Developmental Coordination Disorder, Self-Efficacy Toward Physical Activity, and Play: Does Gender Matter?

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This study investigated the effect of gender on the relationship between Developmental Coordination Disorder (DCD) and self-reported participation in organized and recreational free-play activities. A participation-activity questionnaire and the short form Bruininks-Oseretsky Test of Motor Proficiency was administered to a large sample of children ages 9 to 14 (N = 590). A total of 44 children (19 boys, 25 girls) were identified as having probable DCD. Regardless of gender, children with DCD had lower self-efficacy toward physical activity and participated in fewer organized and recreational play activities than did children without the disorder. While there were no gender by DCD interactions with self-efficacy and play, girls with DCD had the lowest mean scores of all children. These findings are discussed in terms of the social norms that influence boys and girls’ participation in physical activity.

Developmental Coordination Disorder (DCD) is characterized by poor motor proficiency that results in a significant impairment to both social and academic functioning (American Psychiatric Association, 1994). In the absence of an identifiable lesion or pathogen, the diagnosis of DCD is one of exclusion and is made when known existing neurological conditions (e.g., Cerebral Palsy) and intellectual impairments (e.g., Pervasive Developmental Disorder) are not present. Although the manifestation of specific motor impairments in DCD is varied (Visser, 2003), fine motor coordination is typically affected. This often results in poor handwriting skill, which in turn has a negative impact on scholastic performance. It has been estimated that between 5% and 9% of all school age children meet the diagnostic criteria for DCD (American Psychiatric Association, 1994; Kadesjö & Gillberg, 1999), making it among the most prevalent childhood developmental disorders. Unfortunately, the problem is often not diagnosed, and children instead receive unofficial and frequently more damaging labels such as clumsy, awkward, or lazy (Hay & Missiuna, 1998). These children may also suffer
ridicule on the playground where their motor impairments are frequently most visible. Indeed, DCD is sometimes referred to as a playground disorder (Hay & Missiuna, 1998).

Very little of the epidemiology of DCD, in terms of both demographic and/or neurological risk factors, is known. In the absence of an agreed upon diagnostic measure (gold standard), this may, in part, be due to inconsistencies in measurement for assessing the disorder across studies (Dewey, Kaplan, Crawford & Wilson, 2002; Geuze, Jongmans, Schoemaker & Smits-Engelsman, 2001; Visser, 2003). However, even with this problem, a consistent finding in the literature is that the prevalence of DCD appears higher in boys (ratios between 4:1 and 7:1; Henderson & Hall, 1982; Kadesjö & Gillberg, 1999; Miller, Missiuna, Macnab, Malloy-Miler, & Polatajko, 2001; Missiuna, 1994; Schoemaker & Kalverboer, 1994).

Despite the apparent consistency in these findings, even the status of gender as a risk factor for DCD is not unchallenged in the extant literature. Some researchers suggest that boys are more likely than girls are to be diagnosed with DCD because the individuals most likely to detect coordination problems (teachers and parents) have biased perceptions of gender appropriate skill levels and physical abilities (Hay & Donnelly, 1996; Henderson & Hall, 1982). According to this perspective, boys are detected more often than girls are because parents and teachers are more likely to expect higher physical performance from them. Thus, even minor impairments in boys are apt to be more noticed with the same degree of impairment in girls overlooked. Hay and Donnelly (1996), for example, found that teachers were more likely to rate girls’ physical abilities as “below average,” whereas boys were more likely to be rated “above average.” Of course, in the absence of gender bias, girls and boys should have the same ratings (“average”). While not specifically related to DCD, their results show that at least among teachers (and in this case predominately female teachers), there may be an expectation bias favoring boys. It follows from this that boys with motoric problems are more apt to be recognized by teachers because the expectations for performance among boys are so much higher. Girls with similar problems, alternatively, do not stand out to the same degree because the motoric expectations for girls, on average, are lower.

