
An exploratory study of the association between self-esteem levels in adults and retrospective reports of their peer relations and motor skills in childhood

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Abstract

Introduction: The association between motor coordination difficulties (a core feature of Developmental Coordination Disorder) and mental health difficulties, such as low self-worth, anxiety and depression is well documented. This study extends existing research by exploring whether this association is mediated by factors such as bullying or social inclusion during childhood.

Method: This study used a retrospective design in which 217 adult participants completed an online questionnaire which asked about their motor skills in childhood, recollections of peer relationships in primary school, and their current level of self-esteem.

Results: Participants' recollections of their motor skills in childhood was strongly associated with their current self-esteem self-rating. This finding is consistent with previous studies. Investigation of this association suggests it was mediated by participants reporting lower feelings of social inclusion in childhood. This suggests that adults who report feeling socially excluded at primary school are at risk of experiencing lower levels of self-esteem in adulthood. Interestingly, no association was revealed between low levels of adult self-esteem and recollections of overt bullying in childhood.

Conclusions: This finding, if extended suggests that social exclusion in childhood may be a risk factor for future wellbeing and self-esteem of individuals with difficulties with motor skills. This could have important practical implications, highlighting the importance of initiatives offered within primary schools to support social inclusion, especially for those with motor coordination difficulties. Teachers are well trained on anti-bullying tactics and anti-bullying campaigns are promoted to pupils in many areas. However, it is not clear that the impact of social exclusion, which can be harder to monitor, is highlighted as prominently. Further studies should consider gathering information from children and charting their self-esteem and perceived social inclusion longitudinally.

Key words: Developmental Coordination Disorder, Motor Coordination Difficulties, Bullying, Self Esteem, Social Exclusion, School Peer Relations

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1. Introduction

1.1. Developmental Coordination Disorder

Childhood clumsiness has been written about since the early 1900s under a variety of different names such as: Clumsy Child Syndrome (Gubbay, 1975; cited in Vaivre-Douret, 2014), congenital awkwardness (Ford, 1960; cited in Vaivre-Douret, 2014), and childhood apraxia (Walton, Ellis & Court, 1962; cited in Vaivre-Douret, 2014). These difficulties are now referred to as Developmental Coordination Disorder (DCD) (Polatajko, Fox & Missiuna, 1995). DCD is classified as a neurodevelopmental disorder with an onset during the developmental period, characterised by motor ability substantially below what might be expected given an individual's chronological age and opportunity for motor skill learning (American Psychological Association, 2013). DCD frequently co-occurs with additional neurodevelopmental disorders such as Attention Deficit Hyperactivity Disorder (ADHD) (Kaiser, Schoemaker, Albarret, & Geuze, 2015), Dyslexia (Haslum & Miles, 2007), Specific Language Impairment (Hill, 2001) and Autism Spectrum Disorder (Bo, Lee, Colbert, & Shen, 2016). Indeed, in a review paper, Cairney, Veldhuizen and Szatmari (2010) report that approximately half of all children diagnosed with ADHD would also meet criteria for DCD (e.g. Fliers et al., 2010; cited in Cairney et al., 2010).

There is also mounting evidence for the frequent co-occurrence of motor developmental disorders with mental health difficulties such as depression and anxiety. In dizygotic twin pairs with differing levels of motor ability, higher rates of depression have been found in children at risk for DCD than in their co-twins (Pearsall-Jones, Piek, Rigoli, Martin, & Levy, 2011; Piek et al., 2007). Higher levels of depression or anxiety have also been reported in pre-school-aged children scoring higher on measures of motor difficulty (Piek, Bradbury, Elsley, & Tate, 2008), and in adults with diagnosed motor problems (Hill & Brown, 2013). Children with DCD have been reported to experience lower health-related quality of life than TD samples (Caçola & Killian, 2018) and studies have also demonstrated higher levels of motor difficulties in children with pre-diagnosed anxiety disorders (Skirbekk, Hansen, Oerbeck, Wentzel-Larsen and Kristensen, 2012). Falling into the 'at risk' category for DCD (that is, not having a formal diagnosis and being involved in the study either as part of a general population sample or on the rec-

