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Editorial DCD13 “Bridging the Disciplines”

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By using motor skills children are able to explore their environment and interact with people and objects which may initiate developmental cascades across diverse domains (Adolph & Hoch, 2019). It is thus evident that motor coordination difficulties can have a profoundly negative impact on overall functioning and participation (Leonard, 2016). A group of children who suffer from motor coordination difficulties are children with Developmental Coordination Disorder (DCD). DCD is a neurodevelopmental disorder affecting between 5 and 6% of children of the population and is characterized by problems with coordination of fine and/or gross motor tasks resulting in impairments in activities of daily living at home and/or at school (American Psychiatric Association, 2013). Its origin and etiology remain a matter of debate, but it is largely agreed that it is a long-term condition (Cairney, Hay, Veldhuizen, Missiuna, & Faught, 2010; Cantell, Smyth, & Ahonen, 2003; Kirby, Sugden, Beveridge, & Edwards, 2008). In addition, the co-occurrence of motor coordination difficulties and associated difficulties in the cognitive, language, and social-emotional domains creates a challenge for many researchers and practitioners (Tamplin & Miller, 2021). Therefore, a multidisciplinary approach is key in moving the DCD field forward both in terms of theoretical understanding and practical implications (Barnett & Hill, 2019). Both the national and international conferences on DCD and publication of a set of European recommendations for professionals working with individuals with DCD (Blank et al., 2019) have highlighted the importance of multidisciplinary research.

This special issue contains eight papers based on work presented at the 13th International Conference on Developmental Coordination Disorder (DCD13) held between the 5th and 8th of June 2019 at the University of Jyväskylä, Finland. Presenters were invited to submit their work for publication in this special issue and all papers progressed through the journal's standard review process. The main theme of the DCD13 Conference was “Bridging the Disciplines”, whereby themes such as underlying mechanisms, brain research in DCD and developmental disorders, early assessment, diagnosis and intervention, were approached from a multidisciplinary perspective. This approach made up an interesting conference programme for researchers, clinicians, educators, coaches, students, parents, and community members. There were over 300 participants from 25 countries. The three-day conference programme consisted of 6 invited keynotes, 5 thematic symposia, 12 oral paper sessions, 7 workshops, and two poster sessions with 71 research posters. The conference started with a tribute to Professor David Sugden, who passed away on March 13, 2019, organized by colleagues who worked closely together with him. Professor David Sugden was involved in the DCD conferences right from the start, and organized four International Consensus meetings in Leeds which led to the Leeds Consensus Statement, which provided a universal

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standard in diagnosis and assessment of DCD with guidelines for intervention.

Based on the aforementioned, it is probably no surprise that the current special issue has a broad scope; it includes studies across different age groups (preschool children through young adults), countries (UK, France, Belgium, the Netherlands, Italy, South-Africa, and Australia), and disciplines (movement science, health science, neuroscience, rehabilitation, psychology). The exploration of mechanisms underpinning the motor coordination difficulties of individuals with DCD remains an important topic in DCD research which was exemplified in several papers at the conference. Three papers concerning this topic were included in this special issue, of which two focused on oculomotor difficulties as a possible contributing factor to the motor problems of children with DCD. **Warlop, Vansteenkiste, Lenoir, and Deconinck** examined differences and similarities in gaze behaviour during a naturalistic manual task, that is, cup stacking, in typically developing (TD) young adults and those with DCD. They found that the gaze strategy of the DCD group was different from that of the TD group in cup stacking, with more gaze locking to the targets in the DCD group and a higher number of fixations. However, in the more challenging bimanual stacking task, the gaze behaviour of both groups was very similar. **Bellocchi, Ducrot, Tallet, Jucla, and Jover** were interested whether oculomotor difficulties in children with DCD could be explained by the presence of a co-occurring neurodevelopmental disorder. They compared the performance of 7- to 12-year-old children with DCD, children with dyslexia, and children with both DCD and dyslexia on the Developmental Eye Movement (DEM) test. The findings showed only slightly atypical scores on the DEM test for children with DCD, as the only difference with TD children was that children with DCD made more errors. Children with dyslexia and with both DCD and dyslexia showed a wider range of difficulties compared to TD children. According to the authors, the DEM test was very sensitive to the presence of a reading disorder and less to possible oculomotor difficulties. Instead of directly focusing on underlying mechanisms of motor problems, the third paper within this topic focused on the development of a valid and reliable instrument with regard to possible underlying mechanisms. To be able to examine the hypothesis that children with DCD have difficulties with action observation and imitation abilities, which might interfere with the learning of new motor skills, **Bieber et al.** developed a comprehensive protocol for mapping action observation and imitation abilities from a behavioural point of view for children with DCD and TD children. This new psychometrically sound protocol showed that children with DCD have reduced action observation and imitation proficiency compared to TD children.

The following two papers together with several papers presented at DCD13 and an increasing number of recently published papers (e.g., **Harrowell, Hollén, Lingam, & Emond, 2017; Omer, Jijon, & Leonard, 2019; Tamplain & Miller, 2021**) highlight the impact of psychosocial consequences in DCD and the importance of this research for theory as well as practice. **Timler, McIntyre, Harris, and Hands** examined which self-perceptions were associated with a healthy identity (i.e., values his/her social networks, enjoys a range of activities, and has a clear plan to achieve future goals) and if this differed between gender and level of self-reported actual motor competence. They found that the specific self-perceptions and the strength of associations between self-perceptions and identity health scores differed between sexes and between levels of motor competence. The self-perception scores that significantly correlated with identity health scores were quite similar in strength for the females in the TD group and the females in the low motor competence group, with the exception of scholastic competence. For the TD males all dimensions of self-perception showed a moderate association except for physical appearance which was strongly associated to identity health scores, whereas for the males in the low motor competence group, only scholastic competence, behavioural conduct, and global self-worth were strongly associated to identity health scores.

