Motor and co-ordination difficulties in children with social, emotional and mental health difficulties

Elisabeth Hill[1]
Michelle Pratt[2]
Zara Kanji[1]
Alice Jones Bartoli[1]

1. Department of Psychology, Goldsmiths, University of London
2. Department of Psychology, Royal Holloway, University of London

Abstract

To date, very few studies have explored the incidence of motor impairment amongst children with social, emotional and behavioural difficulties (SEMH; formerly SEBD in England following DfE / DoH, 2014). Following research that suggests an increase in motor difficulties in young children and adolescents with SEMH difficulties, this study compares profiles of motor ability using the Movement ABC-2 assessment in children attending a specialist SEMH primary school with a typically developing comparison group and children with a diagnosis of Developmental Co-ordination Disorder. We report an increased prevalence of borderline or clinically significant motor impairment amongst children with SEMH difficulties compared to the comparison group, with 44% of the SEMH special school sample falling within these ranges. We suggest that bearing in mind the increased likelihood for motor impairment is important in SEMH education, as it has likely impact on classroom functioning and ability and motivation to take part in socially and academically relevant activities.

Introduction

Motor problems or co-ordination difficulties are associated with many school-based difficulties including underachievement and social isolation (Asonitou, Koutsouki, Kourtessis, & Charitou, 2012; Gomez et al., 2015; Huau, Velay, & Jover, 2015; Poulsen, Ziviani, Johnson, & Cuskelly, 2008). Such difficulties have also been associated with increased incidence of mental health difficulties in childhood, adolescence and adulthood (Hill & Brown, 2013; Kirby, Williams, Thomas, & Hill, 2013; Lingam et al., 2012; Pratt & Hill, 2011; Zwicker, Harris, & Klassen, 2013). The purpose of this study was to examine the incidence of motor and co-ordination difficulties amongst a sample of children attending a specialist primary school for children with social, emotional and mental health difficulties (SEMH). Formerly referred to in the English education system as social, emotional and behavioural difficulties (SEBD), children with significant difficulties in social and emotional functioning, often manifesting as behavioural difficulties, are now referred to as having 'social, emotional and mental health needs' by the Department for Education (DfE/DoH, 2014). This paper will refer to SEMH in order to be consistent with current terminology, but it is worth noting that much the research cited has uses variants of SEBD to refer to the difficulties experienced by participants. In England, social, emotional and mental health difficulties comprise around 16% of all primary special educational needs (data from DfE, 2015).

At present, relatively little is known about motor difficulties in children with SEMH difficulties. There are, to date, only two studies that has examined motor difficulties in children and adolescents with SEMH/SEBD, the first of these focusing on 5 and 6 year olds (Iversen, Knivsberg, Ellertsen, Nødland, & Larsen, 2006). In this study just over half of the children in the SEMH group met criteria for a DSM-IV (Diagnostic and Statistical Manual, 4th edition, American Psychiatric Association, 2000) diagnosis of DCD (developmental coordination disorder; see below), compared with only 3% of controls. One more recent study recruited adolescents who attend a specialist unit for behavioural difficulties (Van Damme, Sabbe, van West, & Simons, 2015). This study suggested that adolescent boys with behavioural difficulties showed a poorer profile of movement abilities than their typically developing peers, with 79% of these adolescents being considered to have a significant motor impairment. Interestingly, this difference was not accounted for by attention or hyperactivity symptoms. It is clear then that promoting understanding of the increased likelihood of motor impairment amongst children and adolescents with SEMH–type difficulties is important for building an intervention programme that addresses a fuller profile of difficulty. Demonstrating significant levels of motor difficulties in children whose primary difficulties are considered to be in the domain of SEMH may suggest that assessments and teaching strategies for some children should include a motor and/or co-ordination component.

