

(RESEARCH ARTICLE)



Developmental coordination disorders as a factor affecting the self-esteem of individuals with autism spectrum disorder

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Abstract

A common difficulty that individuals with autism spectrum disorder (ASD) are facing is developmental coordination disorders (DCD). Challenges in motor performance and coordination may limit independence, increase anxiety, and negatively impact self-esteem. This concern is a key focus of interventions designed to improve the quality of life of these individuals, particularly during childhood and adolescence.

Aim: The aim of this research is to investigate whether developmental coordination disorders constitute a factor that affects the self-esteem of individuals with autism spectrum disorder.

Methodology: Using a combination of qualitative and quantitative methodological approaches, the study used standardized questionnaires and collected data from teachers, parents, and children through observations and interviews. Ethical issues were also observed throughout the research, ensuring participant confidentiality and informed consent, while statistical analyses, including the t-test and linear regression, were conducted to accurately assess the interaction between social competence and self-esteem.

Results: Individuals with autism spectrum disorder (ASD) often experience developmental coordination disorders, which can negatively affect their skills, coordination, and overall self-esteem. This disorder is linked to a variety of factors, including the type of autism and play preferences, and can hinder social interactions, leading to increased anxiety and feelings of failure among children. Interventions that enhance movement and encourage physical activity are essential to address these challenges.

Conclusions: It is essential to incorporate interventions that enhance self-esteem and motor skills, helping with the holistic development of individuals with ASD. In general, organized physical activities are vital in order to promote improved developmental outcomes for these individuals.

Keywords: Autism Spectrum Disorder; Developmental Coordination Disorder; Self-Esteem; Quality of Life; Children; Adolescence

1. Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition that leads to significant challenges in social communication and behaviour, affecting the socio-emotional development of children (Blake et al., 2003; Corbett et al., 2014; Nathalie, 2011; Vogan et al., 2018). Research shows that children with ASD often struggle with motor skills

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(Courchesne et al., 2011), visual recognition of movement (Blake et al., 2003), and emotion regulation (Diamond et al., 1998), which may hinder their social interactions and adaptability (Nathalie, 2011; Vogan et al., 2018).

Developmental Coordination Disorder (DCD), formerly known as psychomotor clumsiness, is a neurodevelopmental disorder characterized by significant difficulties in motor coordination, affecting children's ability to perform daily activities. Historically recognized as "clumsy child syndrome", it manifests as severe clumsiness, affecting basic skills such as dressing, writing, and participating in physical activities (Meachon et al., 2022).

It has been estimated that the disorder is affecting 6-10% of children, with a higher prevalence in boys compared to girls (Wilson et al., 2020). Children with developmental coordination disorders often face emotional and psychological challenges, such as low self-esteem, social isolation, and behavioural problems, which may exacerbate their motor difficulties (Vouglanis, 2020; 2023; 2024; Vouglanis & Driga, 2023; Vouglanis, Driga, & Drigas, 2022). Early detection and intervention are crucial, as untreated motor disorders can lead to long-term academic and social difficulties, highlighting the importance of appropriate assessment tools and support for affected children (Fogel et al., 2023).

Concluding, the introduction we emphasize the significance of all digital technologies in the field of education of autistics, which is highly effective and productive and facilitates and improves assessment, intervention, and educational procedures via mobile devices that bring educational activities everywhere [41-44], various ICTs applications that are the main supporters of education [45-51], and AI, STEM, and ROBOTICS that raise educational procedures to new performance levers [52-57]. Additionally, the development and integration of ICTs with theories and models of metacognition, mindfulness, meditation, and the cultivation of emotional intelligence [58-74], accelerates and improves more than educational practices and results, especially in autistics education, treating domain and its practices like assessment and intervention.

