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Original research paper

CHARACTERISTICS OF PLAY INTERACTION IN TWINS WITH AUTISM SPECTRUM DISORDER*

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ABSTRACT

Play is a natural state in which children enjoy and practice various cognitive, social, and motor skills. Play observations in the natural learning environment helps practitioners and researchers to develop appropriate intervention. Previous research based on observations in the natural learning environment indicates a large gap between the behavior of children with autism and that of their peers. Although autism occurs relatively frequently in twins, research on their play interaction is scarce. The aim of this research was to determine the dominant type of play and interaction in three pairs of twins with autism spectrum disorder in an everyday school environment, the duration of interactions, the most frequent initiators of interactions, and whether there was a difference with regard to whom the social interaction was directed. Six boys with autism, i.e., three pairs of twins, participated in this research. Data was collected

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by employing questionnaires (A general questionnaire; ZQYT; GARS-3), as well as through observations (The Social Interaction Coding Protocol). The twins' behavior and interaction were recorded by a video camera. The results showed that twins were most frequently involved in manipulative and repetitive play, somewhat less frequently in relational play, while they did not participate in symbolic play. There was no statistically significant difference in the duration of interactions when the initiator was a twin compared to those initiated by another child, while interactions initiated by a teacher lasted significantly longer. The twins interacted with their co-twin least frequently. Furthermore, research results indicated that simple socially directed behavior was the most common type of interaction, followed by coordinated socially directed behavior. The obtained results led to the conclusion that twins with autism most frequently participate in two types of play and that the duration of their interaction varies depending on whether the initiator is a child or an adult. In children with autism, play has a significant role in the educational context. Thus, the data obtained by observing the play of twins with autism is significant for practitioners when evaluating how play characteristics can be used to plan interventions for improving the social interactions of children with autism.

Key words:
autism, behavior, interaction, play, twins.

INTRODUCTION

Autism spectrum disorder. Autism spectrum disorder (ASD) is a neurodevelopmental disorder that occurs in early childhood and is characterized by difficulties in social communication and stereotyped and repetitive activities (APA, 2013). It is believed that the prevalence of ASD may slightly vary from country to country, depending on differences in referral, detection, diagnosis, as well as awareness of autism (Chiarotti & Venerosi, 2020; Delobel-Ayoub *et al*., 2020). For example, the prevalence of ASD in Europe is estimated at 1-2% (Isaksson *et al*., 2018), while data from 2016 show that ASD occurs in one in 54 children in America (Maenner, Shaw, & Baio, 2020).Apart from the increase in ASD prevalence, there is also an increase in twins in families with at least two siblings with autism or autism-related conditions: monozygotic twins are found 12 to 14 times more frequently, and dizygotic four times more frequently, in this population compared to the typical one (Betancur, Leboyer, & Gillberg, 2002; Greenberg, Hodge, Sowinski & Nicoll, 2001).

Twins with autism spectrum disorder. Twins with ASD were most often the subject of studies aimed at assessing the degree of congruence in identical twins with the aim of determining the role of heredity in ASD (Colvert *et al*., 2015; Frazier *et al*., 2014; Hallmayer *et al*., 2011; Ronald & Hoekstra, 2011; Tick *et al*., 2016). By analyzing variations in monozygotic twins with ASD, Castelbaum *et al.* (2019) point out that the role of heredity is non-negligible. However, there are also non-shared environment factors that explain the differences with regard to the severity of clinical symptoms and social skills (SS) in examined twins. Castelbaum *et al.* (2019) explain

this by saying that when a genetic factor contributes to the development of ASD, until the age of four, the individual becomes more sensitive to non-shared environment factors which influence the severity of clinical symptoms and SS and interactions. Similar findings are reported by Neuhaus, Kresse, Faja, Bernier, and Webb (2016) who point out that heredity significantly determines social problems of twins with ASD, but not their SS, indicating that the influence of natural environment (NE) on SS development should be considered in both monozygotic and dizygotic twins with ASD. Despite all these findings, it is noticeable that there are not many research papers on SS, play activities and interactions of twin pairs with ASD in a NE.

Play activities. Play development is gradual, and children first engage in manipulative, then functional, followed by symbolic or representative play (Naber *et al*., 2008). When the play involves interaction with at least one other person, it is called social play, and it includes the following stages: orientation toward another person (e.g., looking at them, at what they are doing, etc.), parallel play (playing individually near or next to another person), and a common focus (play in which the participants share the material, demand and give, etc.) (Power, 2000, according to Bass & Mulick, 2007).