Despite the paucity of studies examining motor abilities in young people with SEMH, relatively more is known about behavioural difficulties amongst children with motor and co-ordination difficulties. Individuals whose motor difficulties are severe may receive a diagnosis of Developmental Co-ordination Disorder (DCD). DCD a discrete motor disorder, coming under the heading of neurodevelopmental disorders in the recently updated DSM-V (American Psychiatric Association, 2013) is diagnosed when motor difficulties (i) are out of keeping with chronological age and general ability; (ii) interfere with activities of daily living and/or educational achievement; and (iii) cannot be accounted for by learning disability or other medical condition (e.g., cerebral palsy). More males are believed to be affected than females and a recent UK study estimates prevalence to be around 2% (Lingam, Hunt, Golding, Jongmans, & Emond, 2009)[1]. Day-to-day motor difficulties are apparent: difficulties with balance, spatial awareness, manual dexterity and hand eye-coordination, for example, causing difficulties at school with handwriting and participation in physical education.

Various studies have indicated that there may be long-term effects of DCD; including social, academic and behavioural (Cairney, Veldhuizen, & Szatmari, 2010; Hill & Brown, 2013; Kirby et al., 2013; Raghu Lingam et al., 2012; Pratt & Hill, 2011). Emck and colleagues (2012) observed that 65% of a child sample with severe motor difficulties met criteria for psychiatric classification. While the results of a systematic review carried out by Zwicker, Harris and Klassen (2013) indicate that children with DCD do more poorly in physical, social and psychological domains than their peers. These effects are also likely to be seen in the classroom, where children with DCD have been reported to be at greater risk of poor outcomes related to learning; including attention, reading, writing and spelling and psychological well-being (e.g. social difficulties and somatic complaints) (Dewey, Kaplan, Crawford, & Wilson, 2002), and difficulties with executive functioning may impede functioning in tasks that have little discernible motor component (Leonard, Bernardi, Hill, & Henry, 2015). The effects persist past childhood, with young adults also demonstrating poor academic and non-academic functioning (Tal-Saban, Zarka, Grotto, Ornoy, & Parush,

[1] It is also the case that gender differences in the incidence of SEMH schools exists. In 2015, the DfE reported a far greater number of boys than girls (24,495 v 3645) with a Statement of Special Education Needs or Education, Health and Care Plan with SEMH difficulties as the primary need (DfE, 2015).

2012). Adults with DCD have also been reported to self-report greater incidences of depression and anxiety than their typically developing peers (Hill & Brown, 2013). Longitudinal studies have also been informative in demonstrating the long-term effects of motor difficulties; one such study focusing on young adults demonstrated poorer quality of life outcomes for those with DCD and those who were 'borderline' for the condition (Tal-Saban, Ornoy, & Parush, 2014). Severe motor and co-ordination difficulties are likely to form part of life-long difficulties, and social, academic and psychological difficulties may persist through adolescence and adulthood.

Although research into motor difficulties in children with a range of emotional, behavioural and psychological problems is still rather limited; research into motor difficulties associated with ADHD may be relevant on account of there being considerable overlap between SEMH difficulties and ADHD symptoms and behaviours. For example, one study examining psychiatric diagnoses in a group of children attending special school for SEMH difficulties reported that 70% met criteria for ADHD (Place, Wilson, Martin & Hulsmeier, 2000). A number of studies have demonstrated increased difficulties in motor control, balance and co-ordination in children with a diagnosis of ADHD (Fliers, de Hoog, et al., 2010; Fliers, Franke, et al., 2010), and there is some evidence to suggest a common genetic basis between the two sets of difficulties (Fliers et al., 2009). It is also important to consider the likely dynamic nature of motor skills and behaviour. Given that the development of gross motor skills in school-aged children is mediated by interaction with peers in games and play, adequate motor skills are likely to be important, particularly given that it has been reported that inability to participate in such activities may have a detrimental effect on social development and well-being (Jarus, Lourie-Gelberg, Engel-Yeger, & Bart, 2011; Raz-Silbiger et al., 2015; Van der Linde et al., 2015; Wagner, Bös, Jascenoka, Jekauc, & Petermann, 2012) .

The current study aims to further examine motor and co-ordination skills in a group of children attending a specialist primary school for children with SEMH difficulties. This is a group of children currently not covered by the existing research (Iversen et al., 2006; Van Damme et al., 2015). Given previous research suggesting that a range of social, emotional and behavioural difficulties are associated with motor difficulties, we expect to find poorer motor and co-ordination skills in an SEMH sample compared to typically-developing controls; and a greater proportion of children with SEMH difficulties reaching criteria for severe motor difficulties than their typically-developing peers. For comparison, we will also include a group of children with a diagnosis of DCD. We do not necessarily expect children with SEMH difficulties to show difficulties as severe as those with a diagnosis of DCD.