2. Theoretical background

High self-esteem is crucial for individuals' quality of life, influencing self-image and interpersonal relationships, particularly during adolescence (Pyszczynski et al., 2004). It acts as a protective factor and is associated with positive outcomes such as psychological adjustment, social self-confidence, and prosocial behaviour (Pepping et al., 2013). The field of positive psychology has introduced two main approaches to well-being: the hedonistic approach, which equates well-being with pleasure and life satisfaction, and the eudemonistic approach, which emphasizes the importance of fulfilling one's human potential and developing virtues beyond mere happiness (Pavot & Diener, 2008; Ryan et al., 2008).

Ryff's (2014) multidimensional model of psychological well-being identifies six core dimensions that contribute to overall well-being: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Each dimension highlights key aspects of healthy functioning, such as the ability to regulate behaviour, manage daily activities, develop capabilities, create meaningful connections, establish meaningful goals, and maintain a positive self-esteem. Together, these dimensions illustrate the various challenges individuals face in achieving a satisfying and fulfilling life (Ryff & Singer, 2008).

Research shows that hedonistic activities, which focus on personal growth and meaningful relationships, yield more significant long-term benefits for well-being than hedonistic activities that provide short-term pleasure (Huta & Ryan, 2010). While hedonistic pursuits may enhance immediate gratification, they do not contribute to lasting life satisfaction, whereas hedonistic activities enhance resilience and a sense of accomplishment (Steger et al., 2008; Huta & Ryan, 2010). Furthermore, studies show that psychological well-being is associated with better health outcomes (Ryff, 2017), although dimensions of well-being, such as personal growth, tend to decline with age (Springer et al., 2011), a trend observed in adolescents where boys generally report higher satisfaction from life than girls (Inchley & Currie, 2016).

The HBSC study highlights the critical role of interpersonal relationships, particularly with peers and parents, in promoting adolescent well-being (Inchley & Currie, 2016). Research by Patalay and Fitzsimons (2018) shows that well-being among adolescents, especially girls, tends to decline over time, influenced by factors such as family income, parental relationships, and school affiliation. Furthermore, a study by Booker et al. (2018) supports these findings, noting that as girls grow older, they often engage in social comparisons that negatively affect their well-being. Finally, Ottova-Jordan et al. (2015) reveal varying trends in well-being across countries, influenced by socioeconomic factors and environmental pressures.

3. Methodology

3.1. Research design

The present study aims to systematically investigate children's DCD and self-esteem through a combination of quantitative and qualitative methodologies. DCD is assessed in various contexts, while self-esteem is assessed using standardized questionnaires completed by children, parents, and teachers. The study focuses on autistic children aged 3 to 22 years from diverse backgrounds, using observation, interviews, and standardized tools for data collection and analysis to better understand the interaction between these factors.

3.2. Questionnaire

The research questionnaire is divided into four sections, focusing on the traits of teachers and children, as well as various assessment tools. The first section is used to collect demographic information about the sample, while the second section employs the Rosenberg Self-Esteem Scale (RSES) to assess self-esteem through 10 statements rated on a four-point Likert scale. The third section utilizes the Motor Control Scale to assess psychomotor skills with 48 questions in different movement and environmental scenarios. Finally, the Social Behaviour in Symbolic Play assesses social interactions through 35 questions, examining behaviours such as autistic, exploratory, parallel, companionship and cooperative behaviours, providing a comprehensive understanding of children's motor and social skills, especially for those with developmental challenges. The above psychometric tools have been used in research in Greece and abroad and their psychometric properties have been proven.

3.3. Sample and data collection

In the survey, 153 teachers from various regions of Greece participated, and were selected through convenience sampling. The relevant data was collected through an electronic questionnaire designed to assess key variables such as DCD and self-esteem in children. The process ensured the anonymity and comfort of the participants, allowing for effective data collection while maintaining confidentiality and facilitating statistical analysis of the findings.

3.4. Data collection and ethical issues

The research maintained objectivity through the use of standardized and reliable instruments, with data collected and analysed using statistical methods to eliminate personal bias. Ethical standards were strictly adhered to, with participants fully informed of the purpose and procedures of the study, and their informed consent was obtained prior to participation. Anonymity and confidentiality were prioritized, and the research protocol received approval from a competent ethics body, ensuring that the study was conducted with respect for the participants and with high ethical standards.

