

A comprehensive special educational diagnostic assessment of five-year-old children with developmental coordination disorder (case studies)

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Abstract. Developmental coordination disorder (DCD) is a neurodevelopmental disorder which affects different areas of an individual's everyday living and learning. Children with DCD are often diagnosed late, at school age, when difficulties with writing, organization and executive functions arise, even though one could have seen signs of probable DCD very early in childhood. The aim of this study was to further assess five-year-old, preschool children recognized as children with DCD, and develop a model for a comprehensive special educational diagnostic assessment of abilities and skills in five-year-old children with DCD. The comprehensive diagnostic assessment comprised observations and assessments of children's everyday skills in their kindergartens. It also included semi-structured interviews with children, their parents and their preschool teachers. Further, children's skills and abilities in all developmental domains (sensory and motor skills, cognitive abilities, social and emotional development, speech and language development, including emerging literacy skills, and early maths skills) were assessed. A qualitative analysis was undertaken to compare individual children's comprehensive assessments. The developed model included both the strengths and weaknesses of the assessed children.

Keywords. Developmental coordination disorder, special education, comprehensive assessment, preschool children, strengths and weaknesses.

Introduction

Developmental Coordination Disorder (DCD) is a neurodevelopmental disorder that manifests itself as difficulties in performing a range of motor tasks, a condition which is evident from early childhood and often persists into adulthood (Cousins & Smyth, 2003; Losse et al. 1991). Signs of DCD include difficulties in processing sensory information, planning, organisation and coordinated motor execution. It is based on an impairment of the brain's functioning which affects one's sensations of touch, balance and the feeling of depth, hence interfering with the ability for

motor planning. It is a hidden disability that causes problems with movement, co-ordination, organisation and processing of sensory information. It can lead to a number of learning and socialization problems (Hellgren et al., 1994; Kadesjö & Gillberg, 1998; Kremžar & Petelin, 2001; Skinner & Piek, 2001). The characteristics of DCD vary according to the age and stage of one's development: younger children may show signs of clumsiness and developmental delays, there might also be marked delays in reaching certain motor milestones (e.g. walking, crawling, sitting, tying shoelaces, using buttons and zippers), while older children may have difficulties in motor aspects of assembling a puzzle, in building models, with ball skills, copying and especially with writing (Kirby & Drew, 2003).

DCD is characterised by a marked impairment in the performance of motor skills that has a significant negative impact on the performance of activities of daily living, where the core aspects of the disorder include difficulties with gross and/or fine motor skills (Sugden, 2006). There is a vast difference in the reported prevalence of DCD in the literature, with estimates ranging from 1.8% (Lingam, Hunt, Golding, Jongmans & Emond, 2009) to 5–6% of school-aged children (Missiuna et al., 2008) or even 6–10% (Cratty, 1993).

Early intervention of children with DCD is essential. According to the definition provided by the European Agency for Development in Special Needs Education (2010), early childhood intervention is »a composite of services/provision for very young children and their families, provided at their request at a certain time in a child's life, covering any action undertaken when a child needs special support to: ensure and enhance her/his personal development, strengthen the family's own competences, and promote the social inclusion of the family and the child«.

The primary objective of early intervention is, according to Majnemer (1998), the enhancement of competence in all developmental areas in order to prevent or reduce further delays and secondary consequences of develop-

mental conditions. Moreover, early intervention has the potential to help families cope with challenges arising at home and in the community due to the developmental condition.

Research has shown that the negative long-term implications of DCD and failure to identify DCD and properly intervene at a young age can significantly affect educational outcomes and long-term physical and mental health (Cantell et al., 2008; Causgrove Dunn & Dunn, 2006; Dewey et al., 2002; Larkin & Rakimov, 2007).

The early identification of developmental difficulties provides a basis for effective treatment. Identifying DCD early on is essential because it can lead to education and guidance to encourage engagement in typical childhood activities and thus decrease the risk of reduced self-esteem and social interaction (Missiuna et al., 2003). Young children who are diagnosed with DCD only later usually achieve fundamental gross and fine motor milestones, but skill acquisition is commonly delayed. Such early motor delay means these children are at an immediate disadvantage and tend to fall behind their peers with regard to acquiring motor skills (Chambers & Sugden, 2002).

According to Ozbič (2006), the diagnosis of DCD is often made (too) late because professionals are trying to help the child with academic skills (e.g. writing and drawing in school), even though the basis for eliminating or reducing difficulties lies elsewhere – in the basic praxis activities such as organisation of the body, space and time.