Method

Participants: Children aged between six and 14 years were recruited through convenience sampling from schools in London and the Home Counties. Participants were recruited from several sources, including a special school for SEMH difficulties (SEMH group only), mainstream primary schools (Typically Developing group only), support groups for those with DCD and through existing research being conducted at Goldsmiths (DCD group only). Only those with a clinical diagnosis of DCD made according to the full DSM-IV criteria and without further overlapping conditions diagnosed such as attention deficit hyperactivity disorder (ADHD) were included in the DCD group. All participants completed the Movement ABC-2 (Henderson, Sugden, & Barnett, 2007) to further document their level of movement skill and the WISC-IV (Wechsler, 2004) to measure their IQ. Children were excluded from the typically-developing group if they had received a diagnosis of a neurodevelopmental disorder prior to participation in the study or if they performed at or below the 15th centile on the Movement ABC-2 (see Measures section below). These 98 children were allocated to one of three groups: 1) children attending a special SEMH school (n=34); 2) children with DCD, attending mainstream school (n=30) and 3) typically developing comparison children with no previous diagnoses of neurodevelopmental disorder (n=30). Further information about the characteristics of each group is provided in Table One.

Design: A between-participants design was used to compare the movement impairments experienced by three groups of children: children attending a special school for SEMH difficulties, those with a diagnosis of DCD attending mainstream school and typically developing comparison children at mainstream school. The dependent variables were total percentile rank on the Movement ABC-2 standardised test (Henderson et. al, 2007) and total percentile ranks for each subscale (manual dexterity, aiming and catching and balance).

Measures:

Movement Assessment Battery for Children (MABC-2; Henderson, Sugden, & Barnett, 2007): A clinical assessment used to investigate the extent of motor impairment. The battery comprises eight items divided into three components: manual dexterity; aiming and catching; and static/dynamic balance. The tasks vary according to the child's age. Each test is scored on a scale of 0-5 with a high score indicating a greater degree of movement difficulty. A total score which was at or below the 5th percentile, is considered to be indicative of serious motor impairments. The MABC-2 has been demonstrated to have good reliability and validity in DCD and typically developing populations (Schulz, Henderson, Sugden, & Barnett, 2011).

Test of General Cognitive Ability: To give an estimate of general cognitive ability, the Wechsler Intelligence Scale for Children, 4^{th} edition (WISC-IV, Wechsler, 1992) was used. This includes assessment of verbal comprehension, perceptual reasoning, working memory and processing speed. Full-Scale IQs (FSIQ), and composite scores are reported in Table One.

Procedure: Ethical approval for this study was granted by Goldsmiths' Research Ethics Committee. Prior to any testing, parents were sent consent forms and had opportunity to give consent for their child to participate in this study. All participating children gave verbal assent prior to testing, were given opportunity to ask questions and were informed that they were able to withdraw from the test at any time if they so wished. The WISC-IV and MABC-2 were administered and scored by a trained researcher, and this took place either at the child's school or at Goldsmiths. After the completion of testing, all participating children were thanked for their time and given an opportunity to ask further questions.

Results

Participant Characteristics: Participant characteristics are presented in Table One. Scores on the MABC-2 are reported in Table Two. We report the percentage of children per group whose MABC-2 total percentile score fell within the range considered indicative of severe motor difficulties (≤15th percentile). According to this cut-off, all children in the DCD group and 13/34 (38%) of the SEMH group fell within this severe impairment range. None of the comparison children scored below the 37th percentile. The comparison group had a higher full-scale IQ than the other two groups, but there was no statistically significant difference between the DCD and SEMH groups. We include FSIQ information here in order to demonstrate that all groups had mean values within the average range, but that there are some group differences, which are also observed elsewhere (Frederickson, Jones, Warren, Deakes, & Allen, 2013; Sumner, Pratt & Hill, 2016). Results of between-group ANOVAs for the WISC-IV composite scores are reported in Table One. For the sake of being conservative, given that there is a statistically significant difference in full-scale IQ between the groups, we will report both ANOVA and ANCOVA results, co-varying for FSIQ (note that co-varying for FSIQ has no impact on the group differences.) Given the known gender differences in both DCD and attendance at SEMH schools, we also investigated whether gender was associated with MABC-2 percentile scores. There were no statistically significant differences on any of the MABC-2 scale percentile scores between male and female participants; therefore we have not included gender as a covariate in between-group analyses. All statistically significant group differences were followed up by post-hoc Tukey HSD tests. Corrections for multiple comparisons (Tukey HSD) are made for the number of between-group analyses.