3.5. Statistical data analysis

The research used both descriptive and inferential statistical methods to effectively analyse the data. Descriptive statistics summarized the sample characteristics and baseline variables, while t-test and ANOVA were used for inferential analysis to compare mean values between groups, with Bonferroni post hoc testing applied to mitigate Type I error. In addition, linear regression was performed to predict dependent variables such as social behaviour and self-esteem based on the DCD, ensuring accurate and reliable investigation of the research questions.

4. Results

4.1. Reliability analysis

Factor reliability analysis used Cronbach's α , revealing excellent reliability across various DCD factors. Specifically, the factors "Child Unmoving/Environment Stable" and "Child Moving/Environment Stable" presented the highest reliability ($\alpha=0.92$ and $\alpha=0.92$, respectively), while other factors also presented strong reliability, with values above 0.91. Regarding social behaviour, "Companion Behaviour" and "Cooperative Behaviour" showed excellent reliability, while "Autistic Behaviour" was rated as high reliability, and "Exploratory Behaviour" and "Parallel Behaviour" were considered acceptable, with "Self-Esteem" also demonstrating acceptable reliability.

Table 1 Reliability analysis

Scale	Factors	Questions	Cronbach Alpha	Reliability
DCD investigation	Child Unmoving/Environment Stable	1-12	0.922	Excellent
	Child Moving/Environment Stable	13-24	0.919	Excellent
	Child Unmoving/Environment Changes	25-36	0.908	Excellent
	Child Moving/Environment Changes	37-48	0.906	Excellent
Social behaviour	Autistic behaviour	1, 2, 5-10	0.819	High
	Exploratory behaviour	3, 4, 11-14	0.697	Acceptable
	Parallel behaviour	15, 16, 17R, 18, 19R	0.652	Acceptable
	Companionship behaviour	20-27	0.902	Excellent
	Cooperative behaviour	28-35	0.913	Excellent
Self-esteem for children	Self-esteem	1R, 2R, 3, 4R, 5, 6R, 7-9, 10R	0.682	Acceptable

4.2. Levels of developmental coordination disorder

Research shows that DCD involves challenges such as maintaining balance, handling objects, and engaging in physical activities.

Analysis of DCD in children revealed different levels of skills in different scenarios, such as when the child is unmoving or moving and when the environment is stable or changing.

The study analysed the DCD using multiple linear regression, with the dependent variable defined as the average of four factors, demonstrating excellent reliability ($\alpha=0.917$). The model showed statistical significance and no multicollinearity issues. Key predictors identified were "Autism Type" and "Play Preference", indicating their substantial effects on DCD (see Table 2).

Table 2 Multiple linear regression with "Movement Coordination Disorder" as the dependent variable

Independent	B	Beta	t	p-value	VIF
Constant	2.624	-	8.263	<0.001	-
Age	0.004	0.065	0.802	0.424	1.434
Teachers	-0.234	-0.09	-1.292	0.198	1.049
Special Education	-0.085	-0.073	-1.017	0.311	1.102
Elementary/Middle School/High School	0.011	0.01	0.126	0.9	1.362
Years of service (11-15)	0.123	0.095	1.126	0.262	1.531
Years of experience in special education (11-15)	0.086	0.054	0.618	0.538	1.67
Type of autism	-0.241	-0.333	-4.347	<0.001	1.26
Physical activity outside of school	-0.107	-0.091	-1.288	0.2	1.07
Play preference	-0.267	-0.198	-2.735	0.007	1.128
Child weight	0.055	0.083	1.188	0.237	1.052

Intense exercise for more than 15 minutes	-0.219	-0.079	-1.039	0.301	1.227
Mild exercise for more than 15 minutes	-0.227	-0.138	-1.878	0.062	1.159

F (12,139) =6.324, p<0.001, R²=35.3%

The investigation of the correlations between DCD factors and social behaviour and self-esteem reveals significant relationships. “Child Unmoving/Environment Stable” shows a positive correlation with “Autistic Behaviour” and negative correlations with various social behaviours and self-esteem. Similarly, “Child Moving/Environment Stable” is negatively correlated with exploratory, parallel, social, cooperative behaviours and self-esteem. The patterns continue with “Child Unmoving/Environment Changing” and “Child Moving/Environment Changing”, both of which are positively correlated with “Autistic Behaviour”, while showing negative correlations with multiple social behaviours and self-esteem, indicating a consistent trend across conditions (see Table 3).