The modern trend of the detection of special needs in children entails an integrated, complex approach to the identification and diagnostic assessment (Magajna, 2010). Currently, the main focus in Slovenian special education is on the “Response to intervention” (RTI) model. Preschool children with special needs are no longer defined by their disabilities, but by their strengths and weaknesses across all developmental domains. Intervention according to this model is set up after comprehensively assessing a child’s achievements in all developmental domains, according to which educational adjustments and accommodations are established and an individual (special educational) intervention programme is put into practice. With the RTI model, the first stage of intervention is the recognition which includes screening, assessment and progress monitoring (Coleman et al., 2006).

The RTI model is based on a continuum of learning disabilities from mild to severe, from easy to complex, from short-term to life-long, etc. It requires the systematic diagnostic assessment and monitoring of children’s achievements, an effective intervention and an evaluation of the success of the executed intervention programme, all of which is done with the collaborative team effort (co-creation) of all participants in the process, with a significant emphasis on working together with the chil-

dren and their parents (Coleman et al., 2006; Magajna et al., 2008).

The main objectives of our study were to further assess five-year-old children who had been recognised as children with DCD in a population-based screening process and, according to their results, find commonalities and differences among those children. The aim was to use those findings to develop a model for a comprehensive special educational diagnostic assessment of five-year-old children with DCD. Our study focused on research questions such as:

- Which social and developmental factors are common among the sampled children with DCD?
- How do the sampled children with DCD perform activities of daily living (ADL)?
- What kind of commonalities and differences in strengths and difficulties were there among the sampled children with DCD?

Material and method

Participants

A convenience sample of five five-year-old boys was made out of a population-based sample of preschool children from public, mainstream kindergartens in Ljubljana, Slovenia. These five boys represented children who had been recognised as children with DCD in a screening process, and whose parents and preschool teachers were prepared to participate in the study.

Table 1 presents the age of the assessed children at the start and end of the research (y.mm).

Table 1. Age of the assessed children (y.mm).

Child	A	B	C	D	E
Age (at the start)	5.4	5.5	5.2	5.4	5.0
Age (at the end)	5.9	5.10	5.7	5.9	5.6

Child D was born preterm (gestation age of 34 weeks), had a low birth weight (2400g), and was born with complications at birth (he did not breathe and needed resuscitation). The other children were born full term with proper weight, and had no complications at birth.

Four children came from families with an average socio-economic background (children A–D), while one child was from a family with a lower, below-average socio-economic background (child E). All families had both parents living together, children A–D had siblings and child E was an only child.

Interviews were only made with the mothers of the children even though both parents had been invited to participate. All mothers had a full-time job; four mothers

(children A–D) had an undergraduate university degree, while one mother had a high school certificate (child E).

The children were enrolled in three different kindergartens and included in four different classes. Eight different professionals participated in the research. They were mainly preschool teachers and their assistants. Since all of the questionnaires were filled in by both professionals in the class, they all represented our sample.

Measures

The following assessment tools were used:

