

The relationship between fine and gross motor ability, self-perceptions and self-worth in children and adolescents

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Abstract

The present study examined the impact of fine and gross motor ability on self-perceptions of male and female children and adolescents. Participants were compared across age group, sex, and level of motor ability. When intercorrelations between self-perceptions were taken into account, the level of movement ability was found to impact upon perceived athletic competence and scholastic competence. When movement was considered in terms of fine and gross motor ability, it was found that those with higher perceived scholastic competence were in the younger group and had better fine motor skills. Furthermore, those with greater perceived athletic competence were also in the younger group, were predominantly male and had better gross motor skills. The types of self-perceptions that influenced self-worth were dependent on the level of motor ability of the participants and varied according to their sex. The implications of these findings are discussed with reference to the necessity to assess specific types of motor deficit when tailoring intervention strategies for children with motor disorders, particularly within the academic setting.

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1. Introduction

For those individuals who demonstrate difficulty with motor skills, such as running, jumping, catching and even buttoning clothes (Henderson & Hall, 1982), manipulation of the environment with the same degree of ease as their more coordinated peers is not possible. This is the case for children and adolescents with Developmental Coordination Disorder (DCD: American Psychiatric Association, 2000). DCD provides a useful framework to examine the effects of motor coordination, and more specifically, of lower levels of motor coordination in children and adolescents. The prevalence of DCD in children has been reported to be as low as 3% and as high as 22% (Larkin & Cermak, 2001). The DSM-IV (APA, 2000) cites the prevalence at 6% for children in the age range of 5–11 years.

Individuals with DCD form a heterogeneous group, varying not only in the degree and type of deficit, but also in the severity of each. For some, their deficits are confined to tasks involving only gross (e.g., running, balance) or fine (e.g., handwriting, using a knife and fork) motor coordination, and for others, their deficit extends to both. In order to assess movement ability, it can be useful to consider movement separately in terms of its fine and gross motor constituents, with variation among these allowing for a more complete picture of individual differences. Indeed, individuals with poorer motor ability such as those with DCD have been found to vary greatly in the type of motor deficit they possess (Henderson, Rose, & Henderson, 1992), a variability which may be increased by sex differences as the individual makes the transition from childhood to adolescence.

Individuals with DCD not only suffer from impaired motor coordination, but are also affected in many other aspects of their development. Schoemaker and Kalverboer (1994) found that children with poor motor coordination were more anxious than their peers when told they would be engaging in physical activity. In a study of children and adolescents between the ages of 8 and 14 years, Skinner and Piek (2001) found that when compared to their normally coordinated peers, those with DCD had higher levels of state- and trait-anxiety and lower levels of perceived self-worth. A study involving children at play during the school recess period (Bouffard, Watkinson, Thompson, Dunn, & Romanow, 1996) found that children with motor coordination difficulties were less active, utilised play equipment less often, and spent less time interacting with other children. Children with movement difficulties will appear to avoid situations in which they might display their lack of competence. This means that they may miss vital opportunities to develop the physical and social benefits of athletic involvement.

That individuals with motor coordination problems may tend to shy away from participation in sporting and game activities is of no real surprise. Harter (1987) suggested that people's actions are motivated by a desire to avoid situations in which one might demonstrate low ability. In addition, Schoemaker and Kalverboer (1994) suggested that withdrawal from such situations may create a vicious circle in which fear of failure leads to withdrawal, which in turn leads to fewer opportunities for the necessary practice of skills. Horn and Hasbrook (1987) posit that children as young as five years of age assess their own competence by comparing their performance with the performance of their peers, and Schoemaker and Kalverboer (1994) suggested that many of the feelings of lack of confidence and low self-esteem may be present in children as young as six years of age.

Harter (1987) examined the relationship between global self-worth and domain specific self-perceptions such as athletic competence, and found that perceived competence was a

strong predictor of self-worth. Children and adolescents with DCD have been found to have lower self-perceptions of athletic competence and scholastic competence than their peers (Cantell, Smyth, & Ahonen, 1994; Losse et al., 1991; Piek, Dworkan, Barrett, & Coleman, 2000; Rose, Larkin, & Berger, 1997; Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001; Van Rossum & Vermeer, 1990). Less consistent results have been found for perceived social acceptance (Rose et al., 1997; Schoemaker & Kalverboer, 1994), although other research involving a larger sample size has shown significant differences between DCD and control groups, for both children and adolescents (Skinner & Piek, 2001). A more consistent difference between DCD and control groups has been found in terms of perceived physical appearance. In several studies, individuals with DCD evidence significantly lower self-perceptions of physical appearance than their well-coordinated peers. This has been found with both younger children (Dunn & Watkinson, 1994; Skinner & Piek, 2001) and adolescents (Losse et al., 1991; Rose et al., 1997; Skinner & Piek, 2001).