ommendation of an educational professional or guardian) appears to carry heightened risk for a number of negative outcomes, including lower self-esteem and poor self-worth (Piek, Baynam, & Barrett, 2006), and increased rates of bullying, fewer friends, and less social support from peers (Piek, Barrett, Allen, Jones & Louise, 2005). And in a study using a retrospective self-report questionnaire, Begerot, Plenty, Humble and Humble (2013) found that lower motor ability in primary school (responses on a three-point scale to the question 'were you regarded as talented in PE at 10–12 years of age?') was strongly correlated with memories of childhood bullying measured on a similar scale.

1.2 Motor ability, peer acceptance and mental health

To the authors' knowledge, only one study has investigated the impact of social acceptance on the association between motor difficulties and self-esteem using a measure specifically designed to determine a child's perceived social inclusion. Schmidt et al. (2015) performed a longitudinal study over thirty weeks into the motor ability, physical self-concept, perceived social acceptance, and self-esteem of over 400 adolescent boys and girls. In this study, they defined physical self-concept as the participants' degree of satisfaction with their own body. The results suggested that physical self-concept acted as a mediator between motor ability and self-esteem for both boys and girls. However, the mediating effect of perceived social acceptance was only significant for boys. This result is initially surprising, for as Schmidt et al. note global self-esteem has been found to depend on the sense of social acceptance for both genders (Denissen et al., 2008; cited in Schmidt et al., 2015). However, the lack of mediation does not necessarily mean that social acceptance is not important to girls' self-esteem; rather it could mean that social acceptance's interaction with motor ability in girls is not as important to their overall self-esteem, or interacts differently. In other words, girls' social-acceptance is not as driven by motor ability in this age group as it is for boys.

1.3 The Environmental Stress Hypothesis

The Environmental Stress Hypothesis (Cairney, Rigoli & Piek, 2013) is a model of possible pathways between DCD and internalizing problems. In it, DCD is the 'primary stressor' which is linked to a series of negative consequences (the secondary

stressors) including inactivity, obesity, and problems with peer relationships. While the primary stressor might be linked directly to internalizing problems, the relationship between the primary stressor and the secondary stressors contributes to negative self-worth and psychological distress which in turn can lead to increased symptoms problems like depression and anxiety.

The motor issues experienced in DCD present unique social challenges for children and adolescents. For instance, competence in activities valued highly by peers can be an important way of achieving social acceptance in childhood (Evans & Roberts, 1987; cited in Schmidt et al., 2015). Physical activity and sport participation often reaches a peak during puber-

ty and the transition into adolescence, approximately between the ages of ten and fourteen (Malina & Litle, 2008; cited in Schmidt et al., 2015). Therefore, the ability to engage competently with these kinds of activities could be important for peer acceptance, particularly in late primary school and early secondary school. The combination of issues with motor planning, motor coordination, and balance often mean that children with DCD experience difficulty with group games and may avoid them entirely (Poulsen, Ziviani, Cuskelly, & Smith, 2007). Figure 1 illustrates a possible series of aversive conditions leading to mental health difficulties based on the Environmental Stress Hypothesis, with a focus on social resources.

