Strategies to Accommodate Children with Developmental Coordination Disorder in Physical Education Lessons

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Physical education teachers often face the issue of planning lessons that can challenge students of varying developmental levels. Many children with low motor ability are diagnosed with developmental coordination disorder (DCD), which is considered one of the major health problems among school-age children worldwide (Green, Baird, & Sugden, 2006). Developmental coordination disorder is categorized by poor motor proficiency that interferes with a child's activities of daily living (Rivilis et al., 2011). Campbell, Missiuna and Vaillancourt (2012) stated that children with DCD are not just low in athletic ability; they struggle to perform the everyday activities that most of us take for granted — zipping a knapsack, tying shoes, using scissors, or buttering bread. Typically, the failure to acquire adequate motor skills remains despite children's intelligence levels (Zoia, Barnett, Wilson, & Hill, 2006). In general, a prevalence of 2–7 percent is likely (American Psychiatric Association, 2013), implying that most school classes have at least one affected child.

Common symptoms of the disorder include marked delays in achieving motor milestones, including those associated with balance, coordination and handwriting skills. The movements of children with DCD are often described as "clumsy" and "uncoordinated," and they frequently lead to performance difficulties in activities of daily living and sports that most typically developing children are able to perform easily (Caçola, 2014). Other general difficulties commonly associated with DCD include poor fine and gross motor control, gross motor sequencing and body awareness, as well as abnormal muscle tone (hypo/hypertonia) and speech fluency. Those general complications can be observed when children with DCD attempt to plan a motor task, organize movements, perform a coordinated action, and adjust movements when demands change, such as moving fast to catch a ball.

Initially, it is important for physical education (PE) teachers to be aware that movements in children with DCD have three main characteristics. (1) They are slower: overall, in comparison with typically developing children, children with DCD perform movements at a slower pace. If facing time constraints, children with DCD may be even slower than when they are not in timed situations (the anxiety and pressure may take over, slowing down the movement even more). Giving them more time (or not focusing on the time it takes to perform a movement task — for example, handwriting — at all) can help. (2) Movements are less accurate: in general, movements of children with DCD are more variable, which makes it difficult for them to perform tasks that require

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a high degree of precision. (3) Movements typically require more effort: children with DCD need to employ more physiological and motor resources than typically developing children do in order to perform the same motor skills. These three characteristics are always present in movements performed by children with DCD, and it is crucial to remember those three features (slower, less accurate, more effort) to understand these students and help them accomplish tasks (Caçola, 2014).

Beyond their motor difficulties, a number of studies have shown that children with DCD tend to report lower perceptions of their own physical competence than do children without motor coordination difficulties (Skinner & Piek, 2001). In addition, teachers report that school-age children with DCD have fewer friends and are more socially isolated than their peers (Piek, Barrett, Allen, Jones, & Louise, 2005; Poulsen, Ziviani, Johnson, & Cuskelly, 2008). Children with DCD have lower self-esteem (Cairney et al., 2007; Missiuna, Moll, King, King, & Law, 2007), possibly because of the fewer social contacts and friendships (Cairney et al., 2007; Poulsen et al., 2008). According to Hands and Larkin (2002), the feelings of inadequacy accompanying poor motor coordination may be constantly reinforced through interactions with peers in school. The long-term consequences of DCD include reduced motivation for participating in physical activity and fewer opportunities for the development of motor skills and fitness (Katartzi & Vlachopoulos, 2011). The children's desire to withdraw from physical activities may also be reinforced by negative judgments about their overall motor performance by their parents, teachers and peers. According to Katartzi and Vlachopoulos (2011), children with DCD tend to have low social status, which may become evident through situations such as not being able to participate in sport teams. Avoiding sport participation may lead not only to a decrease in children's perceived competence (Stodden et al., 2008) but also to a deterioration of their motor performance due to a lack of practice.

This sequence of failures may also have negative consequences in terms of children's physical fitness. That is, most young children develop physical fitness through their daily activities while performing fundamental movements such as running, walking, skipping, climbing, hanging and rolling (Katartzi & Vlachopoulos, 2011). Most importantly, motor proficiency is positively associated with physical activity and inversely associated with sedentary activity in children, but there may be a threshold of motor proficiency above which children may be the most physically active (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). Because movements are difficult for children with DCD, they are less likely to participate in physical activities, and the development of their physical fitness and skills may be compromised. Thus, it is not surprising that children with DCD are not as involved in physical activity and sports as are typically developing children (Jelsma, Geuze, Mombarg, & Smits-Engelsman, 2014).

