

The What, Where, Who, Why, Which, and How of Collaborative Play Involving Autistic Children: A Contextual Inquiry.

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The What, Where, Who, Why, Which, and How of Collaborative Play Involving Autistic Children: A Contextual Inquiry.

This paper presents a study that aims to understand the collaborative play of autistic children. The study was conducted in an inclusive international school and a special education center, in Qatar, with a high number of autistic children. The study examined current practices, challenges, and technological barriers that affect collaborative play among autistic children. A total of 45 interviews were conducted with therapists, teachers, and parents. Additionally, 48 observation sessions were conducted with autistic children in both locations. The data collected from interviews and observation sessions was analyzed using inductive reasoning to carry out thematic analyses. Six themes were elicited from the interviews named 5W-H answering who (Actor), where (Location), what (Tool), why (Purpose), which (Sense), and how (Process) collaborative play is being conducted. Four themes were observed in the observation sessions covering collaborative play, potential for collaboration, coordinated activity, and collaborative activity. The results provide insights into autistic children's collaborative play, which can in turn can guide future research agenda and educational efforts.

Keywords: Autism, Autistic Children, Collaborative Play, Multisensory, Collaboration, Contextual Inquiry.

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 is taking 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-5TM, 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). Thus, to respect the preferences of most autistic individuals, the identity-first language, "autistic person," is used throughout this paper (Kenny et al., 2016).

Play is a crucial part of a child's development, and its educational importance has been extensively studied (Besio, 2018; Besio & Carneseccchi, 2014; Gray, 2017; Weisberg et al., 2016). However, it is difficult to agree on a single definition of play, due to its complexity and significance. As defined by Weisberg et al. (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 & Roopnarine, 2018). Several studies (ELKONIN, 2005; Kravtsova & Maximov, 2014; Polivanova, 2015) classified play into 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 & Mabagala, 2007). There are two types of play: social play and collaborative play. 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 & 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).

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. For example, Conn (Conn, 2015) examined autistic autobiographies and identified patterns of joyful early play experiences. In summary, the neurodiversity perspective emphasizes the need to recognize the challenges, distinctions, and strengths of autistic play.

Generally, toys have been regarded as crucial tools to support play. A toy is an artifact to facilitate play and its positive effects (Zagalo & 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, 2009). 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 & Bryan-Kinns, 2019, 2021). Accordingly, this study aimed to understand the best practices, issues, and barriers associated with collaborative play in autistic children. To accomplish this, a contextual inquiry was conducted in a local special education center and an inclusive school in Qatar. Semi-structured interviews and observations were conducted as part of this study. Teachers, therapists, and parents of 18 autistic children were interviewed in 45 semi-structured interviews. Then, the same children were observed in 48 sessions during their regular schedule. The remainder of this paper is structured as follows: first,

describing the methods and materials used in this contextual inquiry, followed by the results and analysis of the semi-structured interviews and observations. To conclude, the paper discusses the results of the contextual inquiry.