Play-based activities can provide valuable insights into a child's emotional state, problem-solving, relations with others, and behavior. Through play, children associate their inner children's world with the real world. Play activities are related to positive emotions, they motivate children to explore, initiate, and maintain interactions with others, include movement, create opportunities to explore, and are thus invaluable for learning. Play is a natural state in which children enjoy and practice various cognitive, social, and motor skills (Relja, 2019). Regarding play as a means of assessing children's behavior and functioning, Krstić (2022) points out that the evaluator may assess many dimensions of play, children's satisfaction and willingness to play, and recognize children's favored types and the forms of play in which they are successful, how playful they are, and when, where, and with whom they play. Play observations and analysis of the type of play and interactions achieved help evaluators to understand a child's daily experiences, the significance of play in the social context, and the functional level of the child's participation (Miller & Kuhaneck, 2008).

Special attention should be given to the fact that children with developmental disorders often depend on their caregivers, although their need for help and support is difficult to evaluate. Thus, mediated interaction between an adult (a parent or a therapist) is necessary when assessing children's play, especially those with severe developmental disabilities (McConachie *et al*., 2006, according to Krstić, 2022). "Mediated play assessment" is practically a way to evaluate a child who is not able to initiate or participate in play activities without help and support. For this assessment method to be as valid as possible, it is necessary to provide an optimal play environment (e.g., a specially adapted visual and sensory environment), adapted

play materials, and means of augmentative communication if necessary. In addition, play is considered very significant in the educational context. It is believed to provide a naturalistic platform for developing social interactions and acquiring knowledge in the classroom (O' Keeffe & McNally, 2021).

Play activities of children and twins with autism. Research on play activities in general in children with ASD has been quite frequent in the literature over the last few decades. However, it has most often focused on the absence of symbolic play (Baron-Cohen, 1987; Jarrold, Boucher & Smith, 1993; Kasari, Freeman & Paparella, 2006), and on comparing play activities of TD children, or children with other developmental disabilities (DD), with children with ASD (Anderson *et al*., 2004; Wong & Kasari, 2012), while research on the characteristics of other types of play in this population, as well as on their content and structure, has been less frequent (Hancock, 2020). Furthermore, studies show that social play in the NE is associated with increased stress in some children with ASD. However, the stress level is higher only when a child with ASD interacts with unfamiliar co-players (Alagendran *et al*., 2019). On the other hand, research results indicate that siblings of children with autism have significant roles in the development of SS in dyadic interactions and play (Rum, Zachor, & Dromi, 2021).

Previous research based on observations in the NE indicates a large gap between the behavior of children with ASD and their peers, i.e., children with ASD often do not react to the social initiatives of their peers, or if they do, their reactions are untimely (for example: reduced levels of peer interaction, as well as reduced quality and quantity of peer relationships due to difficulties in initiating and responding to joint attention, misunderstanding of eye contact and non-verbal communication, imitation, etc.). These differences can be observed from early childhood and they become very prominent at school, due to the increased demands of the social environment. As a result, children with ASD are considered to remain on the periphery of social networks in the classroom (O'Keeffe & McNally, 2021). These studies also show that carefully planned naturalistic developmental behavioral techniques can improve SS (Gengoux *et al*., 2021). Hu, Zheng and Lee (2018) point out that it is essential to observe and measure initiative and responses separately since they are two completely different SS, both very important for further intervention planning.

By examining the interrelationships of fraternal twins with ASD, 5.5 years of age, Markodimitraki *et al.* (2016), showed that social interactions between these boys most often occurred through episodes of manipulative play. Kypriotaki and Markodimitraki (2018) showed that twins with ASD initiated interactions with their classmates more often than *vice versa*. On the other hand, when it comes to adults, the results indicated that teachers-initiated interaction with twins more often than twins did with teachers.

Few studies have dealt with monitoring the intervention effects on SS in twins with ASD. By examining the effects of planned therapeutic games and specially designed assistive technologies, Taheri *et al.* (2018a; 2018b) determined that there was an improvement in SS and joint play in one twin pair with ASD. The main limitation of these studies was the limited generalization of obtained results to other twins with ASD. Hence authors recommended repeating similar studies with a larger number of twins.