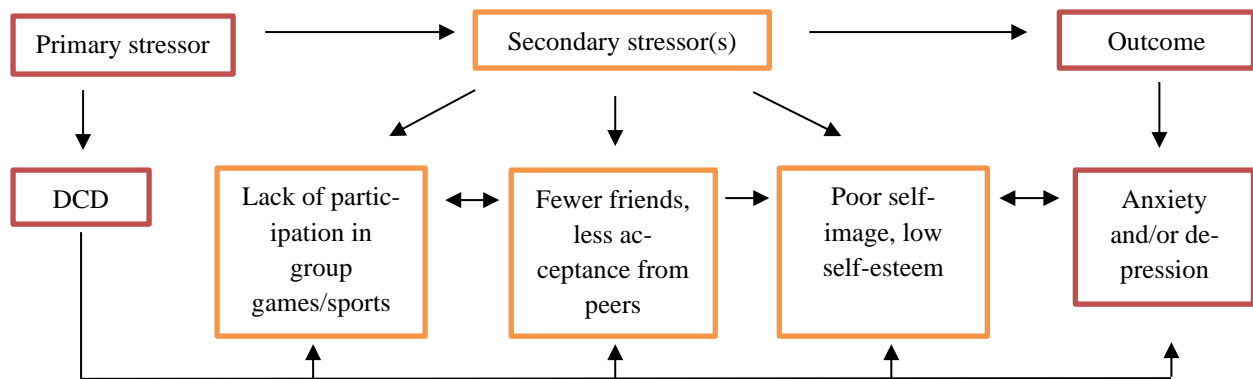


Figure 1: Possible pathways between primary and secondary stressors leading to internalizing problems, using the ESH framework

More recently, path analysis has been used to examine the possible utility of the Environmental Stress Hypothesis as an explanation for enhanced internalising problems in individuals with DCD (Li et al., 2018). The best-fit model included accounted for 21.7% of variance in internalising problems in a sample of 1206 children aged 12 to 14, though only 79 children in this sample were considered to have probable DCD. They found direct effects of probable DCD on internalising problems and on self-worth in girls, but not in boys. There were also mediating effects of physical activity and self-worth found between probable DCD and internalising problems in girls. As the authors note, future research should consider other psychosocial resources such as perceived social support.

1.4 Aim of the current study

The current study aimed to provide a preliminary investigation of the associations between childhood motor difficulties and adulthood self-esteem. It utilised the framework of the Environmental Stress

Hypothesis as a basis for investigating two potential social-environmental stressors: remembered experiences of social inclusion, and remembered experiences of bully victimisation. To determine if the association was related to motor difficulties rather than secondary characteristics of DCD (such as problems with organization and time management, or attention and concentration) a population-based sample was recruited and only questions relevant to the primary motor characteristics of DCD were included. It was hypothesized that:

There would be an association between poor childhood motor ability and poor adulthood self-esteem.

This association would be mediated by reported levels of bullying and social inclusion in childhood.

2. Method

2.1 Participants

A population-based sample was used for this study. Participants were recruited through social media and the mailing list of a student society. A total of 289 people responded. Of these, 72 were removed due to

failure to complete all items, leaving 217 respondents. Participants' gender and age groups are shown

below in Table 1.

Table 1

Number of participants in each age and gender group.

	18-25	25-43	35-44	45 and older	Total (gender)
Male	24	17	5	7	53
Female	27	52	46	23	148
Other	8	7	1	0	16
Total (age)	59	76	52	30	217

2.2 Materials

The questionnaire used in this investigation was adapted from a selection of other questionnaires (referred to hereafter as the component questionnaires). These were modified as to be suitable for adults filling out the questionnaires based on their childhood experiences. All items pertaining to symptoms of DCD other than motor control and motor planning were removed for the purposes of this study (e.g. an item from the Adult Developmental Coordination Disorder/Dyspraxia Checklist: "do you have difficulty managing money?").

The component questionnaires were:

Adult Motor Ability (The Adult Developmental Coordination Disorder/Dyspraxia Checklist; ADC; Kirby, Edwards, Sugden, & Rosenblum, 2010)

The ADC consists of two sections, the first of which refers to problems experienced in childhood and the second of which refers to problems experienced at the time of administration of the checklist. It consists of 40 (10 in the first section, 30 in second) items, 21 of which were removed for the purposes of the study. The questionnaire overall was used to establish that it and the DCDQ'07 had a strong correlation (Pearson's $r(215) = .79, p < .001$), thus indicating that both were tapping into the same areas of motor difficulties. The second part of the questionnaire was used in further statistical analysis and consisted of ten items after item deletion, for instance: "do you avoid hobbies that require good coordination?". It used a four-point Likert scale ("never, sometimes, frequently, always"), and high score indicated a higher degree of motor difficulties. Chronbach's alpha was conducted on the data set after the removal of the items and was found to be high ($\alpha = .87$). Reliability for the second part of the test was slightly weaker than for the test overall ($\alpha = .77$).