Methodology

Overview

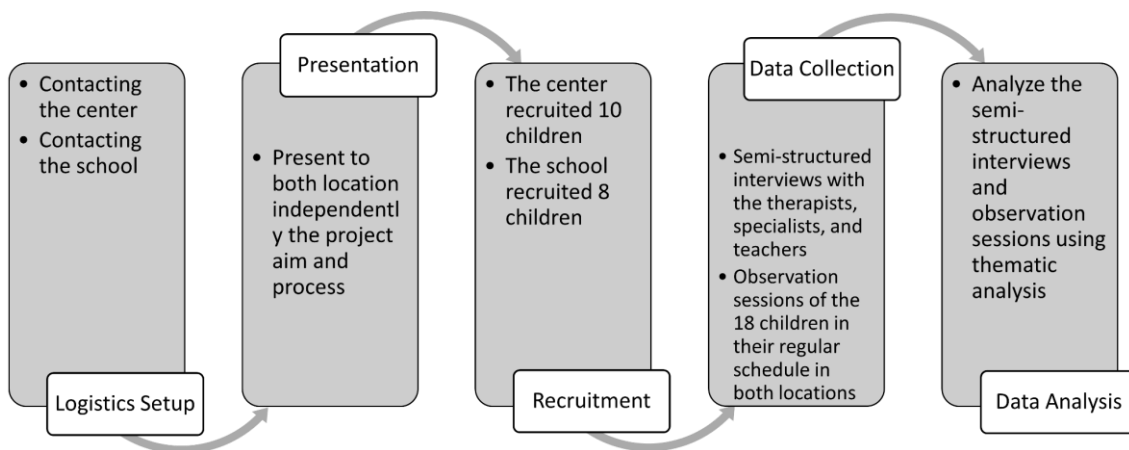


Figure 1 - Study Methodology Flow

In a contextual inquiry conducted in classrooms (Holtzblatt & Beyer, 1997), tools and technologies used by autistic children for collaborative play were examined (refer to figure 1). 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 & Braun, 2017). Authors 1 and 3 carried out 22 interviews with teachers and therapists, and eight with parents, accumulating approximately 16 hours, then conducted 22 observation sessions. Author 2 performed 15 interviews with teachers and parents spending over 4 hours in total and observed 26 sessions. Subsequent sections will present details about participant recruitment, profiling, and the methods used for data collection and analysis.

Study Locations

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, n.d.).

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.

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" 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. 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. 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.

Table 1 - Autistic children's information

Child	Gender	Age	Verbal/non-verbal	Challenges
Center - C				
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
School - S					
	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
<hr/>					
	Min		7		
	Max		12		
	Average		9.61		

Data Collection

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. The interviews began with gathering 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. Appendixes A and B provide demographic

information of specialists and parents respectively.

Observations

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 2.

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, 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 seven hours and 33 minutes 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 ten hours and seven minutes, were collected as shown in Table 2.

Table 2 – Total duration of the observation sessions

Location	Session	Total recorded duration
Center		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
<hr/>	
School	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

Data Processing and Analysis

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

Table 3 - Transcription instructions

Situation	Instruction	Example
Missing DialogueAnd 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

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 & 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 & 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.

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 4 - 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

Collaborative Play

Collaborative Play requires a common aim between the players, as well as awareness, coordination, and communication (Dillenbourg, 1999; Gutwin & 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 & Greenberg, 2002). While dialogue and gestures play a significant role in collaboration, conversations are the dominant mode of communication in most groups (Gutwin & Greenberg, 2002).

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.

Potential for Coordination

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.

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 & 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.

Results

Semi-structured Interviews

Interviews were held with 12 teachers, four PS, six OT, six SLT, and one PT involved in the study. 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 5W-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.