Observation of play in the natural environment. Although very important for cognitive, language, and social development, social interactions in play activities have not been much studied (Kasari & Chang, 2014). Play can be considered a particularly significant opportunity to improve social development in the NE (Holmes & Willoughby, 2005), i.e., an opportunity to develop and strengthen SS, such as by taking turns, sharing, showing initiative, or solving problems (Ashiabi, 2007). Thus, it is not unusual that play-based interventions in the NE (e.g., guided play, involving peers, all in accordance with naturalistic-behavioral approaches) are often recommended for improving SS of students according to the children's interests and levels of development (O'Keeffe & McNally, 2021). Observations in the NE help practitioners and researchers recognize the behavior of children with ASD in social situations and develop appropriate interventions that will be incorporated in peer interactions, thus contributing to SS improvement (Bauminger-Zviely & Shefer, 2021). In addition, Dean and Chang (2021) point out that observations in the NE provide significantly more information than other instruments, such as surveys completed by parents or other staff members who are not present during unstructured school activities, when children communicate with peers in their own way.

The aim. The aim of this research was to determine the dominant type of play and interactions in twins with ASD in an everyday school environment, the duration of such/these interactions, the most frequent initiators of interactions, and whether there was a difference with regard to whom social interaction was directed at (other children, co-twin, or teacher).

METHOD

Participants. Six boys with ASD, i.e., three pairs of twins, participated in this research (see Table 1). All participants were students at one Belgrade school for children with DD. This school also organizes a developmental preschool group within the same building, where special educators work with children with disabilities 3-5.5 years of age, i.e., until transition to a preschool group following a preschool program. For children in the developmental group, a special educator designs an individualized education program with the parents' consent and the opinion of an interdepartmental committee.

The participants were between4.7 and 9.7 years of age (M = 7.27, SD = 2.24). Two participants were included in the developmental preschool group (3A and 3B, data shown in Table 1), two participants attended the first grade (2A and 2B, data shown in Table 1), and two attended the second grade (1A and 1B, data shown in Table 1).

All participants were born prematurely, between the 34th and 37th week of pregnancy (M = 35.33, SD = 1.37). The Apgar score in the first and fifth minute ranged between 8 and 10 (M = 9.00, SD = 0.63).

ASD was diagnosed in all six participants by a child psychiatrist before school enrollment, while the severity of autism was measured for the purpose of this research by analyzing data obtained on The Gilliam Autism Rating Scale – Third Edition (GARS-3, Gilliam, 2013).

The analysis of the Zygosity Questionnaire for Young Twins (ZQYT, Goldsmith, 1991, adapted by Price *et al.*, 2000) showed that one twin pair was dizygotic (zygote score.77), while two pairs were monozygotic (zygote scores .35 and .36).

Table 1: Basic information about twin pairs

Twins	Participant *	Age	Apgar score**	Zygosity	Week of birth	Index GARS-3	Level GARS-3	School
Pair 1	1A	9.7	10/10	Dizygotic	35	108	3 severe	2nd grade
	1B	9.7	9/10			87	2 moderate	
Pair 2	2A	7.4	9/9	Monozygotic	34	114	3 severe	1st grade
	2B	7.4	9/9			112	3 severe	
Pair 3	3A	4.7	9/9	Monozygotic	37	100	2 moderate	Kindergarten group
	3B	4.7	8/9			104	3 severe	

* The number denoting the participants refers to the age of the pair, from the oldest (1) to the youngest pair (3); the letter refers to the order of birth (A – firstborn, B – second born twin);
** The first Apgar score is in the first minute, and the second in the fifth minute after birth (10 is the highest score; scores 8, 9 and 10 show that the newborn is in good health and needs routine care in the delivery room)

Instruments. The general questionnaire was made for the purpose of this research and used to collect general information. *ZQYT* (Goldsmith, 1991, adapted by Price *et al*., 2000) was used to determine the zygosity of twins on the basis of parental reports. The accuracy of this questionnaire is 96.1% at the age of three (compared to DNA analysis) (Price *et al*., 2000). The questionnaire consists of closed-ended questions related to the physical similarities and distinguishing features/physical characteristics of twins. The answers are coded numerically from one to three or four. The coefficient of physical similarity is obtained by adding up the answers and dividing them by the highest possible result. The result zero represents maximum physical similarity, while one represents maximum physical difference.

GARS-3 (Gilliam, 2013) was used in this research to determine the severity of autism in twins. This scale includes 58 items divided into six subscales. Answers are presented as a Likert scale from zero to three (zero – behavior is not applicable to a specific child, three – the child behaves exactly in that way). According to the recommended norms, raw scores are converted into scaled scores in order to obtain an autism index. Cronbach's alpha was above .85 for the subscales, and .93 for autism index (Karren, 2017).