It has also been suggested that gender differences in the presentation of DCD also increase the likelihood that boys will be detected more often than girls. For example, DCD tends to co-occur with externalizing disorders (e.g., ADHD), which are more common in boys. The presence of externalizing behaviors with DCD increases the likelihood of coming into contact with health care professionals (Rappaport, Levine, Aufseeser, & Incerto, 1983; Hay & Missiuna, 1998). The relationship between DCD and other childhood disorders is complex. It is not clear, for example, whether symptoms of inattention and/or hyperactivity are the result of DCD, or whether there is a common, underlying neurological dysfunction that produces both (Kaplan, Wilson, Dewey, & Crawford, 1998; Visser, 2003). Nevertheless, it does seem plausible that if boys are more likely than girls to have both externalizing disorders (e.g., ADHD) and DCD, they will also be more likely to be diagnosed.

If these explanations concerning gender differences in DCD are correct, then the case identification methods used in studies of children with DCD will have a profound impact on the findings and conclusions drawn about the relationship between gender and the disorder. This is a classic example of referral bias. For example, studies that use clinical samples (e.g., Macnab, Miller & Polatajko, 2002;
Sugden & Chambers, 1998) often underrepresent girls simply because they are less likely to be in contact with the formal health care sector. Indeed, some studies only have boys in the sample (e.g., Pitcher, Piek & Barrett, 2002) making the examination of gender differences impossible. Conversely, studies that draw samples from other sources may reach different conclusions regarding the relationship between gender and the disorder. For example, studies based on school sampling frames (e.g., Coleman, Piek, & Livesey, 2001; Dewey et al., 2002) or samples derived from specialized populations of children at risk (e.g., extremely low birth weight) for developing DCD (e.g., Holsti, Grunau & Whitefield, 2002) often find no significant difference in the prevalence of DCD between boys and girls. Together, these findings suggest that the relationship between gender and DCD may not be as clear-cut as the epidemiological literature suggests.

Perhaps as a consequence of differing sampling methodologies, surprisingly little work has focused on whether the impact of DCD children differs by gender. This is particularly evident when one considers the relationship between gender, DCD, and physical activity—both in terms of perceived efficacy toward physical activity and participation. Indeed, while a small body of work has examined the relationship between DCD and participation or involvement in physical activity, this research as not examined whether the impact of DCD or movement difficulties on physical activity differs by gender (e.g., Bouffard, Watkinson, Thompson, Causgrove Dunn, & Romanow, 1996; Cantell, Smyth, & Ahonen, 1994; Hands & Larkin, 2002; Smyth & Anderson, 2000; Thompson, Bouffard, Watkinson, & Causgrove Dunn, 1994). However, it is reasonable to hypothesize that the experience of DCD may be different for boys and girls and that these differences may in turn influence perceptions of efficacy toward physical activity as well as actual participation.

First, while previous research has shown that children with DCD report lower perceived competence with regard to their physical abilities than children without the disorder do (Losse et al., 1991; Piek, Dworcan, Barret, & Coleman, 2000; Skinner & Piek, 2001), research has also shown that the impact of DCD on self-perceptions may not be the same for girls and boys (Cratty, Ikeda, Martin, Jennett, & Morris, 1970; Cratty 1994; Rose, Larkin, & Berger, 1997). Rose and colleagues (1997) reported several significant gender by coordination interactions across several subscales of Harter’s (1985) Self-Perception Profile for Children. Girls with coordination problems reported the lowest levels of scholastic competence, behavioral conduct, and global self-worth when compared to other children (boys with low coordination levels and boys and girls without movement difficulties). Although they did not find a significant interaction between gender and coordination in the perceived athletic competence domain, the results were consistent with their other findings: Girls with coordination problems reported the lowest levels of athletic competence. These results suggest that the impact of DCD on self-perceptions of competence may have greater negative consequences for girls than for boys. Whether these findings are replicable with play and physical activity, outcomes remain untested. However, it is interesting to note that Rose and her colleagues failed to find evidence of a gender interaction with coordination problems when motivational orientation in sport was the outcome (Rose, Larkin, & Berger, 1998). They did find that children with coordination problems and girls (regardless of coordination difficulties) reported lower levels of motivation toward attempting challenging skills.
Second, research on gender differences in beliefs regarding self-efficacy and participation in physical activity among children also suggests the possibility that movement problems may impact boys and girls differently. Girls, in general, tend to report lower self-perceptions of competence in athletic domains than do boys in the same age range (e.g., Causgrove Dunn & Watkinson, 1994; Harter, 1985). Girls have also been found to report lower levels of generalized self-efficacy toward physical activity than boys do (Hay, 1992; Klentrou, Hay, & Plyley, 2003). Since girls without motor impairments are already less likely to perceive themselves as adequate and/or competent with regard to physical activity, it stands to reason that girls with DCD may have even lower perceptions of efficacy and competence (but see Rose et al., 1997).