It is well known that developmentally appropriate physical education facilitates the development of motor skills, increases physical activity levels, and motivates positive attitudes toward physical activity and health (Lonsdale et al., 2013). Because of that, we can easily infer that PE lessons are important for children with DCD. The fact that children with DCD report less enjoyment of PE than do other children (Cairney et al., 2007) could possibly be because no accommodations are provided for their motor skill level. With that in mind, the purpose of this article is to provide PE teachers with general strategies to accommodate children with DCD within larger PE classes. These strategies could enhance the participation, enjoyment and motor learning experiences of children with DCD. This article focuses on five themes that are specific to the PE setting: group instruction, cues of learning, goal setting/routines, product-based approach and constraints.

Group Instruction

The importance of group instruction for children with DCD is crucial. Recently, Wagner, Bos, Jascenoka, Jekauc and Petermann (2012) emphasized the importance of being well integrated in a peer group for various skills, especially for children with DCD. Being included in the group may have aided children's sense of belonging, motivation and participation in PE. According to DeLucia-Waack (2006), groups can address broader psychosocial objectives of confidence, self-efficacy and self-esteem. In addition, group settings can provide a collaborative atmosphere where all children get a chance to be the "helpee" as well as the helper (Martini, Mandich, & Green, 2014). Practical tips to promote participation of children with DCD include separating the class into small groups by level of ability, a strategy used by the mastery climate approach (for more information, see the review by Valentini & Rudisill, 2006). In these groups children could be exposed to different choices of tasks that challenge several different motor skills and allow children to pace their learning process, establish priorities, and develop self-management and self-regulatory strategies (Valentini & Rudisill, 2006). With autonomy, children with DCD, along with all other children, may be able to choose their tasks and equipment and be more motivated to participate and improve their skills. They can also spend more time practicing a task they enjoy or need to improve, or they can decide to practice skills that are more relevant to them. Within the group, the focus should be on individual effort and recognition of small achievements, and evaluation should be self-referenced and based on individualized parameters.

Cues for Learning

Cues for learning have considerable potential in physical education and sport settings (Landin, 1994). Cues are cognitive strategies, labels (e.g., words, phrases, sentences, images, kinesthetic "feeling") that describe the particular aspect of a concept or skill. According to Thomas, Gallagher and Thomas (2001), cues enable children's motor performance by shifting attentional focus from an internal to an external perspective and enhancing comprehension (facilitating information processing) and retention (retrieval of information). Cues can be auditory (verbal), kinesthetic or visual. Verbal/auditory cues are the most used and are often repeated multiple times to ensure that children are not only paying attention but also comprehending the instructions of the task (e.g., saying "hands up" to a child who is about to catch a ball). Verbal/auditory cues are thought to be effective for motor learning because they draw attention to appropriate sensory information, reduce the cognitive load needed to process information relevant to skill execution, and prepare appropriate muscles and motor programs for action (Landin, 1994).

When using auditory cues for teaching children with DCD, it is important to limit the amount of instructions. According to Rink (2010), good cues are accurate, critical to the intended task, limited in number, and age and skill-level appropriate. Kinesthetic cues can be beneficial if the PE teacher has a few moments to help

Goal Setting and Routines

The goal-setting approach suggested here is based on the cognitive orientation to daily occupational performance (CO-OP), which establishes that a child needs to guide him or herself through problem solving (Polatajko, Mandich, Miller, & Macnab, 2001). The efficacy of CO-OP is evident with children with DCD — for example, when using this approach, children tend to generate more effective strategies for motor skill learning (Smits-Engelsman et al., 2013). Children are encouraged to form a mental model of how to attack a movement task; they are led to generate a movement goal, plan its implementation, and reflect on how their performance was or was not successful (i.e., goal, plan, do, check). Children are encouraged to set goals for motor skill learning and physical fitness achievements for the semester, week, day and session. Complementing this approach, it is important that children with DCD take part in the goal-selection process. Checklists that allow children to review their goals and "check off" activities that have been completed are strong motivators for children with DCD. Another strategy that can increase participation and motivate children with DCD to achieve their goals is to encourage the writing (or talking) of their accomplishments and difficulties, along with their feelings about them. Encouraging compliments among the members of the groups after routine completion can also increase self-esteem and motivation.

