and only listened to the teacher, read aloud, or watched a story on the projector. At the center, out of the total recordings made over 7 h and 33 min, 14% were identified as coordinated activities. These activities were typically characterized by a teacher or mediator structuring a class activity for the students to follow, with an average ratio of two children per teacher. During the music session, specific rhythms were played by the teacher, and the children were instructed to follow the rhythm by shaking a musical instrument, namely the maracas. In addition, the children were observed holding hands and stepping on music pads, with three children participating in this activity for 17.1% of the entire music recording sessions. In the art session, the objective was for the children to work collaboratively on a painting, with each child assigned a turn by the teacher, who would call out their names and give them the paintbrush and colors. The turn-taking and painting activity was recorded to have lasted for 24.3% of the total observed art sessions. Sport sessions had the highest proportion of coordinated activities, accounting for 35.1%. In these sessions, the teachers divide the children into groups to participate in competitive activities using balls and connect 4 games. Connect 4 is a classic strategy game in which two opponents compete to line up four disks of their respective color. As players drop the disks into the grid, they stack them vertically, horizontally, or diagonally (Nasa et al., 2018). It appeared that the children were unaware of the purpose and competition element of the connect 4 game, but they coordinated with the teacher to complete

the task. During basketball and ball-collecting activities, the children followed the teacher's instructions. The interactive floor projection sessions recorded had the lowest percentage (14%) of coordinated activities. The activities projected onto the floor were mainly conducted individually rather than collaboratively. Still, there were a few instances where the teacher encouraged several children to join and coordinate in an activity, such as the bubble popper game.

Ten hours were captured in total in the school, out of which only (0.08%) corresponded to Coordinated Activity. Across all videos categorized as Coordinated Activity, an average of two children per teacher were observed. Notably, as per Figure 4, Coordinated Activity occurred exclusively during IPC sessions, with a rate of occurrence of 0.45%. During these sessions, the teacher directed the students to hold hands and dance together, resulting in a high degree of coordination between the children as they moved in unison with the music.

### 3.2.3 Potential for collaboration

After the planned 20 observation sessions at the center, the researchers proposed two additional sessions called free play. These sessions were outside of scheduled activities. Two such sessions were carried out, wherein the 10 autistic children involved in the study were divided into two equal groups and observed in a familiar room with diverse toys they could interact with, without adult guidance. Each session lasted 30 min and was held in a large room within the center, including a ball pit, multisensory box, trampoline, puzzles, sensory toys, slide, and big bouncing balls. Three staff members, an SLT, OT, and the head of the speech and language department, were present to ensure the children's safety, but did not interfere with their play activities. Potential for Collaboration refers to the recordings where awareness seems to be missing with the presence of coordination and communication. Among the recordings, 13.1% showed collaboration potential at the center. C-C3 throws the ball to C-C9, but no response is observed from C-C9, leading C-C3 to walk away. It is essential to mention that C-C8 stood for 30 min without interacting with any toy or other children. The multisensory box caught the attention of multiple children, who approached it simultaneously but played separately, each on a different task on the box.

At the school, the Potential for Collaboration was observed (17.49%) in the Adventure Playground (7.04%), Sensory Room (9.72%), Trampoline (0.07%), and Lunch (0.06%) sessions. In the Adventure Playground, S-C13 displayed interest and communicated by looking at her friend and she imitated her movements while sitting in the backseat of a toy car with another child, but the friend was unaware of her. Children in the same area attempted to engage S-C11 in play with toy bricks but were ignored, and S-C11 did not interact with them. A child tried to approach S-C11, but he became afraid and ran away. Another child asked S-C11 to play, but he did not respond.

### 3.2.4 Collaborative activity

The absence of Collaborative Activity was noted at the center, but in contrast, the school exhibited 7.49% of Collaborative Activity. During the Collaborative Activity, the teacher guided the students to interact and collaborate in a learning-oriented manner. For example, during an IPC session, the teacher instructed the students to take turns sitting in a pirate ship to find and share treasures with their peers. During another IPC session, S-C16 and his friend worked together to create a newsletter. They collaborated by copying the name

of their school from his friend's shirt and including it in the newsletter report. In another music session, the teacher instructed the children in the music session to sit next to each other and follow the notes she played on the xylophone. In the PE session, the teacher assigned an activity involving the baton to facilitate collaborative play, and S-C16 and his group of four friends worked together to achieve the goal of passing the baton to each other while expressing joy and camaraderie. Overall, the results suggest that Collaborative Activity is feasible in a school setting, mainly when facilitated by a teacher who can guide and support the students' interactions.