The Social Interaction Coding Protocol (hereinafter the Protocol) was created for the purpose of this research according to the protocol model used in Markodimitraki *et al*. (2016) by combining the following protocols – *Coding of Individual and Dyadic Play* (Lieber & Beckman, 1991) and *Twin Interaction Rating Scale* (DiLalla, 2006). This Protocol includes all segments from the *Coding of Individual and Dyadic Play* (Lieber & Beckman, 1991), i.e., items that monitor the type of play, and the type of intervention. In addition, the Protocol comprises all seven items from the *Twin Interaction Rating Scale* (DiLalla, 2006). The answers to these seven items were given on a five-point Likert scale. According to the protocol model used in Markodimitraki *et al*. (2016), the Protocol also includes the following information: the number of interactions during a session, initiator of interactions, and duration of interactions. For the purpose of this research, it was decided that the Protocol should consist of two identical segments, one in which interactions of one twin with other children or a teacher are recorded, and the other in which interactions between twins are recorded (more information is given in Table 3).

Procedure. The research was approved by the Ethics Committee of the Faculty of Special Education and Rehabilitation, University of Belgrade. Before the beginning of the research, the school principal gave permission for it to be conducted at his school. He then contacted the twins' parents and informed them about the planned research project in an informal conversation. After that, the parents of twins with ASD and the parents of other children from their class received letters with detailed explanation of the purpose of the research and forms for giving written consent for their children to participate and be recorded. After giving their consent, the parents

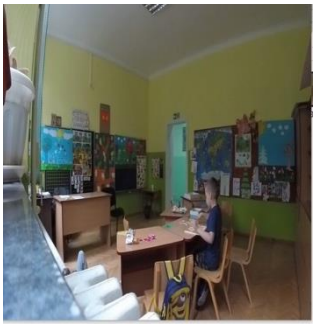
of twins with ASD completed the general questionnaire and the ZQYT. The twins' teachers completed GARS-3.

The twins' social interactions were recorded by a video camera in their classrooms, in 45-minute sessions over 10 consecutive days. Since the recording took place in classrooms that the students were used to and in which they spent most of their time at school, we can refer to this space as NE.

The video camera used in this research was a "Go Pro Hero 5 Session" camera, with recording resolution of 720p. In each classroom, the camera was positioned on high shelves so that it had the largest possible shooting angle and the smallest number of "blind spots". The dimensions of the two classrooms in which the recording took place were 5m x 6m, while the dimensions of the kindergarten classroom were 9m x 5m. The classrooms were equipped with similar furniture (desks, chairs, cabinets with teaching materials and toys: building blocks, puzzles, shape sorting toys, sound toys, etc., and one lazy bag) (Picture 1, Picture 2), while the kindergarten classroom had playgrounds, a larger number of toys (building blocks, puzzles, toys for cooking, playing music, dolls, balls, cars etc.), a mirror, and mats (Picture 3). The classroom equipment was accessible to everyone and children could approach and take available toys and materials according to their interests. The recording took place in the morning, from 8 to 11am.

Picture 1: Classroom of Pair 1 twins

Picture 2: Classroom of Pair 2 twins



Picture 3: Classroom of Pair 3 twins

The teacher and other students from the class were present in the classroom during the recording. Table 2 shows the class structure.

Table 2: Structure of the groups attended by twin pairs

Pair 1 (other students in class)	Pair 2 (other students in class)	Pair 3 (other students in class)
3 boys with ASD	2 boys with ASD	1 boy with Down syndrome
1 girl with ASD	1 girl with hearing impairment	1 boy and girl with ASD
	1 boy with DD and emotional immaturity	1 girl with specific language impairment
		1 girl with intellectual disability, hearing impairment, and motor disorder

The recording took place during the class of leisure time activities. This class is defined as a 45-minute period within which children choose what they will play with and how they will spend their time. We chose the class of leisure time activities because, according to the literature, children have a smaller tendency for social interactions during school routine or transitional activities, since it is believed that they are focused on tasks and events (Hong *et al.*, 2020; McWilliam, Scarborough & Kim, 2003).

Since naturalistic observation was used in this study, this approach allowed the students to choose an object or a toy from their environment and use it for interaction. In order to avoid potentially limiting variations of play activities or student motivation, the authors decided not to offer the students any specific toys, but to observe them in their usual environment and with their usual objects.