- ❖ Research into DCD
 - the Slovenian version of the Movement ABC – M-ABC (Henderson & Sudgen, 2005), the first age band (from 4 to 6 years of age), which included tasks that assess manual skills, ball skills, and static and dynamic balance; the reliability based on the test-retest was 0.97 for the five-year-old children; the M-ABC was used as a reference-standard for DCD – probable DCD was identified in children whose results were below the 15th percentile;
 - the Slovenian version of the Developmental coordination disorder questionnaire – DCDQ-SI (Wilson & Crawford, 2007, 2012, in Terčon et al., 2012), designed for a parental assessment of control during movement, fine motor skills and general motor coordination in children aged 5 to 15 years; the questionnaire was used with both parents and preschool teachers who knew the children under study for longer than 6 months;
 - the Beery-Buktenica Developmental test of visual-motor integration – VMI (Beery, 1997), the first part, which is used for identifying the visual-motor integration of children aged from 2 to 8 years; with the reliability of the Rasch-Wright coefficient at between 0.95 and 1.00, Cronbach's alpha coefficient for five-year-old children was 0.84; cut-off scores for difficulties in visual-motor integration were below the 13th percentile;
 - VMI Visual Perception (Beery, 1997), designed to assess visual perception in children aged from 3 years to adulthood, with the reliability of Cronbach's alpha coefficient being 0.87 for five-year-old children; cut-off scores for difficulties in visual perception were below the 13th percentile;
 - VMI Motor Coordination (Beery, 1997), designed to assess motor coordination in children aged from 3 years to adulthood, with the reliability of Cronbach's alpha coefficient being 0.88 for five-year-old children; cut-off scores for difficulties in motor coordination were below the 13th percentile;
 - The Imitation of Gestures (Bergès & Lézine, 1972, in Povše Ivkić & Govedarica, 2000) – the 1st and 2nd parts include activities of simple and complex movements based on which feeling for direction in space, the skill of movement imitation and motor planning with motor execution can be assessed for children aged 3 to 6 years; cut-off scores for difficulties were presented by the 1st quartile;
- ❖ Comprehensive assessment (an interdisciplinary team: a SEN teacher, a psychologist and a speech and language therapist)
 - developmental scales for five-year-old children – scales for assessing children's developmental achievements in gross motor skills, fine motor skills, sensory skills and sensory integration, speech and language development, development of play, ADL skills, social, emotional and moral development skills, cognitive abilities, emerging scholastic skills and knowledge; scales were developed specifically for this research;
 - the Questionnaire for developing a profile of children aged 5 to 7 years (Ozbič et al., 2013) for preschool teachers' comprehensive assessment of children aged 5 to 7 years, with the intention of screening children at risk of developing specific learning disabilities; with the reliability of Cronbach's alpha coefficient ranging from 0.689 to 0.967; the 10th percentile represented a borderline result, while the 5th percentile represented cut-off scores for teachers' apprehension of the observed children having difficulties in a specific domain;
 - Raven's Coloured Progressive Matrices – CPM (Raven et al., 1999) designed to assess general intellectual abilities of children aged 4 to 11 years, with the reliability of Cronbach's alpha coefficient being 0.89; cut-off scores were below the 1st quartile;
 - the Social Competence and Behaviour Evaluation Scale – SCBE (LaFemier & Dumas, 2001) for preschool teachers' assessment of social competencies, ways of emotional expression, and difficulties in the social adaptation of children aged 2.6 to 6.8 years, with the reliability of Cronbach's alpha coefficient ranging from 0.76 to 0.95 for individual basic and composite scales for Slovenian children; cut-off scores were below the 1st quartile;
 - general Speech Development Scales (Marjanovič Umek et al., 2007) for preschool children, including scales for speech comprehension, verbal expression and scales for meta-linguistic skills, with the reliability of Cronbach's alpha coefficient ranging from 0.68 to 0.98 for individual scales; cut-off scores were below the 1st quartile;
 - a preventive speech and language assessment in five-year-old children (unknown author) for the assessment of articulation, vocabulary, verbal expression and the physiognomy of the oral musculature.

Procedures

Nine to ten sessions were conducted, once a week for 45 minutes in the children's kindergartens, i.e. two observations, three to four individual sessions with the SEN teacher, one session with the psychologist, one session

with the speech and language therapist, and two sessions for interviews with the parents and teachers. The interviews were recorded and transcribed, with the transcriptions being later authorised by the interviewees. All of the sessions were held in the children's kindergartens, except for the session with the speech and language therapist that was held in a community health centre.

Equal assessment standards were adopted (all assessments were made in the morning, at approximately the same time; the rooms were properly ventilated, with proper lighting etc.).

The assessment of cognitive abilities and the questionnaires that required a psychologist's review were all carried out and assessed by a properly trained psychologist for the individual assessment tools. Children's achievements in the speech and language domain were assessed by a speech and language therapist.

Fundamental ethical principles of humanistic research and the principles of the Declaration of Helsinki were considered, i.e. volunteer participation, the possibility of declining further participation during the research, the subjects' parents were presented with the contents and procedures of the research in great detail etc. Anonymity, confidentiality and the protection of personal information were ensured. The research was approved by the Slovenian Medical Ethics Committee.

Statistical analysis

Multiple-case studies were conducted and a comparative qualitative analysis was made using a cross-case comparison.

Results

Figure 1 presents the model for a comprehensive special educational diagnostic assessment of five-year-old children with DCD that was applied in the research.

The five children were assessed and different characteristics and levels of their functioning were exhibited. Table 2 shows the characteristics of the assessed children that were determined through the observations of the children in kindergarten, assessments of their developmental achievements in individual sessions, and their parents' and teachers' assessments of their strengths and weaknesses.

