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A Study on Displacement Skills and Problem Behaviors in Intellectually Disabled Children: Variations by Disability Type

Yu Su[1,*], Yi He[1], Qin Wu[1]

[1]*Physical Education of Sichuan Normal University, Chengdu, 610000, Sichuan, China*
[*]*Corresponding author: 597482342@qq.com*

Abstract: *This study examined the differences in displacement skills and problem behaviors between children with varying types of intellectual disability, and explored the correlation between the two variables. Ninety intellectually disabled children who completed the TGMD-2 displacement skills and SDQ assessments were recruited as participants. Analyses using covariance, partial correlation, and multiple linear regression were conducted to investigate the differences and associations. Results revealed that significant differences in displacement skills and problem behaviors existed among children with different types of intellectual disability. Displacement skills and problem behaviors were positively correlated, and displacement skills had predictive effects on problem behaviors in intellectually disabled children. These findings suggest that developing displacement skills in intellectually disabled children may positively influence their accompanying problem behaviors.*

Keywords: *Intellectual Disabilities; Children; Displacement Skills; Problem Behaviors*

1. Introduction

These disabilities can be further classified into specific types, including specific intellectual disability (SID), down syndrome (DS), cerebral palsy, and autism spectrum disorders (ASD), depending on accompanying physical and neurological impairments [1,2]. Global prevalence data indicate that intellectual disabilities are neurodevelopmental disorders affecting approximately 3% of children and adolescents [3]. Individuals with intellectual disabilities often experience behavioral challenges such as hyperactivity, maladaptive emotions, inappropriate social interactions, and aggressive tendencies, which may hinder their ability to engage in prosocial behavior [4]. Compared to typically developing children, those with intellectual disabilities generally exhibit higher levels of problem behavior [5] and lower levels of physical fitness in areas including speed, agility, strength, flexibility, balance, coordination, reaction time, cardiovascular endurance, and muscle endurance [6]. Problematic behaviors associated with intellectual disabilities significantly contribute to antisocial behavior and social rejection during adolescence and adulthood [7].

The gross motor skill of displacement refers to the ability to perform movements that result in displacement or changes in position of the body in space. Displacement skill is one of the main indicators used to evaluate gross motor skills [8]. The development of gross motor skills can enhance physical health and promote the coordinated development of cognitive functions [9-10]. The development of fundamental motor skills during childhood significantly influences cognitive functions and maturation of the motor nervous system [11]. However, children with intellectual disabilities experience delayed development of basic motor skills compared to typically developing peers [12].

The purpose of this study is to explore the differences and correlations between displacement skills and problem behaviors in children with intellectual disabilities of different degrees.

2. Methods

2.1 Participants

A total of 90 children (70 males and 20 females) with intellectual disabilities who successfully completed the assessments were recruited from two specialized educational institutions . The participants had a mean age of 9.13±1.73 years, a mean height of 135.30±12.37 cm, and a mean

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weight of 34.18±11.90 kg. Considering the accompanying physical and neurological impairments associated with intellectual disabilities, participants were also categorized into three disability types: Specific Intellectual Disability (SID), Down Syndrome (DS), and Autism Spectrum Disorder (ASD) [2]. By reviewing the personal information file of the 90 participants, the distribution of disability types was as follows: SID (n=21), DS(n=12), and ASD (n=57).

2.2 Materials

2.2.1 Body morphology

Height and weight of participants were measured using the InBody J30 pediatric body composition analyzer (BioSpace Co., Ltd, Korea). During the test, participants were instructed to stand barefoot on the device with relaxed posture, hold the hand electrodes with both hands, gaze straight ahead, and remove shoes and socks.

2.2.2 Displacement Skills

The Test of Gross Motor Development-II (TGMD-2) was used to evaluate displacement ability in children with intellectual disabilities [8]. The TGMD-2 assesses six displacement skills: running (8 points), galloping (8 points), hopping (6 points), leaping (10 points), horizontal jumping (8 points), and sliding (8 points). Each skill is scored as either 1 point for proper form or 0 points for improper form, with a maximum total score of 48 points across two trials. The TGMD-2 has been cross-culturally validated and shown to have good reliability and validity. In the present study, the TGMD-2 displacement skills demonstrated good internal consistency with a Cronbach's α of 0.859.