Differences in socialization experiences may also explain gender differences in the impact of DCD on play and physical activity. For example, it has been suggested that girls are taught to be dependent on, and focus more on the needs of others (Coakley, 1994). This external orientation may explain why girls are less internally motivated toward sport/activity than boys are (Rose et al., 1998). Moreover, the fear of social disapproval may steer girls away from competitive games and play (Figler & Whitaker, 1991). Girls are also more likely to be taught to avoid challenging and adventurous situations and instead seek safe, secure play environments (Greendorfer, Lewko, & Rosengren, 1996). As a result, girls will be less likely to engage in vigorous, active play than will boys. The lack of participation in these activities likely also explains why their efficacy beliefs regarding physical activity are apt to be lower than their male peers.

Girls and boys also assign differing priorities to sports and athletic abilities in relation to self-definition. In one study, boys rated being a good athlete as the most important aspect of social status for males (Chase & Dummer, 1992). If boys place more value on sports and physical activity than girls do to define themselves, it may be that girls with DCD are more likely to be hypoactive than boys are with the condition because the consequences for not engaging in such activities is much less threatening to their identities. Finally, it is already well established that physical activity patterns do differ by gender—boys appear more active than girls (Hay, 1992; Best, Blackhurst, & Makosky, 1992; Klentrou et al., 2003). It seems reasonable to hypothesize that the impact of motor proficiency problems may further exacerbate gender differences.

Although there is sufficient reason to believe girls and boys with DCD may differ in regard to both their efficacy beliefs toward, and actual participation in, physical activity, surprisingly little work has examined the consequences of DCD with regard to these issues. In this study, we address two research questions:

1. Do children with DCD report lower levels of generalized self-efficacy toward physical activity and lower levels of participation in free play and organized activities than do children without movement problems?

2. Does gender influence the relationship between DCD and generalized self-efficacy toward physical activity and lower levels of participation in free play and organized activities?
Method

Participants

The study involved a cross-sectional investigation of all students in grades four through eight from five elementary schools in the Niagara Region of Ontario, Canada. Eight children with previously known learning disorders were allowed to take part in the study but were excluded from the analyses. Eighteen children with preexisting physical limitations, excluded from physical education classes due to medical reasons, were excluded from the study. A total of 590 children (322 males, 268 females) provided informed consent (parental consent also) and participated in the study from a potential sample of 929 (63.62% response rate). This sample represented 12.4% of all 9 to 14-year-old children living in the city of St. Catharines (the major urban center in the Niagara Region; Statistics Canada, 2001). The age range of the sample was 9 to 14 years, and the mean age was 11.46 (SD = 1.46).

In this sample, 7.5% (n = 44) of the children meet the requirements for probable DCD. Of these children, 57% are girls (N = 25) and 43% are boys (N = 19). Consistent with previous research that has used school-based samples, we find no significant differences in DCD prevalence between boys and girls ($X^2 = 2.582, df = 1, p = .108$).

Dependent Variables

Physical Activity. The Participation Questionnaire is a 61-item questionnaire that requires children to report their actual participation levels in the areas of free-time play, seasonal recreational pursuits, school sports, community sports teams and clubs, and sport and dance lessons. Participation in organized activities encompasses a one-year period, and free play is recalled from typical pastime choices. Subtotals are available for unorganized activity (free play) and organized activity (sports teams, lessons). The scale is calculated using “activity units” with each unit corresponding to a physically active recreational choice, sports team, or sport or dance lesson. Reliability of the Participation Questionnaire among elementary school children has been previously established with a test-retest reliability of 0.81 (Hay, 1992). For this study, we use both sub-scales (free play and organized activities) as dependent measures (Free Play: $M = 14.35$, $SD = 4.52$, min = 0, max = 28; Organized Activities: $M = 5.26$, $SD = 5.48$, min = 0, max = 22).

