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Can gymnastic teacher predict leisure activity preference among children with developmental coordination disorders (DCD)?

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ABSTRACT

The aims of the study were to analyze: (1) whether significant differences exist between children with typical development and children with developmental coordination disorders (DCD) in their preference to participate in leisure activities (2) whether the teacher estimation of activity form (TEAF) evaluation predicts participation preference. Participants were 68 children, aged 6–9.83 years, 35 diagnosed as DCD by pediatrician and based on the Movement ABC (M-ABC) and 33 children with typical development. The controls were matched by age and gender to the DCD group. The children filled the preference for activities of children (PAC) and their sport teacher completed the TEAF.

Significant differences were found between the groups in their participation preference based on the PAC items and subscales as well as in the TEAF scores.

Significant correlations were found between the TEAF and PAC subscales. TEAF score significantly predicted children's preference to participate in leisure activities.

Study results recommend using the TEAF for screening DCD and to further consider participation issues among children with DCD as a preventive aid for consequently socio-emotional implications of DCD.

1. Introduction:

Developmental coordination disorders (DCD) is a prevalent yet under-recognized movement skill disorder. DCD is defined as a condition where motor ability is below that expected for age and cognitive ability, but is not attributable to any diagnosed sensory or neurological problems. The motor coordination difficulties significantly interfere with child's participation in everyday activities and academic achievement (American Psychiatric Association, 2000). As such, DCD is one of the most common disorders affecting school-aged children (Wann, 2007).

Children with DCD often show severe secondary outcomes such as difficulty with social relationships, lower self-worth and self-esteem, anxiety, depression, leading to emotional and behavioral disorders (Missiuna, Rivard, & Batlett, 2006; Poulsen, Ziviani, Cuskelly, & Smith, 2007). Thus, secondary outcomes of DCD may also contribute to the negative affects on child's participation.

Participation refers to the nature and extent of a person's involvement in life situations. Participation is essential for psychological and emotional well-being as well as for skill development, and contributes to one's life satisfaction and sense of competence (World Health Organization – WHO, 2001).

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The World Health Organization, international classification of functioning, disability and health (2001) emphasizes that functioning is the interaction of the individual with his/her physical, social, and psychological environment. Thus, it is important to refer to the interaction between the individual's body structures/functions and his/her ability to perform activities and to participate in real-life (WHO, 2001).

Studies highlight that DCD negatively affect the child's participation in terms of limited skills of self care, academic tasks (difficulties in writing, typing), leisure activities, recreational activities or a combination of all these (Kirby, 2011; Polatajko & Cantin, 2005). Thus, it is necessary to use a vast point of view in DCD evaluation and treatment which will also include referring to participation patterns of children with DCD.

When evaluating participation, it is important to recognize that one of the major determinants of participation in leisure and recreation is individual *preferences* or interests (Searle & Jackson, 1985). Interest in taking part in activities is closely related to an individual's level of participation. Thus, preference can lead to participation, and participation can also lead to the development of stronger interests (Garton & Pratt, 1991).

The evaluation should also refer to participation in various environments. However, while most studies about participation of children with disabilities focused on school environment, additional knowledge is required regarding participation in after school hours. This important time includes ADL, play and leisure activities (Jarus, Lourie-Gelberg, Engel-Yeger, Bart, 2011). Moreover, the evaluation of participation in leisure activities should refer to various activities, including: recreational activities, active physical activities, social activities, skill-based activities, and self-improvement/educational activities which can be categorized under two domains: *Formal activities*, such as music or art lessons, organized sports, or youth groups, are more structured, have rules and organization, involve leaders and often require pre-planning. *Informal activities*, such as reading, talking on the phone, or doing a puzzle, are typically more spontaneous, occur with less planning, and have only few rules (Kalscheur, 1992; King, Law, Kertoy, & Yung 2003; King et al., 2004; Sloper, Turner, Knussen, & Cunningham, 1990).

While most previous studies about the negative impacts of DCD on children's participation are mainly reported by parents (Summers, Larkin, & Dewey, 2008), the present study used a child's self report – the preference for activities of children (PAC) (King et al., 2004). This was based on the literature according to which children hold a unique, valid, and stable view about themselves (Sturgess, Rodger, & Ozanne, 2002).