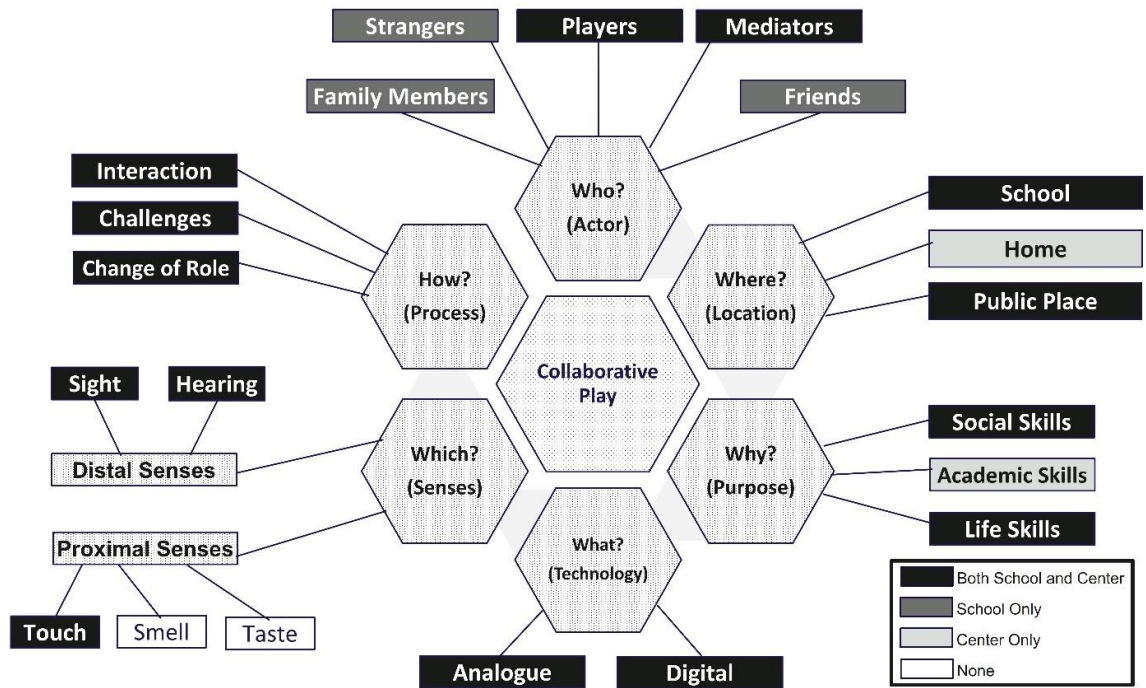


Figure 2 - 5W-H Model for thematic analysis

Actors (Who? - W1):

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

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

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 & 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 & 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

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 & Woodward, 2012a). 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 & Woodward, 2012a). 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

Senses (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, 2019a) 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, 2019a). 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

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 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

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 2 and 3 illustrate the theme distribution for the center and school, respectively.