In examining the relationship between specific domains of self-perception and self-worth, Harter (1987) found that certain domains contributed more as predictors of self-worth. For children in grades 3–8, self-perception of physical appearance made the biggest contribution to self-worth, followed by social acceptance, scholastic competence, athletic competence and finally behavioral conduct. Perceived physical appearance was also an important predictor of self-worth in children (Piek et al., 2000) and adolescents (Harter, 1990; Skinner & Piek, 2001). In addition, scholastic competence was a significant predictor of self-worth in children (Piek et al., 2000) and adolescents (Skinner & Piek, 2001) with DCD.

Harter (1985, 1988) pointed out that self-perception domains were intercorrelated. For the Self-Perception Profile for Children (Harter, 1985), scholastic competence and behavioral conduct were related, as were perceived physical appearance, athletic competence, and social acceptance. Similar relationships were present for the Self-Perception Profile for Adolescents (Harter, 1988). Based on this relationship, Harter (1985) suggested that “while it is difficult to infer causality, it seems likely that physical attractiveness and athletic prowess may lead to greater acceptance of popularity among one’s peers” (p. 21). Hendry (1978) has shown that the importance of physical appearance is different across sex in terms of peer group popularity, with adolescents typically emphasizing physical characteristics and abilities. For girls, having a ‘nice figure’ or being ‘pretty’, were important factors. For boys, being ‘handsome’ and ‘sporting’ were deemed important. Similarly, Chase and Dummer (1992), in examining the determinants of social status in children, found that boys rated athletic ability and physical appearance as the most important determinants of social status for males, and physical appearance as the most important determinant in females. Young girls on the other hand, viewed physical appearance as the single most important determinant of social status for both boys and girls.

The present study examined the relationship between motor ability, in terms of its fine and gross motor constituents, and the self-perceptions of male and female children and adolescents. Fine motor control is believed to be important for the academic and possibly social realms. Rose et al. (1997) suggested that printing and writing are important in the early primary years for the expression of ideas, and that children with motor difficulties may sometimes appear untidy and slow to dress due to their inability to quickly and efficiently sequence the necessary fine motor movements. This may affect the way others perceive them on a social scale, and may affect their ability to perform certain activities at school (Wright & Sugden, 1996). Furthermore, grooming tasks such as brushing one’s hair

and putting on makeup require fine motor coordination. For older girls with motor coordination difficulties, difficulties in performance of these tasks may have a deleterious effect on their self-worth. With the high necessity to conform to group standards during adolescence (Hendry, Shucksmith, Love, & Glendinning, 1993), it could be expected that matters of dress and personal appearance will have an impact upon the self-worth of girls.

Gross motor ability may impact on physical appearance, as having the resources to engage in physical activity will enhance one's overall physique (Rose et al., 1997). Due to the higher importance placed by boys on sporting ability and physical prowess it is expected that gross motor ability in boys will be predictive of their perceived physical appearance. It has been suggested that from infancy, children are stereotyped on the basis of their sex into certain roles, and that there is sex bias towards play in particular ways and with certain types of toys (Bandura, 1986). Young boys are rewarded more than girls for the development of motor skills, such as the gross motor skills involved in block play, and are encouraged to participate in physical activities more than girls (Fagot, 1985). Skillfulness in games is suggested to be one of the best predictors of social status in children (Gallahue & Ozmun, 1998; Weingarten, 1980). Conceivably then, gross motor deficits could also impact upon athletic and social spheres, particularly for boys.

