Physical and social play of preschool children with and without coordination difficulties: preliminary findings

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Key words: Developmental coordination disorder, play, early childhood.

Introduction: This preliminary study investigated the play skills and frequency of engagement in play of young children with and without motor coordination difficulties.

Method: Using a quasi-experimental design with two independent groups, the play of 21 children aged 4-6 years with (n = 11) and without coordination difficulties (n = 10) was assessed using the Revised Knox Preschool Play Scale and the Play Observation Scale, based on 30 minutes of videotape of play at preschool. Motor skills were assessed using the Developmental Coordination Disorder Questionnaire – German and the Movement Assessment Battery for Children – Second Edition.

Results: Significant differences were found in developmental play skills between the two groups, specifically in the children’s overall play age and in gross and fine motor play, with lower play ages found for children with coordination difficulties. Frequency of engagement and social interaction in play was significantly different: children with coordination difficulties spent more time as onlookers, or in transition, than their typically developing peers. They were more frequently involved in an aggressive incident and had higher frequency of negative affect than the control children during play.

Conclusion: Children with coordination difficulties engaged in less mature gross and fine motor play than the control group. Difficulties in social interaction seem to be evident at a younger age than has previously been described. Early identification of these difficulties may provide directions for intervention; however, this needs to be more fully explored with a larger sample.

Introduction

Play provides opportunities for young children to explore their environments and to develop and practise a range of skills, including (1) fine motor (Belsky and Most 1981), (2) gross motor (Pellegrini and Smith 1998), (3) problem-solving (Russ 1998), (4) self-regulation (Pellegrini and Smith 1998, Pellegrini et al 2007) and (5) social interaction (Stagnitti and Unsworth 2000). Developmental coordination disorder (DCD) is a condition that challenges engagement and participation in various occupational roles, including that of player. It has been demonstrated that the presence of DCD limits a child’s engagement in typical childhood occupations, such as bicycle-riding, playing on the school playground, writing, craft activities and self-care (Miller et al 2001, Polatajko and Cantin 2006, Missiuna et al 2007). Studies with school-aged children have shown that the reduced participation becomes more apparent over time and can lead to secondary psychosocial issues, such as low self-esteem, depression and victimisation (Cantell et al 2003, Larkin and Summers 2004, Missiuna et al 2006a, Missiuna et al 2007, Piek et al 2008, Stephenson and Chesson 2008).

With limited studies conducted with children younger than 6 years of age (Geuze et al 2001, Jongmans 2005), it is not yet known whether the play engagement of young children with DCD is any different from that of
their peers. Investigating and comparing the engagement of preschool children in childhood occupations, such as play, may provide useful information to support early intervention strategies. The aim of this preliminary study was to examine whether there were any differences in play behaviour and frequency of engagement in play in preschool children between the ages of 4 years 0 months and 6 years 11 months with and without coordination difficulties.

DCD affects approximately 6% of all children (American Psychiatric Association [APA] 2000) and is characterised by extreme awkwardness and difficulty learning new motor skills (Visser 2003, Cantin et al 2007). Very few studies have been conducted with children with DCD before they enter school. Missiuna et al (2006b, 2007) found that almost all parents of children with DCD identified differences in motor ability before their child was 4 years old, including difficulty participating in gross motor play and playground activities. A limitation of this study was that it relied on parental recollection rather than independent real-time observation.

Bar-Haim and Bart (2006) used the Play Observation Scale (POS) (Rubin 2001) to examine the play and social participation of children with different motor abilities in their first year of school. With a sample of 88 5-year-old children, they found that children with higher motor abilities engaged more frequently in social play than children with lower motor abilities. Low motor ability was also associated with a high frequency of social reticence, which has been identified as a risk factor for social maladjustment (Rubin et al 1993, Rubin and Coplan 1998, Coplan et al 2001). The link between children’s motor abilities and motor-based play is more obvious, while the underlying link between motor ability and social play is less well understood.

Several studies have found that school-aged children with DCD participate in play less often than their typically developing peers (Smyth and Anderson 2000, 2001, Cairney et al 2006, 2010), are more likely to be onlookers (Schoemaker and Kalverboer 1994, Smyth and Anderson 2000) and are more likely to experience social isolation in the play environment (Poulsen et al 2008, Cairney et al 2010).

Hence, the objective of this study was to investigate the play skills and frequency of different types of play of 4-6 year old children in German preschools. Specifically, it was hypothesised that children with motor coordination difficulties would demonstrate (1) lower overall play age, as measured by the Revised Knox Preschool Play Scales (RKPPS) (Knox 2008), and (2) less frequent engagement in play as measured by the Play Observation Scale (POS) (Rubin 2001).