Table 3 Correlations between DCD factors, social behavior, and self-esteem

Factors	Child Unmoving/Environment Stable	Child Moving/Environment Stable	Child Unmoving/Environment Changing	Child Moving/Environment Changing
Autistic behaviour	.322**	0.148	.240**	.296**
Exploratory behaviour	-.440**	-.380**	-.254**	-.359**
Parallel behaviour	-.333**	-.325**	-.342**	-.400**
Companionship behaviour	-.372**	-.357**	-.463**	-.538**
Cooperative behaviour	-.493**	-.492**	-.522**	-.570**
Self-esteem	-.309**	-.190*	-.173*	-.274**

** p<0,01, *p<0,05

4.3. Self-esteem levels

The assessment of self-esteem in autistic children reveals several insights based on the parents’ responses. A significant majority of parents believe that their child recognizes their positive traits (83.66%) and feels that they deserve equal treatment (71.90%). In addition, many children express satisfaction with themselves (66.67%) and do not harbour a negative self-image (56.86%). However, there are concerns, as a notable percentage of parents report that their child feels unsuccessful (58.82%) and lacks self-respect (63.40%), indicating areas where self-esteem may need further support (see Table 4).

Table 4 Self-esteem

Questions	Mean	SD	Totally disagree	Disagree	Agree	Totally agree
5. Thinks that he/she has good traits.	2.93	0.7	5.88%	10.46%	68.63%	15.03%
7. Believes that he/she deserves as much as the rest.	2.78	0.83	9.8%	18.3%	56.21%	15.69%
9. Is satisfied with himself/herself.	2.66	0.86	13.07%	20.26%	54.25%	12.42%
3. Has no negative attitude about himself/herself.	2.6	0.91	13.07%	30.07%	40.52%	16.34%
8. Does things as well as others.	2.48	0.94	18.3%	28.76%	39.87%	13.07%
1. Sometimes he/she doesn't feel useful. [R]	2.46	0.8	13.73%	32.03%	48.37%	5.88%

6. Doesn't consider himself/herself successful.[R]	2.29	0.81	16.99%	41.83%	35.95%	5.23%
10. Thinks he/she doesn't respect himself/herself as much as he/she should..[R]	2.22	0.85	20.92%	42.48%	30.07%	6.54%
4. Is not proud of himself/herself. [R]	2.19	0.83	21.57%	42.48%	31.37%	4.58%
2. Sometimes he/she is mean. [R]	2.16	0.89	27.45%	34.64%	32.68%	5.23%

Multiple linear regression analysis for self-esteem revealed a statistically significant model with a low degree of fit. Key predictors included "Child Unmoving/Environment Stable", the role of teachers in the SMEAE/ENEgy/KEDASY and physical activity outside of school (see Table 5).

Table 5 Multiple linear regression with "Self-esteem" as the dependent variable

Independent	B	Beta	t	p-value	VIF
Constant	2.859	-	15.638	<0.001	-
Child Unmoving/Environment Stable	-0.173	-0.256	-2.118	0.036	2.711
Child Moving/Environment Stable	0.068	0.095	0.637	0.525	4.128
Child Unmoving/Environment Changing	0.133	0.181	1.198	0.233	4.216
Child Moving/Environment Changing	-0.197	-0.281	-1.839	0.068	4.334
SMEAE/ENEgy/KEDASY	-0.255	-0.245	-3.102	0.002	1.152
Type of autism	-0.019	-0.034	-0.381	0.704	1.476
Physical activity outside of school	0.215	0.232	2.979	0.003	1.125