Table 3: Explanation of types of play and interaction according to Lieber and Beckman (1991) and of types of twins interactions (DiLalla, 2006)

Type of play		Type of interaction
Repetitive	using objects in a stereotypical and repetitive way. A child may turn a certain toy in his/her hands, smell it, put it in mouth, bang it down in order to produce a sound, etc.	New look – a look which occurs as a child's reaction to initiation or behavior of a partner as an immediate response to their activity;
Manipulative	using toys or other objects, more precisely, simple handling of toys.	Simple socially directed behavior (SDB) – a look + another form of behavior – e.g., smile, touch, vocalization;
Relational	a child groups objects on the basis of perceptual features, or combines them to form a construction (e.g. puzzles, blocks, etc.)	Coordinated SDB – a look + 2 forms of behavior;
Symbolic	represents the highest level of play and requires a child to be able to imitate or be involved in pretend play. This type of play is characterized by realistic, but also substitutive use of objects, pretending, imagination, sequencing play	Behavior which elicits a reaction – not directed at others, but elicits a reaction;
		Elicited response – nonsocial reaction to behavior of others, without a focused look;
		Isolated SDB – no partner response
Explanation of Twin Interaction Rating Scale (DiLalla, 2006)		
Domineering — How domineering was this child? How much did s/he try to tell the other child what to do? Rated 1 (*not at all domineering*) to 5 (*extremely domineering*).		
Complying — How much did this child comply with commands or requests from the other child? Rated 1 (*never complied*) to 5 (*always complied*).		

Enjoyed Other — How much did this child enjoy playing with the other child? Rated 1 (*didn't enjoy at all*, e.g., told the other child to go away) to 5 (*really enjoyed*, e.g., played happily and boisterously with other child, acted as though they had been good friends for a long time).
Other Enjoyed — How much did the other child enjoy playing with this child? Rated 1 (*didn't enjoy at all*, e.g., told the other child to go away) to 5 (*really enjoyed*, e.g., played happily and boisterously with other child, acted as though they had been good friends for a long time).
Prosocial — How often did this child engage in prosocial behaviors, such as complimenting, offering a toy, offering to help, or instigating an interaction? Rated 1 (*no prosocial behaviors*) to 5 (*very many examples of prosocial behavior*).
Difficult — How difficult was this child? Difficult included behavior such as complaining, being rude, hurting the other child, becoming extremely boisterous, or ignoring the other child. Rated 1 (*not at all difficult, a real pleasure to be around*) to 5 (*extremely difficult*).
Aggressive — How often did this child engage in aggressive behavior, including hitting, grabbing toys, or insulting? Rated 1 (*no aggressive behaviors*) to 5 (*very many aggressive behaviors*).

All interactions were coded in both segments of the protocol, depending on the partners in interaction. The coding of all protocols was performed by the second author of this paper, and then by an independent associate with a master's degree in special education. In the original research (Lieber & Beckman, 1991), the reliability of Lieber and Beckman's protocol was 84% on the type of play assessment, and 87% on the assessment of the type of interaction. In her research, DiLalla (2006) stated that the reliability of her rating scale of twins' interactions was 95%.

In our research, the concordance between the two examiners was high. This was achieved by calculating the mean for the data for which full concordance was not achieved. Cohen's kappa coefficient for "Type of play" variable was .92, and for "Type of interaction"$k = .93$ ($p < .001$).

Data analysis. The Statistical Package for Social Sciences, version 20 (SPSS 20) was used for data analysis, including descriptive measures, frequency measures, chi-square test (χ^2), bivariate chi-square test, Mann-Whitney U and Kruskal-Wallis nonparametric tests.

RESULTS

Analysis of the Social Behavior Coding Protocol – Frequency of Types of Play

Analysis of the Social Behavior Coding Protocol indicated that play situations occurred in 165 interactions, out of a total of 291 recorded by a video camera. The participants most frequently engaged in manipulative play (44.2%), somewhat less in repetitive play (43.0%), and least frequently in relational play (12.7%). The participants did not engage in symbolic play. A statistically significant difference with regard to the frequency of three types of play was confirmed by univariate chi-square test (χ^2 = 31.56, df = 2, p< .001). The contrast test determined that manipulative play occurred significantly more frequently than relational play (χ^2 = 28.77, df = 1, p< .001), and that repetitive play occurred much more frequently than relational play (χ^2 = 27.14, df = 1, p< .001). The same procedure showed that there was no statistically significant difference in the frequency of manipulative and repetitive play (χ^2 = 0.03, df = 1, p = .87).

Bivariate analysis of the type of play with regard to the participants indicated a statistically significant correlation between the participants and the type of play they engaged in (χ^2 = 52.68, df = 10, p< .01) (Table 4).