## 4 Discussion

This study investigated collaborative play among autistic children in two educational settings, a center for children with disabilities and an inclusive school, evaluating the current application, practices, and challenges in collaborative play. A total of 45 semi-structured interviews, leading to the 5W-H model themes: Actors (Who?), Location (Where?), Purpose (Why?), Type of Technology (What?), Senses (Which?), and Process (How?), were conducted. Additionally, 48 observation sessions with 18 autistic children revealed four themes: Collaborative Play, Coordinated Activity, Potential for Collaboration, and Collaborative Activity. These findings expose discrepancies between reported and actual play behaviors, forming the basis for subsequent discussions that will provide a deeper understanding and yield recommendations to enhance collaborative play among autistic children in educational setting.

### 4.1 Concept of collaboration

The term "collaboration" has been elusive to define; however, and mentioned above, "collaborative play" is generally understood as a type of play in which two or more individuals participate in a shared space while working toward a common goal or purpose (Voida et al., 2010). Existing literature has suggested that collaborative play is associated with developing crucial skills, including social and communication, problem-solving, negotiation, cooperation, shared decision-making, and social interactions (Wenger et al., 2021). Nevertheless, autistic children often face challenges with social interactions, including collaborative play (Weitlauf et al., 2014). During the interviews in the school and the center, it became clear that participants employed the term "collaborative play" to denote activities involving the participation of multiple children who share a common objective. This practice in line with the definition of play found previously in the literature (Weisberg et al., 2013; Smith and Roopnarine, 2018). The results obtained from the observation sessions in the center showed that there is an inconsistency between social and collaborative play. Coordinated activities were mainly observed with clear guidance from adults toward the play. Complete guidance seems to affect children's awareness of having a partner to play with and following the adults' directions. According to the findings, the center's VB-Mapp program emphasizes social play rather than collaborative play. Observations in the school setting suggest that providing an appropriate environment, such as a playground and trampoline, and effective human factors that promote collaborative play can increase the probability for collaboration to happen among autistic children.

The presence of free play sessions, such as a playground and trampoline, allows children to engage in physical activities and interact with their peers in a relaxed and enjoyable setting. As a result, with appropriate preparation and support, autistic children can effectively participate in collaborative play. Moreover, the insights gleaned from the observations underscore the significant role played by an encouraging, inclusive environment in fostering collaborative play in autistic children. Therefore, to stimulate the evolution of collaborative play skills in autistic children within an educational context, it is strongly suggested that a comprehensive definition and a uniform set of characteristics for collaborative play be formulated.

In the realm of child development, peer play has been recognized as a pivotal element in cultivating communicative competencies (Chapin et al., 2018) and in establishing substantive social relationship and friendships (Wolfberg et al., 2015). Nevertheless, there has been a deeper discussion concerning the role of play and peer play within the context of inclusive education (Pyle and Alaca, 2018; Zosh et al., 2018). The domain of play extends across a wide spectrum, encapsulating facets such as free play, guided play, games, and playful instruction such a diversified approach to play is particularly relevant for autistic children, considering their distinctive play behaviors and necessities. Notably, during interviews, one teacher posited the concept of creating an environment for autistic children, that would facilitate daily interactions with their peers and address real-world challenges. The teacher contended that this model could enhance the social and communication skills of autistic children, subsequently amplifying their collaborative play. The development of peer play holds potential in enhancing collaboration both among autistic children and between them and their neurotypical peers. However, while the value of peer play remains unquestioned in child development, its nuances and application in inclusive settings, especially for autistic children, necessitate further attention and understanding.

### 4.2 Self-initiated play

Self-initiation is crucial for autistic children since it can enhance their social skills and peer relationships (Strain and Shores, 1977). However, autistic children may frequently face difficulty beginning play and social interactions (Ke and Im, 2013). Allowing autistic children to play with toys of their choice might enhance their ability to participate in collaborative play (Marti et al., 2009). Throughout the interviews conducted at the center, parents and therapists consistently emphasized that autistic children generally do not initiate collaborative play or play by themselves, which can affect their social development. It was observed that the flow of the session and the selection of a particular toy were currently determined by the teacher and therapists, resulting in the absence of children's initiation. For instance, during a free play session at the center, one child initiated the play with others, but the play did not reach collaboration due to the lack of responses.

In the school, the opportunities for collaborative play among autistic children were more likely to occur during sensory sessions. There were some indications of potential collaborative play when a child approached his peer but were ignored for unclear reasons. It appeared the school was utilizing several strategies to encourage autistic children's social interaction and play, as evidenced by the teachers' efforts to facilitate play and promote independence. Hence,

the environment can promote self-initiated play since out-of-classroom activities can improve social skills (Escobedo et al., 2012), preparing a conducive environment for autistic children by including free play sessions in their regular schedule and supporting them more in choosing their toys during sessions could enhance their self-initiated play.