[*Table One here*]

[*Table Two here*]

Motor and co-ordination skills:

Descriptive data and F-values for both ANOVA and ANCOVA are provided in Table Two. Since there was no appreciable effect of including FSIQ as a covariate, we will refer only to ANOVA results here, with effect sizes for information. Effect size quantifies the size of the difference between two groups, and is useful here to better understand the magnitude of difference where there is a statistically significant difference. For the partial eta squared values presented here, the effect sizes may be considered as large. There was a statistically significant main effect of group for the total MABC-2 percentile score ($F_{(2,97)}=67.21$, $p<.001$, $\eta\rho^2 = .59$), where both DCD and SEMH groups performed more poorly than the comparison group (both $p <.001$). The DCD group also performed more poorly than the SEBD group ($p<.001$). Percentile scores for each subscale of the MABC-2 were also investigated using the same method. For the ‘Manual Dexterity’ subscale, there was a main effect of group ($F_{(2,97)}=46.40$, $p<.001$, $\eta\rho^2 = .49$). Post-hoc analyses revealed statistically significant differences between all three groups, where the DCD and SEMH group performed more poorly than comparison children (both $p<.001$) and the DCD group performed more poorly than the SEMH group ($p<.001$). There was also a main effect of group for the ‘Aiming and Catching’ scale ($F_{(2,97)}=30.48$, $p<.001$, $\eta\rho^2 = .39$). Post-hoc analyses revealed statistically significant group differences between the DCD group and the other two groups (both $p<.001$), but no difference between the SEMH group and comparison children ($p=.34$). Finally, there was a statistically significant group difference for the ‘Balance’ subscale ($F_{(2,97)}=55.31$, $p<.001$, $\eta\rho^2 = .54$), with statistically significantly poorer performance by the DCD and SEMH groups than comparison children (both $p<.001$) , and poorer performance by DCD group than the SEMH children ($p<.01$).

We also examined whether the groups differed in their proportions of children whose scores on the –ABC-2 fell within the severe difficulties range (≤15th percentile; see Figure One). As dictated by their diagnosis, all participants in the DCD group fell within this range, and Chi square analyses yielded statistically significant differences between all three groups (Comparison/DCD: $\chi^2 = 64.00$, df = 2, p <.001; Comparison/SEMH: $\chi^2 = 17.29$, df = 2, p <.001; SEMH/DCD: $\chi^2 = 33.90$, df = 2, p <.001).

[*Figure One here*]

Discussion

This study aimed to explore the incidence and severity of motor and co-ordination difficulties amongst children attending a specialist school for SEMH difficulties. It is clear that there is a greater level of motor problems amongst children with SEMH difficulties than in the mainstream school population. In this study, 44% of a group of children with severe SEMH type problems showed borderline or definite motor coordination difficulties as assessed with the MABC-2, compared to no children in the control group (and an expected prevalence rating of around 2%).

The findings of this study are in line with others that report an increased incidence of motor and co-ordination difficulties amongst children with social, emotional and behavioural difficulties (Iversen et al., 2006; Van Damme et al., 2015). This research was able to assess motor and co-ordination difficulties only in children attending a specialist primary school for SEMH difficulties, and so further research is required to examine the incidence of similar difficulties in children with SEMH in alternative education provisions and in mainstream education. Motor and co-ordination difficulties have been robustly associated with ADHD (Fliers, de Hoog, et al., 2010; Fliers, Franke, et al., 2010), and a high incidence of ADHD amongst children with SEBD has also been reported (Cassidy, James, & Wiggs, 2003; Place, Wilson, Martin, & Hulsmeier, 2000). This study was not designed to examine the association between attention difficulties and SEMH and motor difficulties, but future research could examine this as a method of better understanding some the difficulties displayed by some children with SEMH difficulties across the range of educational contexts.