Self-Efficacy Toward Physical Activity. The Children’s Self-perception of Adequacy in and Predilection for Physical Activity (CSAPPA) scale is a 20-item scale designed to measure children’s self-perceptions of their adequacy in performing and their desire to participate in physical activities (Hay, 1992). This self-report scale requires approximately 20 min to complete and utilizes a structured alternative choice format to present descriptions of physical activities. For example, a child is asked to choose what most describes them between pairs of sentences such as “some kids are among the last to be chosen for active games” but “other kids are usually picked to play first” and then to indicate whether the selected sentence was either “sort of true for me” or “really true for me.” Hay (1992, 1996) designed the CSAPPA scale for children 9-16 years of age and it has demonstrated a high test-retest reliability ($r = 0.84$-$0.90$) as well as strong
predictive and construct validity (Hay, 1992, 1996). The CSAPPA scale has three imbedded factors: adequacy (confidence in), predilection (preference for), and enjoyment of physical education class. The scale differs quite substantially from previous work (e.g., Skinner & Piek, 2001) where self-efficacy is only limited to perceived competence in specific athletic abilities. This instrument is a measure of global or generalized self-efficacy that captures the degree to which children feel they are adequate in relation to other children, would select active over sedentary activities, and their enjoyment of physical education classes. It has been argued that this broader construct is more useful for both predicting and understanding physical activity in children (Hay, 1992). In this study we use the full scale (M = 61.05, SD = 11.29, min = 25, max = 76, α = 0.91)

The children completed both the participation and CSAPPA questionnaires in groups during regular school hours in a classroom setting.

Independent Variables

_Dev_**_opmental Coordination Disorder (DCD)._** Motor proficiency was evaluated using the short form Bruininks-Oseretsky Test of Motor Proficiency (BOTMP-SF). This test examines the full scope of motor proficiency (static and dynamic balance, reaction time, bilateral coordination, etc.) using selected items from the full scale. The short form has been validated against the full scale with inter-correlations between .90 and .91 for children in the 8 to 14 age range (Bruininks, 1978). It was designed for use when large numbers of children are surveyed as it takes 30 min to complete as opposed to two hours for the full version. While not providing an in-depth analysis of each aspect of motor proficiency, it does provide an excellent assessment of general motor functioning. The BOTMP-SF was individually administered to each consenting child in the school’s gymnasium behind a curtained barrier to ensure confidentiality. Furthermore, the BOTMP-SF examiner was blinded to the Children’s Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA) scale results. A BOTMP-SF standard score (age adjusted) below 38 was required to classify a diagnosis for probable DCD. Children who score below 38 are at or below the 10th percentile rank on the BOTMP-SF.

We use the term probable DCD because our method of case-identification is a field test administered by trained researchers, not a diagnostic protocol administered by a licensed health care professional (e.g., pediatrician or occupational therapist). Moreover, although our case-identification method follows most of the criteria stipulated in the DSM-IV (American Psychiatric Association, 1994), it is not complete. The DSM-IV stipulates four criteria for the diagnosis: (a) significant motor impairment below the age-expected norms; (b) motor problems must result in significant impairment to activities of daily living and/or academic achievement/performance; (c) condition cannot be due to other known physical conditions (e.g., cerebral palsy, muscular dystrophy) or pervasive developmental delay; and finally, (d) if mental retardation is present, motor impairments must be below the norm (age appropriate) expected for these children. In this study, the BOTMP-SF is used for criterion A, and, as mentioned in the discussion of the participants, all children with known learning disabilities and physical health problems were excluded from the analyses (Criterion C and D). Criterion B (limitations in activities of daily living) is the only part of the diagnosis we did not measure. However, as Visser (2003)
notes, most studies do not take into account the exclusion criteria in the DSM-IV. Although future research will need to address this problem, we elected to use the term probable DCD so our work can be compared to other studies.

Gender (males, females) and age in years (from 9 to 14), height (m), and weight (kg) are included as covariates in the analyses. Height and weight were measured using a calibrated hospital scale and stadiometer.

**Analysis**

In this study, we use a 2 (DCD) by 2 (Gender) ANCOVA with age, height, and weight as covariates to examine both the main effects of DCD and gender and the interaction between them for three outcome measures: generalized self-efficacy, free play participation, and participation in organized activities. Given the exploratory nature of the analysis, the minimum alpha level is set at $p < 0.05$ for statistical significance. In addition, effect sizes were reported for all significant results.