In diverse human cultures, it is commonly observed that children have an inherent inclination to engage in play under normal circumstances (Hyder, 2005). This study, however, focuses specifically on the dynamics of play among autistic children, examining these behaviors in the contrasting environments of a school and a center for children with disabilities. In the school setting, more opportunities were noted for collaborative play, especially during sensory sessions. Instances were observed where a child would approach a peer for potential collaborative play, though these attempts were occasionally not reciprocated for reasons that were not immediately apparent. The school appeared to actively employ strategies to encourage social interaction and play among autistic children. Teachers played a crucial role in this context, facilitating play and promoting independence, thereby creating an environment conducive to self-initiated play, which is known to enhance social skills (Escobedo et al., 2012). The analysis highlighted a clear connection between play and broader developmental outcomes, supporting the concept that play allows children to learn about their community, explore their inner selves, engage in abstract thinking, and develop communication skills (Yoon and Lee, 2010). Therefore, findings of this study indicate that creating a supportive environment for autistic children—including integrating free play sessions into their regular schedule and supporting their autonomy in choosing toys—can significantly improve their engagement in self-initiated play.

As this study analysis delved deeper into the practices of these two settings, the differences became more pronounced. Children who began their education early in the inclusive school were immersed in a curriculum that not only emphasized play as a crucial element for developing peer relationships but also as a tool for enhancing socialization skills. The inclusive atmosphere of the school was evident in its classroom dynamics and strategic seating arrangements, which facilitated a collaborative learning atmosphere. On the contrary, the center exhibited a lack of structured play interventions, resulting in a noticeable deficiency in peer collaboration. The disparities were further highlighted during break times. In the school setting, children actively engaged in outdoor activities and social interactions, including during lunch and break experiences that fostered a sense of friendship. In contrast, the center adopted a more isolated approach, with children seated separately during lunch, which impeded opportunities for social interaction and cooperative play. Therefore, this study emphasizes the critical importance of early intervention and inclusive practices in educational settings. Although the limitations of this study were acknowledged and the possible influence of other factors, the findings offer valuable insights into the fundamental role of play in the social development of autistic children.

### 4.3 Role of mediator

This study broadens the range of investigation to encompass not only individual interactions but also the wider contexts of the school and the center. The observations and collected data suggest a higher

incidence of collaborative play among children in the school setting compared to those in the center. This observation is in line with existing research that underscores the significance of structured play in early childhood education (Seach, 2007). Theodorou and Nind (2010) further advocate for the role of teachers in leveraging play as a vital tool for communication and education to foster inclusivity.

Guided play can help children to play while receiving adult guidance in a structured environment, allowing them to develop their social, physical, and cognitive skills through exploration (Weisberg et al., 2016). While many studies have examined collaborative play for autistic children with the help of a mediator, Theodorou and Nind (2010) found that a mediator providing minimal guidance can encourage autistic children to initiate collaborative play. Additionally, autistic children tend to be more comfortable and collaborative in familiar environments (Bontinck et al., 2018). Across sessions, it was observed that children often seek guidance from adults during their play. Therefore, collaborative play can be facilitated through guided play, familiar environments, and social support. Building upon this, the profound influence of adult guidance on children's play becomes evident, particularly when delivered with careful consideration. Engaging in play under thoughtful adult supervision not only enriches the social interactions within the activity but also imparts a positive impact on the cognitive development of children, as emphasized by Ward (1994).

This is exemplified in a school setting where effective teaching methods are employed. When a teacher adeptly explains an activity, breaking it down into manageable steps, the children not only comprehend the instructions but also demonstrate a remarkable ability to replicate the teacher's actions. This instructional approach cultivates a harmonious rhythm among the children, fostering seamless coordination and collaboration. In essence, the symbiotic relationship between well-structured adult guidance and children's play not only enhances the enjoyment of the activity but also contributes significantly to the overall development of collaborative and social skills. At the school, a tailored curriculum and designated classes ensure that each child receives a personalized learning experience and behavioral support. This approach, advocated by Ward, emphasizes the importance of placing children in environments where they can be seen, understood, and encouraged to reach their maximum potential. In the realm of children's play, daycare providers and adults involved in children's activities must recognize the nuanced impact of various factors, including time, location, experiences, and materials, on the outcomes of play. This understanding, as highlighted by Ward (1994), becomes a crucial perspective for policymakers and educators when considering the implementation of collaborative play activities in educational settings.