During the observations in their kindergarten classrooms and individual observations, all of the children showed a marked impairment in ADL. Most of them (children B–E) had difficulties eating and were messy eaters.

Free play and assessments in individual sessions revealed difficulties with motor planning and their plan's execution in children A, C, D and E.

All of the children avoided motor activities, especially in group games that included imitation of movements, and any kind of sports activities (i.e. playing football with neighbourhood children). Both teachers and parents reported that they had been avoiding some motor tasks in the past as well, especially drawing and playing on the outdoor playground equipment.

Children C, D and E showed signs of attention deficit (and hyperactivity) disorder (AD(H)D). Because none of the children had been assessed by a paediatrician or child psychiatrist, a diagnosis of AD(H)D could not be obtained. In addition, co-morbidity with speech and language impairments was found in children B and D.

In contrast, all of the children's strengths were considered to be in the verbal domain. Both their parents and their teachers, and according to our observations in kindergarten, they were all considered to be more verbal and showed a vast imagination. They all liked to discuss a lot of topics with their peers and teachers; their choice of free play was mostly verbal and imaginative (role playing, play that includes dramatization).

According to the interviews with their preschool teachers, child A often played the classroom clown, children B and C were considered to be the 'philosopher' of the class, child D was the one with the biggest imagination in the class, and child E was considered to be a chatter-box.

Child B was regarded as a gifted child, while children A and C showed above-average intellectual abilities, even though all of their CPM results were not as high as expected (as seen in Table 3).

In their interviews, the parents of children A, C and D, and the teachers of children A–D diminished the extent of the DCD-related impediments, and displayed a really poor insight into the difficulties exhibited by the children.

Further, according to our observations, three children (A, B and D) had difficulties with social skills, even though their teachers (see the SCBE results in Table 3) and parents (as stated in the interviews) had not observed this. In addition, both the teachers and parents of children C and D, and the teacher of child B stated in their interviews that the children's motor difficulties are due to a lack of practice.

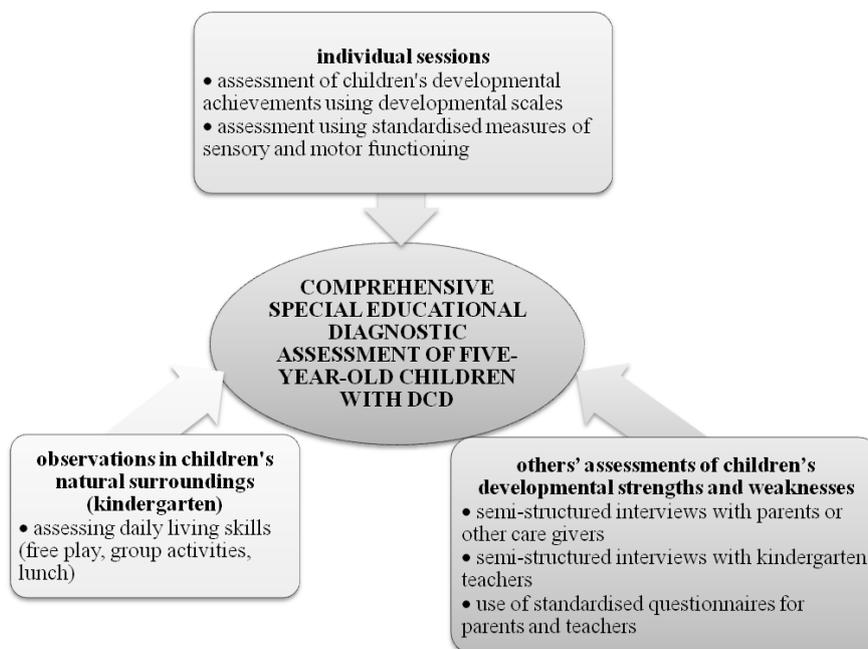


Figure 1. Model for the comprehensive special educational diagnostic assessment of five-year-old children with DCD.

Table 2. Characteristics of the assessed children.