Product-based Approach

Product-based (or task-oriented) approaches are extremely effective ways of teaching motor skills in children with DCD (Smits-Elgelsman et al., 2013). Even though the process (quality) of motor skills is sometimes emphasized in school-based PE, children with DCD respond little to process corrections — that is, corrections that focus on the mechanics of the motion instead of the outcome of the movement. Even though product-based approaches are more effective for children with DCD, some skills are dependent on correct motions for the product to be achieved. In that case the recommendation is to focus on the minimal process requirements for the successful completion of the task. An example is to set up targets when throwing a ball or Frisbee; in that way, the focus automatically shifts from the arm motion to hitting the target.

the child with DCD individually, as sometimes it is difficult for him or her to connect auditory and kinesthetic information. It is also important to reinforce important verbal cues at the same time the teacher is physically moving the child through the step. Kelly and Melograno (2004) and Kelly, Wessel, Dummer and Sampson (2010) provided several examples of how to add instructional cues to a variety of activities and skills in physical education. For example, for hop and gallop, the cue would be "move to the beat"; for catch, "arms up" (to be ready to catch a ball) and "flex, reach, fingers, retract, fluid" (for the full catching motion). When teaching the mature pattern for throwing, a simple visual cue would be "make a T when you throw," and a verbal cue would be "follow through" (Kelly et al., 2010). Obviously, these cues can be modified according to the age and interest level of the children involved. For example, the "follow through" cue used so children can finalize the movement correctly can also be called "hand on pocket" for younger children.

Constraints

An emerging theoretical framework in motor learning that is relevant to PE lessons advocates a constraints-led perspective for acquiring movement skills (Renshaw, Chow, Davids, & Hammond, 2010). Designing developmentally appropriate tasks and accommodating different motor-skill levels within the same PE lesson requires a flexible and creative analysis of the PE teacher for task goals, equipment choice, environmental contexts, and individual abilities. With different strategies to accommodate children with DCD in PE classes, it is always important to keep Newell's constraints approach in mind so that proper adjustments can be made when needed (for a review, please see Gagen & Getchell, 2006). Constraints have been defined as boundaries that shape

the emergence of behavior from a movement system (e.g., learner) seeking a stable state of organization (Newell, 1986). In other words, constraints are situations that can either facilitate or limit behavior, encouraging some movements while discouraging others (Haywood & Getchell, 2009). They are simply characteristics of the individual, environment or task that influence the production — and over time, development — of movements. A constraint can exist as a characteristic of an individual (e.g., height, strength), an element of the environment (e.g., grassy surfaces, weather conditions, amount of light), or as part of the task that the individual is trying to do (e.g., batting a ball, climbing a jungle gym; Haywood & Getchell, 2009).

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Children with DCD can be included in any activity when certain task constraints are modified for their abilities. For example, when practicing shooting a basketball, it is important to make the hoop bigger and lower. Also, a lighter or smaller ball could make a difference in task success. For jump-rope activities, using a long scarf to substitute for an actual jump rope slows down the process and is therefore easier for children with DCD to track the movement. An example for juggling/catching is to use scarves, plastic bags or balloons to slow down the object motion and to allow the sequence to be performed (Haywood & Getchell, 2009). The adaptation of these constraints can also be related to the first strategy presented in this article: group instruction. It is possible to associate different possibilities within the groups with different constraints levels. For example, some stations might provide materials that facilitate movement for children with DCD, while other stations might use equipment that challenge movement progressively.

Summary

Development coordination disorder is a condition characterized by low motor proficiency typically associated with poor balance, coordination and handwriting skills (Caçola, 2014), affecting 2–7 percent of school-age children (American Psychiatric Association, 2013). Because of their motor difficulties, children with DCD suffer from anxiety and lower self-esteem, and they are usually less sociable than typically developing children (Missiuna et al., 2014). The long-term consequences of this condition include reduced motivation for participation in physical activity and reduced opportunities for the development of motor skills and fitness (Katartzi & Vlachopoulos, 2011). Children with DCD also tend to report lower enjoyment of PE classes, which could be the result of not experiencing success in this environment. This article outlined five strategies (i.e., group instruction, cues of learning, goal setting/routines, product-based approach, and constraints) that can aid PE teachers in accommodating children with DCD and can ensure their participation and success.

