

## DEVELOPMENTAL COORDINATION DISORDER IN CHILDREN

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### Abstract

#### Objective

In this article, a motor skill disorder called developmental coordination disorder (DCD), that is usually first diagnosed during childhood, is explained and discussed. In the year 1987, DCD was formally recognized as a distinct disorder in children by the American Psychiatric Association (APA). DCD is a generalized term for the children who have some degrees of impairment in the development of motor coordination and therefore have difficulties with physical skills which significantly interfere with their academic achievements and /or performing everyday activities. As they develop, other age-related tasks are also below average. Because these impairment & conditions are often associated with emotional distress, they can seriously interfere with the person's everyday life and social relationships. Reviews indicate that most of the training procedures have only a limited effect on the development of general coordination, and that they have no effect at all on academic progress. This includes approaches based on assumed underlying deficiencies such as sensory integration deficits and kinesthetic functioning deficits, as well as the more traditional perceptual - motor training. One new approach is Cognitive Orientation to daily Occupational Performance (CO-OP), based on problem - solving strategies and guided discovery of the child and task specific strategies. The aim of this article was to inform, promote and disseminate more information about some difficulties in applying the diagnostic criteria for DCD. Also, a brief review of the researches on the intervention methods is presented.

**Keywords:** Developmental coordination disorder, Motor skills disorder, Childhood disorder, Intervention methods

### Introduction

Perhaps you know someone who has a block about math or physics, or you may have had a classmate who had trouble with reading and needed assistance with course assignments, or you may know a child who has trouble with motor coordination. In extreme forms, these problems may reflect a specific developmental disorder which is a deficit or delay in an area of functioning such as academic skills, language and speech, or motor coordination (1). In this article, a motor skills disorder called developmental coordination disorder (DCD) that is usually first diagnosed in children is explained and discussed. This disorder usually develops during the earlier years of life and is due to an abnormal development and maturation in motor coordination (2). It should be mentioned that in the year 1987, DCD was formally recognized as a

distinct disorder in children by the American Psychiatric Association (APA). Approximately 20 percent of the children have significant impairments in important cognitive, motor, or communication skills (APA, 2000) (3). These problems are more common in boys than girls. They can greatly affect a child’s achievement in school and can lower self-esteem and well-being (4).

Also, it is noted that DCD, which is a motor skills disorder, is relatively common and as many as 6 percent of the children between the ages of 5 and 11 suffer from it (3). In the early stages of life, children with DCD have trouble with sitting, crawling and walking. As they develop, other age-related tasks are also below average which can lower their self-esteem and well-being and can greatly affect a child’s achievement in school. The aim of this article was to inform, promote and disseminate more information about some difficulties in applying the diagnostic criteria for DCD. Also, a brief review of the researches on the intervention methods is presented.

**Review of the Researches on the Definitions**

In the year 1987, DCD was formally recognized as a distinct disorder in children. However, prior to this, children with poor motor coordination were often labeled” clumsy”. In other words, the term

has evolved from earlier categories such as” clumsy child syndrome”. Meanwhile other labels for this disorder are”developmental dyspraxia ” and ” physical awkwardness”, although there are ongoing attempts to redefine and separate these out (2,5,6 ). It should be mentioned that in 1987, the term “DCD” was introduced by the American Psychiatry Association (APA), but another formally recognized term for this disorder is Specific Developmental Disorder of Motor Function (SDDMF) which was introduced by the World Health Organization (WHO) in 1992 (6,7). Also, it should be noted that term DCD is now recognized internationally as the preferred term to refer to this disorder and condition (2, 8).

Now, some formal definitions for this disorder are as follows:

- The diagnostic criteria for the DCD from the APA’s DSM-IV, is:
  - Performance in daily activities that require motor coordination is substantially below that expected given the person’s chronological age and measured intelligence. This may be manifested by marked delays in achieving motor milestones (e.g. walking, crawling, sitting), dropping things, clumsiness, poor performance in sports or poor handwriting (table1).

**Table1.** Axis Disorders of DSM-IV-TR

Category	Description	Examples of disorders
Disorder usually first diagnosed in infancy, childhood or adolescence	Disorder that usually develop during the earlier years of life, primarily involving abnormal development and maturation	-learning disorders
		-Motor skills disorders communication disorders pervasive developmental disorders (e.g. autistic disorders)
		-Attention-deficit disorders and disruptive behavior disorders
		-Feeding and eating disorders of infancy and early childhood
		-Tic disorders
		-Elimination disorders

- As mentioned earlier, another formally recognized term for this disorder is Specific Developmental Disorder of Motor Function (SDDMF ) (9), which was introduced by the WHO in 1992 and the definition for this condition was presented in the WHO’s ICD-10 as follow:  
The main feature of this disorder is a serious impairment

in the development of motor coordination that is not solely explicable in terms of general intellectual retardation or of any specific congenital or acquired neurological disorder, other than the one that may be implicit in the coordination abnormality (10).

