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Is School Function in Children with Down Syndrome the Same as Their Normally Developing Peers? A Preliminary Study

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ABSTRACT

Background: Active participation in school is an effective way to foster children's cognitive and social development. Children with Down syndrome (DS) face various challenges in the school environment due to different impairments in body functions and structures.

Methods: In this cross-sectional study, a convenience sample of 51 children with DS was recruited from five schools for exceptional children, and their normally developing peers were recruited from four regular schools in Isfahan, Iran. Parents and teachers completed a demographic information questionnaire, and only teachers completed the School Function Assessment (SFA).

Results: Children with DS had a moderate level of participation (criterion score=60.04). Their school function scores were significantly lower than those of their normally developing peers. No significant relationship was found between gender, age, or educational level and school function scores in children with DS (P>0.05).

Conclusion: The school functions of children with DS significantly differed from those of their normally developing peers. Children with DS performed significantly better in physical tasks than in cognitive-behavioral functions. The weakest cognitive-behavioral functions requiring particular rehabilitation interventions are task behavior/completion and safety.

Introduction

Down syndrome (DS) is the most common cause of intellectual disabilities, leading to growth retardation as well as motor and cognitive dysfunction. Children with DS experience various physical, sensory, perceptual, cognitive, and developmental challenges [1, 2]. Impairments in body functions and structures—such as physical, sensory, perceptual, and cognitive difficulties—result in various dysfunctions in daily life activities, educational skills, home and social activities, and maladaptive behaviors among children with DS [3-5]. In a study of DS incidence by maternal age in an Asian population, the incidence of DS among Asian women ≤26 years of age, 27-33 years of age, and ≥34 years of age was 0.67‰, 0.29‰, and 2.07‰, respectively [4].

According to the International Classification of Functioning, Disability, and Health (ICF), higher participation in daily activities is associated with better quality of life, increased self-confidence, skill development, and a sense of competence [6, 7]. Spontaneous participation in school-related activities is a crucial aspect of cognitive and social engagement in children [8]. The psychosocial environment of the school is critical for promoting mental health and developing

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the skills necessary for effective participation, such that better performance in school is linked to improved quality of life and overall well-being [8-11]. Themes of school participation include educational activities (classroom and homework assignments), unstructured activities (e.g., friendship and play), class-based activities, and social roles related to the school environment [12-14].

Students with exceptional needs, such as those with Down syndrome (DS), exhibit different limitations in school performance compared to their typically developing peers, resulting in reduced participation in school-related activities and diminished interaction with the school environment [8, 13]. Identifying and understanding school functioning in children with DS is crucial, as it significantly impacts their participation and quality of life [1]. Evaluating school function provides comprehensive information on students' participation, support needs, and performance across various areas of school activities. To assess children's function and participation in the school environment, the School Function Assessment (SFA) was developed in 1998 by Coster et al. [15]. The SFA offers valuable information for professionals involved in enhancing school performance, such as occupational therapists, enabling improvements in the school environment and, consequently, better participation in various daily activities [16].

Previous studies have focused on children with other disabling conditions and have primarily been conducted in countries such as the United States, Iceland, and China [17]. Due to differing cultural contexts and limited research on school function in children with Down syndrome (DS) in Iran, there is a lack of comprehensive understanding about the nature of school function and the specific challenges faced by children with DS in the school environment, as well as how their performance compares to that of their typically developing peers. Increased knowledge about the school function of children with DS can aid in making informed decisions on how best to support them and implement effective strategies to facilitate active and meaningful school participation. Therefore, the present study was designed to evaluate the school function of children with DS using the School Function Assessment (SFA) and to compare their school function participation scores with those of their typically developing peers in Iran.

Methods

Design and Procedure

In this cross-sectional study, a convenience sample of 51 children with Down syndrome (DS) was recruited from five schools for exceptional children in Isfahan, Iran. The sample size was determined using the formula:

$$N = \frac{Z^2_{(1-\frac{\alpha}{2})} \times \sigma^2}{d^2}$$

Z1-α/2 is the confidence coefficient, d is the absolute error of estimation, and sigma represents the standard deviation of the scores in each area, expressed as a percentage. With a confidence level of 95% and an absolute error of estimation d=5, along with standard deviation values extracted from Daunhauer's study, the required sample size was calculated to be 60 [18].