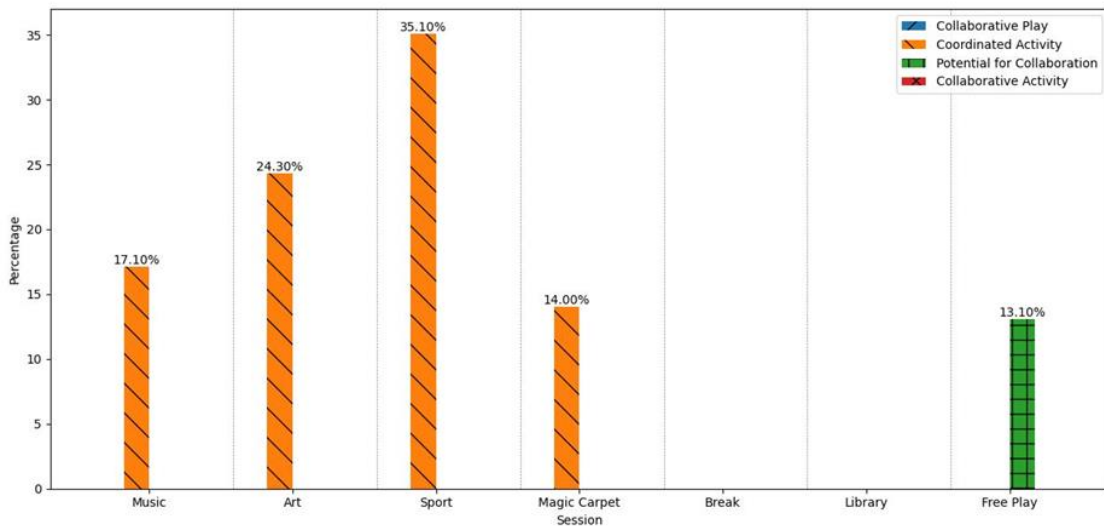


Figure 3 - Distribution of the themes for the observation sessions in center

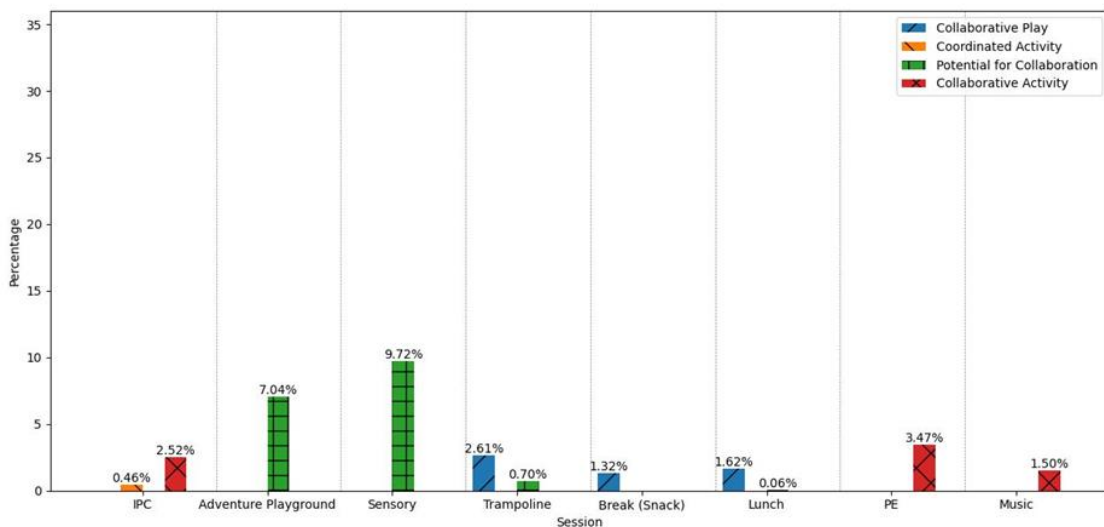


Figure 4 - Distribution of the themes for the observation sessions in school

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.

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 seven hours and thirty-three minutes, 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 discs of their respective color. As players drop the discs 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.

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 minutes 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 minutes 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.

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.

Discussion

This study investigated collaborative play among autistic children in a disability center and an inclusive school, evaluating the current use, 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.

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 towards a common goal or purpose (Volda 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 is in line with the definition of play found previously in the literature (Smith & Roopnarine, 2018; Weisberg et al., 2013).

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 our observations underscore the significant role played by an encouraging, inclusive environment in fostering collaborative play in autistic children. In conclusion, to stimulate the evolution of collaborative play skills in autistic children, it is strongly suggested that a comprehensive definition and a uniform set of characteristics for collaborative play be formulated.

Self-initiated Play

Self-initiation is crucial for autistic children since it can enhance their social skills and peer relationships (Strain & Shores, 1977). However, autistic children may frequently face difficulty beginning play and social interactions (Ke & 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). In conclusion, 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.

Role of the Mediator

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 (Theodorou & 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.

Interviewees indicated that they play an important role in preparing their children for collaboration with friends and family members. Teachers and therapists agreed that activities and play usually occur with a mediator, since many autistic children do not wish to interact with their peers. The teachers at the center guided the autistic children during their sport sessions to grasp the discs, run toward the grid, and place the discs there. Similarly, in the school, teachers and therapists were observed to make concerted efforts to create a supportive environment, suggesting that their involvement is critical to the success of collaborative play sessions. These findings emphasize the importance of a collaborative effort between all parties involved in support of autistic children as they develop their social and communication skills. While mediation is essential for certain autistic children, self-guiding them during activities could enhance their social and collaborative abilities.

Awareness in Collaborative Play

As mentioned, awareness is a crucial aspect of collaboration (Endsley, 1995). However, the study revealed that autistic children often lack awareness of collaborative play or activities, despite being given guidance and following rules. For example, during a sports session in the center, children did not seem to comprehend the activity's purpose or the other participants' presence. This lack of awareness may be attributed to the assumption that autistic children always require guidance to participate in activities and play. However, the lack of awareness in collaborative play among autistic children is not universal, as some sessions in the school showed that children were aware of their

surroundings and peers. For instance, in IPC and music sessions, some children demonstrated interest and awareness of the play itself, such as recognizing when their name was called by their friends during play. These behaviors indicate that the children are aware that they are part of a collaborative play toward a specific goal. This finding suggests that fostering interest and awareness in play can contribute to developing collaborative skills among autistic children. Therefore, it is recommended to inform autistic children about ongoing collaboration during play and to stimulate collaboration to enhance their awareness. Additionally, pairing children with peers who share similar interests or are self-directed toward each other can encourage awareness during collaborative play.

