Developmental Coordination Disorder: Issues, Identification, and Intervention

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Developmental Coordination Disorder

Issues, Identification, and Intervention

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Physical educators can play a critical role in identifying and assessing this developmental disorder of motor function in students, as well as in implementing an intervention.

Learning disabilities are a pervasive issue throughout our educational system in the 21st century. In 1999-2000, 2.8 million or six percent of public school students obtained some form of special education for their learning disabilities (U.S. Department of Education, 2002). In the early 1990s, some children with movement problems were identified as having an independent learning disorder referred to as developmental coordination disorder (DCD). Since its identification, DCD has garnered a fair amount of empirical attention, because children with DCD have issues as wide-ranging as poor academic achievement (Cantell, Smyth, & Ahonen, 2003), social-emotional difficulties (Losse et al., 1991), and health issues (Bouffard, Watkinson, Thompson, Dunn, & Romanow, 1996), many of which are long-term effects (Skinner & Piek, 2001). Because DCD involves deficits within the motor domain, the physical educator can play an important role by helping to identify the disorder, assessing the movement deficit, and participating in the intervention for children who have DCD.

What Is DCD?

In the simplest terms, a child with DCD is one who has difficulty with motor coordination. In the past, these children were called clumsy or physically awkward (Barnett, Kooistra, & Henderson, 1998; Dewey & Wilson, 2001). Clinically, however, the disorder has had other labels, including developmental dyspraxia, sensorimotor integration and/or motor-planning problems. The International Classification of Diseases (World Health Organization, 2003, section F82), referred to the syndrome as a "specific developmental disorder of motor function." More significant to people in the United States is the classification in the *Diagnostic and Statistical Manual of Mental Health Disorders* (DSM-IV; the American Psychiatric Association, 1994), which identified DCD as an independent disorder under the category of learning disorders.

According to the DSM-IV, a child must meet three specific criteria in order to be diagnosed with DCD: (1) motor performance that falls substantially below the expected level for age and intelligence; (2) motor performance that interferes with academic achievement or activities of daily living; and (3) no known general medical cause (e.g., cerebral palsy, hemiplegia, or muscular dystrophy) and does not meet the criteria for pervasive developmental disorder. Not surprisingly, children with DCD are a heterogeneous group. They may exhibit deficits in fine motor, balance, and/or visuomotor skills (Cermak & Larkin, 2002; Kaplan, Wilson, Dewey, & Crawford, 1998; Lefebvre & Reid, 1998; Przysucha & Taylor, 2004).

Table 1. Possible Motor Performance Difficulties Due to DCD

Type of Deficit	Example of Skill
Gross motor coordination	Catching a ball, skipping
Fine motor coordination	Zipping coat, tying shoes, handwriting, buttoning
Spatial ability	Bumping into people, tripping
Balance	Balance on one leg, balance beam
Planning	Task completion, organization, sequencing activities

Adapted from Henderson & Sugden, 1992

Identification of DCD

It is important to identify DCD as early as possible in a child's life. However, in younger children, it may be difficult to know whether the deficits represent DCD or result simply from developmental delay. In fact, approximately 50 percent of children identified with DCD eventually "catch up" to their peers, indicating that their motor problems were developmental delay in one or more areas. The remaining children, however, have persistent problems, which suggests DCD rather than developmental delays. Given the relationship that DCD has with academic performance and/or activities of daily living, physical educators should err toward over-identification, so that any child at risk for DCD can be diagnosed as early as possible. Recognition of DCD in children is usually confirmed by a pediatrician, but parents and teachers play a key role early in the process. The first step is to note whether a child has movement difficulties at home, in the classroom, or in gross motor settings that affect his or her everyday life (table 1). For example, a child may bump into people, objects, or walls when walking, or be unable to button a coat. Parents contribute to the identification of DCD by providing qualitative insights about eating, dressing, and other activities that teachers may not observe. Classroom teachers are likely to see specific motor deficits in handwriting or other fine motor difficulties, such as using scissors. They may also observe spatial and body awareness problems (e.g., bumping into desks or other children).