2.2.3 Problematic Behaviors

The Strengths and Difficulties Questionnaire (SDQ) is a reliable tool developed by Goodman R, used to assess the psychological well-being of special children and adolescents. It consists of 25 items divided into five dimensions. The difficulty score is evaluated using 20 items and includes four dimensions: emotional, conduct, hyperactivity, and peer problems, which assess negative emotions and problematic behaviors of the subjects. The strengths section comprises five items that evaluate positive behaviors of the subjects in the prosocial behavior dimension. The SDQ questionnaire is a valid tool for diagnosing problem behaviors in children with ID in clinical settings .[13]

2.3 Data Analysis

The data were analyzed using SPSS 22.0 and expressed as mean ± standard deviation (M ± SD). The significance level for the differences in the data analysis results was set as follows: $P < 0.01$ for extremely significant, $0.01 < P < 0.05$ for significant, and $0.05 < P < 0.1$ for marginally significant.

3. Results

3.1 Analysis of displacement skills and problem behaviors in children with different types of ID

3.1.1 Displacement Skills

The study utilized covariance analysis to investigate the mean displacement skill scores of children with varying types of ID, while controlling for gender, age, and body weight. Table 1 presents the results, which indicate no significant differences in mean displacement skill scores among children with different types of ID [$F(188.236)=2.128$, $\eta2=0.048$, $P>0.1$]. However, children with ASD exhibited significantly higher displacement skill scores than those with DS ($P <0.05$), whereas no significant differences were observed in the other pairwise comparisons ($P >0.1$). There are certain differences in the displacement skills among children with different types of intellectual disabilities, with ASD (28.01) > SID (25.34) > DS (21.54).

3.1.2 Problem Behaviors

The study utilized covariance analysis to investigate the mean total SDQ scores, as well as the mean difficulty and strength subscale scores, of children with varying types of ID, while controlling for gender, age, and body weight. The results, presented in Table 1, indicate marginally significant differences in mean total SDQ scores among children with different types of ID [$F(47.794)=2.645$, $\eta2=0.059$, $P <0.1$]. Specifically, children with SID exhibited significantly higher mean total SDQ

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scores than those with DS (P <0.05), while children with ASD had slightly higher mean total SDQ scores than those with DS (P<0.1). No significant differences in mean total SDQ scores were observed between children with SID and those with ASD (P>0.1). There are certain differences in the total scores of SDQ among children with different types of intellectual disabilities, with SID (23.07) > ASD (22.14) > DS (19.53).

The study revealed highly significant differences in mean difficulty scores among children with varying types of ID [F(80.610)=5.444, η2=0.115, P<0.01]. Children with SID and ASD exhibited significantly higher mean difficulty scores than those with DS (P<0.01), while no significant differences in mean difficulty scores were observed between children with SID and those with ASD (P>0.1). There are certain differences in the difficulty scores among children with different types of intellectual disabilities, with SID (19.09) > ASD (18.81) > DS (14.83).

No significant differences were found in mean strength scores among children with varying types of ID [F(8.737)=1.409, η2=0.032, P>0.1]. Post-hoc pairwise comparisons also did not reveal any significant differences (P>0.1).

Table 1: Marginal Mean Estimates (MME) of Displacement Skills and Problem Behavior Levels in Children with Different Types of Intellectual Disabilities.

Index	MS	F	η^2	P	Type	MME	95%CI	
							lower-bound	upper-bound
Displacement Skills	188.236	2.128	0.048	0.125	SID	25.34	21.06	29.61
					DS	21.54	15.92	27.16
					ASD	28.01	25.42	20.60
SDQ	47.794	2.645	0.077	0.059	SID	23.07	21.14	25.00
					DS	19.53	16.99	22.07
					ASD	22.14	20.97	23.32
Difficulties	80.610	5.444	0.115	0.006	SID	19.09	17.34	20.84
					DS	14.83	12.53	17.13
					ASD	18.81	17.75	19.87
Strengths	8.737	1.409	0.032	0.250	SID	3.98	2.85	5.11
					DS	4.70	3.22	6.19
					ASD	3.33	2.65	4.02

3.2 Correlation analysis of displacement skills and problematic behaviors in children with ID

The results, presented in Table 2, a partial correlation analysis was conducted to examine the relationship between displacement skills and problem behaviors among children with ID, while controlling for gender, age, and body weight. Among children with SID, no significant correlation was found between displacement skills and the scores of SDQ, difficulties, or strengths (P>0.1). In children with DS, displacement skills showed a marginally significant positive correlation with the strengths score (r=0.640, P<0.1), but no significant correlation was observed between displacement skills and the SDQ or difficulties score (P>0.1). For children with ASD, displacement skills were significantly and positively correlated with the SDQ score (r=0.284, P<0.05). However, no significant correlation was found between displacement skills and the difficulties or strengths score (P>0.1).