Obviously, there should be a multidisciplinary approach to planning and teaching for children with DCD. In addition to the suggestions provided here, it is important that the PE teacher be involved in the process of optimizing and managing the learning environment for children with DCD along with other school personnel. The provision of accommodations and modifications for everyday activities by all educators can help children to be more successful in the school environment. Due to differences in skill and ability among children with DCD, particular techniques and strategies may be more appropriate for one child than for another. Working collaboratively with educators and families, it is possible to create teaching environments that encourage successful participation and achievement of children with DCD.

Physical education is important and relevant for all children, being one of the most special experiences during childhood. Not surprisingly, several studies have indicated that level of motor competence affects self-perception in many aspects of a child's life (e.g., Vedul-Kjelsas, Sigmundsson, Stensdotter, & Haga, 2011). All the positive aspects of PE (facilitating development of motor skills, increasing physical activity levels, and motivating a positive attitude toward physical activity and health) can significantly influence children's lives (Lonsdale et al., 2013). Obviously, all children

need the benefits associated with physical education participation, and children with DCD need these benefits even more. It is crucial that strategies are implemented so that children with DCD, despite their motor difficulties, are able to join and enjoy the PE class environment.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Caçola, P. (2014). Movement difficulties affect children's learning: An overview of developmental coordination disorder (DCD). *Learning Disabilities, 20,* 98–106.

Cairney, J., Hay, J., Mandigo, J., Wade, T., Faught, B. E., & Flouris, A. (2007). Developmental coordination disorder and reported enjoyment of physical education in children. *European Physical Education Review, 13*, 81–98.

Campbell, W. N., Missiuna, C., & Vaillancourt, T. (2012). Peer victimization and depression in children with and without motor coordination difficulties. *Psychology in the Schools, 49*, 328–341.

DeLucia-Waack, J. L. (2006). *Leading psychoeducational groups for children and adolescents*. Thousand Oaks, CA: Sage.

Gagen, L. M., & Getchell, N. (2006). Using "constraints" to design developmentally appropriate movement activities for early childhood education. *Early Childhood Education Journal, 34,* 227–232.

Green, D., Baird, G., & Sugden, D. (2006). A pilot study of psychopathology in developmental coordination disorder. *Child, 32*, 741–750.

Hands, B., & Larkin, D. (2002). DCD and physical fitness. In S. Cermak & D. Larkin (Eds.), *Developmental coordination disorder* (pp. 172–184). San Diego, CA: Singular Press.

Haywood, K. M., & Getchell, N. (2009). *Life span motor development* (5th ed.). Champaign, IL: Human Kinetics.

Jelsma, D., Geuze, R. H., Mombarg, R., & Smits-Engelsman, B. C. M. (2014). The impact of Wii Fit intervention on dynamic balance control in children with probable developmental coordination disorder and balance problems. *Human Movement Science, 33*, 404–418.

Katartzi, E. S., & Vlachopoulos, S. P. (2011). Motivating children with developmental coordination disorder in school physical education: The self-determination theory approach. *Research in Developmental Disabilities, 32*, 2674–2682.

Kelly, L. E., & Melograno, V. J. (2004). *Developing the physical education curriculum: An achievement-based approach*. Champaign, IL: Human Kinetics.

Kelly, L. E., Wessel, J. A., Dummer, G. M., & Sampson, T. (2010). *Everyone can! Skill development and assessment in elementary physical education*. Champaign, IL: Human Kinetics.

Landin, D. (1994). The role of verbal cues in skill learning. *Quest, 46*, 299–313.

Lonsdale, C., Rosenkranz, R. R., Peralta, L. R., Bennie, A., Fahey, P., & Lubans, D. R. (2013). A systematic review and meta-analysis of interventions designed to increase moderate-to-vigorous physical activity in school physical education lessons. *Preventive Medicine, 56*, 152–161.

Martini, R., Mandich, A., & Green, D. (2014). Implementing a modified cognitive orientation to daily occupational performance approach for use in a group format. *British Journal of Occupational Therapy, 77*, 214–219.

Missiuna, C., Cairney, J., Pollock, N., Campbell, W., Russell, D. J., Macdonald, K., … Cousins, M. (2014). Psychological distress in children with developmental coordination disorder and attention-deficit hyperactivity disorder. *Research in Developmental Disabilities, 35*, 1198–1207.