In order to address and prevent DCD negative outcomes on children's participation, the evaluation process should start as early as possible (Polatajko, Fox, & Missiuna, 1995; Schoemaker et al., 2006). For that, early screening needs to be performed. The literature highlights that this screening may be also performed in non-clinical settings (Hay, Hawes, & Faught, 2004). One main setting is school, in which children participate in a major part of their time (Faught et al., 2008). Since motor testing is both time consuming and expensive, questionnaire-based assessments were developed for screening DCD (Cairney, Hay, Faught, Flouris & Klentrou, 2007). Some of them were based on parents report (e.g., DCDQ) (Wilson, Kaplan, Crawford, Campbell, & Dewey, 2000) and child's report (Hay et al., 2004). Additional studies mentioned the importance of referring to teacher's report (Faught et al., 2008; Schoemaker, Smits-Engelsman, & Jongmans, 2003), since teachers observe children engaging in different play (e.g., recess) and in scholastic activities (e.g., handwriting) (Faught et al., 2008).

Yet, a debate exists between researchers in regard to the suitable teacher's report tool. Wright and Sugden (1996) used the M-ABC teacher checklist in conjunction with the M-ABC performance test to determine the prevalence among Singaporean children with DCD. They found that the checklist was moderately correlated with the M-ABC test but the sensitivity was very low (14.3%). Schoemaker et al. (2003) reported an even lower correlation between the teacher's checklist and the MABC, but found much higher rates of sensitivity (50–80% at the 15th percentile cut-point across age groups) and encouraged to search for alternative instruments. Faught et al. (2008) used the teacher estimation of activity form (TEAF) (Hay, 1992; Hay & Donnelly, 1996) and found that sports teachers showed an accurate understanding of their students' physical ability potential and activity behavior. The authors stated that it is easier for teachers to report on "general perceptions" of the children's physical ability, than on specific motor domains (e.g., ball skills) as found in other teachers' checklists for screening DCD.

Taking it all together, it is important to screen DCD as early as possible, and when found, refer to its vast affects, including child's participation.

The purposes of this study were to examine (1) whether significant differences exist between children with typical development and children with DCD in their preference to participate in leisure activities and in their physical activity level as reported by their sports teachers, (2) whether the sports teacher reports predict child's participation preference.

Answering these aspects may illuminate the importance of sports teachers in screening DCD and highlight the necessity of referring to child's participation patterns in intervention process.

2. Methods

2.1. Participants

Participants were 68 children, aged 6–9.83 years. All participants were registered in mainstream public schools in the northern region of Israel. Participants' familial socioeconomic status ranged from low to high, in accordance with parents' reports about their mean income level per month and the values published by the Central Bureau for Statistics in Israel (2011).

The study group included 35 children with DCD, as diagnosed by a pediatrician/developmental neurologist as suffering from DCD, according to the DSM-IV criteria, and by occupational therapists who examined the children by using the

Movement Assessment Battery for Children (MABC) (Henderson & Sugden, 1992). All the children in the study group scored below the 15th percentile in the MABC, indicating their risk for motor difficulties. The control group included 33 children with typical development, matched by age and gender to the study group. All of the children in the control group scored above the 15th percentile on the MABC. A significant difference between the groups was found in mothers' years of education ($t = 4.31$, $p \leq .0001$).

Exclusion criteria were positive neurological findings, chronic diseases and syndromes, unfixed sensory impairments (such as glasses for visual impairments), or treatment with medications that affect the functioning of the nervous system.

2.2. Instruments

2.2.1. Demographic questionnaire

This questionnaire was designed by the authors and included data on family socio-demographic status, child's health status, medications, treatments, and para-medical therapies. The questionnaire was filled by the children's parents.

2.2.2. Movement assessment battery for children (MABC) (Henderson & Sugden, 1992)

The MABC was developed as a clinical and research tool that provides an indication of motor functioning across fine and gross motor tasks for children 4–12 years old. There are four age-related item sets, which measure manual dexterity, ball skills, static balance, and dynamic balance. Each set consists of eight items and scores range from 0 to 5 on each item, resulting in a total score between 0 and 40 per set. The total scores can be transformed to percentile scores. According to the Dutch standardization of the MABC, the American norms are valid for the Dutch population (Smits-Engelsman, 1998). Moreover, the MABC has acceptable validity and reliability (Henderson & Sugden, 1992).