Table 2: Partial Correlation Results between Displacement Skills and Problem Behavior in Children with Types of Intellectual Disabilities.

Type	Variate	SDQ		Difficulties		Strengths	
		r	P	r	P	r	P
SID	Displacement Skill	0.095	0.709	-0.104	0.682	0.292	0.240
DS	Displacement Skill	0.573	0.107	0.151	0.689	0.640	0.064
ASD	Displacement Skill	0.284	0.037	0.213	0.123	0.157	0.256

3.3 Multivariate linear regression analysis of the impact of displacement skills on problematic behaviors in children with ID

After identifying a significant correlation between displacement skills and related scores in children with autism spectrum disorder, a further investigation was conducted into the impact of displacement skills on problem behavior scores. Displacement skills had a significant impact on SDQ score in children with ASD (β=0.271, P<0.05), with a coefficient of determination of R2=0.073 (Table 3) . However, there was no significant correlation between the score of displacement skills and SDQ total score and difficulty score in children with SID and DS, and therefore, regression analysis was not

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appropriate.

Table 3: Regression Analysis Results of Displacement Skills and SDQ in Children with Intellectual Disabilities.

Type	DV	Variate	B	SE	β	T	P	R^2	Durbin-Watson
ASD	SDQ	Constant	18.590	1.839	-	10.106	0.000		
		Displacement Skills	0.128	0.061	0.271	2.086	0.042	0.073	2.235
DV: Dependent variable									

4. Discussion

Research indicates that ID can be categorized into three types: ID without co-occurring physical impairments or autistic behavior, ID accompanied by physical impairments (such as DS, the most prevalent type of ID in China, which is accompanied by physical impairments), and ID co-occurring with ASD. While several scholars have studied large motor development in children with ASD and DS [14] , no studies have reported differences in levels of displacement skills among children with ID without co-occurring physical impairments or autistic behavior, DS, and ASD.

The study discovered that individuals with ID, DS, and ASD share similar overall characteristics in spatial skills. Nonetheless, when comparing the groups, those with ASD demonstrated better spatial skills than those with DS. Additionally, individuals with ASD scored higher than those with ID and DS. It is important to note that ID, DS, and ASD are all disorders of the brain and nervous system that share similarities in cognition, emotions, and psychological disorders [2]. Regarding physical disabilities, limb impairment stands out as a prominent feature of DS, resulting in diminished body control. Conversely, children with ASD generally display less severe physical impairments when compared to individuals with ID and DS [15]. Furthermore, children with ID without comorbidities tend to exhibit more positive emotional expressions. This, to some extent, elucidates why children with ASD outperform their counterparts with ID without comorbidities and DS in terms of spatial displacement skills.

The study revealed that individuals with different types of ID exhibit varying overall SDQ scores. Specifically, those with ID and ASD had higher overall SDQ scores than those with DS. Further analysis showed significant differences in the scores of difficulties in assessing negative emotions and problematic behaviors among children with different types of disorders. Those with ID and ASD had significantly higher scores of difficulties than those with DS. However, there were no significant differences in the scores of strengths in assessing prosocial behavior among children with different types of disorders. This suggests that the differences in overall SDQ scores among those with ID, DS, and ASD mainly appeared in the scores of difficulties in assessing negative emotions and problematic behaviors. Regarding psychological disorders, individuals with DS experience severe physical impairments, while those with ID exhibit more expressive behavior and emotions, leading to more physical activity. Children with ASD typically exhibit more severe symptoms than those with ID and have mental developmental delays, difficulty adapting to the environment, and communicating with others [16]. This partially accounts for why children with ID have more problematic behaviors than those with ASD and DS.

In summary, individuals with ID without comorbidities and those with DS face physical limitations, whereas individuals with ASD exhibit superior spatial skills compared to those with ID without comorbidities and DS. Additionally, problematic behaviors are less prevalent among individuals with ASD than those with ID without comorbidities and DS. Among these populations, individuals with DS exhibit the lowest performance in spatial skills, while those with ID without comorbidities exhibit the highest occurrence of problematic behaviors.

5. Conclusion

Children with autism have better displacement skills than those with pure intellectual disabilities or Down syndrome, while children with pure intellectual disabilities exhibit the most severe symptoms of behavioral problems. The displacement skill scores of autistic children may directly affect their total SDQ scores. This suggests that improving the displacement skills of children with developmental disabilities can positively influence their accompanying behavioral problems.

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