Childhood Motor Ability (The Developmental Coordination Disorder Questionnaire 2007; DCDQ'07; Wilson et al., 2009)

The DCDQ'07 is a parent questionnaire designed to screen for possible motor problems in children aged between five and fifteen. As such, questions and responses were re-worded so as to ask the respondent to answer in reference to themselves during childhood. For example the item "your child throws a ball in a controlled and accurate fashion" became "I could throw a ball in a controlled and accurate fashion". Responses were on a five-point Likert scale ("not at all like me, a bit like me, moderately like me, quite a bit like me, extremely like me"). The DCDQ'07 consists of 15 items and was reverse-scored for the purposes of analysis so that high scores would indicate a higher degree of motor difficulties to allow for easier comparison with the ADC. Chronbach's alpha was calculated after re-wording and showed strong reliability ($\alpha = .92$).

Childhood Experiences of Bullying (Revised Olweus Bully/Victim Questionnaire; OBVQ; Cornell & Bandyopadhyay, 2010; Olweus, 2010)

The OBVQ is intended to measure how many incidents of certain kinds of bullying children and young people regularly experience or commit. It asks children to answer questions with regard to the previous few months, which was adapted for adult participants so as to refer to an 'average two months' during the participant's primary school years. Responses were along a five-point Likert scale ("never, once or twice, two or three times a month, about once a week, several times a week"). A high score indicated a higher prevalence of bullying. It consists of 40 items such as "I was called mean names, made fun of, or teased in a hurtful way". Items related to racial, gendered or internet-based bullying were removed, as were items related to demographic information or to how often the respondents had been the aggressor rather than the victim. Six items remained after item deletion, and Chronbach's alpha performed on the data set indicated good reliability ($\alpha = .89$).

Childhood Experiences of Social Inclusion (The Social Inclusion Scale; SIS)

The SIS was created for the purposes of this study. It is intended as a measure of general social inclusion in childhood and consists of nine items, such as “I felt accepted by my peers”. Participants were asked to rate statements on a four-point Likert scale: “not at all like me, somewhat unlike me, a bit like me, very like me”. Reliability testing on this scale was high ($\alpha = .93$).

Adulthood Self-Esteem (The Rosenberg Self-Esteem Scale; RSES; Rosenberg, 1965)

The RSES consists of ten items, e.g. “I feel that I have a number of good qualities”. Participants responded to statements regarding their feelings towards themselves on a four-point Likert scale: “strongly agree, agree, disagree, strongly disagree”. Items were reverse-scored for analysis so that a high score would indicate high self-esteem thus enabling easier com-

parison with other scales. Reliability for the scale was high ($\alpha = .93$).

2.3 Procedure

Ethical approval was given by the University of York. Consent was given via the first item of the online questionnaire, which outlined the aims of the investigation and the rights of the participant and requested that they acknowledge this and confirm that they consented to take part by selecting the ‘I consent’ option. The component questionnaires were administered in the order they appear in the materials section. The last section of the questionnaire was used as a debrief section.

As shown in Table 2, an initial analysis using Pearson’s correlation coefficient revealed highly significant correlations between all variables.

Table 2

Pearson’s correlation coefficients between the measures

	Child motor	ADC full	Adult motor	Social inclusion	Bullying	Self-esteem
Child motor						
ADC full	.79					
Adult motor	.71	.93				
Social inclusion	-.60	-.55	-.49			
Bullying	.47	.47	.45	.70		
Self-esteem	-.44	-.41	-.40	.46	-.36	

‘ADC Full’ refers to the full version of the Adult DCD/Dyspraxia Checklist, ‘Adult motor’ refers to the second part of the Adult DCD/Dyspraxia Checklist only. All figures were highly significant ($p < .001$).