Inclusion criteria included a pediatrician's diagnosis of DS, an age range of 6 to 12, mild intellectual disability, and consent from parents and teachers to participate in the study. Children with other neurological or psychiatric disorders, as well as those with incomplete questionnaires, were excluded.

After the research protocol was approved by the ethics committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.RETECH.REC.1400.174) and the necessary licenses obtained from responsible organizations, including the Department of Exceptional Education and Training of Isfahan Province, participants were recruited from five schools for exceptional children in different regions of Isfahan using a convenience sampling method. After signing written consent forms, parents and teachers completed a demographic information questionnaire.

At this stage, the primary researcher conducted an educational session to familiarize teachers who had the most contact with the children over the last four months of the study and to explain how to complete the questionnaires. The demographic questionnaire included data on children's age, gender, grade, primary method for written work, primary means of mobility, and primary means of transportation to and from school.

Once the teachers were thoroughly acquainted with the School Function Assessment (SFA) and its measurement and scoring methods, the questionnaire was given to them for completion for the children with DS in the presence of the primary researcher. If the primary researcher verified the accuracy of the first completed questionnaire by each teacher, the teachers were then allowed to complete the SFA for the remaining children in the school environment.

Given the greater difficulty in accessing children with Down syndrome compared to their typically developing peers, the samples of children with DS were collected first from five exceptional schools in Isfahan. Subsequently, to match the samples, normally developing children were selected purposefully and homogeneously from four regular schools, ensuring they shared similar characteristics with the children with Down syndrome.

All students were educated in public special schools and regular classrooms. Their primary means of communication were verbal, their primary method for written work was handwriting, and their main means of mobility was independent walking.

Main assessment tool: School Function Assessment Scale (SFA)

The School Function Assessment (SFA) is a criterion-referenced tool developed in 1998 by Wendy Coster et al. [15] in the United States to assess the functional skills of both normally developing students and students with disabilities in elementary school (from preschool to sixth grade). It measures students' participation in non-academic and social aspects of school performance. This test consists of 320 items organized into three main sections: 1) Participation: assessing student involvement in six school-related activities; 2) Task Supports/Adaptation:

measuring the level of support and adaptations needed for the child in the school environment; and 3) Activity Performance: assessing the student's ability to perform specific physical and cognitive/behavioral tasks in the classroom and school settings [19, 20]. The approximate time to complete the entire questionnaire is two hours.

The SFA's validity (Cronbach's alpha coefficient ranging from 0.84 to 0.99) and test-retest reliability (ICC: 0.85 to 0.99) have been confirmed for use among Persian-speaking Iranians [21]. To analyze and compare scores across different areas of the SFA, raw scores were converted to a 100-point scale [15]. On this scale, scores above 70 indicated strong functionality, 60 and 69 indicated moderate difficulty performing activities, and below 60 indicated severe difficulty [3].

A statistician, blinded to the study's aims, analyzed the data using SPSS Version 20 (SPSS Inc., Chicago, IL, USA). Categorical variables between groups were compared using the chi-square and Fisher's exact tests, while continuous variables were analyzed with an independent t-test. Pearson's correlation coefficient was employed to examine the relationships between SFA items and their association with other demographic and clinical features. Statistical significance was set at $P<0.05$.

Results

Due to incomplete questionnaires from seven participants and the withdrawal of two others who chose not to share their questionnaire results, 51 samples were ultimately included in the study. Since data collection occurred during the school holiday season, it was not feasible to obtain additional samples. The final analysis, therefore, comprised 51 children with DS (mean age±SD=9.5±1.8 years) and 51 normally developing peers (mean age±SD=9.3±1.2 years). The demographic characteristics of the participants are presented in Table 1.