While parents and classroom teachers may participate in the initial identification process, physical educators should consider themselves an essential contributor to the identification and assessment of DCD. Physical educators are trained to observe and assess movement. They monitor students in varied, complex movement situations, and the typically developing children under their supervision provide a strong basis for comparison. In fact, research suggests that physical educators identify children with DCD more accurately than classroom teachers (Piek & Edwards, 1997).

When persistent problems are observed, the Movement Assessment Battery for Children (MABC; Henderson & Sugden, 1992) is one of the most frequently used tests to systematically assess movement difficulties (Geuze, Jongmans, Schoemaker, & Smits-Engelsman, 2001). Other tests such as the Bruininks-Oseretski test can be used as well (Bruininks, 1978), but these will not be discussed here. There are two parts of the MABC: a checklist and a performance test. The checklist serves as a screening tool; various questions are best answered by parents, some by classroom teachers, and others by physical educators. Each question is rated using a four-point scale for performance, ranging from unsuccessful to successful. The checklist incorporates questions regarding a variety of movement situations from simple to complex. There are four movement assessment contexts that range from easy to hard (table 2). The least challenging context is one in which the child is stationary and the environment does not move; an example of this would be a child drawing or cutting out figures while seated at a desk. In a more difficult context, the child is moving, but the environment is stable. For example, a child may move around stationary playground equipment. Next, the child may be stationary, but the environment moves in some way (e.g., a child who is batting in softball). The most difficult context occurs when both the child and the environment move, such as in a game of soccer or tag. In order to screen a child using the MABC checklist, the physical educator must observe and rate the child in each of these contexts.

Quantitative Assessment of Movement Deficits

Should the MABC checklist confirm the presence of a motor deficiency in a child, the physical educator can follow up with the performance-based MABC test (Henderson & Sugden, 1992). This tests three distinct motor abilities: manual dexterity, balance, and ball skills. Each ability area includes three or four items, and the items have an associated quantitative score and qualitative descriptor. There are four specific age bands (4-6, 7-8, 9-1, and 11-12 years) with age-appropriate test items within each band (table 3). The test is very easy to learn and administer, and it takes only 20 to 30 minutes for each child. Percentiles are associated with specific scores on the test, and children scoring at or below the 15th percentile are considered at risk for DCD (if they also meet the other criteria set by DSM-IV). Those scoring at or below the fifth percentile are almost certainly candidates for the diagnosis. In addition to percentile ranking, qualitative descriptors associated with each test help to identify specific deficiencies. At this point, the physical educator can

begin to design specific interventions tailored to meet the needs of the individual child.

Physical educators should keep in mind one important criterion for determining whether a child has DCD or is simply developing at a speed well below average. If the child improves relatively quickly with practice, he or she is likely not to have DCD. In other words, children with DCD improve far more slowly with practice than typically developing or developmentally delayed children—in fact, general physical education may not help them. Children with DCD will require extra practice or help in terms of movement education.

Intervention Programs

Two different philosophical approaches to intervention have been developed: the bottom-up and the top-down approaches. The bottom-up approach suggests that intervention and remediation techniques should be aimed at the underlying processes or components that seem to be missing, thereby enabling movement skills to emerge. For example, sensory integration techniques tend to target the vestibular system (e.g., Ayers, 1972), so-called process-oriented approaches tend to target the kinesthetic system (e.g., Lazlo & Bairstow, 1985), and perceptual motor techniques tend to target the visual system (e.g., Wallen & Walker, 1995).

In contrast, top-down approaches try to remediate specific skills by providing problem-solving situations and/or practice in that skill. These approaches can be task-specific, where the child practices a specific skill (e.g., Revie & Larkin, 1993) or more cognitively oriented. Examples of the latter are *cognitive motor*, where a child identifies particular motor problems (Henderson & Sugden, 1992); *problem solving*, where the child must evaluate task attainability (Bouffard & Wall, 1990); or *verbal self-guidance*, also known as *cognitive orientation to daily occupational performance* (CO-OP), where the child must establish verbal goals (Wilcox & Polatajko, 1993). An example of the CO-OP approach is the four-step self-talk strategy, in which the physical educator helps the children learn to talk themselves through the solution to a problem (figure 1).