3. Results

3.1 Mediated Regression Analysis

Mediated regression analysis was conducted in order to investigate the relationships between the variables of interest. This allows for associations between variables in the model to be estimated, as well as overall direct and indirect model effects (Field, 2013). For instance, looking at the Bullying variable, it is possible to calculate the association between childhood motor ability and bullying, and the association between bullying and self-esteem. This analysis is also used to determine whether the association between childhood motor ability and adulthood self-esteem is mediated through bullying

(the indirect effect) or whether there is an independent relationship between childhood motor ability and adulthood self-esteem regardless of bullying (the direct effect). In the following models, childhood motor ability (referred to as Child Motor) was the predictor variable and adulthood self-esteem was the outcome variable (Self-esteem). In the first model, amount of experienced bullying (Bullying) and level of social inclusion (Social Inclusion) were included as mediator variables. In the second model, adulthood motor ability (Adult Motor) was also included as a mediator variable.

3.1.1 Preliminary analysis

Figure 2 displays the relationships between childhood motor ability and adulthood self-esteem, with social inclusion and bullying as mediators. Higher scores on the DCDQ'07 were strongly associated with higher reported rates of bullying in childhood ($\beta(1,215) = .47, t = 7.82, p < .001$) and lower feelings of social inclusion ($\beta(1,215) = -.60, t = -11.08, p < .001$). Higher childhood social inclusion then had a positive relationship with adulthood self-esteem ($\beta(3,213) = .28, t = 3.06, p = .003$). There was a sig-

nificant direct effect of childhood motor ability on of adulthood self-esteem ($\beta(1,215) = .47, t = 7.82, p < .001$). Bullying did not have a significant association with adulthood self-esteem ($\beta(3,213) = -.04, t = -0.45, p = .650$).

There was a significant indirect effect of social inclusion ($\beta(2,214) = -.17, p = .003$) but not of bullying ($\beta(2,214) = -.02, p = .653$). This means that in addition to the direct effect, the association between the variables Child Motor and Self-esteem is also mediated through Social Inclusion.