Table 1: Demographic characteristics of participants

Variables	Normally developing peers	Children with DS
Age (Year): Mean±SD	9.3±1.2	9.5±1.8
Gender		
Male (N, %)	29,56.8%	30, 58.8%
Female (N, %)	22, 43.1%	21, 41.2%
Educational grade		
Preschool (N, %)	28, 54.9%	29, 56.9%
First (N, %)	17, 33.3%	17, 33.3%
Second (N, %)	4, 7.8%	4, 7.8%
Third (N, %)	2, 3.9%	1, 2.0%

Table 2: School function in children with Down syndrome

School function test Domains	Criterion Score	SD	CI	
			Upper Limit	Lower Limit
1. Participation	60.04	13.22	63.76	56.32
2. Task Supports				
Physical Task assistance	67.17	16.79	77.83	56.50
Physical task adaptation	72.17	16.10	82.39	61.94
Cognitive-behavioral task assistance	44.25	16.53	54.75	33.75
Cognitive-behavioral task adaptation	52.0	15.27	61.70	42.30
3. Activity Performance-Physical Tasks				
Travel	74.67	11.5	82.01	67.32
Maintaining and changing position	80.42	13.34	88.90	71.94
Recreational movement	63.17	13.76	71.91	54.43
Manipulation with movement	72.25	12.24	80.03	64.47
Using materials	61.92	9.58	68	55.83
Setup and cleanup	77.08	15.04	86.64	67.53
Eating and drinking	75.08	17.38	86.12	64.04
Hygiene	70.25	16.87	80.97	59.53
Clothing management	68.50	12.26	76.29	60.71
Up-down stairs	76.83	21.20	90.31	63.36
Written work	53.83	15.87	63.92	43.75
Computer and equipment use	44.42	12.24	52.20	36.64
4. Activity Performance-Cognitive-Behavioral Tasks				
Functional communication	57.83	17.61	69.02	46.65
Memory and understanding	59.75	16.54	70.26	49.24
Following social conventions	53.42	11.74	60.87	45.96
Compliance with adult directives and school rules	57.08	16.63	67.65	46.52
Task behavior-completion	49.08	13.85	57.88	40.29
Positive interaction	55.50	10.26	62.02	48.98
Behavior regulation	51.08	12.93	59.30	42.87
Personal care awareness	57.83	17.70	69.08	46.59
Safety	51.25	13.82	60/03	42.47

Strong activity performance: (criterion score>70); Moderate level of challenge: (60<criterion score>69); Greatest challenge: (criterion score<60); SD: Standard deviation; CI: Confidence interval

We examined all domains to identify areas of strength and challenge within the educational context. The school function scores of our participants are presented in Table 2. Notably, the scores in all areas of the School Function Assessment (SFA) for children with DS were significantly lower than the cutoff scores for the performance of their normally developing peers in this study.

Compared to typically developing students, children with Down syndrome required significantly more assistance and adaptations to perform tasks (Figure 1).

Children with Down syndrome achieved significantly lower scores in activity performance, both in physical and cognitive-behavioral tasks, compared to their typically developing peers (Figures 2 and 3). Pearson correlation analysis indicated no significant relationships between age, education level, or gender and the various areas of school function (P>0.05).

Discussion

This study explored school function and its correlation with demographic and clinical characteristics in children with DS.

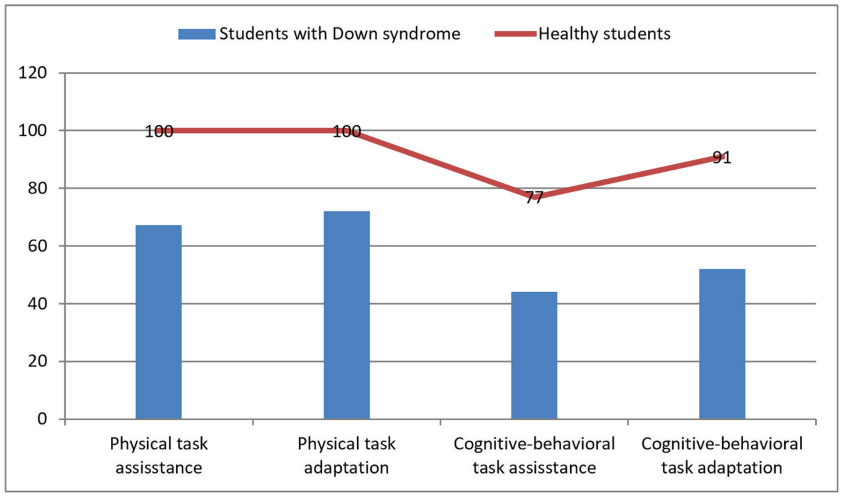

Figure 1: Comparison of tasks and supports required in the school environment between students with Down syndrome and healthy students.