Table 4: Frequency (and row percentage) distribution of different types of play for each participant

	Manipulative		Relational		Repetitive		Total
	f	%	F	%	F	%	f
1A	5	27.8	1	5.6	12	**66.7**	18
1B	6	15.4	0	0.0	33	**84.6**	39
2A	19	**63.3**	5	16.7	6	20.0	30
2B	11	**42.3**	7	26.9	8	30.8	26
3A	15	**62.5**	3	12.5	6	25.0	24
3B	17	**60.7**	5	17.90	6	21.4	28
Total	73		21		71		165

* The number denoting the participants refers to the age of the pair, from the oldest (1) to the youngest pair (3); the letter refers to the order of birth (A – firstborn, B – second born twin).

The results of the univariate chi-square test indicate a statistically significant difference in the frequency of three different types of play when the initiator was a twin (χ^2 = 31.42, *df* = 2, *p*< .001). A significant difference was observed in favor of the frequency of manipulative play compared to relational play (χ^2 = 22.50, *df* = 1, *p*< .001), as well as in repetitive and relational play, with repetitive play being more frequent (χ^2 = 32.96, *df* = 1, *p*< .001). Again, there was no significant difference between the frequency of manipulative and repetitive play (χ^2 = 1.49, *df* = 1, *p* = .22).

No significant difference was found in the frequency of three types of play when the interactions were initiated by another child (χ^2 = 4.56, *df* = 2, *p* = .10).

Differences in the type of play frequency were observed when a teacher initiated the interactions (results of the omnibus test – χ^2 = 6.68, *df* = 2, *p* = .03). The frequency of manipulative play was significantly higher than the frequency of repetitive (χ^2 = 4.00, *df* = 1, *p* = .046) and relational play (χ^2 = 4.83, *df* = 1, *p* = .028), while there were no significant differences between relational and repetitive play (χ^2 = .043, *df* = 1, *p* = .84).

Analysis of the Social Behavior Coding Protocol – Duration of Interactions and the Frequency Distribution of Different Types of Interaction

The total number of interactions recorded by video camera was *N* = 291. The average duration of interactions was 22.96 seconds (*SD* = 26.12; 95% CI [20.28, 25.93]). The shortest interaction was two seconds, while the longest lasted for 164 seconds. The highest percentage of interactions, 88.66%, lasted between 2 and 50 seconds. In other words, the distribution of data on the duration of the interaction variable significantly deviates from the model of normal distribution (*W* = .71, *df* = 291, *p*< .001), i.e., it shows a strongly positive asymmetry (standardized *Sk* = 17.87). With regard to that, we should bear in mind that the median of the interaction duration is 15.00 (*IQR* = 22.00).

When the interaction was initiated by a twin, its median duration was 23.84 seconds (*Mdn* = 14.00, *IQR* = 23.00); the interaction lasted for about 14.66 seconds when initiated by another child (*Mdn* = 9.00, *IQR* = 15.50), while the interaction initiated by teachers lasted for 31.35 seconds (*Mdn* = 20.00, *IQR* = 25.00). The results of the Kruskal-Wallis test indicate a significant difference in the median duration of interactions initiated by different initiators (*H* = 29.42, *df* = 2, *p*< .001).

The results of the Mann-Whitney test indicated that the difference in duration of interactions when the initiator was a twin, as opposed to the ones initiated by another child, was marginally significant (*U* = 5020.50, *p* = .057), while the interactions initiated by a teacher lasted significantly longer than the ones initiated by a twin (*U* = 2985.00, *p*< .001) or another child (*U* = 1026.0, *p*< .001).

There were 136 (46.8%) interactions of twins with other children (whether initiated by a twin or another child), 139 (47.7%) with a teacher, while the number of interactions within a twin pair was 16 (5.5%). At school, twins with ASD interacted with their twin pair least frequently, and significantly less frequently than with other children ($\chi^2 = 94.74$, $df = 1$, $p < .01$) and teachers ($\chi^2 = 97.61$, $df = 1$, $p < .01$), while the frequency of interactions with teachers and other children was not significantly different ($\chi^2 = 0.03$, $df = 1$, $p = .86$).

The total number of interactions between twins and teachers was 139, of which 79 were initiated by twins, and the remaining 60 were initiated by a teacher. This difference was not statistically significant ($\chi^2 = 2.60$, $df = 1$, $p = .11$), which indicated that the twins initiated interactions with teachers as frequently as teachers did with them.

The frequency distribution of different types of interaction is shown in Table 5. The results of chi-square test indicate a significant difference in the distribution of the types of interaction ($\chi^2 = 293.47$, $df = 5$, $p < .001$).