The current study divided total motor ability into fine and gross motor coordination, to more easily assess their differential impact on the perceived competencies of male and female children and adolescents. Harter's (1978) model of competence motivation can be extended to examine the impact of the level of motor function in children and adolescents on their perceived self-worth, with gross motor dysfunction being more likely to result in peer criticism, and fine motor deficits more likely to be interpreted by peers, parents and teachers as poorer academic ability. Since Harter's model holds that perceived competencies are domain specific, it can be expected that differences in fine and gross motor control will have a differential impact on the perceived competencies of male and female children and adolescents. Another important initiative of the current study is that it takes into account the intercorrelations between self-perceptions. This has not been considered in previous studies that have investigated self-perceptions and self-worth in children and adolescents with motor coordination problems.

2. Method

2.1. Participants

A total of 265 children and adolescents selected from seven metropolitan schools were involved in this study. Given the differences between children and adolescents identified in self-perceptions in other studies (e.g., Skinner & Piek, 2001), children were divided into two age groups, a group of 164 primary school children (80 girls and 84 boys) aged between $7\frac{1}{2}$ and 11 years (Mean = 9.10, SD = 0.81) and a group of 101 secondary school adolescents (64 girls and 37 boys) aged between 12 and $15\frac{1}{2}$ years (Mean = 13.84, SD = 1.12). Children and adolescents were excluded from the study if they were identified with any neurological or intellectual disability. As none of the children were in special education classes they were assumed to be of at least average intelligence.

Participants were categorised as either with or without DCD depending on whether they scored above or below 84 on the Neuromuscular Development Index (NDI) of the MAND. This cutoff score was used because of its equivalency to the 15th percentile

(Tan, Parker, & Larkin, 2001), as Geuze, Jongmans, Schoemaker, and Smits-Engelsman (2001) recommended “a standard quantitative [criterion cutoff score of] the 15th centile on a standardized test of fine or gross motor performance to detect motor problems” (p. 32). A further criterion for DCD according to the DSM-IV (APA, 2000) is that the poor motor ability impacts on academic achievement or daily living. However, as this has been difficult to operationalize in the past, most studies investigating DCD have not measured this (Geuze et al., 2001). Henderson and Barnett (1998) argue against the strict adherence of this criterion as “the inclusion of any such criterion detracts from the importance of motor competence in its own right” (p. 461).

2.2. Apparatus

2.2.1. McCarron Assessment of Neuromuscular Development (MAND)

This measure has been designed as a screening, evaluation and research tool for clinicians, therapists, educators, and researchers (McCarron, 1982), and is designed to assess children from 3.5 to 18 years of age in terms of their fine and gross motor development. It is made up of five fine motor items and five gross motor items for a total of ten items assessing one- and two-handed dexterity, grip strength, jumping, and balance skills. The fine motor tasks are: Beads in a box (right and left hand), Beads on a Rod (eyes open and closed), Finger Tapping (right and left hand) Nut and Bolt (large and small bolt), and Rod Slide (right and left hand). The gross motor tasks include: Hand Strength (right and left hand), Finger–Nose–Finger (eyes open and closed), Jumping for Distance, Heel–Toe–Walk (forward and backward), and Standing on One Foot (eyes open and closed on each leg). Raw scores from the 10 tasks are converted to scaled scores ranging from 1 to 20 with a mean of 10. The sum of the scaled scores is then converted to a Neuromuscular Development Index (NDI) with a mean of 100 and a standard deviation of 15. Test–Retest reliability coefficients as provided by McCarron (1982, p. 15) are fine motor score, $r = .98$; gross motor score, $r = .96$; and total motor score, $r = .99$. Added utility of the test comes from its ability to analyse the skills underlying gross and fine motor tasks.

2.2.2. Self-perception profiles

The self-perception profiles were designed to assess self-perceptions and global self-worth. The measure has versions appropriate for both children (Self-Perception Profile for Children [SPPC]: Harter, 1985) and for adolescents (Self-Perception Profile for Adolescents [SPPA]: Harter, 1988), and were designed to measure self-perception domains of Scholastic Competence, Social Acceptance, Athletic Competence, Physical Appearance and Behavioral Conduct. For adolescents three additional subscales are included: Job Competence, Romantic Appeal, and Close Friendship. However, because they have been found to be less highly correlated with self-worth, with correlations ranging between $-.31$ and $-.44$ (Harter, 1990), these three were omitted from measurement for the purpose of this study. Both versions also include a subscale designed to evaluate global self-worth that assesses self-esteem independent from the competence domains. The overlap between content across the two versions allows for a switch of versions at the appropriate age level and allows for comparison of the subscale scores across the two versions (Byrne, 1996; Harter, 1985). The internal consistency for the six-item scale used in the present study was found to be $.77$ as indexed by Chronbach’s alpha.