Although there is little research on the differences among intervention approaches, several important points should be emphasized. First, evidence suggests that most interventions seem to work to a certain extent, and there is little to suggest that one intervention is better than another. Rather,

Table 2. Example Activities from the Movement ABC Checklist

ENVIRONMENT	CHILD: *Stationary*	CHILD: *Moving*
Stable	Cutting, drawing, buttoning, zipping, standing on one leg	Walking around furniture
Moving	Catching a ball, throwing at a target	Chasing other children, kicking a moving ball

it appears as though *general learning principles* (and the teacher) are more important than the program itself (Mandich, Polatajko, Missiuna, & Miller, 2001; Sigmundsson, Pederson, Whiting, & Ingvaldsen, 1998; Sugden & Chambers, 1998, 2003). What interventions have led to improvements in DCD children? Pless and Carlsson (2000) conducted a meta-analysis of 32 intervention studies and found that, in general, the top-down approach studies appeared to be slightly better than the bottom-up approaches. It also found that group- or home-based approaches tended to work better than one-on-one interventions. Finally, the more practice, the better; interventions that occurred three to five times a week led to more improvement than those occurring less often.

Principles of Intervention

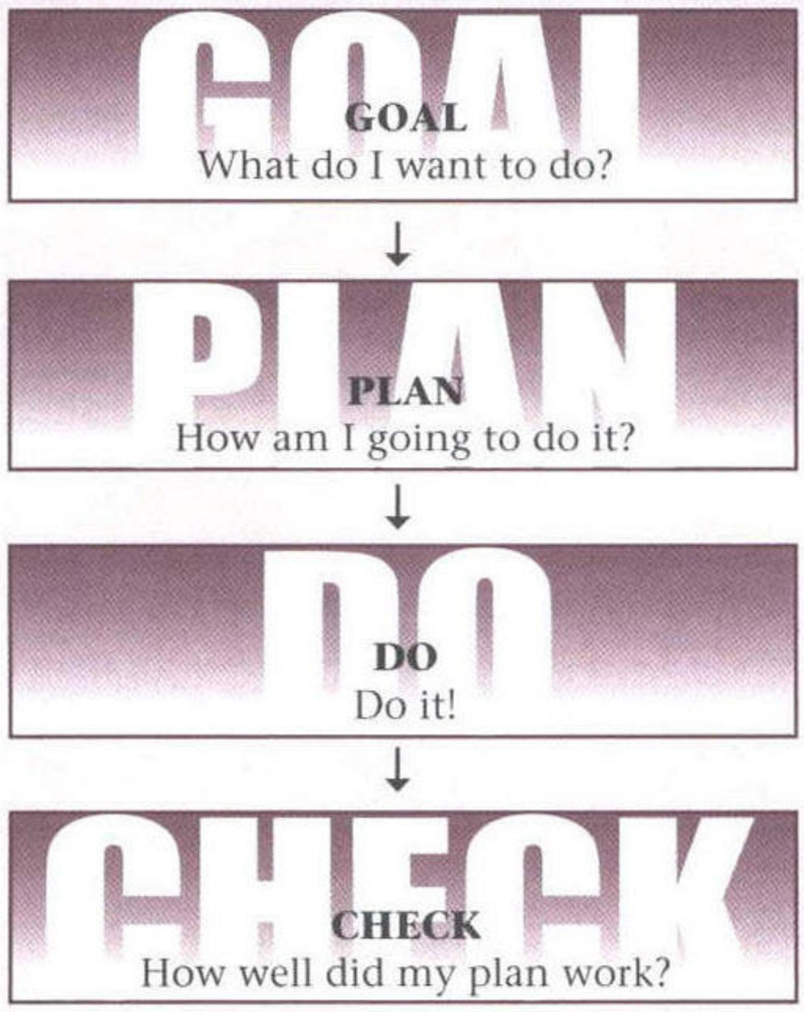
Many physical educators have had a class in motor control and learning. The research discussed in such a course should be applicable in creating intervention programs for children with DCD. Three specific principles will be discussed: practice distribution, feedback, and goal setting.