Table 5: Type of interaction distribution

	f	%
Simple SDB	145	49.8
Coordinated SDB	65	22.3
New look	44	15.1
Elicited response	34	11.7
Behavior	2	0.7
Isolated SDB	1	0.3
Total	291	100

As shown in Table 6, when the interactions were initiated by a twin or a teacher, simple SDB was the most frequent ($n = 101$, $P = 65.6\%$, i.e.,$n = 25$, $P = 41.7\%$), while the most frequent type of interaction when the initiator was another child was elicited response ($n = 26$, $P = 33.8\%$).

Table 6: *Type of interaction and the initiator*

	Twin	Another child	Teacher	Total
Simple SDB	101	19	25	145
Coordinated SDB	43	8	14	65
New look	6	24	14	44
Behavior	2	0	0	2
Elicited response	1	26	7	34
Isolated SDB	1	0	0	1
Total	154	77	60	291

DISCUSSION

This research was conducted with the aim of examining typical play interactions of three pairs of twins with ASD in their NE. The obtained results indicated that the twins with ASD most frequently engaged in manipulative and repetitive play. The type of play in which objects were grouped or combined was much less frequent, while symbolic play was completely left out. Similar results were obtained in the research conducted by Markodimitraki *et al.* (2016). Their twin pair most frequently engaged in manipulative play, followed by repetitive play. Since there was almost no difference in the frequency of manipulative and repetitive play in our research, we assumed that such findings may be related to the different ages of our participants. Younger participants in our study, who were closest in age to the twin pair from the Greek study, were predominantly engaged in manipulative play, characterized by simple handling of toys, observing them, holding them in hands and exchanging them for a short period of time, which is similar to the findings of Markodimitraki *et al.* (2016). It appears that the frequency of repetitive play increases with the participants' age. Repetitive play in our research was characterized by waving toys, turning them around, tapping them, bringing them close to eyes and moving them away, as well as focusing on details.

The results of our research showed that there was no statistically significant difference in the number of interactions initiated by a teacher compared to the ones initiated by one of the twins. Kypriotaki and Markodimitraki (2018) obtained opposite results, where out of 20 interactions between twins and teachers, all 20 were initiated by a teacher. This difference in the results can partly be explained by the fact that our research included three teachers in three classes. We assume

that the personality of teachers and students, the number of children in class, as well as specific characteristics of each student can affect the number of achieved interactions. Children with ASD often initiate interactions with adults in situations when they need help, when they cannot do something on their own (Anderson *et al.*, 2004; Drain & Engelhardt, 2013), which was also common in our research. In most situations, the youngest twins initiated interaction with a teacher by asking the teacher to caress them, carry them, hug them, sit them on their lap, etc. The oldest twins initiated interactions with teachers when they wanted to be rewarded for a completed task or when they needed something which was out of their reach. Twin 1B often approached the teacher with a request to repeat a certain word or sentence which comprised part of his repetitive actions. On the other hand, in most cases, teachers approached the twins when they had a request for them or when they wanted to include them in group activities. When initiating interaction, the teachers in our research addressed the students individually rather than as a group, i.e., they focused on each individual child. Such teacher behavior is believed to be related to increased engagement in children (McWilliam *et al.*, 2003). However, the literature states that explaining, providing additional information, as well as teacher presence in the place where an activity is taking place, may contribute much more to a child's engagement than making requests, asking questions, or responding to students' requests (McWilliam *et al.*, 2003).

The ability of twins with ASD to initiate interactions with teachers, as well as with other children, is a reflection of the preserved capacities of these children and can be seen as a basis for planning further steps when providing support. Kypriotaki and Markodimitraki (2018) explain the tendency of twins with ASD to initiate interactions with teachers by the fact that they have always been surrounded by people who have been their interactive partners at home or at school, since they have their co-twin and have an increased need for support, and that in this way they may have raised the level of responsiveness to people in their environment and to initiating interactions.

Although twins initiated interactions with teachers as equally as teachers with them, the interactions initiated by a teacher lasted significantly longer than the ones initiated by a twin or another child. It is assumed that maturity, experience, as well as professional knowledge of teachers contributed to this result (Kypriotaki & Markodimitraki, 2018).