-The definition of the DCD provided by Halgin and Whitbourne (1) in their book named "Abnormal Psychology: clinical perspectives on psychological disorders" is as follows:

The primary form of motor skills disorder is DCD which is characterized by marked impairment in the development of motor coordination. Children with this disorder encounter problems in academic achievement and daily living because of their severe lack of coordination unassociated with another developmental disability (for example cerebral palsy).

-The definition of the DCD provided by Susan Nolen-Hoeksema (11) in their book named "Abnormal Psychology: clinical perspectives on psychological disorders" is as follows:

The one motor skills disorder, called Developmental Coordination Disorder (DCD) involves deficits in fundamental motor skills such as walking, running, or holding on to objects. This disorder is not diagnosed if a child's motor skills deficits are due to a medical condition such as cerebral palsy (C.P), muscular dystrophy, or a serious mental disorder such as autism.

On the whole, we can say that DCD is a generalized term for the children who have some degrees of impairment in the development of motor coordination and therefore have difficulties with physical skills which significantly interfere with their academic achievement and /or performance on the Activities of Daily Living (ADL) (4). It should be mentioned that about one out of every twenty children of primary school age has this condition. In other words, it has been estimated that this disorder is relatively common with as many as 6 percent of the children between 5 and 11 years of age meeting the diagnostic criteria of APA (3). Meanwhile, although the incidence decreases as children get older, many have some difficulties which persist into adulthood and which affect their psychological well-being and their self-esteem (12, 7).

### The Causes

DCD is a disorder in which the development of motor coordination is impaired and the condition is not due to any specific acquired or congenital disorder of a general medical condition. In this disorder, this is typical that there is an immaturity of the development of CNS (Central Nervous System), although this has little if any confirmation (11).

There is also evidence that as diagnostic procedures evolve, many children who would previously have been diagnosed as DCD are found to actually have specific disorders such as a minor brain lesion (13). Also, despite attempts to reach a consensus (including international links such as Polatajko, 1995 (14)), DCD has been and remains as an ill-defined category with an assumed causation. Also, in the studies by Ayres, 1987, and Schmidt et al, 1987, there are early indications that this category does not represent a single grouping (15, 16).

Meanwhile, more recently, Visser (17) in the year 2003 reviewed a range of recent researches on DCD (including cluster analyses) which indicated that there were a number of possible subgroups. Also, the review confirmed that relatively little is known about the causes and outcomes of DCD.

Halgin and Whitbourne (1), on the causes of DCD, have stated that it is because of severe lack of coordination which is unassociated with another developmental disability (for example, cerebral palsy).

Also, regarding the causes of DCD, Susan Nolen-Hoeksema (10) have stated that it is not due to a medical condition such as cerebral palsy, muscular dystrophy, or a serious mental disorder such as autism.

On the whole, by this brief review of the causes of the DCD, we can conclude that it seems to be a multi-factorial disorder rather than a disorder with an individual cause.

### The Symptoms:

When delays or deficits in fundamental skills are severe enough to interfere with a child's progress and development, the child may be diagnosed with a learning disorder, a communication disorder, or a motor skills disorder (Susan Nolen-Hoeksema) (10) (table2).

Halgin and Whitbourne (1) believe that in the early stages of life, children with DCD have trouble with sitting, crawling and walking. As they develop, other

age-related tasks are also below average. They may be unable to tie shoelaces, play ball, complete a puzzle, or even write legibly.

Just the same, Susan Nolen-Hoeksema (10) mention that A young child with DCD may be clumsy and very slow

in achieving major milestones such as walking, crawling, sitting, tying shoelaces, or zipping pant. Older children may be unable to assemble puzzles, build models, play ball, or write their names.

**Table2.** Disorders of cognitive, motor, and communication skills: These disorders involve deficits in specific skills

Disorder	Description
<b>Learning disorders</b>	
Reading disorders (dyslexia)	Deficits in ability to read
Mathematics disorder	Deficits in mathematics skills
Disorder of written expression	Deficits in ability to write
<b>Motor skills disorders</b>	
Developmental coordination disorder	Deficits in ability to walk, run , hold on o objects
<b>Communication disorders</b>	
Expression language disorder	Deficits in ability to express oneself trough language
Mixed receptive-expressive language disorder	Deficits in both to express oneself trough language, and to understand the language of others
Phonological disorders	Use of speech sounds inappropriate for age or dialect
Stuttering	Severe problems in word fluency

On the whole, the main symptoms of DCD are briefly as follows:

- 1- Delay in achieving motor milestones such as sitting, crawling, walking, etc, due to poor motor coordination (9).
- 2- Low performance in ADL and academic achievements (1).
- 3- Difficulties with gross and fine physical skills (18).
- 4- Impaired performance on visual-spatial cognitive tests (10).
- 5- Motor clumsiness (10), Poor handwriting (19), Poor performance in sports (10), etc.