$F(7,145)=5.765$, $p<0.001$, $R^2=21.8\%$

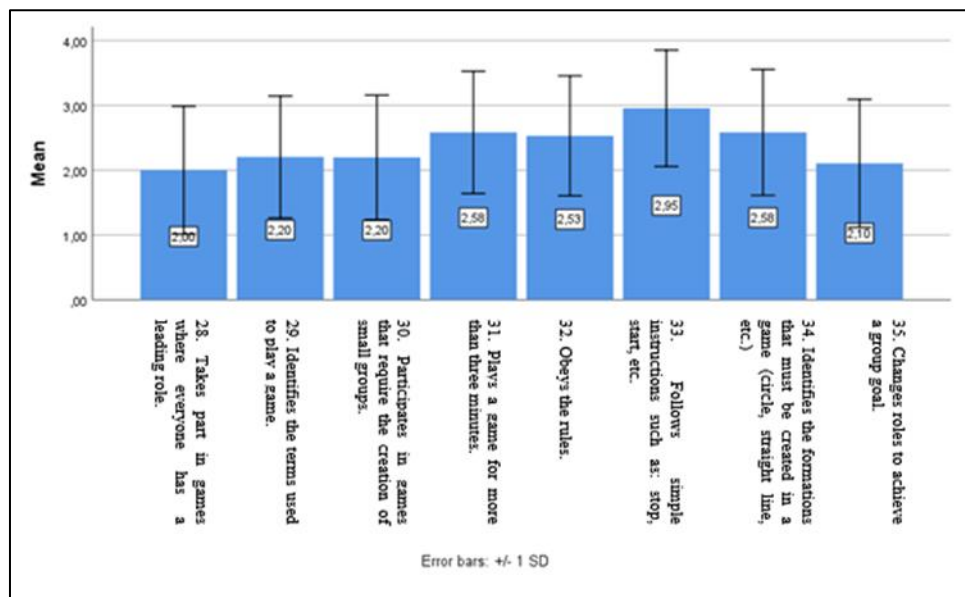


Figure 1 Cooperative behavior

Also, difficulties in psychomotor coordination may prevent participation in social events, which may negatively affect the development of positive relationships with peers (see Figure 1).

“Self-esteem” is a complex concept shaped by an individual’s ability to cope with everyday challenges and experience social acceptance (Pepping et al., 2013). Individuals with DCD often experience adverse reactions from those around them, including rejection or feelings of isolation. Research findings show that there is a statistically significant correlation between self-esteem measures and social behaviour parameters (Table 2).

The significant relationship between social behaviour and DCD suggests that those who struggle with physical activities often form a negative self-image. This, in turn, affects overall feelings of personal worth and competence, as social interactions play a critical role in building self-esteem (Ryff, 2014).

5. Conclusion

Individuals with autism spectrum disorder (ASD) often experience DCD, which may impair their motor performance and coordination, leading to increased anxiety and reduced self-esteem. This issue is particularly important during childhood and adolescence, as it affects children’s independence and quality of life. Furthermore, the severity of autistic symptoms and attention difficulties are associated with emotional and behavioural challenges.

The research showed that DCD manifests itself in various scenarios, with key predictors being the type of autism and play preferences. The study found significant associations between DCD, social behaviour, and self-esteem, revealing that difficulties in motor skills can negatively affect social interactions and self-esteem. Also, while many parents report that their children recognize their positive traits, a significant number express concerns about their child’s feelings of failure and low self-esteem. Understanding the effects of DCD and implementing targeted interventions can provide essential support. Interventions that focus on improving motor skills and promoting physical activity are essential, as they can enhance social competence and self-esteem in children with ASD. Participation in physical activities has been shown to enhance social skills and motor coordination, highlighting the importance of understanding the factors that influence the socioemotional behaviours of children with ASD.

It is therefore necessary to incorporate practices that promote self-esteem and motor improvement, contributing to the comprehensive development of individuals with ASD. Overall, structured physical activities also play a critical role in promoting better developmental outcomes for these individuals.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

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