Child	Characteristics of the assessed children	
A	Strengths	Verbal skills, early maths skills, common knowledge
	Weaknesses	Moderately poor gross motor skills including coordination, balance, ball skills, motor planning, poor sensory integration; poor social skills and ADL skills
B	Strengths	Verbal skills, early maths and literacy skills, common knowledge; vast knowledge of specific themes and vast imagination; considered gifted
	Weaknesses	Extremely poor gross motor skills including coordination, balance, ball skills; dysarthria; poor social skills and ADL skills
C	Strengths	Verbal skills, early maths skills, common knowledge and vast imagination, memory skills; extremely empathetic and socially competent
	Weaknesses	Extremely poor fine and gross motor skills including coordination, balance, ball skills, motor planning, and body awareness; attention, hyperactivity; poor ADL skills
D	Strengths	Verbal skills, vast imagination
	Weaknesses	Extremely poor fine motor skills, visual perception, motor planning, body awareness, coordination, poor sensory integration; attention, language processing, dysarthria; poor social skills and ADL skills
E	Strengths	Verbal skills, vast imagination
	Weaknesses	Moderately poor fine and gross motor skills including coordination, balance, ball skills, visual perception, motor planning, poor sensory integration; attention, hyperactivity, language processing; poor ADL skills

Table 3 presents percentiles of the individual assessment tools used with the sampled children. The cut-off scores (percentiles) were not always the same and were selected with reference to the determined cut-off values for individual assessment tools.

All of the children were assessed below the 15th percentile in the M-ABC. Children A, B and C showed marked difficulties in motor skills since their M-ABC results were below the 5th percentile, which suggests severe motor difficulties. Further, all children were assessed in DCDQ by their preschool teachers below the

cut-off scores that suggest probable DCD. On the other hand, the DCDQ for parents showed relevant differences in their assessment of children A and D. Using the VMI, only children C and D showed a marked impairment in visual-motor integration and in motor coordination, while children D and E showed an impairment in visual perception. Taking the imitation of movements into consideration, child D showed difficulties in both simple and complex imitations, while child A only showed difficulties in complex movement imitations. In contrast, child B

excelled in the latter. Child D also performed extremely poorly on the CPM.

All five children performed without implications of difficulties in LSGR-LJ. Children A and B exceeded in all three domains, while child C did well in speech comprehension and expression, and child E performed well on comprehension alone.

The basis of the profile of the 5- to 7-year-old children and the SCBE were the questionnaires completed by the preschool teachers. When taking the SCBE results into account, child C excelled in all four domains, and children B and E were considered to be children with the smallest internalising problems. On the other hand, social competence was considered poor for children A and E, while externalising problems were found in child E as well.

Table 3. Percentiles of individual assessment tools for children A–E.

	A	B	C	D	E
M-ABC	4	4	2	9	12
DCDQ-SI teachers	0-10	0-10	0-10	0-10	0-10
DCDQ-SI parents	>10	0-10	0-10	>10	0-10
VMI	25	81	6	1	16
VMI Visual Perception	61	42	70	5	8
VMI Motor Coordination	19	53	6	12	32
B-L part 1	75	75	75	0-25	50
B-L part 2	0-25	75-99	50	0-25	50
PROFILE for 5-to7-year-olds	10-25	50-75	25-50	10-25	10-25
Attention, Concentration, Behaviour and Behavioural Management	5	10-25	50-75	10	5-10
Motor Skills	1-5	1-5	25	10-25	1-5
Communication, Sociopragmatics	5-10	75-90	75-90	10-25	10
Speech and Language Comprehension and Expression	10-25	90	25-50	25-50	10-25
Verbal Memory	5-10	99	50	10	10
Graphic Visual Perception, Perception and Colour Naming	50-75	50-75	10-25	10-25	5-10
Orientation of Time and Space	25	99	50	25	1-5
Metaliter Skills	10-25	99	25-50	25-50	10-25
Emerging Literacy	5-10	90-95	25-50	25-50	10-25
GraphemPerception, Graphomotricity	25-50	50-75	5-10	25	10-25
Emerging Maths Skills	25-50	99	25-50	10-25	10-25
Metacognition	10	90	75	50	25
SCBE Social Competence	20	75	92	30	18
SCBE Externalising Problems	52	30	87	30	15
SCBE Internalising Problems	50	98	88	80	60
SCBE General Adaptation	35	75	94	40	25
CPM	25	25	>25	5-10	>25
LSGR-LJ Comprehension	>95	>95	90	70	80
LSGR-LJ Expression	85	>95	85	35	35
LSGR-LJ Metalinguistic Perception	90	>95	50	55	50

 Above-average results (overall strengths)
  Borderline difficulties
  Difficulties