Limitations 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 & 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.

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The authors report there are no competing interests to declare.

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Appendices

Appendix A - Summary of the demographic information of the therapists and teachers

Participant Code	Highest Degree	Gender	Age	Years of Experience	Nationality	Age group of children	# Children	Location
C-T1	Bachelor	Male	41-50	23	Jordan	3-12	20-30	center
C-T2	Bachelor	Male	41-50	18	Egypt	3-10	>50	center
C-T3	Bachelor	Female	20-30	5	Jordan	6-12	>50	center
C-T4	Bachelor	Male	31-40	17	Egypt	3-21	>50	center
C-T5	Bachelor	Female	20-30	5	Jordan	4-12	20-30	center
C-T6	Bachelor	Male	31-40	18	Jordan	10-13	<20	center
C-T7	Bachelor	Male	41-50	20	Egypt	6-15	>50	center
C-T8	Bachelor	Male	31-40	16	Egypt	6-14	31-40	center
S-T9	Bachelor	Female	41-50	25	South Africa	6-12	41-50	School
S-T10	Masters	Female	31-40	7	British	4-12	>50	School
S-T11	Masters	Female	31-40	15	British	4-12	>50	School
S-T12	Masters	Female	31-40	9	British	6-12	41-50	School
C-PS1	PhD	Male	31-40	14	Jordan	1.5-50	>50	center
C-PS2	Masters	Male	31-40	10	Jordan	7-14	<20	center
C-PS3	PhD	Male	20-30	7	Jordan	3-18	>50	center
C-PS4	Bachelor	Female	41-50	16	Jordan	1-16	31-40	center
C-OT1	Bachelor	Female	31-40	20	Lebanon	5-17	>50	center
C-OT2	Bachelor	Male	31-40	9	Jordan	2-20	41-50	center
C-OT3	Bachelor	Male	20-30	6	Jordan	4-16	>50	center
C-OT4	Bachelor	Male	31-40	10	Jordan	3-14	>50	center
S-OT5	Masters	Female	41-50	16	Canadian	4-12	>50	School
S-OT6	Bachelor	Male	31-40	10	Tunisian	4-12	<20	School
C-SLT1	Masters	Male	41-50	20	Jordan	1.5-19	>50	center
C-SLT2	Bachelor	Male	41-50	20	Jordan	3-23	>50	center
C-SLT3	Bachelor	Female	31-40	9	Jordan	1-24	>50	center
C-SLT4	Bachelor	Male	> 50	25	Tunisian	4-21	>50	center
C-SLT5	Bachelor	Female	20-30	5	Jordan	3-14	>50	center
S-SLT6	Masters	Female	20-30	6	British	4-12	>50	School
C-PT1	Bachelor	Male	41-50	19	Jordan	3-21	>50	center

Appendix B – Summary of the parents' demographic information

Parent code	Highest degree	Age	Nationality	Gender	# Children	# Autistic children	Rank among siblings	Corresponding child
C-P1	High School	51+	Qatar	Female	4	1	2	C-C1