Although several studies have shown that motor coordination difficulties are related to problems with peer relationships and social communication (e.g., **Dewey & Volkovinskaia, 2018; Zwicker, Suto, Harris, Vlasakova, & Missiuna, 2018**), the role that motor coordination difficulties have on the perceptions that other people hold about the social competencies of individuals with DCD has not yet been examined. The next paper reported the social stereotyping of adults with and without DCD from visual cues by TD adults. With an innovative approach, **Gentle, Shaheen, Tunstall, and Hegarty** found that adults with DCD are judged as less socially competent than TD adults. Timler et al. and Gentle et al. took very different approaches but converge on the conclusion that understanding of the psychosocial consequences of having DCD is of critical importance for the development of intervention protocols that can improve the secondary consequences of this condition.

The topic of persistency or growing out of DCD has been researched before, but most studies are from more than a decade ago (e.g., **Cantell et al., 2003; Losse et al., 1991**). There are scarcely any follow up studies investigating developmental stability and change in DCD. Two papers in this special issue detail the developmental course of motor coordination difficulties. **Houwen, Kamphorst, van der Veer, and Cantell** examined the degree of rank-order and individual-level stability in motor performance in 3- to 4-year-old children with different levels of motor skill proficiency based on three six-monthly waves of assessment. These authors found moderate to high rank-order stability in motor performance in this age group, with a somewhat lower stability estimate for the longer (i.e., one year) interval than for the shorter (i.e., six months) intervals. No significant differences in rank-order stability coefficients were found between 3- and 4-year-old children and between girls and boys. With regard to individual-level stability, it turned out that for ~50% of the children at risk for motor coordination difficulties (≤ 16 th percentile on the Movement Assessment Battery for Children-2 [MABC-2]) and ~90% of typically developing children the classification based on the cut-off score on the MABC-2 was stable. However, based on the Reliable Change Index,¹ over 90% of the whole sample showed individual-level stability. **McQuillan, Swanwick, Chambers, Schlüeter, and Sugden** addressed the degree of individual-level stability in motor performance in 7- to 14-year-old children with and without DCD based on three waves of assessment with time between testing being on average ~20 weeks. A clinically significant change in motor performance (10-point difference - either positive or negative- in MABC-2 total test score) was

¹ The reliable change index is a method for examining if the difference in a child's scores over time exceeded (increased or decreased relative to) the expected change (**Jacobson & Truax, 1991**).

seen in less than a quarter of the children with severe motor coordination difficulties (≤ 5 th percentile MABC-2), whereas all children with moderate coordination difficulties (6-16th percentile MABC-2) showed a clinically significant positive change. These results suggest that those with more severe motor coordination difficulties are more at risk to keep these problems after 1 to 1.5 years.

The last paper in this special issue focused on the impact of practice on motor skill acquisition, retention, and transfer in 6- to 12-year-old children with DCD and TD children using a variety of active video games. **Smits-Engelsman, Bonney, and Ferguson** reported that the initial performance of children on the Nintendo Wii ski game was lower for children with DCD compared to TD children. In addition, both children with and without DCD showed short-term learning and retention, but the improvement on the Wii ski game over 10 weeks was lower for children with DCD as compared to their TD peers. The authors argue that TD children experience superior learning on the Wii ski game (i.e., were faster and more accurate) than children with DCD and that this also may indicate superior skill transfer (i.e., near transfer). However, more research is needed to confirm that children with DCD have a problem to transfer skills to other contexts.

In conclusion, the topics of this special issue cover a variety of issues relevant for DCD and reflect the importance of a multidisciplinary point of view in this field. Following on from the research presented at the DCD13 Conference and the international clinical practice recommendations for DCD by the European Academy of Childhood Disability (Blank et al., 2019), we will provide some suggestions for further research. A clear understanding of how DCD continues to develop from (early) childhood through adolescence and adulthood is lacking. Longitudinal studies are needed to obtain more information about the developmental course of DCD in adolescence and adulthood (Blank et al., 2019). Although the amount of papers on DCD in adolescents and adults is increasing, it is still limited; not only with regard to the developmental course, but also with regard to age-appropriate standardized assessment methods and interventions (Blank et al., 2019). In addition, further research is needed to understand the contributors and pathways of psychosocial problems in individuals with DCD, as these problems can have a lifelong negative impact on functioning (Tamplain & Miller, 2021). Regarding intervention more research is needed to explain why children with DCD have difficulty to learn motor tasks, and to examine what are the most optimal conditions to stimulate motor learning in these children during intervention.

We close by expressing our gratitude to Mark Williams (Editor in Chief of Human Movement Science), the submitting authors, many expert reviewers who were incredibly generous with their time, and the helpful staff at Elsevier. The willingness of DCD researchers and clinicians to continue organizing international DCD conferences, even almost three decades after the first one in London, continues. DCD14 will be organized in Vancouver in 2022. It is a sign that there is a strong wish to make DCD better understood and more known - and ultimately to be able to transfer this knowledge into clinical practice in order to help those with DCD.

Declarations of interest

None.

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