Method

Design

A quasi-experimental design with two independent groups, one with probable DCD (motor difficulties) and a matched group of typically developing children, was used.

Ethics approval for this study was obtained from the University of Queensland Human Research Ethics Committee.

Participants

Seventy-four mainstream preschools1 in Munich (Germany) and surrounding suburban and rural areas were approached, and nine agreed to participate. All children aged between 4 years 0 months and 6 years 11 months (and their parents) attending a participating preschool were invited to take part. Information packs were distributed to 452 parents, 106 of whom signed consent forms, and 48 children underwent further motor skill assessment on the basis of the Developmental Coordination Disorder Questionnaire – German (Wilson et al 2010). Group status was determined using the Movement Assessment Battery – 2 (MABC-2) (Henderson et al 2007) and developmental information provided by the parents.

Eleven children with probable DCD (10 boys, 1 girl), mean age 4 years 7 months (SD 8.09 months), were matched for age, gender and ethnicity with 10 control children (9 boys, 1 girl), mean age 4 years 9 months (SD 9.99 months), in the same preschool class wherever possible. One child with probable DCD was not able to be matched with a control child in this preliminary study.

Measures

Developmental Coordination Disorder Questionnaire – German (DCDQ-G)

The DCDQ-G (Wilson et al 2010) is the German version of the DCDQ (Wilson et al 2007) and is being validated in an ongoing study. The DCDQ is a 15-item scale, which asks parents or caregivers to consider how well their child performs certain motor activities, and activities of daily living, compared with his or her peers. The score indicates whether a child is either at risk for, or probably does not have, DCD and provides information to satisfy Criterion B (see Table 1) of the DSM-IV-TR guidelines for a diagnosis of DCD (APA 2000). Population-based studies in Canada and the Netherlands have demonstrated that the DCDQ is reliable and valid (Wilson et al 2000, Schoemaker et al 2006, Cairney et al 2008), and that sensitivity and specificity are acceptable (Schoemaker et al 2006, Wilson et al 2007).

Movement Assessment Battery for Children – Second Edition (MABC-2)

The MABC-2 (Henderson et al 2007) is the revised version of the Movement Assessment Battery for Children (MABC)

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1Preschool in Germany is called kindergarten and is provided by the Catholic and Protestant Churches, as well as local councils. Attendance is recommended but not compulsory. Children typically attend kindergarten from age three onwards and enter school in the September following their sixth birthday. The final year of kindergarten is called ‘Vorschule’, that is, preschool, and means preparation for school entry. As kindergarten means different things in different countries, the term ‘preschool’ is used to avoid confusion.
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Table 1. Diagnostic criteria for developmental coordination disorder (American Psychiatric Association 2000, p55)

A. Performance in daily activities that require motor coordination is substantially below that expected given the person’s chronological age and measured intelligence. This may be manifested by marked delays in achieving motor milestones (for example, walking, crawling, sitting), dropping things, ‘clumsiness’, poor performance in sports, or poor handwriting.

B. The disturbance in Criterion A significantly interferes with academic achievement or activities of daily living.

C. The disturbance is not due to a general medical condition (for example, cerebral palsy, hemiplegia, or muscular dystrophy) and does not meet the criteria for a Pervasive Developmental Disorder.

D. If mental retardation is present, the motor difficulties are in excess of those usually associated with it.

(1992) and is widely accepted as an appropriate test to satisfy Criterion A of the DSM-IV-TR guidelines (Crawford et al 2001, Geuze et al 2001, Rodger et al 2007, Tsai et al 2008). While less information is available on the MABC-2 than the MABC, it is the only version that has been translated and validated with a German population (Petermann et al 2008).

Revised Knox Preschool Play Scale (RKPPS)
The Revised Knox Preschool Play Scale (RKPPS) (Knox 2008) is an observational assessment providing a description of children’s developmental play skills from birth to 6 years. The assessment includes 12 items of play behaviour divided into four dimensions: (1) space management (gross motor); (2) material management (fine motor); (3) pretence (symbolic); and (4) participation (use of language, humour and type of social play). The RKPPS provides a ‘play age’, that is, a measure of the child’s developmental play skills. Studies using earlier versions of the RKPPS indicate acceptable reliability and validity (Bledsoe and Shepherd 1982, Harrison and Kiethofner 1986). The most recent version of the RKPPS has also been found to be reliable and valid (Jankovich et al 2008, Lee and Hinojosa 2010).