Each subscale is comprised of five items for a total of 30 items. Scores for each item range between 1 and 4 with 1 reflecting a low perceived competence and 4 reflecting a high perceived competence. The test takes approximately 20 min to administer and consists of a structured-alternative format in which, firstly, the individual is asked to decide which of a pair of statements best reflects them and secondly, they decide if it is “really true for them” or “sort of true” for them. This format decreases the tendency for participants to give socially desirable responses. Internal consistency for the eight subscales of the SPPA has been demonstrated to be good and ranging between .55 and .93 (Byrne, 1996). No test–retest reliability is available, however, the test is supported by an 8-factor structure with all factor loadings exceeding 0.3 (Byrne, 1996). The SPPA was normed on white lower to middle, through upper to middle class students in the USA.

2.3. Procedure

This study adhered to the ethical guidelines for human experimentation as set out by the National Health and Medical Research Council of Australia. Information sheets outlining the research were sent to schools participating in the study, along with school consent forms to be signed by the principal. Once the principal consent forms had been returned, letters containing information sheets, parental consent forms, and medical history questionnaires were disseminated by the schools. Testing sessions took place at school during normal school hours. Sessions lasted no longer than the length of one school period (1 h), so as to mimic as closely as possible the school environment, ensuring minimal disruption to the children’s school activities. The Harter scales were administered first as a group, and then each child was individually tested on MAND, along with other testing that was not part of this particular study.

3. Results

The focus of the first analysis was on the differences between DCD and control children on a conceptual set of competency measures that included scholastic competence, social acceptance, athletic competence, physical appearance, and behavioral conduct. The zero-order correlations between the dependent variables are presented in Table 1. It can be seen that all five competencies were significantly intercorrelated. Note that the highest correlations occurred between athletic competence and physical appearance (.478), athletic

Table 1
Zero-order correlations between each of the dependent variables (*N* = 265)

	Scholastic competence	Social acceptance	Athletic competence	Physical appearance
Scholastic competence				
Social acceptance	.276**			
Athletic competence	.299**	.368**		
Physical appearance	.300**	.344**	.478**	
Behavioral conduct	.358**	.140*	.204*	.307*

* *p* < .05 (two-tailed).
** *p* < .01 (two-tailed).

competence and social acceptance (.368), and scholastic competence and behavioral conduct (.358), as found by Harter (1985, 1988).

A multivariate ANOVA examined differences between DCD and control children on the linear combination of the dependent variables (DVs) as a function of the sex of the participant. The multivariate main effect for group was found to be statistically significant, $F(5, 257) = 6.73$, $p < .001$, Wilk's $\Lambda = .884$. The strength of the multivariate relationship as indexed by partial η^2 was .116. There was also a statistically significant multivariate main effect for sex, $F(5, 257) = 6.55$, Wilk's $\Lambda = .887$, partial $\eta^2 = .113$. The two-way interaction between sex and group was statistically non-significant, $F(5, 257) < 1$, demonstrating that the group difference on the linear combination of the DVs does not depend on the sex of the individual. The linear discriminant function (LDF) underlying the multivariate main effect for group was therefore investigated further.

The structure matrix for the correlations between each DV and the LDF revealed highest loadings for scholastic competence (.773) and athletic competence (.747), followed by physical appearance (.591), behavioral conduct (.460), and social acceptance (.265). In order to explore the redundancy of the DVs, a stepdown analysis was also performed. Scholastic competence was entered on the first step and found to differ significantly across the groups, stepdown $F(1, 263) = 19.696$, $p < .001$. Athletic competence was next to be entered and, controlling for scholastic competence, also explained a significant amount of variance, stepdown $F(1, 262) = 15.191$, $p < .001$. No further DVs added unique variance. The subset of DVs that included only scholastic competence and athletic competence therefore statistically significantly separated the groups. The remaining DVs were redundant.