Interviewees showed the pivotal role of mediators in preparing children, especially those facing social challenges such as autistic children, for collaboration with peers and family. Teachers and therapists echoed this sentiment, acknowledging the need for mediators to guide autistic children through activities. For instance, at the center, teachers provided guidance during sports sessions for autistic children, facilitating their engagement in activities like handling disks, running to designated areas, and placing disks. Mundy et al. (1986) have illuminated the challenges faced by autistic children in joint-attention skills, reinforcing the importance of supportive environments. Collocated mediated collaborative scenarios, highlighted as an optimal strategy, demonstrate substantial benefits

for individuals, particularly autistic children, in developing social skills. These scenarios foster behaviors like assistance-seeking, turn-taking, and knowledge sharing, addressing social communication challenges (Crowell et al., 2019). This approach underscores the inherent link between collaboration and social communication, offering an effective avenue for enhancing social skills and promoting initiatives in joint attention and communication.

#### 4.4 Awareness in collaborative play

The importance of awareness in collaboration is highlighted by Endsley (1995) assertion. However, the study reveals a notable lack of awareness among autistic children when it comes to collaborative play or activities, even with guidance and rules in place. This lack of awareness is not uniform, as demonstrated by varying behaviors observed in different sessions. For example, during sports sessions, some children did not comprehend the purpose of the activity or the presence of others, while in IPC and music sessions, some showed interest and awareness, recognizing their name during play. Contrary to the assumption that autistic children always need guidance, the study suggests that fostering interest and awareness in play can contribute to developing collaborative skills.

To support these observations, Battocchi et al. (2009) detail the Collaborative Puzzle Game (CPG), a tabletop interactive activity designed to promote collaboration among autistic children. The game's design, featuring digital pieces requiring simultaneous touch and drag actions by two players, addresses the coordination needs observed in autistic children during collaborative activities. The positive impact of the Collaborative Puzzle Game on fostering collaboration is evident in their findings, indicating that players need to be consciously aware of the necessity for collaboration. This awareness is vital for cooperative actions, as both participants must press the button for collaborative actions to occur. Hence, the study highlights the pivotal role of fostering awareness among autistic children in developing their collaboration skills. Strategies such as encouraging interest, stimulating awareness, and informing children about ongoing collaboration during play are recommended for enhancing their collaboration skills. Additionally, pairing children with similar interests or self-directed tendencies can further encourage awareness during collaborative play.

#### 4.5 Limitation and future work

Although the present study provided valuable insights into the current practices of collaborative play among autistic children, it is still subject to several limitations. First, the observation sessions were only held in the center and at the school during regular schedules and settings. Thus, observing autistic children at their homes, or social gathering spaces, such as parks, could lead to different results since children may act more freely and spontaneously with their families and friends, than with teachers and therapists. Secondly, during the free play sessions in the center, some of the autistic children were unfamiliar with the other participants, something which suggests a lack of regularity in shared spaces and activities. Thus, having a more coherent group of autistic children who meet regularly and know each other could lead to a different result. Lastly,

peer groups and culture are important aspects to consider for classroom dynamics and socialization (Wolfberg et al., 2015). Cultural and socio-economical conditionings need to be considered, as the study discussed pertain to circumstances of specific Qatari educational environments.

This study is part of a more encompassing project addressing the co-design of a collaborative play tool for autistic children (Hijab and Al-Thani, 2022). While this paper only discusses collaborative play, inclusive play is yet another important area that will be investigated in the future, given the distinct difference between collaboration among autistic children and that between them and their neurotypical peers. Future studies could also investigate the interaction between autistic children, the tools used in coordinated activities, and their potential for collaboration.

### 5 Conclusion

This study underscores the significance and complexities of collaborative play among autistic children within two educational environments, including a center for children with disabilities and an inclusive school. The research brings to light the essential role of the environmental setting, mediator guidance, and individual child's awareness in fostering successful collaborative play. Results showed that within the two educational settings, collaborative play was used mainly for educational purposes to reach an educational objective. Furthermore, the concept of self-initiated play was emphasized, suggesting that fostering autonomy in choosing play activities could potentially enhance collaborative play among autistic children. However, the study revealed a common lack of awareness among the children regarding the collaborative nature of their play, indicating a need for explicit instruction and encouragement to foster this understanding. Despite the enlightening findings, the research acknowledges the need for a more diverse observational environment and the consideration of socio-cultural factors. As part of a larger project designing a collaborative play tool for autistic children, future directions include investigating the dynamic interaction between the children and the tools used in coordinated activities, with an emphasis on enhancing collaboration. This study contributes significantly to the ongoing conversation about fostering essential social and communication skills in autistic children, a cornerstone of their holistic development.

#### Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

#### Ethics statement

The studies involving humans were approved by Research Board of the Qatar Biomedical Research Institute. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written

informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

## Author contributions

MHFH: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. SK: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. NaA: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. JN: Conceptualization, Methodology, Writing – review & editing. MQ: Conceptualization, Methodology, Writing – review & editing. AO: Conceptualization, Methodology, Writing – review & editing. NoA: Conceptualization, Methodology, Writing – review & editing. DA-T: Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2024.1273757/full#supplementary-material>

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