**Results**

Results of the ANCOVA are presented in Table 1. Because we are interested in the effect of gender on the relationship between DCD and generalized self-efficacy and participation in play activities, and because there is so little published data on gender by DCD differences, we report means by gender for each outcome for children with DCD and those without in Table 2.

**Generalized Self-Efficacy**

Generalized self-efficacy toward physical activity showed significant effects for DCD (see Table 1). Children with DCD reported lower self-efficacy toward physical activity ($M = 62.16$, $SD = 10.52$) than did children without DCD ($M = 48.30$, $SD = 11.90$). There was also a main effect for gender with boys reporting higher self-efficacy toward PA ($M = 62.65$, $SD = 10.92$) than did girls ($M = 59.22$, $SD = 11.38$). The gender by DCD interaction was not significant.

**Organized Activities**

There was a significant main effect of DCD on participation in organized activities (see Table 1). Children with DCD were less likely to participate in these activities ($M = 5.26$, $SD = 5.49$) than children without the disorder ($M = 5.31$, $SD = 5.48$). There was no main effect for gender and the interaction between gender and DCD was not significant.

**Free Play**

ANCOVA results of free play reported in Table 1 show a significant main effect of DCD. Children with DCD ($M = 13.79$, $SD = 4.22$) were less likely than their motor proficient peers ($M = 14.81$, $SD = 4.72$) to engage in recreational free play activities. Similar to the other outcomes, there was no main effect for gender and no interaction between gender and DCD.
Table 1  ANCOVA results for Generalized Self-Efficacy, Organized Activities and Free Play Scales

<table>
<thead>
<tr>
<th>Scales</th>
<th>DCD F(1,574)</th>
<th>η²</th>
<th>Gender F(1,574)</th>
<th>η²</th>
<th>Gender by DCD F(1,574)</th>
<th>η²</th>
<th>Age F(1,574)</th>
<th>η²</th>
<th>Height (m) F(1,574)</th>
<th>η²</th>
<th>Weight (kg) F(1,574)</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized self-efficacy</td>
<td>59.19 ***</td>
<td>.096</td>
<td>4.70 *</td>
<td>.008</td>
<td>0.23</td>
<td>.000</td>
<td>1.50</td>
<td>.003</td>
<td>3.01</td>
<td>.005</td>
<td>3.78</td>
<td>.007</td>
</tr>
<tr>
<td>Organized activities</td>
<td>7.57 **</td>
<td>.016</td>
<td>0.61</td>
<td>.001</td>
<td>0.45</td>
<td>.001</td>
<td>3.09</td>
<td>.013</td>
<td>1.88</td>
<td>.000</td>
<td>6.69 *</td>
<td>.001</td>
</tr>
<tr>
<td>Free play</td>
<td>9.58**</td>
<td>.013</td>
<td>0.07</td>
<td>.000</td>
<td>0.40</td>
<td>.001</td>
<td>7.74 **</td>
<td>.005</td>
<td>0.51</td>
<td>.012</td>
<td>0.01</td>
<td>.003</td>
</tr>
</tbody>
</table>

*Note.***p < .001; **p < .01; *p < .05; η² = Partial Eta-squared.*
Although there is sufficient reason to hypothesize that the impact of DCD on physical activity and perceived efficacy toward physical activity may be different for boys and girls, we could find no published research that explicitly examines the issue. Our results suggest that in terms of self-perceptions toward physical abilities, boys and girls with probable DCD are disadvantaged relative to their motor proficient peers. Regardless of gender, children with DCD report lower levels of generalized self-efficacy and lower participation in free-play and organized activities than do children without the disorder. These results are consistent with both observational studies (Bouffard et al., 1996; Thompson et al., 1994) and anecdotal evidence (Guba, 1975; Wall, 1982), which suggests that children with movement problems are less likely than other children to participate in physically active play.