An inspection of the univariate results revealed that the groups differed on scholastic competence, $F(1, 261) = 19.68$, $p < .001$, athletic competence, $F(1, 261) = 20.30$, $p < .001$, physical appearance, $F(1, 261) = 12.20$, $p < .001$, and behavioral conduct, $F(1, 261) = 7.212$, $p = .008$ but not in terms of social acceptance, $F(1, 261) = 2.75$, $p = .099$. It must be stressed however that the multivariate results indicated that the unique differences lie only with scholastic competence and athletic competence. The univariate differences in behavioral conduct and physical appearance reflected their shared variance with the other dependent variables.

Children with DCD were poorer than their control counterparts in both fine ($t(263) = -12.00$, $p < .001$) and gross ($t(263) = -13.33$, $p < .001$) motor skills. At issue is how fine and gross motor ability contributed to their self-perceptions of scholastic and athletic ability. Separate hierarchical regressions were performed on perceived scholastic and athletic ability as criterion variables. On the first step, age, fine motor ability, gross motor ability, and gender were entered. Group membership was added on the second step. When scholastic competence was the criterion variable, on the first step both age, $\beta = -.038$, $t(260) = -2.28$, $p = .023$, and fine motor ability, $\beta = .013$, $t(260) = 2.96$, $p = .003$, accounted for *unique* variance but gross motor skills and sex did not. The participants with higher perceived scholastic competence were the younger group, and had better fine motor skills. On the second step, group membership was added and found to have statistically significant *incremental* variance, R^2 change = .015, $F_{\text{change}}(1, 259) = 4.302$, $p = .039$. Though small, this result suggests that some additional factor may also contribute to self-perceptions of scholastic competence in the DCD group compared to control children. The results suggest that the lower perceived scholastic ability in DCD children may be related specifically to their poorer fine motor skills.

When perceived athletic competence was the criterion variable, on the first step the statistically significant predictors were age, $\beta = -.064$, $t(260) = -3.79$, $p < .001$, sex, $\beta = -.310$, $t(260) = 3.668$, $p < .001$, and gross motor ability, $\beta = .018$, $t(260) = 4.28$, $p < .001$, but not fine motor ability. The participants with greater perceived athletic competence were the younger group, male and had better gross motor skills. On the second step group membership was added and did not add any statistically significant *incremental* variance, R^2 change = .006, $F_{\text{change}}(1, 259) = 2.048$, $p = .154$. The results suggest that the lower perceived athletic ability in DCD children may be related specifically to their poorer gross motor skills.

Given that perceived scholastic and athletic competence were important dependent variables that separated groups with and without motor coordination problems further analyses were performed to investigate the relationship of these two variables to self-worth, based on Harter's (1987) model of self-worth. Both athletic and scholastic competence in combination explained a statistically significant proportion of variance in self-worth (R^2 change = .209, $F_{\text{change}}(2, 262) = 34.526$, $p < .001$).

A test for parallelism was performed to determine whether the prediction equations for athletic competence and scholastic competence, as predictors of self-worth, were equivalent for each group and sex combination. The regressions significantly departed from parallelism ($F(3, 253) = 4.16$, $p < .05$). For males in both groups, perceived athletic competence was a statistically significant determinant of self-worth but scholastic competence did not add unique variance. Athletic competence furthermore was of equivalent importance to males in both the DCD (sr squared = .340) and control (sr squared = .286) groups. For females, perceived scholastic competence was important to the self-worth of females in both groups, but explained more unique variance for DCD (sr squared = .393) than for control (sr squared = .266) females. Interestingly, athletic competence was not important for control females but was for DCD females.

4. Discussion

Children and adolescents with poor motor ability have been identified as being at risk of social, emotional and behavioral problems that have been linked to their poor motor ability (e.g., Dyck et al., 2004; Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001). According to Harter (1987), such problems may be linked to the individuals' perceptions of their abilities in a variety of domains. Past research has found that children and adolescents with DCD have lower perceptions of their physical appearance (e.g., Dunn & Watkinson, 1994; Losse et al., 1991; Skinner & Piek, 2001), athletic competence (e.g., Cantell et al., 1994) social acceptance (e.g., Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001), scholastic competence (e.g., Cantell et al., 1994; Rose et al., 1997), and behavioral conduct (e.g., Rose et al., 1997). Likewise, in the current study, when univariate analyses were performed, group differences were found for scholastic competence, athletic competence, physical appearance, and behavioral conduct. The present study, however, did not find any statistically significant univariate differences between the groups for social acceptance.