Play Observation Scale (POS)
The Play Observation Scale (POS) (Rubin 2001) draws on the play hierarchies developed by Parten (1932) and Piaget (1962) to record and categorise a child’s free play behaviour according to social and cognitive qualities of play. The scale uses a time sampling method to capture different types of cognitive play, including functional, constructive and dramatic play and games-with-rules as they occur within a social context. Categories for social play include solitary, parallel and group activity. The POS has been used to capture descriptive data on the type, frequency and social context of young children’s play (Barnett 1991, Coplan and Rubin 1998, Rubin and Coplan 1998) and has been used with children with different motor abilities (Bar-Haim and Bart 2006).

Procedure
Participating children underwent further motor assessment on the basis of DCDQ-G scores. As German cut-off scores have not yet been determined, all children with a DCDQ-G of 50 or less were matched for age, gender and ethnicity with children with a greater DCDQ-G score and selected for testing with the MABC-2. Children with a MABC-2 percentile of 9 or less were assigned to the probable DCD group; children with a percentile of 25 or more to the typically developing group. Four children with a score of less than 50 on the DCDQ were over the 25th percentile on the MABC-2. As the supplementary developmental information provided by the parents did not indicate any difficulties, these four children were included in the typically developing group. Where possible, children were matched for gender, age and ethnicity within the same preschool; in cases where this was not possible, a child from another preschool from the same type of location (city, suburban or rural) was used as the match. Children in both groups were videoed individually during free play for 15 minutes indoors and 15 minutes outdoors, giving a total of 30 minutes of free play per child.

The play of the children was assessed by the first author using two different play measures based on coding from the videotapes at a later date. An independent rater blind to the group status of each child rated the videos of six children (28% of the entire sample). This provided interrater reliability estimates on 28% of videotapes, which is consistent with other studies in occupational therapy using ratings of children’s performance from videotapes (Buys et al 2006, Rodger et al 2009). Interrater reliability was established using the intraclass correlation coefficient for both the RKPPS (r = 0.848) and the POS (r = 0.860).

Results
Owing to the small sample, nonparametric tests (Mann-Whitney) were performed for the two play measures (RKPPS and POS). In the RKPPS, significant differences were found in the overall play age (U = 24.00, z = -2.192, p = 0.028) and in the domains of space management (U = 18.50, z = -2.620, p = 0.008) and material management (U = 26.50, z = -2.011, p = 0.045). Children with probable DCD demonstrated a lower play age in these domains than the children in the control group. No significant differences were found in the domains of pretence and participation.

Significant group differences were found in the frequencies of play behaviour on the POS. Children with probable DCD had a negative affect more often (U = 19.00, z = -2.569, p = 0.009) and were more frequently involved in an aggressive incident, either as victim or aggressor, than children in the control group (U = 26.50, z = -2.143, p = 0.034). These children were also more frequently onlookers rather than players (U = 14.00, z = -2.897, p = 0.003) and spent more time in transition, that is, moving between or changing activities, than in actual play (U = 26.50, z = -2.015, p = 0.044) (see Table 2).
Table 2. Preliminary results

<table>
<thead>
<tr>
<th>Variables</th>
<th>DCD (n = 11) x (SD), Range</th>
<th>Typically developing (n = 10) x (SD), Range</th>
<th>Mann-Whitney U</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months)</td>
<td>54.927 (8.09), 48-75</td>
<td>56.90 (9.99), 48-74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCDQ-G score</td>
<td>43.73 (6.44), 32-56</td>
<td>52.30 (6.58), 43-61</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>RKPPS percentile</td>
<td>6.80 (3.01), 2-9</td>
<td>44.0 (21.15), 25-75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total play age (months)</td>
<td>39.81 (8.48), 24-54</td>
<td>47.90 (5.50), 40-56</td>
<td>24.00</td>
<td>-2.192</td>
<td>0.028*</td>
</tr>
<tr>
<td>Space management</td>
<td>39.00 (12.44), 21-54</td>
<td>54.60 (7.18), 48-66</td>
<td>18.50</td>
<td>-2.620</td>
<td>0.008**</td>
</tr>
<tr>
<td>Material management</td>
<td>40.45 (8.55), 26-51</td>
<td>48.60 (7.23), 38-60</td>
<td>26.50</td>
<td>-2.011</td>
<td>0.045**</td>
</tr>
<tr>
<td>Pretence</td>
<td>34.09 (16.34), 12-54</td>
<td>36.00 (12.65), 21-54</td>
<td>52.00</td>
<td>-0.214</td>
<td>0.845</td>
</tr>
<tr>
<td>Participation</td>
<td>46.09 (9.45), 29-63</td>
<td>52.10 (6.54), 39-60</td>
<td>32.00</td>
<td>-1.624</td>
<td>0.109</td>
</tr>
</tbody>
</table>

POS (% total play time)