Our finding that children with DCD report lower self-efficacy toward physical activity is also broadly consistent with previous work that reports children with DCD reporting lower perceived competence with regard to physical ability (Losse et al., 1991; Piek et al., 2000; Skinner & Piek, 2001). However, we did not find support for a gender by DCD interaction with these outcomes. Does this suggest that perhaps gender does not matter? We do not believe so. Although the tests for interactions were not significant, we believe this may be due to a lack of statistical power. Indeed, with only 19 boys and 25 girls with DCD, it is not surprising that gender by DCD interactions failed to reach the threshold of statistical significance. However, a visual inspection of the data reveals some interesting patterns worthy of further consideration (see Table 2). For example, it is interesting to note that girls with DCD report the lowest levels of generalized self-efficacy toward physical activity and the lowest levels of participation in both free play and organized activities (compared to boys with DCD, and boys and girls without DCD). In

<table>
<thead>
<tr>
<th>Scales</th>
<th>DCD</th>
<th>No-DCD</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Girls (n = 25)</td>
<td>Boys (n = 19)</td>
</tr>
<tr>
<td>Generalized self-efficacy</td>
<td>46.32 50.89</td>
<td>60.60 63.43</td>
</tr>
<tr>
<td>M</td>
<td>11.36 12.39</td>
<td>10.50 10.38</td>
</tr>
<tr>
<td>Organized activities</td>
<td>2.08 3.21</td>
<td>5.65 5.35</td>
</tr>
<tr>
<td>M</td>
<td>2.89 4.06</td>
<td>5.58 5.57</td>
</tr>
<tr>
<td>Free play</td>
<td>12.40 12.73</td>
<td>13.94 14.94</td>
</tr>
<tr>
<td>M</td>
<td>4.23 4.66</td>
<td>4.20 4.71</td>
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<tr>
<td>SD</td>
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### Discussion

Although there is sufficient reason to hypothesize that the impact of DCD on physical activity and perceived efficacy toward physical activity may be different for boys and girls, we could find no published research that explicitly examines the issue. Our results suggest that in terms of self-perceptions toward physical abilities, boys and girls with probable DCD are disadvantaged relative to their motor proficient peers. Regardless of gender, children with DCD report lower levels of generalized self-efficacy and lower participation in free-play and organized activities than do children without the disorder. These results are consistent with both observational studies (Bouffard et al., 1996; Thompson et al., 1994) and anecdotal evidence (Guba, 1975; Wall, 1982), which suggests that children with movement problems are less likely than other children to participate in physically active play.

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addition, with regard to organized activities, the pattern of mean score differences between boys and girls are consistent with an interaction effect (see Figure 1). The difference in mean scores on organized activities between boys and girls with DCD (mean difference = 1.13) is greater than the mean difference between boys and girls without DCD (mean difference = 0.30). Moreover, it appears that girls without DCD may be somewhat more likely to participate in organized activities than boys without DCD, although the absolute difference is very small (0.30). As well, the difference in mean scores on generalized self-efficacy between boys and girls with DCD (4.57) is larger than the difference in means between boys and girls without the disorder (2.83), which is also suggests that with larger numbers of boys and girls (and smaller standard errors), a gender by DCD interaction may be present.

Although tentative, these results suggest further work with larger samples of boys and girls with DCD should be conducted to see if these preliminary results hold. Larger samples of both boys and girls with the disorder will allow for a more powerful test of a gender by DCD interaction with play and perceived efficacy outcomes.

If gender really does influence the kinds of activities in which children with DCD engage, why might this be? From a theoretical point of view, these differences in the expression of play/physical activity resonate with culturally/
socially-constructed notions of acceptable behavior for boys and girls. The pressure to perform in organized activities (especially team sports) is high for boys, thereby explaining why boys with significant motoric impairment still participate in such activities to a greater degree than girls with the condition. For boys, the cost of not participating in organized activities may be greater than the cost of not participating well. However, in terms of more discretionary behaviors (i.e., free play), we find that boys with probable DCD are less likely to participate than boys and girls without the disorder, and the differences between boys and girls with DCD is much less pronounced. Thus, it may be that in the absence of external pressure from peers, parents, and teachers, and when more personal control over participation is available, both boys and girls with DCD opt for less physically active pursuits. Unfortunately, we do not have data on the reasons why children do or do not engage in either free play or organized activities. It would also be of interest to know if, in fact, there is a perceived pressure to participate in organized activities among boys with DCD and who or what the source of that pressure is (e.g., peers and/or parents). For example, the role that father’s play, if present, in influencing participation in organized activities among boys with DCD is especially intriguing. We wonder whether fathers may be more likely than others to push their sons into organized activities regardless of their motoric abilities, particularly if the father has a history of such participation himself. Families, especially parents, play a critical role in determining whether children participate in organized activities such as sports (Côté, 1999). Examining the potential effect parents and siblings has on influencing participation in children with DCD remains an important area for further inquiry.