There was duplication and redundancy inherent in the univariate analysis of multiple measures. In a multivariate analysis taking into account the intercorrelations between the self-perception measures, it was found that only athletic competence and scholastic competence explained unique variance. Physical appearance and behavioral conduct on

the other hand appeared important in the univariate analysis but were redundant in the multivariate analysis. When considering those variables on which DCD and control children differ, it is important to take into consideration the intercorrelations between measures.

Given the crucial differences in perceived scholastic and athletic competence for children and adolescents with DCD compared with controls, it was asked how deficits in fine and gross motor ability might underlie these self-perceptions. After all, children with DCD in particular display deficits in either fine or gross motor ability and sometimes both. In a regression analysis, as predicted, poor fine motor ability was associated with lower perceived scholastic ability. This is to be expected given the importance of fine motor skills in the classroom situation where fast and competent handwriting will impact on the individual's scholastic performance (Cantell et al., 1994). An additional finding was that adolescents had a poorer perception of their scholastic ability than the younger group. This is consistent with other research that has identified a decline in self-evaluation in adolescence and may demonstrate that adolescents are more aware of differences in their abilities than younger children (Harter & Robinson, 1988; Marsh, Barnes, Cairns, & Tidman, 1984). No sex differences were identified which suggests that both boys and girls had equivalent perceptions of scholastic ability.

Gross motor ability, by contrast, did not impact on perceptions of scholastic competence. However, gross motor ability and not fine motor ability was found to affect perceived athletic competence. Similarly, adolescents had a poorer perception of their athletic ability than the younger group of children. Again, this may be because the older group were able to more clearly define their perceptions of ability than the younger group. For boys, athletic ability is seen as one of the most important determinants of social status (Chase & Dummer, 1992). As a result, boys may be highly critical of their own athletic ability, possibly using elite performance as an indicator of good athletic competence. In Australia and other Western societies, sport and elite athletes (particularly male athletes) are highly acclaimed and are ever present in media. For boys who have motor coordination problems, this may have a substantial impact on their perceived athletic competence.

What are the implications of these findings for the individual's psychosocial well-being, in particular, their self-worth? Both perceived scholastic and athletic competence were found to contribute to the variance in self-worth, but differently for males and females. In males, perceived athletic competence, but not scholastic competence, was a significant determinant of self-worth, and was equally important for males with or without DCD. Given the link between gross motor ability and athletic competence, it is clear that the male with DCD who has poor gross motor ability is at risk of lowered self-worth, and the social and emotional implications.

For females with and without DCD, scholastic competence, linked with fine motor ability, was important for their self-worth. Perceived athletic competence, linked with gross motor ability, was also seen to contribute to self-worth in females with DCD. This suggests that the psychosocial implications may be more severe for girls with DCD as their self-worth may be compromised regardless of whether they have fine or gross motor ability. A significant sex effect has been found in some studies with girls having lower perceptions of self-worth than boys (e.g., Rose et al., 1997). This finding may in part account for some of the ambiguous finding for self-worth in the past, as several researchers have failed to find significant differences in self-worth between individuals with DCD and controls (Cantell et al., 1994; Maeland, 1992; Piek et al., 2000; Van Rossum & Vermeer, 1990).

Other authors have reported significant differences (Rose et al., 1997; Schoemaker & Kalverboer, 1994; Skinner & Piek, 2001). For example, Skinner and Piek had more girls in their sample compared with many of the previous studies. This may explain why self-worth was found to be significantly poorer in this study. As DCD can be diagnosed for children who have either a fine or a gross motor problem, these results demonstrate the need to identify the type of motor deficits, fine or gross, before the self-worth findings can be appropriately interpreted.

5. Conclusion

The present study adds support to the argument that is building concerning the presence of poor social and emotional outcomes in individuals with poor movement ability. Using DCD as a framework to examine low-level movement ability, the present study found evidence to support the lower self-perceptions of physical appearance, athletic competence and global self-worth in poorly coordinated children and adolescents.

The differential impact of fine and gross motor ability on self-perceptions and on males and females emphasizes the need to take into account these factors when exploring psychosocial factors in DCD. In particular, more attention needs to be taken as to whether an individual with DCD has fine, gross, or both fine and gross motor deficits. It is only by separating these variables that the appropriate approaches can be designed to address the motor and psychosocial problems of children and adolescents with DCD.

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