**A Review of Researches on Intervention Methods**

You may be wondering why a person’s difficulty with math or reading is regarded as a neurological or/and psychological disorder. This is actually a very controversial issue. Some clinicians feel it is inappropriate to include learning difficulties in a classification system designed for the diagnosis of neuro-psychological disorders.

However, the rationale for including these conditions is that they are often associated with emotional distress, and they may seriously interfere with the person’s everyday life and social relationships (1).

Therefore, over time, these emotions will have a cumulative impact on the individual’s self-esteem and sense of well-being. For example, a child who has difficulty with motor coordination, such as a child with DCD, may not learn to sit, crawl, stand or walk. It should be noted that because of this motor skills disorder, he or she will probably feel ashamed and anxious during playing football with his or her friends, and these emotions will seriously interfere with the individual and social relationships (4).

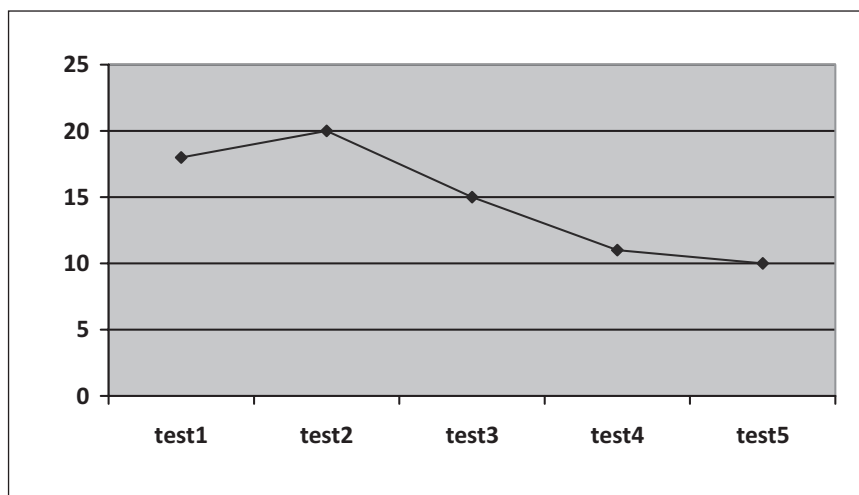
It is unlikely that a general intervention aimed at a single, underlying common difficulty be effective for all cases.

Reviews such as those written by Sigmundsson (20) and Mandich et al. (21) indicate that most of the training procedures have only a limited effect on the development

of general coordination, and that they have no effect at all on academic progress. This includes approaches based on assumed underlying deficiencies such as sensory integration deficits and kinesthetic functioning deficits (inaccurate kinesthetic perceptions), as well as the more traditional perceptual-motor training. However, specific trainings do appear to have a significant impact on those skills which are targeted with some minor impacts on wider abilities. Therefore, specific training procedures, which are based on meaningful targets in real contexts, are useful for the children (either in terms of their educational skills or independence) (18, 22).

This has been supported by a recent interventional study by Sugden & Chambers (23) on intervention in children with DCD and the role of parents and teachers in which the emphasis was on children performing functional

tasks in a setting which was as similar as possible to everyday life. This study involved three sessions of support per week for 14 weeks held at home or at school and was carefully planned and controlled. It should be noted that the outcome derived from the Movement Assessment Battery for Children (ABC) test, which is a popular screening monitoring device by Henderson and Sugden (24) and is made up from a norm-referenced test and a criterion referenced check list, was highly significant and meaningful for the children involved and continued even after the intervention was halted. There were individual variations in outcomes and some children made excellent progress whilst others evidently had greater problems (underlining the fact that there is probably a range of different causes) (Figure 1).



**Fig 1.** The movement ABC ( Assessment Battery for Children) test is a popular screening and morning device by Henderson & Sugden,(1992) with scores on the rest from 0 to 40 ( higher scores are worse).

In a study by Schoemaker et al (25) on the psychometric properties of the Movement Assessment Battery (ABC) for children, it was found that scores on the test and the checklist of the movement ABC test correlated significantly and that the test met reasonable standards for reliability and validity. They found that movement ABC test could be useful as a screening instrument for children with DCD .

Other recent interventions have been based on the

contextualized and psychological nature of children’s functioning. One new approach is the Cognitive Orientation to daily Occupational performance (CO-OP), based on problem – solving strategies and guided discovery of child and task specific strategies. Miller, I. et al (26), in a pilot trial, found that cognitive therapy for children with DCD was more effective than techniques which were mainly based on motor aspects of skill acquisition.

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