Practice Distribution. Practice is probably the most important variable of all. Research in motor learning shows that a

Table 3. Movement Assessment Battery for Children

Age band	Manual Dexterity	Balance	Ball skills
4–6	Threading beads	One-leg balance	Catching beanbag
7–8	Threading lace	Stork balance	One-hand bounce and catch
9–10	Peg board	One-board balance	Two-hand catch
11–12	Cutting shape	Two-board balance	Throwing at target

Figure 1. CO-OP: A Four-Step Self-Talk Strategy



massed practice schedule works best at improving performance during the initial stage of learning a task (Schmidt & Wrisberg, 2004). In other words, children should receive extensive repetition and multiple practice attempts at the same skill until they achieve a basic level of mastery. Once they consistently perform the skill, the practice schedule can become distributed or varied, which assists learning after the initial attempts. For example, if catching a ball is the skill to be learned, then the child should repeat the skill with the same distance and from the same point on the floor until he or she can perform the skill with some degree of consistent form. Subsequently, the location from which the child catches the ball should be varied, as well as other factors such as the size and speed of the ball and the height of the trajectory. When applying this principle, physical educators should keep in mind that it will take more practice trials for children with DCD to achieve basic mastery than typically developing children.

Positive Feedback. The physical educator should provide positive feedback following the child's initial attempts to perform a skill. This feedback should be specific enough to allow the child to correct errors. For example, feedback like "try harder" should be replaced with "use your legs to create more power." The feedback should also encourage multiple attempts. At first, teachers should provide feedback frequently (almost every attempt). Once the child begins to acquire the skill, a faded feedback regimen will encourage independence so that the child does not depend on feedback for a successful performance. Children with DCD will require more feedback and for a longer time than typically developing children.

Achievable Goal Setting. Goal setting is another principle that clearly facilitates motor skill learning. First, one must set clear performance goals. When the children see their goals, they should perceive them to be obtainable. The goals should be difficult enough to provide a challenge to the child, but easy enough to be within reach. Once a goal is consistently achieved, one should set a new goal; thus, goals are short term and progressive. For children with DCD, physical educators should set goals that consist of small, obtainable steps and should make sure the children are aware of their progress so that they get a sense of accomplishment in a particular task.

Additional Ideas. The following ideas are relatively new and less well established. However, each shows some promise and deserves to be considered in addition to the above principles.

- Use a cognitive strategy such as the previously mentioned CO-OP, in which children are actively, cognitively involved in problem solving and learning the skill. For example, "What do you need to be able to skip?" (Miller, Polatajko, Missiuna, Mandich, & Macnab; Polatajko, Mandich, Miller, & Macnab, 2001).
- Give externally based cues that ask children to look at a target rather than think about a specific limb action. For example, "Look at where the ball is going" (Wulf, Shea, & Park, 2001).
- Use rhythmic auditory cueing to guide movements. For example, "Can you step in time to this beat?" (see Thaut, McIntosh, & Rice, 1997, for an example in a different population).

Summary: What to Do in the Schools

If a physical educator suspects a child has DCD, then he or she should refer the child following the established guidelines for screening and evaluation within the state and school district. A physical educator can use the MABC checklist as an initial screen and the MABC performance test as a basis for referral for further testing. If a child is diagnosed with DCD, the physical educator should be involved in a discussion with the intervention team, including parents. Two initiatives that can be promoted are to give physical education homework that the parents agree to lead rather than merely monitor, and to promote extra physical education in small group settings.

Within a physical education class, a physical educator cannot easily devote extra or special time to the one or two children who may have DCD. However, classes that are run on an individual basis provide the best environment for intervention with students who have DCD. For example, letting children explore different ways of rolling across a mat, with the emphasis on creativity rather than form, is a more comfortable environment in which children with DCD can be successful. However, it is a mistake to ignore form or the teaching of specific skills altogether. Ultimately, a balance of approaches needs to be sought. It is the responsibility of the teacher to set progressive goals for all levels of skill and track the children's progress as often as possible.

Additional strategies that may aid children with DCD within the physical educations lesson are to avoid picking teams based entirely on merit and to utilize peer-teaching, which has a benefit for all children.

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