

## **Developmental coordination disorder (DCD) and play behavior in children with autism spectrum disorder**

Dimitra Gatzoyia<sup>1</sup>, Spyridon-Georgios Soulis<sup>2</sup>, Harilaos Zaragas<sup>3</sup>,  
Vasilios Koutras<sup>4</sup>, Danai Rapti<sup>5</sup>

<sup>1</sup> Department of Early Childhood Education (E.C.E.D.U.), University of Ioannina, Greece,

<sup>2</sup> Department of Primary Education, University of Ioannina, Ioannina, Greece, <sup>3</sup> Department of Early Childhood Education (E.C.E.D.U.), University of Ioannina, Greece,

<sup>4</sup> Department of Early Childhood Education (E.C.E.D.U.), University of Ioannina, Greece,

<sup>5</sup> Department of Primary Education, University of Ioannina, Ioannina, Greece,

Corresponding Author: Dimitra Gatzoyia

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### **I. Introduction**

According to the new diagnostic criteria of DSM – 5 by the American Psychiatric association, the term “Autism Spectrum Disorder” refers to a group of symptoms that entail difficulties in social interaction, communication and repeated stereotypical behavior and interests (American Psychiatric Association, 2013). ASD was divided into three levels according to the severity of the case. People who need support and have difficulties in communication and socialization belong to level one. Level two includes people who need substantial support and face serious difficulties while level three includes people who require very substantial support and have grave difficulties in socialization and flexibility (American Psychiatric Association, 2013).

People with a developmental disorder, like autism spectrum disorder, have a deficit in their motor and social skills. The main difficulties that these people experience, regarding their motor skills, are in skillfulness, balance, and motor coordination. Due to their clumsiness and their lack of social interaction, people with autism spectrum disorder heavily depend on their caregivers. These caregivers have also taken on the task to train them in obtaining social skills (Scharoun et al, 2015). Motor skills help people experience and learn about their surrounding environment. Fine motor skills include the ability to write with a pencil, collecting small objects, cutting with scissors and having precision in their movements. People with autism spectrum disorder face difficulties in the execution of those activities and as a result their self-esteem is negatively affected and they give up trying. Moreover, people with autism spectrum disorder can sometimes behave with anger or aggression if they cannot complete a motor activity (Scharoun et al, 2015).

Physical awkwardness has been recognized as one of the most common developmental disorders during childhood. According to Wall (1982) children with physical awkwardness are those who do not have neurological problems and yet fail to execute motor activities expected in the environment they live at an acceptable level. In 1994 the American Psychiatric Association (DSM-IV, 1994) recognized physical awkwardness as a special motor dysfunction and called it Developmental Coordination Disorder (DCD) - a term which has been adopted and used by all those who deal with this phenomenon. Countries of Europe (Sweden, Denmark, Italy) and countries of Asia (Japan, China) have shown great interest in DCD lately. As a result, there is a large amount of research that is being carried out in this field (Crawford, Wilson & Dewey, 2001; Chow & Henderson, 2003).

When children use their imagination during play they are able to understand the language and the rules of the game (Peeters, 2000). Children with ASD, though, face great difficulties and cannot play in the usual manner that typically developing children do. The play of a child with ASD compared to that of a typically developing one is not only different but also it is deemed inappropriate for its age (Peeters, 2000). The inability of a child with ASD to play has an important negative effect on all levels of its development (Powel & Jordan, 2001). The child’s lack of skills in playing causes its social isolation and marginalization.

Regarding the child’s kind of play, many theories have been developed which categorize it according to various features (Meire et al., 2007). Most of the classification attempts divide play evolutionally, according to the child’s age and its developmental level. Another classification that can be made, besides taking into account the skills that are developed in each developmental stage, is to divide play into group play and solitary play. The evolution of play also depicts the integration of the child within a group because as the child grows it moves from solitary play to cooperative play.

Taking the aforementioned into account, the aim of the present research is to explore the social behavior through play (autistic/unoccupied, solitary/exploratory, parallel, associative/interactive, cooperative) and how this behavior is linked to the Developmental Coordination Disorder of the children with Autism Spectrum Disorder.

## II. Methodology

### *The Sample*

The sample of the research consisted of 151 children, between the ages of 6 and 12, with an official diagnosis of autism spectrum disorder. These children attend public schools and other education structures of mainland Greece. The written consent of the parents of the children was asked in order to collect the data.