2.2.3. Preference for Activities of Children (PAC) (King et al., 2004)

This instrument is used for evaluating children's preference to participate in activities outside mandated school hours, with no relation to whether the activities are actually performed. Each activity is presented on a card with a drawing of the activity and a phrase (in words) describing the activity. The version used in this study contained 49 items. Scores are obtained for five activity types, derived through factor analysis of participation preference data: recreational, active physical, social, skill-based, and self-improvement/educational scales; domain (formal/informal activities), or overall.

The child is asked to sort the cards into three piles according to how much he/she prefers to do the activity, as follows: (1) really likes to do; (2) sort of likes to do; and (3) does not like to do the activity. Mean scores are calculated for each activity type, for each domain, and for the PAC total score, ranging from 1 to 3. Preliminary assessments of the PAC have demonstrated sufficient internal consistency, test-retest reliability, and validity (King et al., 2004).

2.2.4. Teacher estimation of activity form (TEAF, Hay, 1992; Hay & Donnelly, 1996)

The child's teacher is asked to answer 10 questions regarding their students' motor ability, participation in physical activity, and generalized self-efficacy toward physical activity, based on observations made during school-based activities (Hay & Donnelly, 1996). The first six items focus on personal observations of the student during physical education classes, intramural sports, interschool sports, lunch periods, and recess. The other four items ask the teacher to rate the student in a number of hypothetical situations dealing with physical activity.

TEAF items are rated on a 5-point Likert-type scale, with responses including: (1) well below average, (2) somewhat below average, (3) average, (4) somewhat above average, and (5) well above average. Teachers are asked to rate children relative to others of the same age and gender.

The TEAF was found to have good psychometric properties: a significant correlation was found between hypothetical and concrete items ($r = .89$, $p < .01$) (Hay, 1992). The TEAF has high internal consistency (Cronbach's alpha = .98) (Faught et al., 2008) as well as good concurrent validity with measures of physical activity and fitness as The children's self perceptions of adequacy in and predilection toward physical activity (CSAPPA, Hay, 1992), that measures children's self-perceptions of their adequacy in performing and their desire to participate in physical activities ($r = 0.45$, $p = .001$). Good concurrent validity was also found with participation questionnaire (Hay, 1992; Hay & Donnelly, 1996; Hay et al., 2004) ($r = 0.25$, $p = .001$) which asks children to report about their participation levels in free-time play, seasonal recreational pursuits, school sports, community team sport and clubs, and sports dances and lessons (Faught et al., 2008).

2.3. Procedure

Ethical approval for this study was provided by the Israeli Ministry of Education. All parents signed a consent form allowing their children to participate in the study and completed the demographic questionnaire. A meeting was set with all children who fulfilled the inclusion criteria in their schools. All evaluations were administered to each child individually in a quiet room. Their sports teachers completed the TEAF.

2.4. Data analysis

Descriptive statistics were used to describe the sample and the main variables.

MANCOVA with mother's years of education serving as covariate was performed to examine the significance of the differences between groups for the sub-categories of the MABC, PAC and TEAF. The differences between the groups in the total scores of the MABC, PAC and TEAF were analyzed by ANCOVA, with mother's years of education serving as the covariate.

The correlations between TEAF and PAC were examined by Pearson correlation test.

A linear regression analysis was applied to test whether TEAF score significantly predicted the PAC scores.

Alpha Cronbach test examined the internal reliability of specific PAC items in each group.

The level of significance was set at .05 for all statistical tests.

3. Results

3.1. Background characteristics

3.1.1. Socio-demographic features of both groups:

Table 1 summarizes the participants' socio-demographic data. While no significant differences were found between the groups for children's age, significant differences were found for mother's years of education ($t_{59} = 3.12$, $p = .003$). As mentioned above, this variable was held constant at the comparisons between groups.