C-P2	No High School	41-50	Qatar	Male	2	2	2	C-C2
C-P3	High School	31-40	Qatar	Female	4	2	2	C-C3
C-P5	Bachelor	41-50	Sudan	Female	2	1	1	C-C5
C-P6	High School	51+	Sudan	Male	4	1	4	C-C6
C-P7	Bachelor	41-50	Syria	Male	4	1	3	C-C7
C-P8	High School	31-40	Qatar	Female	3	1	1	C-C8
C-P9	Bachelor	31-40	Qatar	Female	3	1	1	C-C9
S-P11	Masters	31-40	Polish	Female	1	1	1	S-C11
S-P12	Bachelor	41-50	Syria	Male	3	1	1	S-C12
S-P13	Bachelor	31-40	Canada	Female	1	1	1	S-C13
S-P14	Master	41-50	Oman	Female	4	1	3	S-C14
S-P15	Masters	41-50	Pakistan	Female	1	1	1	S-C15
S-P16	Bachelor	31-40	British	Female	1	1	1	S-C16
S-P17	Bachelor	31-40	British	Female	3	1	1	S-C17
S-P18	Bachelor	41-50	Canada	Female	3	1	3	S-C18

Appendix C – Interview Analysis Themes Code Book

Theme	Sub-theme Code	Description	
Actors (Who?)	Players	Children and participants who participate in the collaborative activity.	
	Mediators	Helps the children to interact in the collaborative play activity. In this role, the mediator facilitates the user's action on the object of interest, in a way that would not be possible without the mediator(Bødker & Klokmoose, 2011).	
	Friends	A person who is drawn to people of the same age and, in terms of relationship content, is drawn to "ones in which people visited, went out together, discussed shared past times, and participated in an organization together (Policarpo, 2015)	
	Stranger	Someone who is not a member of the indigenous grouping, does not have a close relationship with someone, and does not maintain membership with one another (Harman, 2011).	
	Family Members	A group of persons united by ties of marriage, blood, or adoption (Burgess, 1952).	
Location (Where?)	School	Collaborative activities are being held in classrooms and school-based environments.	
	Home	Collaborative activities are being held in a home environment.	
	Public Place	Collaborative activities are held in parks, restaurants, cafés, or community places (MacQueen et al., 2001).	
Purpose (Why?)	Social Skills	Skills needed for social interaction such as communication, greeting, and eye contact.	
	Academic Skills	Skills needed in educational content such as writing, counting, and reading.	
	Life Skills	Skills necessary for a productive daily life, such as toileting, grooming, and other personal care activities(Ayres et al., 2013).	
Type of Technology (What?)	Analogue	Analogue media, within a design discipline context, encompasses everything uninfluenced by computer-based media, and generally articulates design visualization by freehand or manual manipulation (Caldwell & Woodward, 2012b).	
	Digital	In digital mediums, human-computer interaction is usually achieved through the use of Computer Aid Software or Virtual Reality (VR) tools. Hence, everything influenced by computer-based media(Caldwell & Woodward, 2012b).	
Process (How)	Interaction	The interaction occurs during collaborative play activities.	
	Challenges	The challenges faced while children are participating in collaborative play activities.	
	Change of Role	Action is taken to solve the challenges faced and change of actors' roles.	
Senses (Which?)	Distal Senses	Sight	The usage of sight in a specific tool in collaborative play(Korsmeyer, 2019b).
		Hearing	The usage of hearing in a specific tool in collaborative play(Korsmeyer, 2019b).
	Proximal Senses	Touch	The usage of touch in a specific tool in collaborative play(Korsmeyer, 2019b).
		Smell	The usage of smell in a specific tool in collaborative play(Korsmeyer, 2019b).
		Taste	The usage of taste in a specific tool in collaborative play(Korsmeyer, 2019b).

Tables

Table 1. Autistic children's information

	Child	Gender	Age	Verbal/non-verbal	Challenges
Center - C					
	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
School - S					
	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 observation sessions

Location	Session	Total recorded duration
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Center		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
School		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

Table 3. Transcription instructions

Situation	Instruction	Example
Missing DialogueAnd 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 4. 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