The results showed that none of the teachers considered the observed children as having difficulties in general (see the general profile results in Table 3). Attention, concentration, behaviour and behavioural management were considered extremely poor in child A and poor in child E, whereas child D had borderline results. Extremely poor motor skills were considered only in children A,

B and E. Communication and sociopragmatics were regarded as poor only in child A, while children B and C had excellent results. None of the children had poor results in speech and language comprehension and expression; again, child B had excellent results in this domain. Verbal memory was considered poor in child A, and again the results for child B were excellent. Teachers

assessed poor graphic visual perception, perception and colour naming and extremely poor orientation in time and space in child E. Orientation in time and space, met-aliteral skills, emerging literacy, emerging maths skills and metacognition were again assessed as excellent in child B. Child A was found to have poor skills in emerging literacy. Graphem perception and graphomotricity were considered to be poor in child C alone.

When considering all of the above-mentioned domains in the teachers' questionnaires while individually observing and assessing the children, child A was assessed above the teachers' estimates, and did not show signs of communication, sociopragmatics, emerging literacy and verbal memory difficulties. Child E's achievements, on the other hand, were individually assessed below the assessment made by his teacher – he showed signs of poor graphomotricity, had obvious signs of problems in the attention and concentration domain, and had difficulties with speech and language comprehension and expression, not to mention poor motor skills. The latter was also inadequately assessed by child C's preschool teacher.

Discussion

When considering the developmental and social factors in the present research, there was only one child who was born preterm and with low body weight, while one child came from a family with a lower socio-economic status. Other research studies suggest that DCD occurs more often in children with an extremely low birth weight (Lingam et al., 2009), in preterm infants (Goyen & Lui, 2009; Lingam et al., 2009), in children with speech and language impairments (Gaines & Missiuna, 2007) and in children from families with a lower socio-economic status (Lingam et al., 2009).

Taking co-morbidity into account, two children were assessed as children with SLI, two children showed signs of ADHD and in one child ADD symptoms were observed. According to other studies (Blank et al., 2012; Dewey et al., 2002; Kadesjö & Gillberg, 1998; Kirby & Drew, 2003), AD(H)D and DCD often co-occur – nearly half of all children with DCD also have attention and hyperactivity problems. Interestingly, none of the assessed children showed signs of autistic spectrum disorder (ASD) – Asperger's syndrome, even though it is considered one of the most common co-morbidities in children with DCD (Dowell et al., 2009; Kadesjö & Gillberg, 1998; Kirby & Drew, 2003).

When it comes to children's functioning with regard to ADL, the observed children showed marked impediments as well. Since ADL functioning is one of the diagnostic criteria (American Psychiatric Association, 2013; Blank et al., 2012; Chambers & Sugden, 2002; Kirby & Drew, 2003; Lingam et al., 2009; Summers et al., 2008; Rodger et al., 2003) such poor performances in ADL were expected. However, another impeding problem discovered in the present research was that the parents and

preschool teachers had generally not observed the children's poor performance in ADL as such. Even though, according to Summers, Larkin & Dewey (2008), the motor difficulties of children with DCD have a significant impact on the performance of a wide range of daily activities, such an impact was not stressed enough by some of the parents and preschool teachers of our observed children. Rodger et al. (2003) suggested that this lack of consistency may be due to differences between parents' perceptions and children's performance in more standardised evaluations, and differences in the context in which the activities of daily living were performed. They emphasised that many families still needed to improve their understanding of their children's participation in such activities.

Further, the present research found several commonalities and differences in the strengths and difficulties of the sampled children with DCD. Taking the assessment of the children's strengths into consideration, all of the observed children excelled in the verbal domain and mostly chose verbal games and imaginative play. Unfortunately, to our knowledge, almost no research can be found on common strong abilities of children with DCD. Our findings are, however, in agreement with Missiuna, Rivard & Pollock (2011) who emphasised that many children with DCD can demonstrate strong abilities in other areas, such as advanced reading skills, a creative imagination, sensitivity to the needs of others, and/or strong oral communication skills. This issue certainly demands the greater attention and interest of DCD researchers.

When considering the assessed weaknesses, no two children exhibited the same commonly observed DCD characteristics, which is also evident from other studies e.g. Blank et al., (2012) and Kirby & Drew (2003).