3.1.2. MABC scores of both groups:

Table 2 presents the means and standard deviation of M-ABC four subscales (manual dexterity, ball skills, static balance, and dynamic balance) as well as the M-ABC total score in each group. As expected, children with DCD scored significantly higher (worse performance) than controls in the M-ABC total score but also in each of the four subscales.

3.2. Differences between groups in their preference to participate in leisure activities, based on the PAC

As presented in Table 3, significant differences were found between children with DCD and controls in the total PAC score, in the formal and informal domain and in each of the five activity types: children with DCD scored higher in all categories (reflecting lower preference to participate in the activities).

3.3. Differences between groups in their TEAF scores

As presented in Table 4, the sport teachers of children with DCD reports included significantly lower TEAF total score (expressing lower motor abilities) (mean = 22.42 ± 6.62) as compared to the controls (mean = 38.08 ± 4.48) ($F_{1,57} = 71.65$, $p < .0001$). Similar difference between the groups was found in regard to each of TEAF items.

Table 1
Participants' socio-demographic data.

	Children with DCD ($n = 37$)	Typical controls ($n = 37$)
Gender		
Number of boys	24	21
Number of girls	11	11
Child's mean age	7.67 ± 1.02	7.84 ± 0.78
Mother's years of education	12.37 ± 2.88	15.25 ± 2.56
Familial socioeconomic status (%)		
Low	34.3	0
Average	31.4	31.3
High	34.3	43.8
Missing	0	25

Table 2
Comparison of MABC scores between groups (lower scores = better performance).

	Children with DCD ($n = 35$)		Typical controls ($n = 33$)		$F_{1,60}$
	Mean	SD	Mean	SD	
Mean of manual dexterity total score	3.29	.91	1.29	.73	55.41***
Mean of ball skills total score	2.75	1.23	.79	.74	43.72***
Mean of balance total score	1.45	1.31	.29	.36	10.75**
Total MABC score	2.46	.78	.79	.34	74.83***

** $p \leq .01$.
*** $p \leq .001$.

Table 3
Comparison of PAC mean scores between groups (higher scores = lower preference).

PAC scales (score range = 1–3)	Children with DCD ($n = 35$)		Typical controls ($n = 33$)		$F_{1,55}$
	Mean	SD	Mean	SD	
Total activities	1.56	.16	1.34	.14	18.47***
Formal domain	1.61	.23	1.32	.16	17.57***
Informal domain	1.55	.17	1.35	.18	10.76**
Recreational activities	1.47	.21	1.29	.21	8.31**
Active physical activities	1.61	.36	1.26	.19	11.53**
Social activities	1.54	.27	1.37	.31	3.18
Skill-based activities	1.62	.31	1.37	.26	6.21*
Self-improvement activities	1.61	.31	1.42	.32	2.42

* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .001$.

Table 4
Comparison of TEAF scores between groups (higher scores = better performance).

	Children with DCD ($n = 35$)		Typical controls ($n = 33$)		$F_{1,60}$
	Mean	SD	Mean	SD	
TEAF 1	2.42	.73	3.83	.48	45.64***
TEAF 2	2.28	.78857	3.87	.33	59.13***
TEAF 3	2.31	.91	3.91	.65	39.89***
TEAF 4	2.17	.82	3.75	.53	49.81***
TEAF 5	2.68	.75	3.91	.58	33.15***
TEAF 6	2.22	.81	3.79	.51	45.74***
TEAF 7	2.02	.78	3.71	.46	63.11***
TEAF 8	2.08	.85	3.66	.48	46.46***
TEAF 9	1.91	.81	3.75	.73	51.32***
TEAF 10	2.28	.89	3.87	.61	38.51***
Total TEAF score	24.42	6.62	38.08	4.48	71.65***

*** $p \leq .001$.

3.4. Correlations between the PAC and TEAF subscales

Children with lower motor abilities according to TEAF reported lower preference to participate in leisure activities based on PAC total score ($r = -.57$, $p < .0001$) and on most PAC scales scores: recreational activities ($r = -.43$, $p = .01$); active physical activities ($r = -.51$, $p = .002$); self improvement activities ($r = -.34$, $p = .04$) and informal activities ($r = -.56$, $p < .0001$).