The implications of motor impairment are further reaching than simply having difficulties with co-ordination. DCD has been associated with difficulties in the classroom, particularly related to maths and handwriting (Gomez et al., 2015; Huau et al., 2015), and academic underachievement is a common hallmark of student in SEMH provision (Lane, Barton-Arwood, Nelson, & Wehby, 2008; Mulcahy, Krezmien, & Maccini, 2014; Nelson, Benner, Lane, & Smith, 2004). It is also likely to be important to consider the impact of concomitant difficulties in executive functioning that have been reported to be associated with DCD (Leonard et al., 2015). Students in SEMH settings have been reported to have severe executive dysfunction (as well as a relatively high number of ADHD diagnoses), and it may well be worth considering the association between these difficulties and motor impairment (Frederickson et al, 2013; Mattison, Hooper, & Carlson, 2006).

This study was the first to examine the prevalence of motor impairments across a primary age SEMH setting, following from studies examining both early childhood and adolescence (Iversen et al., 2006; Van Damme et al., 2015). This was also the first study to directly compare a group of children with SEMH difficulties with a group of children with a diagnosis of DCD. However, several limitations should be considered, and accounted for in future research. Firstly, as we have already noted above, this study only considers children with SEMH difficulties attending special school. Children with SEMH difficulties are educated across many settings, and it will be important to explore whether such motor and co-ordination difficulties are associated with SEMH across these contexts. Secondly, we acknowledge that this study may have also benefited from also measuring ADHD symptomology in all of the groups. The associations between motor impairment and ADHD are compelling, and given the very high prevalence of ADHD diagnosis in SEMH settings (Place et al., 2000), it would seem prudent to bear this in mind in future research. Thirdly, although no statistically significant gender differences are reported here, it should be noted that the SEMH sample was entirely male (there were no female pupils at the school at the time of recruitment). There is also a greater prevalence of SEMH type difficulties diagnosed in males than females (DfE 2015; Maughan et al., 2004), so this occurrence is not unexpected. There is also an increased prevalence of DCD diagnosis amongst boys compared to girls (Sugden & Chambers, 1998). Although there is not a clear consensus on the nature of sex differences in motor ability during childhood, some report differences of small effect size magnitude (Thomas & French, 1985), while others report no differences (Bonvin et al., 2012). It will also be useful to consider the impact of potential motor impairments amongst girls with SEMH difficulties.

The findings of this study underscore the importance of screening and multidisciplinary assessment of this group of children in order to screen for possible motor difficulties. As children with severe behavioural and emotional problems traditionally are assessed within educational or psychiatric settings, motor difficulties may easily be overlooked. It is clear from this study that not all children with SEMH difficulties have concomitant motor impairment, however many more than would be expected in the general population do show impairment at a clinically significant level, and it seems sensible to address this in any multidisciplinary assessment and intervention planning. It may be particularly prudent to consider screening for such difficulties at the level of the school (for example, see Gwynne & Blick, 2004 and Schoemaker, Flapper, Reinder-Messelink & de Kroet, 2008), and increasing educational professionals' working knowledge of the potential impact of motor and co-ordination difficulties on classroom behaviour and performance, as well as who to ask for a next step assessment of a child's difficulties. The combination of severe behavioural and emotional problems and motor coordination difficulties makes this group of children particularly vulnerable with regard to participation in culturally valued motor skills. The children's motor coordination problems could easily increase an already substantial risk for social exclusion, with implications for assessment and choice of intervention strategies.

Table One: Sample characteristics by group

	Mean (SD)			ANOVA F-value (test of group differences)	Direction
	SEMH	DCD	Comparison		
Age	9y 10m (1y 3m)	9y 9m (2y 6m)	9y 4m (1y 9m)	.69	-
FSIQ	86.64 (5.69)	88.09 (12.61)	96.43 (9.45)	6.36*	TD>SEMH, DCD
Verbal Comprehension	88.54 (8.54)	92.38 (10.33)	92.47 (6.69)	1.06	-
Perceptual Reasoning	92.38 (11.52)	91.06 (15.58)	98.33 (14.39)	2.11	-
Working Memory	88.23 (11.42)	90.62 (12.25)	101.10 (11.21)	8.47**	TD>SEMH, DCD
Processing Speed	95.46 (7.86)	87.47 (13.79)	100.23 (9.34)	10.22**	TD>DCD