### *Measuring Instrument*

Two weighted questionnaires were used for the conduction of the research. The Sherrill – UVA – APE (Sherill, 2004) was used for the rating of social behavior during play. It is a 4 –point Likert type scale which is simple and easy to use and assesses the social behavior of the child during play (Hovart et al. 2007). This scale of social behavior during play is divided into five levels according to the type of play. More specifically it assesses a) the autistic/unoccupied behavior b) the solitary/exploratory behavior c) the parallel behavior d) the associative/interactive behavior e) the cooperative behavior. This scale allows the researcher to define how often the subject presents a certain attitude during play and it also allows the evaluation of the subject’s progress.

In addition, the Movement Assessment Battery for Children (Henderson & Sugden, 1992) was used which is a valid and reliable measurement instrument for DCD (Crawford, Wilson & Dewey, 2001; Chow & Henderson, 2003; Croce et al, 2001). The specific instrument consists of four statements which gradually measure more complicated interactions between the child and the environment. More specifically, the first statement is “The child is stationary and the environment is stable”, the second statement is “The child is moving and the environment is stable”, the third statement is “The child is stationary and the environment is changing” and the fourth statement is “The child is moving and the environment is changing”.

### *Statistical Analysis*

Exploratory factor analysis was used for the statistical analysis of the data. The Varimax criterion for analytic rotation in factor analysis was used in order to simplify the expression of a particular sub-space in terms of just a few major items each. The descriptive statistics, mean and standard deviation were calculated to summarize and describe the data while the Pearson correlation efficient was calculated to correlate the scales. The results of the primary analysis were combined in linear regression models to determine the independent prognostic factors. The level of significance was equal to 0.05 in all cases and the analysis was done with the statistical package SPSS v22.0

## III. Results

84% of the sample was boys and only 16% was girls. Their mean age was  $8\pm 3$  years. As far as the type of autism is concerned, 7 out of 10 participants were medium functioning (level 2).

Regarding the DCD in the statements “The child is stationary and the environment is stable” and “The child is moving and the environment is stable” the results are around the mean. This finding shows that this kind of behavior is relatively common. The statement “The child is stationary and the environment is changing” is above the mean which means that it is quite common behavior. Finally, the statement “The child is moving and the environment is changing” has the highest rate, thus, it is considered very common behavior (Table 1)

**Table 1** Motor test MAB-1

	N	Min.	Max.	M.O.
The child is stationary and the environment is stable	149	0	34	16.4±7.6
The child is moving and the environment is stable	147	0	33	17.6±7.6
The child is stationary and the environment is changing	140	0	36	20.7±8.4
The child is moving and the environment is changing	145	0	34	19.9±8.2

As far as the social behavior of children during play is concerned, the autistic/unoccupied behavior, the solitary/exploratory behavior and the parallel behavior were close to the mean – a finding which suggests that these three types of behavior were common within the sample. On the other hand, the associative/interactive behavior and the cooperative behavior were below the mean – a finding which suggests that these types of behavior were not that common (Table 2).

**Table 2 Social Play Behavior Inventory**

	N	Min.	Max.	M.O.
Autistic/Unoccupied	144	10	27	17.8±3.8
Solitary/Exploratory	146	8	24	16.0±3.4
Parallel	141	5	19	11.4±2.2
Associative/Interactive	143	8	28	13.9±4.3
Cooperative	148	8	32	16.8±5.7

The linear regression analysis regarding the DCD of the child with autism showed the following: a) when the child is moving and the environment is changing the autistic/unoccupied behavior is higher b) when the child is stationary and the environment is changing the solitary/exploratory, the associative/interactive and the cooperative behavior is lower c) when then child is stationary and the environment stable the cooperative behavior is lower d) when the child is moving and the environment is stable its behavior does not seem to be affected (Table 3)

**Table 3 Regression Analysis (p-values)**

	The child is stationary and the environment is stable	The child is moving and the environment is stable	The child is stationary and the environment is changing	The child is moving and the environment is changing
Autistic/Unoccupied	0.585	0.745	0.305	<b>0.006</b>
Solitary/Exploratory	0.110	0.392	<b>0.005</b>	0.860
Parallel	0.796	0.225	0.472	0.416
Associative/Interactive	0.985	0.628	<b>0.021</b>	0.283
Cooperative	<b>0.001</b>	0.177	<b>0.005</b>	0.740

#### IV. Discussion

According to the statistical analysis, the DCD has a statistically important relationship with all parameters of social behavior.