3.4.1. Predicting children's participation level by TEAF scores

As presented in Table 5, TEAF total score predicted the scores in most PAC scales, except for social activities scale and self improvement scale. The highest TEAF prediction percentages were found in regard to active physical activities (39%) and formal activities (44%).

Further examination yielded to significant differences between the groups in specific eight PAC items (see Table 6). For all of these items the mean scores of children with DCD were significantly higher than those of the children with typical development meaning lower preference to participate in the activities.

The internal reliability of these eight items was $\alpha = .64$. Deleting the item 'participating in community organizations' elevated the internal reliability to $\alpha = .68$.

A mean score was computed to the left seven items and was inserted to the regression analysis as a dependent variable. The results of the regression indicated that M-ABC score predicted 15% of the variance of the mean score of these seven activities ($F_{1,65} = 11.52$, $\beta = -.38$, $p = .001$), while the TEAF mean score predicted 51% of the variance of the mean scores of these seven activities ($F_{1,65} = 68.25$, $\beta = -.71$, $p < .0001$).

4. Discussion

The present study compared the preference to participate in leisure activities of children with DCD and typical controls, and also explored whether the TEAF predicted participation preference among children with DCD. This aim supports the application of the ICF model to children with DCD and enables a better understanding of how limitation in activity performance impacts their participation (Mandich, Polatajko & Rodger, 2003). Considering the negative effects of DCD on child's emotional status and physical health (mostly related to reduced strength and endurance, increased body fat and

Table 5
Predicting PAC scores by TEAF sum score.

Variable	Model 1			Model 2		
	B	SE·B	β	B	SE·B	β
Recreational activities						
Group	.18	.06	.39**	−.016	.09	−.04
TEAF				−.013	.005	−.54**
R^2		16			26	
F for change in R^2		10.61**			7.88**	
Active physical activities						
Group	.35	.08	.49***	−.012	.12	−.017
TEAF				−.02	.006	−.64***
R^2		25			39	
F for change in R^2		18.51***			13.49***	
Social activities						
Group	.17	.07	.28***	.09	.13	.14
TEAF				−.005	.007	−.18
R^2		8			9	
F for change in R^2		5.01*			.67	
Skill based activities						
Group	.25	.07	.39**	.02	.12	.04
TEAF				−.014	.006	−.44*
R^2		15			22	
F for change in R^2		10.29**			4.94*	
Self improvement activities						
Group	.18	.08	.27*	.02	.14	.03
TEAF				−.01	.007	−.31
R^2		7			11	
F for change in R^2		4.74*			2.16	
Formal activities						
Group	.29	.05	.57***	.06	.09	.13
TEAF				−.014	.004	−.55**
R^2		33			44	
F for change in R^2		27.48***			10.95**	
Informal activities						
Group	.19	.04	.48***	.09	.07	0
TEAF				−.012	.004	−.59**
R^2		23			36	
F for change in R^2		17.09***			11.27**	
Total PAC score						
Group	.22	.04	.58***	.02	.06	.05
TEAF				−.13	.003	−.66***
R^2		34			49	
F for change in R^2		28.82***			17.14***	

* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .001$.

Table 6
The differences between groups in specific PAC items (higher scores = lower preference).

	Children with DCD ($n = 35$)		Typical controls ($n = 24$)			p
PAC items	Mean	SD	Mean	SD	T_{57}	
Doing pretend or imaginary play	1.65	.80	1.25	.60	−2.21	.005
Racing or track and field	1.54	.78	1.00	.00	−4.11	.000
Bicycling, in line skating, or skateboarding	1.71	.85	1.20	.50	−2.83	.000
Playing games	1.85	.91	1.12	.44	−4.08	.000
Watching TV or a rented movie	1.51	.74	1.12	.33	−2.71	.000
Shopping	1.82	.92	1.20	.50	−3.31	.000
Taking care of a pet	1.94	.96	1.12	.44	−4.36	.000

deteriorated cardio-respiratory fitness) (Cairney et al., 2007) it is of most importance to screen and treat DCD as early as possible.

The finding support TEAF's ability to differ between the groups, screen children with DCD and predict their preference to participate in leisure activities. The findings are in one line with the results of Faught et al. (2008) about teachers' ability to

accurately understand their students' physical ability and activity behavior, as reflected by the TEAF. TEAF's correlation with acceptable DCD diagnostic tools as the MABC, emphasize the importance of involving teachers in DCD screening.