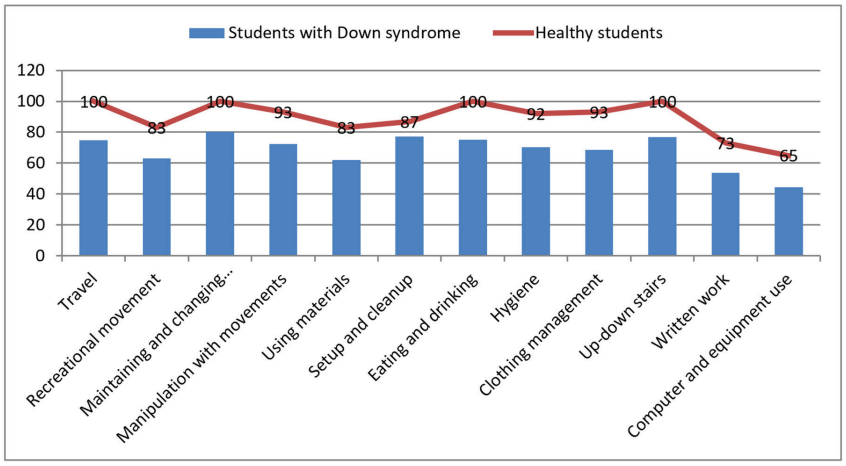

Figure 2: Comparison of activity performance in the physical tasks section between students with Down syndrome and healthy students.

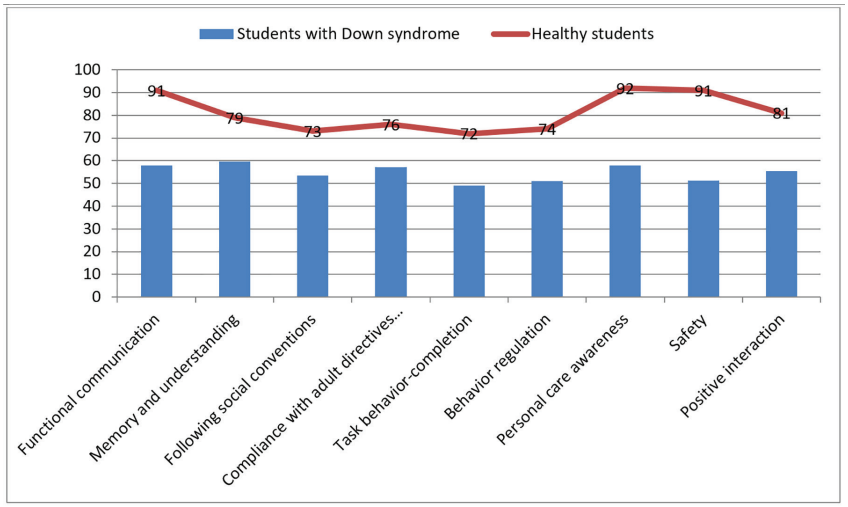

Figure 3: Comparison of activity performance in the cognitive/behavioral tasks section between students with Down syndrome and healthy students.

Our findings indicate that these children exhibit moderate participation levels (scores between 60 and 69) across all domains of school function, including physical, cognitive, and social activities. This is consistent with the results reported by Daunhauer et al. [3], which also indicated moderate participation in this population.

Furthermore, scores in all areas of the School Function Assessment (SFA) for children with DS were significantly lower than the cut-off scores established for typically developing peers. The nature and extent of disability significantly influence participation in various personal and social contexts, which is evident in children with DS who experience lower participation in daily activities and life skills compared to their normally developing counterparts [1, 7, 10, 22].