Also, since expectations regarding physical performance may be greater for boys than for girls (e.g., Hay & Donnelly, 1996), it may be the case that parents and/or teachers recognize motor impairments in boys more readily and, as a result, are more likely to actively encourage participation in organized sport in the hopes that through participation, skill deficits can be improved. This may be particularly true when attribution of poor performance is laziness or lack of motivation, both believed to be “curable” through sport. Again, in the absence of data concerning reasons for participation, we cannot test this possibility.

The findings for girls are also consistent with the gendered nature of physical activity in childhood. Unlike boys, the pressure to engage in such activities is not as great and, therefore, girls can choose to opt out with little external pressure from teachers, family, and peers. As well, girls may be less competitive than boys (Gentle, Caves, Armstrong, Balding, & Kirby, 1994), which also explain why girls with DCD do not feel compelled to compete in organized activities. However, girls with DCD report the lowest levels of participation in free play as well. Thus, it may the case that in the absence of external pressure to participate, girls with DCD will opt for inactivity even in situations where formal pressures to perform are not as prominent. As stated previously, further work that actually measures reasons for participation in both types of activities is required to test these possibilities. Moreover, we still need to verify that these gender by DCD interactions are, in fact, present. We believe the results, however, are compelling and certainly support further investigation into gender differences in physical activity among children with DCD.

Some of the literature on DCD suggests that boys are much more likely to have the condition than are girls (Kadesjö & Gillberg, 1999; Miller et al., 2001; Missiuna, 1994; Schoemaker & Kalverboer, 1994). However, it is possible that this reflects a
bias regarding detection favoring boys and disadvantaging girls (Hay & Donnelly, 1996). Support for this latter hypothesis is found in the literature comparing studies that use clinical versus population or community-based samples. Studies that use school samples, for example, often find no differences in probable DCD between boys and girls (e.g., Dewey et al., 2002; but see Henderson & Hall, 1982). Our study also supports this proposition. We find no significant gender differences in DCD in our school-based sample. While compelling, there may be reasons other than sampling differences that are responsible for the varied findings regarding gender differences in the prevalence of the disorder. For example, inconsistencies in the literature may be due to differences in the evaluation/assessment protocols used for detecting movement proficiency problems in children. The latter would be especially problematic if the tests themselves vary in their ability to accurately detect movement problems in girls (Chen & Cohen, 2003). There is currently no gold standard test for the diagnosis of DCD (Dewey & Wilson, 2001). It is typically diagnosed with motor competence tests such as the Bruininks-Oseretsky test (BOTMP) or the Movement-Assessment Battery for Children (M-ABC). The BOTMP is the most commonly used standardized test to diagnose DCD in North America (Crawford, Wilson, & Dewey, 2001). In this study, we use a short form of the BOTMP, which has been validated for elementary school age children (Bruininks, 1978; Bruininks & Bruininks, 1977). Dewey et al. (2002), whose study also included a school-based sample, employed multiple tests including the BOTMP and the M-ABC and found no gender differences in DCD. It seems unlikely, therefore, that the failure to find significant gender differences in DCD with school-based samples is solely due to measurement. Nevertheless, further examination of factors other than sampling as a potential cause of gender differences in the prevalence of DCD is certainly warranted.

One limitation in the present study concerns nonresponse. In particular, we do not have data on the children whose parents refused to sign the consent to participate forms. We do not know, therefore, if there are differences between those children who participated and those who did not. It may be the case that parents of children with coordination problems may be more likely to refuse than parents of children without movement problems. Moreover, it is plausible that boys with movement problems, assuming that boys with DCD are more likely to be noticed by parents, may comprise a larger proportion of the nonrespondents than girls with movement problems. If this is so, then our gender ratio may be a function of systematic nonresponse. Asking parents to complete a short interview to ascertain why they are refusing to let their child participate should be considered in future studies of this kind.