The results show that if the DCD of a child with ASD is high, its social behavior is more limited in the case where the child is stationary and the environment is changing. In the case where the child is stationary and the environment is changing, the autistic/unoccupied behavior, the associative/interactive behavior and the cooperative behavior in play diminishes. Furthermore, in the case where the child is stationary and the environment is stable, the high DCD of the child causes less cooperative behavior in play. According to the relevant literature the typical development of the child has a positive effect on the “normal” development of its social and motor skills (Kim et al., 2016). However, children with autism spectrum disorder have deficits in their motor and social skills. The difficulties that they face regarding their motor skills are in skillfulness, balance and motor coordination (Lloyd et al., 2013). Due to the DCD and the lack of social interaction, children with autism depend on their caregivers who are in charge of helping them with their everyday activities and training them to obtain social skills (Scharoun et al, 2015).

The motor skill affects the way in which a child with autism interacts with its environment. In other words, it affects the way it perceives the environment, the way it communicates with others and its ability for linguistic development. Children with high functioning autism have a better control of motor coordination which means that they have more chances of being able to take care of themselves and socially interacting with others (Gowen & Hamilton, 2012).

The statement “The child is moving and the environment is changing” seems to have an important effect on the autistic/unoccupied behavior and it does not depend upon the level of the child’s functionality. The solitary behavior of the child changes and becomes higher as the DCD increases. The solitary behavior triggers depression and as a result the child with ASD becomes socially secluded and physically inactive. This means that the child experiences great disappointment due to the failure in communication and cooperation with its peers. Thus, is becomes inactive and does not opt for physical activities (Mazurek, 2014).

The solitary/exploratory behavior is significantly affected because it diminishes as the DCD rises. When “The child is stationary and the environment is changing” there are serious difficulties in the child’s socialization and flexibility. In this case the child is in need of substantial support because it has an inflexible adherence to certain activities which are non functional routines of its everyday life and are hard to change. It is also hard for this child with autism to adapt to a changing environment (Fuentes et al, 2014).

Regarding the statement “The child is stationary and the environment is changing” and the statement “The child is stationary and the environment is stable” the DCD has an important effect on the cooperative behavior. More specifically, the higher the DCD in these cases, the lower the cooperative behavior. This situation applies to children with autism regardless of their functionality.

The difficulty that the child with autism faces in cooperative behavior lies mainly in its inability to perceive the notion of the “other” and to respect their needs. Moreover, it is difficult for a child with autism to maintain its self-control and attention which leads to a difficulty in performing tasks (Mundy, et al, 2009).

The findings of the present research show that if the motor skills of children with autism are limited and their surrounding environment is designed in a way that reinforces DCD, the level of social dysfunction and the severity of the disorder are higher. Children with DCD face problems in the execution of simple, everyday tasks such as brushing one's teeth, playing with a ball and doing up one's shoes. Meanwhile, they are vulnerable to bullying within their school and their social environment. Moreover, they have low self-esteem which affects their quality of life even in their adult life (Dewey et al., 2007).

The present research has the following limitations: a) the sample consisted of people with a wide age range. Probably their classification in age groups would lead to conclusions according to the change in age b) a scale and a questionnaire were used to collect the data. This method allowed the motor and social behavior of children with autism who participated in the research to be assessed by a third party. Yet, the issue of objectivity might still arise since the assessment was done according to the subjective views of the observers and the context within which the assessment was made might influence the way the child's behavior was perceived. Finally, another limitation could be considered the fact that the sample was from a specific area of Greece and its size was relatively small.

In conclusion, the DCD of the child with autism affects its social behavior in play. More specifically, the higher its DCD is, the more its motor behavior worsens and social deficits are observed. Regardless of the child's functionality, if the DCD is high the child's social skills regarding play are diminished. In fact, an environment which changes increases the level of social dysfunction and the severity of the disorder. Due to the DCD, the child with autism experiences repeated failures which lead the child to refrain from physical activities and result in its poor physical condition.

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