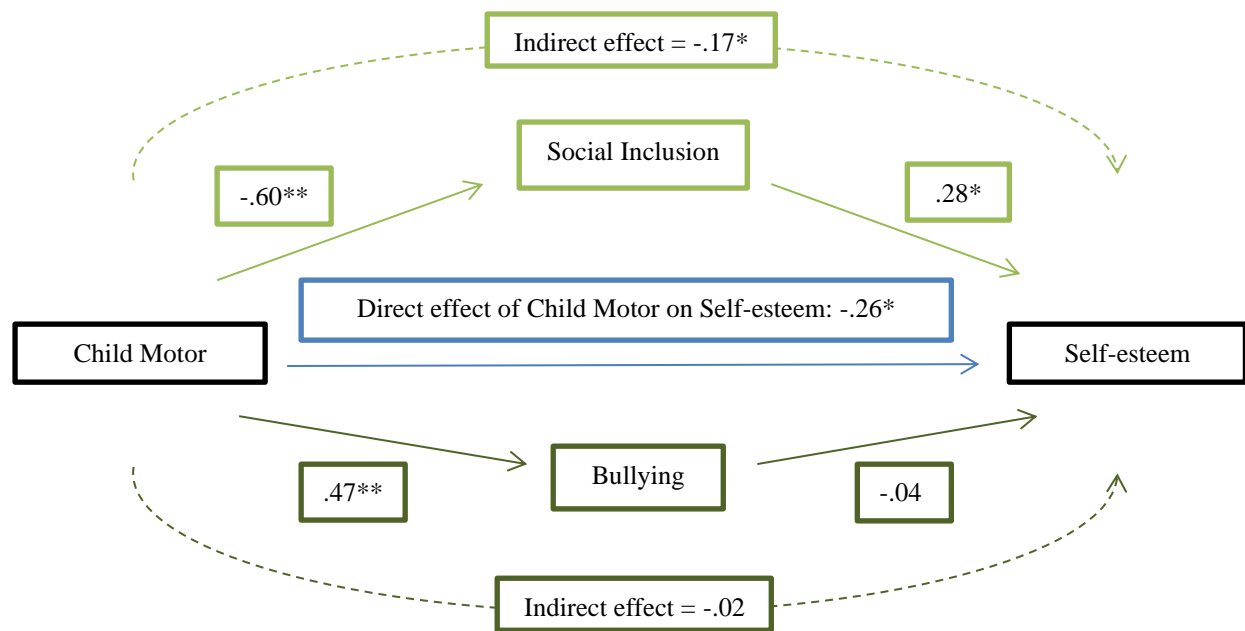


Figure 2: Model showing the interactions between scores on the DCDQ'07 ('Child Motor') and the Rosenberg Self-Esteem Scale ('Self-esteem'). Regression coefficients marked with '*' were significant to $p < .005$. Those marked with '' were significant to $p < .001$.**

3.1.2 Second analysis

For the second analysis, a measure of adulthood motor ability was also included as a mediating factor. Figure 3 displays the relationships between these variables. The direct effects of childhood motor ability on social inclusion and bullying remained the same. The effect of childhood motor ability on adulthood motor ability was significant ($\beta(1,215) = .71, t = 14.63, p < .001$). The relationship between social inclusion and adulthood self-esteem remained similar in the second analysis ($\beta(4,212) = .28, t = 3.07, p = .002$), while the association between experiences of childhood bullying and adulthood self-esteem fell ($\beta(4,212) = -.02, t = -.20, p = .839$). Adulthood motor ability and self-esteem were not significantly related ($\beta(4,212) = -.14, t = -1.63, p = .105$) and in this analy-

sis the direct relationship between childhood motor ability and self-esteem also failed to achieve significance ($\beta(4,212) = -.17, t = -1.884, p = .067$). The indirect effect of social inclusion remained significant ($\beta(3,213) = -.17, p = .003$). There was no indirect effect of adulthood motor ability ($\beta(3,213) = -.10, p = .107$) and the indirect effect of bullying dropped even further ($\beta(3,213) = -.01, p = .840$).

4. Discussion

This study found significant associations between both childhood motor ability and social inclusion, and childhood motor ability and bullying. The direct effect of childhood motor ability on adulthood self-esteem was significant in the first model, meaning that some of the variation in adulthood self-esteem could be explained purely by childhood motor ability scores.