Another result of the present study referred to the lower preference of children with DCD to participate in leisure activities as compared to typical controls. In addition, this study found that the TEAF had the ability to correlate with PAC scores and to predict child's preference to participate in leisure activities. The highest prediction level related to formal and active physical activities. It is well established that meaningful participation also depends on the person's feeling of control over the activity, a sense of challenge from the activity and the enjoyment of an activity (Allison, 1996; Simeonsson, Carlson, Huntington, McMillen & Brent, 2001). Children with DCD struggle to learn new motor skills. Their lower enjoyment from physical activities, leads them to avoid these activities and avoid environments where physical activity is promoted, such as the school playground (Faught, Hay, Cairney & Flouris, 2005). This situation reduced the child's opportunities to practice motor performance (Schoemaker & Kalverboer, 1994).

Indeed, previous reports refer to the interaction between the limited motor abilities of children with DCD and their participation patterns. Fong, Lee, and Pang (2011) found that impaired balance of children with DCD was significantly associated with their participation diversity. Jarus et al. (2011) revealed that children with DCD participated in fewer activities and with less intensity in total. Yet, as the present study revealed, the impacts of DCD do not limit themselves only to participation in physical activities, but rather influence participation in other leisure activities, as was reported in previous study (e.g. Cairney, Hay, Faught, Mandigo, & Flouris, 2005; Jarus et al., 2011).

The current study indicated that the TEAF predicted 51% the variance of the mean score of seven activities. Only three of them belonged to physical activities (racing, bicycling, playing games). The interesting point is that the other four activities were 'doing pretended or imaginary play', 'watching TV or rented movie', 'shopping' and 'taking care of pet'. It seems that these activities relate to difficulties previously mentioned among this population in internal representation of visual imagery (Wilson et al., 2004) required for pretended or imaginary play, and organization in space and time (Rosenblum, 2006) required for example in shopping or taking care of pet.

Interestingly, in the present study, children with DCD did not differ from their typical peers in their preference to participate in social activities. According to the literature, children with DCD have significantly lower participation in social-physical activities than typical peers (Poulsen, Ziviani, & Cuskelly, 2007). They spend more time alone in physical and social play in the school playground as onlookers and were excluded from particular types of play due to their lack of the appropriate movement skills (Smyth & Anderson, 2000). The impaired self confidence, impaired interpersonal relationships of children with DCD (Missiuna, Moll, King, King, & Law, 2007; Poulsen, Johnson & Ziviani, 2011; Watkinson et al., 2001) may limit their social participation. This highlights the tremendous pressure children with DCD face from their school peers during curricular, co-curricular physical activities (Faught et al., 2008) and leisure activities.

Yet, the results of the present study emphasize how children with DCD want to be similar to their peers, to be socially accepted and involved in social activities. Mandich et al. (2003) reported that once the children with DCD were able to participate in activities with their peers, it changed their lives. They gained confidence and were more willing to try new activities believing they could master them now. Thus, clinicians should refer to social participation also in regard to impaired motor abilities, as in children with DCD.

In summary, DCD should be screened and treated as early as possible. TEAF may serve as a tool for screening DCD in the daily school environment. The evaluation and intervention process for children with DCD should consider their participation, also based on child's self report. Improved understanding of participation and of activity limitations in children with DCD is essential for clarifying diagnostic criteria, guiding assessment, and making evidence-based decisions regarding intervention (Magalh'aes, Crdoso, & Missiuna, 2011).

Enhancing child's participation in physical activities may reduce health risk, as overweight and fitness conditioning (Dewey & Wilson, 2001; Faught et al., 2005; Fong, Lee, Chan, et al., 2011). Nevertheless, participation evaluation should also refer to other leisure activities and mainly to social activities in order to eliminate child's low perceptions about peer relations, elevate self confidence and thus encourage participation with peers (King et al., 2006). By using the PAC, therapists may enhance child's involvement in creating intervention goals that refer to child's natural environment and thus elevate intervention efficiency, optimizing child's participation in daily living and enable optimized development for children with DCD (Engel-Yeger, 2008).

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