Most of the observed children had difficulties with motor coordination, balance and ball skills both according to the M-ABC and according to skills tested in individual sessions. Such difficulties are most commonly manifested in children with DCD (e.g. Blank et al., 2012; Cermak et al., 2002; Kirby & Drew, 2003). Most of the observed children had problems with ideation or motor organisation in terms of motor planning as well. Both the execution and/or planning of the complex imitation of gestures can be problematic for children with DCD (Ayres, 1972). Cermak (1985) also noted that therapists in clinical practice distinguished between children who showed motor planning deficits and those with deficits in the coordination or execution of motor tasks. The former appeared to have a general problem with organising and planning their approach to tasks, whereas the latter appeared to know how to plan their approach to a particular task, but experienced difficulty executing the task (Le Normand et al., 2000). Some authors (e.g. Ayres, 1972; Cermak, 1991) have considered these motor planning problems to be due to difficulties in integrating information from the bodily senses i.e. sensory integration.

The current research showed that only a few of the observed children had difficulties with visual-motor integration and visual perception. Even though research suggests that difficulties in visual-motor coordination are often manifested in children with DCD (Blank et al., 2012; Bonifacci, 2004; Kirby & Drew, 2003, Van Waelvelde et al., 2004), one must emphasise that not all children with DCD exhibit difficulties with visual-motor coordination. Gheysen et al. (2011), for instance, discovered that children with DCD demonstrate general learning of visuo-motor task demands comparably to that of typically developed children, but fail to learn the visuomotor sequence.

Also taking the CMP results into consideration, they had been expected to be lower due to common perceptual impediments in children with DCD. Further analysis of the CMP test scores indicated that primarily perceptual abilities are required to solve the test, although abstract reasoning is involved in the solution of matrices and in conservation of substance (equivalence) tasks (Heinz Wiedl & Carlson, 1976). The relatively low performance of children A and B was surprising since their VMI and the VMI VP were not below-average. Recent research (Zupančič & Svetina, 2012) argues that the Slovenian CMP norms lack proper differentiation specifically with regard to five-year-old children and that CMP should therefore not be used as a sole diagnostic measurement of children's intellectual abilities. According to the results in the present research, CMP is not an optimal diagnostic tool for assessing the general intellectual abilities of preschool children with DCD.

Sensory integration and body awareness difficulties were also problematic for some of the observed children. According to Ayres (1972) and Cermak (1991), such difficulties are common in children with motor problems. Elbasan et al. (2012) argue that problems in taking visual, tactile and proprioceptive inputs and integrating them in an appropriate way leads to ADL deficiencies in children with DCD, which are especially dependant on the tactile system.

Interestingly, although some of the observed children showed poor social skills when observed in different social situations, their social competencies were not viewed as such by their teachers and their parents. Skills in sports and games are considered one of the best predictors of social status in childhood, and difficulty with social skills may be both a primary and a secondary problem in children with DCD (Blank et al., 2012; Cermak et al., 2002). Schoemaker & Kalverboer (1994) established links between motor coordination difficulty and socio-emotional problems with children as young as six years old. Piek et al., (2008) found an association between motor coordination and anxious/depressed behaviour in preschool-age children – children at risk of DCD who participated in their study were found to have significantly higher reported scores on the anxious-depressed scale compared with children with higher scores on motor ability. Those authors emphasised that

further research into anxiety in preschool children at risk of DCD should be conducted because such a deduction needs more support. Since our present study suggests that parents and teachers do not have a proper insight into their children's possible poor social and emotional difficulties, this is also a pressing issue for further research.

Conclusion

Our model for a comprehensive special educational diagnostic assessment of five-year-old children with DCD turned out to be quite efficient, although it was not tested for its efficiency on a larger scale. The model involved gathering information from three different sources (the child, parents and teacher) in three different ways (observation in class, individual assessments, gathering information from parents and teachers) and thus complied with qualitative research standards. It was economical and time-efficient because it included both diagnostic assessments commonly undertaken in health institutions and an assessment normally made in an educational institution to formulate an individualised plan for intervention. The model gave us a profound understanding of the children's strengths and special needs, included an interdisciplinary approach and emphasised the need for teamwork and a partnership between the children, parents, teachers and specialists.

The present research also pinpointed several issues needing further research such as common strong abilities in children with DCD, and parents' and teachers' provision of their children's special needs, especially in preschool. Finally, our proposed model of a comprehensive diagnostic assessment calls for more research and development.

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