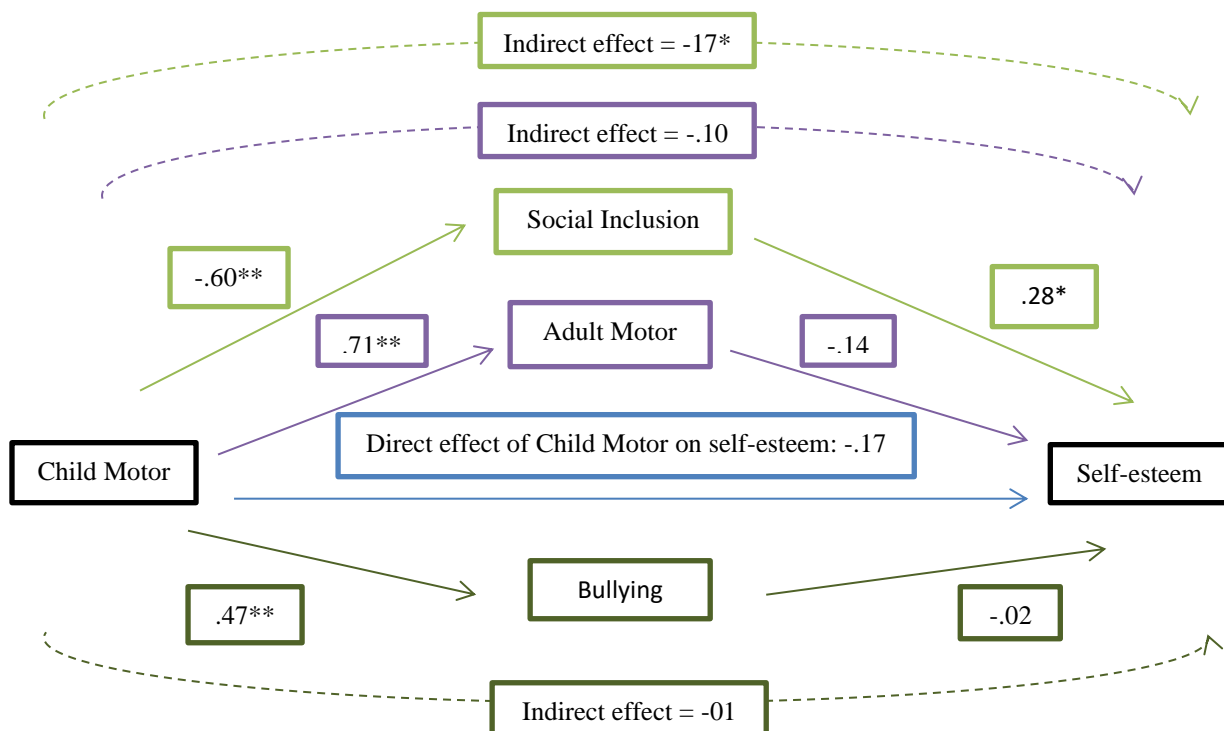


Figure 3: Model with adult motor ability included ('Adult Motor'). All regression coefficients marked with '' were significant to $p < .005$, those marked with '***' were significant to $p < .001$.**

This effect ceased to be significant when adulthood motor ability was added into the analysis, indicating that any specific effect of motor ability on self-esteem is likely to be a combination of childhood and adulthood motor abilities, but that this association is very small. Bullying did not have a significant effect on self-esteem in either model, while social inclusion was highly significant across both models. Analysis of the indirect effects in both models revealed that social inclusion had a significant mediating role in the relationship between childhood motor ability and adulthood self-esteem, but bullying and adulthood motor ability did not.

The findings of a strong association between childhood motor difficulties, higher rates of bullying, and lower feelings of social inclusion support findings from previous studies on social well-being and motor coordination in children (e.g. Cairney et al., 2010). The link between these issues in childhood and adulthood self-esteem was also supported in this study, adding further evidence to the theory that motor difficulties can have a long-term effect on self-esteem. The hypothesised mediating effect of social inclusion and bullying was found for social inclusion, but not for bullying.

That social inclusion was a significant mediator but not bullying is a very surprising finding. Many researchers have previously found links between motor ability, higher rates of bullying, and lower self-esteem in school-age children (e.g. Piek et al., 2005). The high reliability of the Social Inclusion Scale suggests that, while still possible, problems with the scale are unlikely to account for the unexpected differences. While a great deal of further investigation on the topic is required, it is suggested here that the difference between the findings of the current paper and the findings of previous works on the topic of motor ability, bullying and self-esteem may be due in part to scales assessing bullying either not taking social inclusion into account as a protective factor or a problem in itself, or in fact tapping into areas more relevant to social inclusion. For instance, a child with friends who gets on reasonably well with their peers may be protected from the worst effects of bullying, whereas a child who is never bullied but never included socially either may spend years suffering the effects of loneliness, ostracism, and poor self-image.

It is plausible that with further investigation a proper distinction between bullying and social inclusion/exclusion will be established and the protective effect of social inclusion will be shown to be stronger

than the damaging effect of bullying. If that is the case, it will be necessary to properly study a) the causes of low social inclusion, b) the short- and long-term effects emotionally, and c) ways to better combat this in primary school.