Missiuna, C., Moll, S., King, S., King, G., & Law, M. (2007). A trajectory of troubles: Parents' impressions of the impact of developmental coordination disorder. *Physical and Occupational Therapy in Pediatrics, 27*, 81–101.

Newell, K. M. (1986). Constraints on the development of coordination. In M. Wade & H. T. A. Whiting (Eds.), *Motor development in children: Aspects of coordination and control* (pp. 341–360). Dordrecht, Germany: Martinus Nijhoff.

Piek, J. P., Barrett, N. C., Allen, L. S., Jones, A., & Louise, M. (2005). The relationship between bullying and self-worth in children with movement coordination problems. *British Journal of Educational Psychology, 75*, 453–463.

Polatajko, H. J., Mandich, A. D., Miller, L. T., & Macnab, J. T. (2001). Cognitive orientation to daily occupational performance (CO-OP): Part II – The evidence. *Physical & Occupational Therapy in Pediatrics, 20*, 83–106.

Poulsen, A. A., Ziviani, J. M., Johnson, H., & Cuskelly, M. (2008). Loneliness and life satisfaction of boys with developmental coordination disorder: The impact of leisure participation and perceived freedom in leisure. *Human Movement Science, 27*, 325–343.

Renshaw, I., Chow, J. Y., Davids, K., & Hammond, J. (2010). A constraints-led perspective to understanding skill acquisition and game play: A basis for integration of motor learning theory and physical education praxis? *Physical Education and Sport Pedagogy, 15*, 117–137.

Rink, J. E. (2010). *Teaching physical education for learning* (6th ed.). Boston, MA: McGraw-Hill.

Rivilis, I., Hay, J., Cairney, J., Klentrou, P., Liu, J., & Faught, B. E. (2011). Physical activity and fitness in children with developmental coordination disorder: A systematic review. *Research in Developmental Disabilities, 32*, 894–910.

Skinner, R. A., & Piek, J. P. (2001). Psychosocial implications of poor motor coordination in children and adolescents. *Human Movement Science, 20*, 73–94.

Smits-Engelsman, B. C. M., Blank, R., Van Der Kaay, A. C., Mosterd-Van Der Meijs, R., Vlugt-Van Den Brand, E., Polatajko, H. J., & Wilson, P. H. (2013). Efficacy of interventions to improve motor performance in children with developmental coordination disorder: A combined systematic review and meta-analysis. *Developmental Medicine and Child Neurology, 55*, 229–237.

Stodden, D. F., Goodway, J. D., Langendorfer, S. J., Roberton, M. A., Rudisill, M. E., Garcia, C., & Garcia, L. E. (2008). A developmental perspective on the role of motor skill competence in physical activity: An emergent relationship. *Quest, 60*, 290–306.

Thomas, K. T., Gallagher, J. D., & Thomas, J. R. (2001). Motor development and skill acquisition during childhood and adolescence. In R. N. Singer, H. A. Hausenblas, & C. Janelle (Eds.), *Handbook of sport psychology* (2nd ed., pp. 20–52). New York, NY: Wiley.

Valentini, N. C., & Rudisill, M. E. (2006). Goal orientation and mastery climate: A review of contemporary research and insights to intervention. *Estudos de Psicologia (Psychology Studies), 23*, 159–171.

Vedul-Kjelsas, V., Sigmundsson, H., Stensdotter, A. K., & Haga, M. (2011). The relationship between motor competence, physical fitness, and self-perception in children. *Child*, *38*, 394–402.

Wagner, M. O., Bos, K., Jascenoka, J., Jekauc, D., & Petermann, F. (2012). Peer problems mediate the relationship between developmental coordination disorder and behavior problems in school-aged children. *Research in Developmental Disabilities, 33*, 2072–2079. doi:10.1016/j.ridd.2012.05.012

Wrotniak, B. H., Epstein, L. H., Dorn, J. M., Jones, K. E., & Kondilis, V. A. (2006). The relationship between motor proficiency and physical activity in children. *Pediatrics, 118*, e1758–e1765.

Zoia, S., Barnett, A., Wilson, P., & Hill, E. (2006). Developmental coordination disorder: Current issues. *Child, 32*, 613–618. doi:10.1111/j.1365-2214.2006.00697.x