Figures

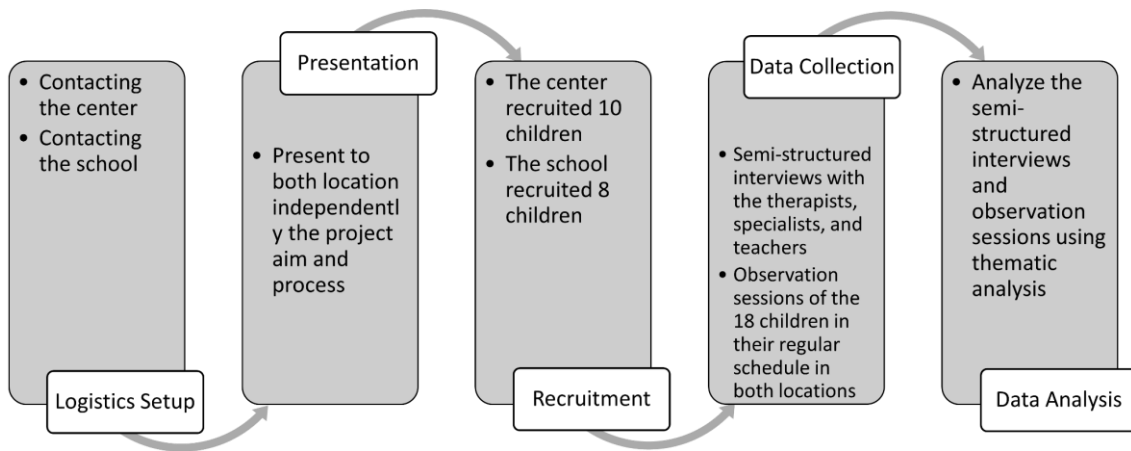


Figure 1

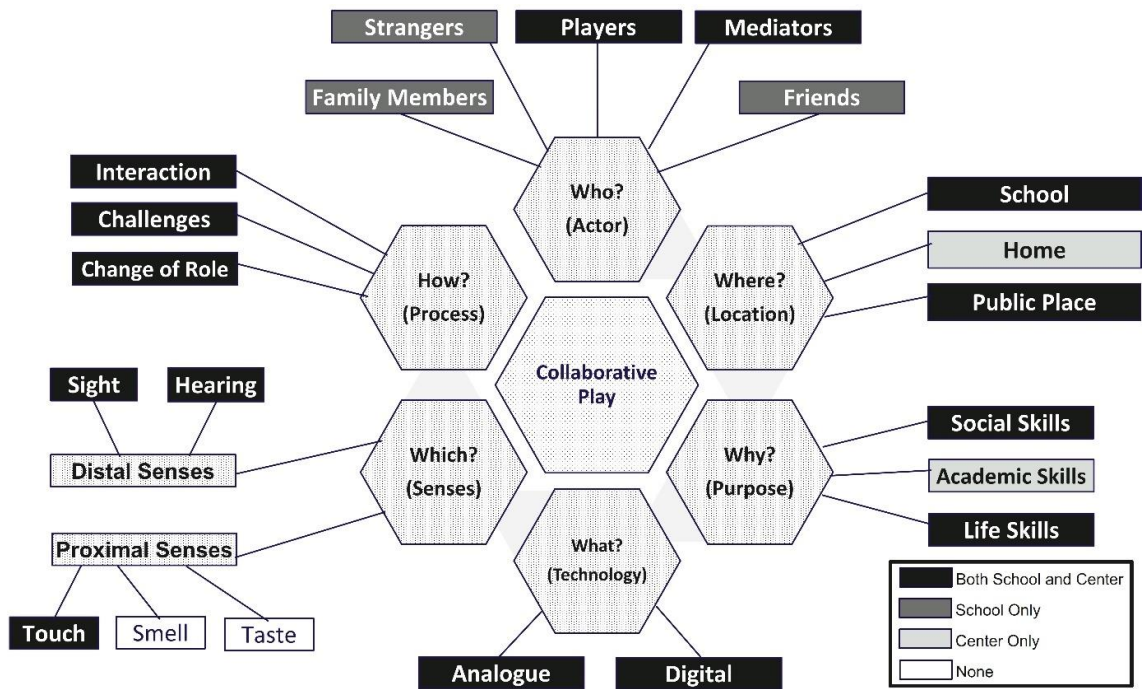


Figure 2

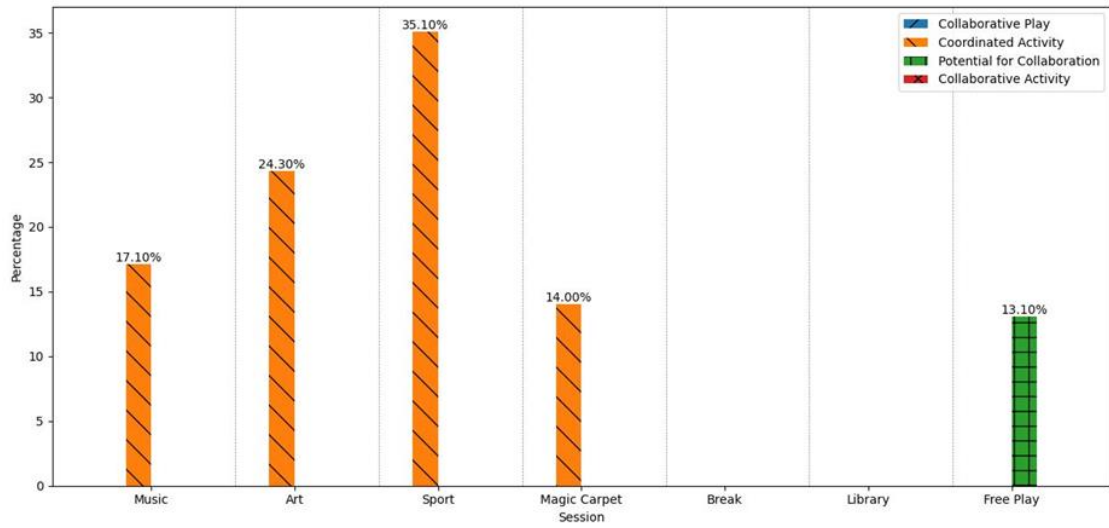


Figure 3

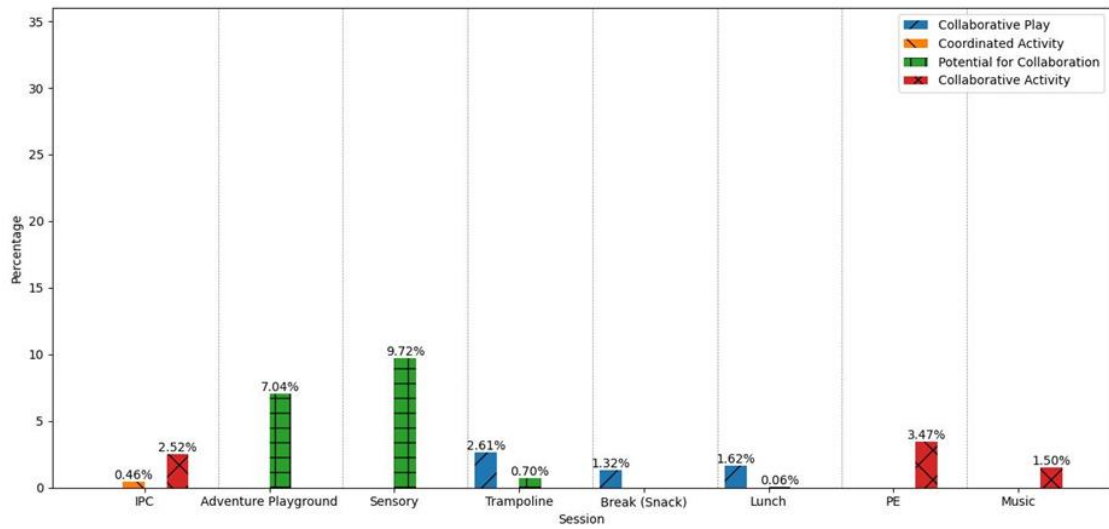


Figure 4

Figures Caption

Figure 1. Study Methodology Flow

Figure 2. 5W-H Model for thematic analysis

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

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