Schmidt et al. found perceived social acceptance to be a mediator between motor ability and self-esteem in boys but not in girls. They note that this is a surprising finding, given the support for the impact of peer acceptance on self-esteem from other studies such as Thomaes et al. (2010; cited in Schmidt et al., 2015) who found that peer approval among 11-year-olds was associated with significant increases in self-esteem and peer disapproval with significant decreases. In the current study, separate analysis was not possible for males and females due to the discrepancy in sample size between the genders and the relatively low number of males in the same. Nevertheless, the current study found a mediating effect of social inclusion between motor ability and self-esteem despite a large percentage of responders being female, which is at odds with Schmidt et al.'s findings. This could be due to a number of factors: methodological differences, for instance. Schmidt et al. used multiple measures of motor ability in a longitudinal design, whereas this study employed a retrospective design and only collected data on motor ability from self-report questionnaires. Another possibility is the age of participants and the time scales of the studies. Schmidt et al. focussed on reported self-esteem in adolescents after a 30-week period. It is possible that the effects of motor difficulties on self-esteem manifest differently for males and females across adolescence and into adulthood, with the effect of motor difficulties and social exclusion on self-esteem only becoming apparent for females later. Such gender differences would need to be examined separately and considered in future longitudinal studies across a longer time frame.

4.1. Limitations and future directions

This is an initial study and has some limitations which need to be addressed in future studies.

The study was retrospective in nature and is therefore subject to possible memory inaccuracies and biases. However if memory bias was a factor, it would arguably be expected that this memory bias would affect self-reported measures of both social exclusion *and* bullying (i.e. that bullying would also be associated with low self-esteem). The fact that this was not found suggests that memory bias does not seem to

provide an explanation for the results of the current study.

The study gathered only minimal demographic data on the participants. Further data such as on socio-economic status would be interesting to compare to these findings. Motor ability, bullying and self-esteem all have well-established links in the literature, so other factors (like SES) are important in determining whether the mediating effect of social exclusion but not bullying is maintained.

In the future, further studies that are longitudinal in nature can help in determining whether there is an enduring association between motor ability, social inclusion, and self-esteem through childhood and even into early adulthood. The ability to compare longitudinal data on motor ability, social well-being and self-esteem across different time points would also be valuable in replicating the findings of this study.

Determining whether social inclusion in childhood is more important than bullying for long-term self-esteem and mental health outcomes would benefit all areas of developmental psychology, not just the study of motor disorders. Understanding whether the relationship is damaging (i.e. social exclusion contributes to emotional harm), protective (i.e. social inclusion helps prevent emotional harm) or has aspects of both is crucial identifying how to address it.

If this association is supported by future investigations, the author suggests a departure from the exclusive focus on physical ability and team games in school environments, and more focus on cooperation and play in situations with little or no motor requirements. In team sports, playing poorly has a negative impact on the entire group. Allowing children to experiment with games where physical ability is not the only way to solve issues or gain points could prove beneficial to children who are not as physically capable as their peers, enabling them to show that they are able to engage competently in group activities and thus help with their own estimation of self-worth and popularity among their peers.

4.2. Conclusion

This investigation provides support to the idea that motor issues in childhood are associated with other negative effects, leading to low self-esteem that can still be observed in adulthood. Social inclusion was a significant mediator between motor ability and self-esteem, which has implications for interventions in primary schools aimed at improving the social well-

being of children with motor problems. Moreover, the spectrum approach taken by this study to motor ability and the other variables of interest may indicate a relationship whereby even mild motor difficulties can be associated with negative outcomes, though further investigation is required to explore this relationship. Surprisingly, this study did not provide support for the idea that bullying mediates the long-term association between motor ability and self-esteem. Potential methodological issues notwithstanding, this difference between the current study's findings and the evidence for a significant relationship between bullying, motor ability and self-esteem could be due to conflation in the literature between the variables social inclusion and bullying, which this paper asserts are in fact two *separate* areas of social well-being.

Conflict of interests

Authors declare no conflict of interests.

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