* p < .01, ** p<.001

Table Two: Descriptive data and group differences for Movement ABC-2 performance (data given in percentiles)

	Mean (SD)			ANOVA F-value (test of group differences)	ANCOVA F-value (co-varying for group differences in FSIQ)	Direction
	SEMH	DCD	Comparison			
MABC2 percentile	29.65 (28.02)	2.49 (2.52)	61.47 (21.12)	67.21**	72.02**	TD> SEMH >DCD
Manual Dexterity	24.12 (18.39)	1.99 (4.23)	46.50 (26.27)	46.40**	37.91**	TD> SEMH >DCD
Aiming and Catching	56.16 (30.02)	16.88 (25.42)	65.60 (24.37)	30.48**	30.40**	TD, SEMH >DCD
Balance	25.31 (28.01)	9.08 (9.62)	60.73 (17.42)	55.31**	53.62**	TD> SEMH >DCD

** p<.001

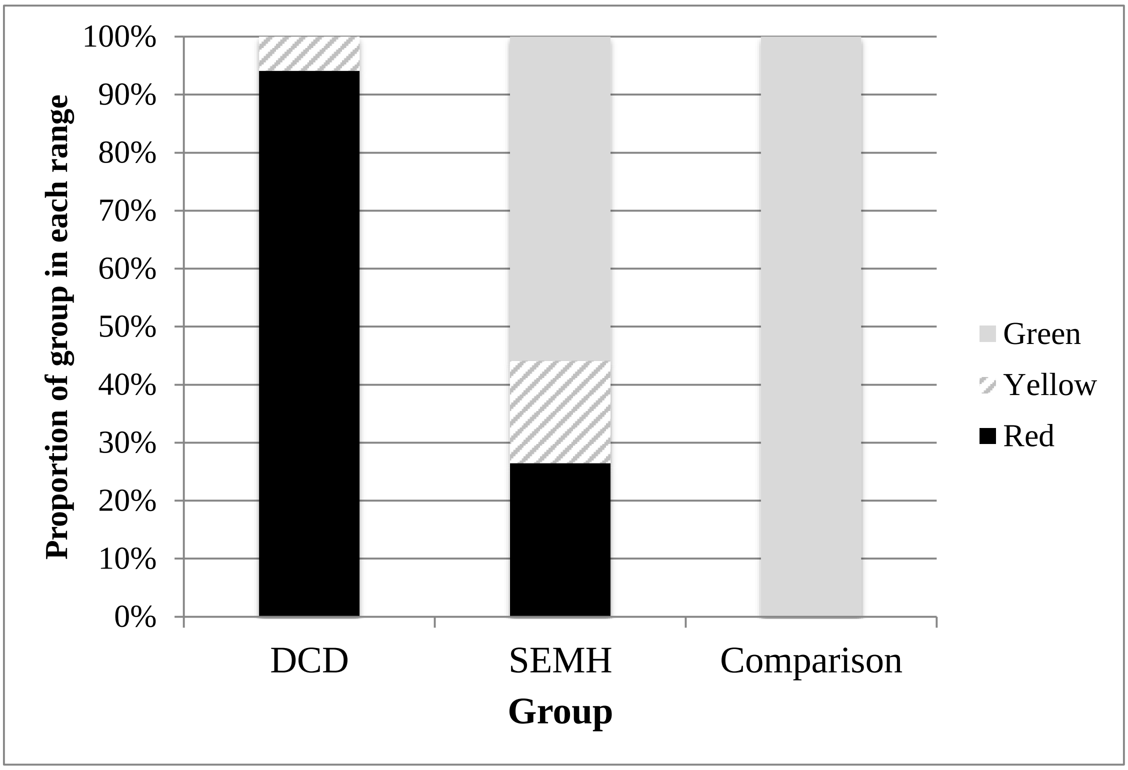

Figure One: Proportion of participants per group with MABC2 scores in clinically impaired range (red), borderline impairment (yellow) and typical range (green)

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