The school function assessment revealed that students with Down syndrome (DS) demonstrated better physical performance than cognitive-behavioral functions, aligning with the findings of Daunhauer et al. [3]. In the physical performance section, the highest scores were associated with maintaining and changing positions, setting up and cleaning up, navigating stairs, and self-feeding activities. Conversely, the lowest performance was observed in using materials, written work, and computer use. Children with DS excelled in gross motor movements and self-care tasks but struggled with tasks requiring fine motor skills, bilateral motor coordination, in-hand manipulation, and eye-hand coordination. These challenges can be attributed to underlying issues such as cerebral hypoplasia and hypotonia [23-25]. Additionally, the consistently low performance in the cognitive-behavioral section may stem from structural and developmental impairments within their nervous systems [26].

Among the nine components of the cognitive-behavioral section, the weakest functional areas identified were task behavior/completion and safety. Task behavior/completion involved visual and auditory attention, activity completion, and the ability to modify approaches to tasks or materials as needed. These tasks demand cognitive skills such as attention, concentration, and adaptive behaviors, often impaired in children with Down syndrome (DS) [27-29]. The safety section included keeping unsafe objects out of the mouth, identifying emergencies, and recognizing dangerous areas. Safety concerns are a primary reason for the delayed entry of children with DS into school, often linked to inadequate supervision and a lack of resources, including trained staff and appropriate equipment [30]. Therefore, educational programs to empower children with DS to navigate safety issues in the school environment should be prioritized [3, 18].

Notably, children with DS demonstrated their best performance in memory, understanding, and functional communication in the cognitive-behavioral section. The School Function Assessment (SFA) encompasses various communication methods, including verbal, gestural, written, and computerized forms designed to convey intended meanings. Consequently, receptive language skills are emphasized over expressive language skills in the SFA, and literature suggests that children with DS tend to perform well in non-verbal communication [18, 26, 28]. Additionally, some items in the memory and understanding section require visuospatial memory, and research indicates that children with DS exhibit better performance in visuospatial working memory compared to auditory working memory [31].

Our results indicated that the needs of children with Down syndrome (DS) in performing activities are better addressed through assistance rather than adaptation. Specifically, children with DS require more assistance than adaptation to engage in school activities. The present study's findings highlight the need for support in both the physical and cognitive-behavioral domains within the school environment. Notably, the lower scores observed in the cognitive-behavioral domain compared to the physical domain suggest that these children require greater support in cognitive-behavioral areas during school-related activities.

The poor performance of students with DS in the cognitive-behavioral section relative to the physical domain underscores the necessity for adaptations in both behavioral (e.g., the use of reinforcers, designated seating arrangements, specific positioning in queues, increased supervision or feedback, and extended time for activities) and cognitive areas (e.g., modifying the speed or sequence of activities, providing additional repetition or practice, implementing an alternative curriculum, and facilitating peer engagement). This disparity in performance, coupled with the generally lower cognitive skills (IQ and executive function) among students with DS, significantly impacts their goal-directed behaviors and may contribute to maladaptive behavioral issues that hinder academic success, independence, and adaptive functioning in the school setting [29, 32].

Based on the current study's findings, school-based occupational therapists must identify meaningful functional activities that enhance participation for children with Down syndrome, particularly in areas where they demonstrate weaknesses. Occupational therapists should also work to educate families and teachers, empowering them to support these children in achieving more meaningful participation within the classroom and school environment. Additionally, there is a need for increased cognitive rehabilitation efforts to facilitate better participation and overall engagement in school activities.

Several limitations in our study should be considered for future research. First, the extensive number of items in the School Function Assessment (SFA) may have hindered some teachers' cooperation during data collection. Second, the sample size was relatively small, necessitating caution regarding our findings' generalizability. Lastly, including children with Down syndrome in higher age groups and educational levels in future studies could provide clearer insights into their school function and the specific support and adaptation needs they require.

Conclusion

Our findings indicate that the school functions of

children with DS differ significantly from those of their typically developing peers. Notably, children with DS demonstrate better physical performance than cognitive-behavioral functions. The areas of cognitive-behavioral functioning that show the greatest need for rehabilitation interventions include task behavior/completion and safety.

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