Although twins are always directed towards each other, the results of our research showed that they interacted with their co-twin least frequently, i.e., that twins with ASD interacted with each other very rarely in a school environment, sometimes not even once during a 45-minute recording session. Rare situations in which they interacted occurred when one of the twins got the teacher's or another child's attention, which he/she seemed to enjoy. Then, the other twin would join in or try to impose. This caused a short conflict between the twins, and one of them

would leave. Research conducted on typically developing (TD) twins indicates that twins are predominantly focused on each other at an early age, and that in school and later on, they more frequently and more intensively interact with other peers (DiLalla, 2006). On the other hand, the results of a study dealing with the behavior of preschool twins with different disabilities showed that the twin pairs most often played with each other (Markodimitraki *et al*., 2016a).

Although Lieber and Beckman (1991) stated that "new look" was the most common reaction of children with DD and children with ASD during interactions, the results of our research showed that the most frequent type of interaction was simple SDB. Simple SDB is considered to be a higher form of social behavior, which includes a focused look and another activity that a participant performs towards his/her partner in interaction, in order to initiate or maintain it. The fact that coordinated SDB was the second most frequent type of interaction is surprising since it includes a focused look and two or more activities when interacting with others. Knowing that the area of social communication and interaction is an area of extreme difficulty for people with ASD, this finding is encouraging and raises questions about the potential influence that twins have on each other and their mutual social development. In addition, the result which indicates the need for further research is the fact that the twins most frequently reacted to other children's initiative with antisocial behavior, while they reacted to a teacher's or a co-twin's initiative with simple SDB. Future studies should further monitor and code all individual teacher activities, since it remains unclear whether and to what extent the teachers adequately responded to interactions of children with disabilities and children with ASD, given that the literature indicates that teachers in preschool groups, even when they are specialized for children with ASD, do not successfully recognize children's communicative attempts (Keen, Sigafoos, & Woodyatt, 2005), i.e., that teachers do not have adequate knowledge of the significance of joint attention skills for play development, as well as on the application of scientifically based techniques which can stimulate play development (Anderson *et al*., 2004; Wong & Kasari, 2012).

Limitations and recommendations for future research. The main limitation of this study is the small sample. Another limitation of this research is the fact that the data was collected in one school in a fairly homogenous area with regard to ethnicity and socioeconomic status. The lack of data on the twins' intellectual functioning level can also be considered a limitation. Another limitation of this research is the fact that we did not monitor the variety of toys the twins played with, playing in different contexts, or the relations between reactions of other children and teachers and the play activity itself. Thus, future research should include additional variables collected in different parts of the country and environments.

Pedagogical implications. Apart from the mentioned shortcomings, this study does have its advantages. We believe that such research studies are key to strengthening our preliminary understanding of how we can best support twins with ASD in their play activities, and how and in which direction we can conduct further research in order to determine the most effective techniques for encouraging play activities in these children. Educators and teachers should carefully observe the specific behavior of children (and twins) with ASD during preschool and school play interactions in order to design support programs that would improve the quality and duration of these interactions. Since domestic research indicates that children with good play interaction also have better social skills, it is clear that the findings of such and similar studies could be useful in creating individualized education support plans and individualization measures (Đurić-Zdravković *et al*., 2019). In addition, it is suggested that improving play skills could contribute to the acquisition of learning content, and that educators and teachers could consider self-development in the field of play therapy for children and applying new knowledge in preschool and school contexts (*Child Centered Play Therapy – CCPT*) (Japundža-Milisavljević, Đurić-Zdravković, & Milanović-Dobrota, 2022). On the other hand, educators and teachers in an inclusive preschool and school context could try to apply *Peer Mediated Intervention*, both during school lessons and unstructured school activities, since that provides additional opportunities for developing social interactions among peers and improving play skills (Beslać & Banković, 2022). In addition, guided play, naturalistic, and behavioral interventions can be used to improve all types of play in children with autism in preschool and school contexts (O'Keeffe & McNally, 2021). Finally, it should be emphasized that if educators and teachers have the opportunity to work with twins with autism, they should bear in mind that twins are naturally used to daily out-of-school interactions and can thus encourage one another. Since they attend school together for a number of years, the findings of this research should be considered when providing support.

CONCLUSION

The obtained results show that twins with ASD most often participate in two types of play, manipulative and repetitive, and that they initiate interactions with teachers as often as teachers with them. Furthermore, it is interesting that the twins in our research, when reacting in interactions, most frequently exhibited a somewhat higher form of social behavior (than expected), including a focused gaze and other activities performed between partners in interaction (e.g., smile, touch, vocalization) to initiate or maintain it. The ability to initiate interactions and the elements of appropriate reactions during contact can be considered as an encouraging result that can be an opportunity for further improvement and development of these skills for practitioners.

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