A question for further consideration is what are the long-term consequences of these differences with regard to health outcomes? One concern for children with DCD is that their motor proficiency problems lead to an inactive or sedentary lifestyle, which in turn increases the likelihood of developing chronic health problems as they age. Our results support this concern. Both boys and girls report lower perceived self-efficacy and actual participation in physical activity. In addition, girls may be at even greater risk than boys although this needs to be tested in further work. Longitudinal data is required to examine whether inactivity in childhood in children with DCD leads to inactivity later on in life. Moreover, there are many potential modifying factors (e.g., diet, gendered perceptions of body image, socializing agents) that may also impact the relationship between DCD and
activity over the life course. Future work will need to consider these factors in analyses. Nevertheless, there is data to suggest that the physical activity patterns established in childhood and adolescence do persist into adulthood (Pate et al., 1999; Raitakari et al., 1994; Robertson-Wilson, Baker, Derbyshire, & Côté, 2003). If this is also true for children with DCD, then the potential long-term negative consequences of physical inactivity for these kids is a concern.

A second consideration arising from this data is the potential need for differential interventions for boys and girls with DCD. Even in the absence of a true gender by DCD interaction, effective intervention strategies for dealing with inactivity and DCD may be different for boys and girls. Although the structural problem may be similar—poor motoric coordination—and equally unamenable to change, the social context may vary substantially. In learning to cope with the consequences of this limitation, quite different strategies may be necessary for boys and girls. Strategies developed to promote physical activity may be likewise required to differ. In particular, our results suggest that interventions designed to promote greater uptake of both organized and discretionary physical activities in girls in particular may be especially important in children with the disorder.

We know of no published research that has examined whether gender influences the relationship between DCD and perceived adequacy toward physical activity and participation in physical activities. Our results are somewhat consistent with Rose and her colleagues who found that the effect of motor coordination problems on motivational orientations to sport and perceived athletic competence did not vary by gender (Rose et al., 1997, 1998). However, we believe the failure to find a significant interaction may be due to a lack of statistical power. When mean scores between boys and girls are inspected (stratified analysis), our results suggest that girls may be especially disadvantaged since their participation in free play and organized activities is the lowest of all children in the sample. Although these findings are compelling, this study is merely a first step. Further research will have to examine gender by DCD interactions in larger samples to confirm these preliminary findings. If supported, the reasons why boys and girls with DCD engage in different kinds of activities and the long-term consequences of these engagements should be examined.

References


**Authors’ Notes**

1By diagnosed, we are, of course, referring to diagnosis by health professional. Although an argument could be made that only those who need care get referred, it is much more likely that only children with concomitant diagnoses (e.g., Attention Deficit Disorder) are recognized by parents and teachers and then referred on to health care professionals (Hay & Missiuna, 1998). Children who are “clumsy” may simply avoid activities where their motor problems are apt to be most noticeable and therefore remain undetected in the school system (Hay & Missiuna, 1998). There is also the issue of who should actually make the diagnosis. For example, is a physician required to ensure that children do have DCD and not Muscular Dystrophy or Pervasive Developmental Disorder? This issue has not been adequately addressed in the literature.

2It is important to note that in both these studies, there are more boys than girls who meet the criteria for disorder. However, unlike the gender ratios reported in other studies, there are very small differences between the sexes. In the Dewey et al. (2002) study, there are no significant differences in DCD between boys and girls. In the Coleman et al. (2001) study, there were slightly more boys (58%) than girls. They did not report whether these differences were significant. It is our contention that differences in sampling do appear to impact the gender distribution of the disorder.

3See Hay (1992) for the survey items for the CSAPPA. The participation questionnaire is available upon request.

4The large standard deviations suggest that the distribution of organized activities is skewed. We therefore transformed the variable into a binary measures (1 = zero or one activities, 0 = 2 or more activities) based on the distribution of reported participation. We next ran a nonparametric test to examine a possible gender by DCD interaction (Mantel-Hanzel test). The results are consistent with those reported in the text. Girls with DCD are more likely than other children to report 0 or 1 activities—the interaction failed to reach statistical significance.