<table>
<thead>
<tr>
<th>Variables</th>
<th>DCD (n = 11) x (SD), Range</th>
<th>Typically developing (n = 10) x (SD), Range</th>
<th>Mann-Whitney U</th>
<th>z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solitary play</td>
<td>8.55 (8.44), 0-23</td>
<td>7.00 (10.38), 0-27</td>
<td>43.50</td>
<td>-0.818</td>
<td>0.431</td>
</tr>
<tr>
<td>Parallel play</td>
<td>16.55 (12.18), 0-34</td>
<td>17.70 (21.23), 0-60</td>
<td>47.00</td>
<td>-0.566</td>
<td>0.591</td>
</tr>
<tr>
<td>Group play</td>
<td>42.36 (19.09), 9-71</td>
<td>61.60 (26.99), 12-94</td>
<td>30.50</td>
<td>-1.727</td>
<td>0.088</td>
</tr>
<tr>
<td>Transitional</td>
<td>12.64 (6.74), 1-22</td>
<td>7.20 (5.07), 1-14</td>
<td>26.50</td>
<td>-2.015</td>
<td>0.044**</td>
</tr>
<tr>
<td>Onlooker</td>
<td>13.91 (8.08), 2-29</td>
<td>4.10 (6.02), 0-20</td>
<td>14.00</td>
<td>-2.897</td>
<td>0.003**</td>
</tr>
<tr>
<td>Positive affect</td>
<td>28.82 (18.45), 12-70</td>
<td>41.20 (11.66), 15-54</td>
<td>28.00</td>
<td>-1.903</td>
<td>0.058</td>
</tr>
<tr>
<td>Neutral affect</td>
<td>62.09 (19.51), 22-83</td>
<td>56.20 (12.59), 41-82</td>
<td>39.50</td>
<td>-1.094</td>
<td>0.289</td>
</tr>
<tr>
<td>Negative affect</td>
<td>8.91 (5.82), 0-18</td>
<td>2.70 (4.55), 1-14</td>
<td>19.00</td>
<td>-2.569</td>
<td>0.009**</td>
</tr>
<tr>
<td>Aggression</td>
<td>2.36 (3.01), 0-10</td>
<td>0.40 (0.70), 0-2</td>
<td>26.50</td>
<td>-2.143</td>
<td>0.034**</td>
</tr>
</tbody>
</table>

DCDQ-G = Developmental Coordination Disorder Questionnaire – German; MABC-2 = Movement Assessment Battery for Children – Second Edition; RKPPS = Revised Knox Preschool Play Scale; POS = Play Observation Scale; *p ≤ 0.05; **p ≤ 0.01.

Discussion

These preliminary results show that children as young as 4 years with coordination difficulties are already demonstrating different patterns of engagement in play at preschool from their typically developing peers. Differences in the space management domain reflect gross motor skills, for example, climbing playground equipment, playing football and tag; differences in the material management domain indicate difficulties with fine motor skills, such as construction with small building blocks, craft activities and painting. These are key domains that are known to be affected by DCD (Smyth and Anderson 2000, Miller et al 2001, Missiuna et al 2006b, Missiuna et al 2007) and central to the diagnostic criteria (APA 2000).

That there were no significant differences in the pretence and participation domains demonstrates that children with coordination difficulties engage age-appropriately in some forms of play, and may be adapting to their difficulties by choosing other, less physically demanding, forms of play. These findings are similar to those of Missiuna et al (2006b, 2007), who found that parents reported that their school-aged children with DCD chose to engage in non-motor based types of play.

Given the nature of DCD, difficulties engaging in the domains of space and material management are not unexpected. However, it is of concern because it indicates that the children who need to gain and practise movement skills are not engaging in the activities that would enhance these skills. The results provide some support for the activity deficit hypothesis (Wall et al 1985, Wall 2004), which theorises that children with poor motor skills engage less often, and with less intensity, in physical activities than children with good motor skills (Bouffard et al 1996, Larkin and Summers 2004). As motor skill is developed and enhanced through engagement in motor activities (that is, practice) (Schmidt and Lee 1999, Wall et al 1985), the gap between children with good and poor motor skills continues to widen with development. It has been established that differences in the amount of engagement in play (particularly physical play) exist between school-aged children with good and poor motor skills (Schoemaker and Kalverboer 1994, Smyth and Anderson 2000, 2001), and, in addition, that these differences become more evident as the children progress through school. However, to date, this hypothesis has not been applied to children in preschool settings. These preliminary findings suggest that preschool children with coordination difficulties are not engaging in fine and gross motor play as often as their peers, and consequently are not gaining the practice needed to develop these skills further. Identification of children with coordination difficulties during the preschool years may allow targeted support of play skills and close the gap between these children and their peers.

The significant differences in frequencies of onlooker and transitional behaviour show that children with DCD spend less time actively involved in play than their peers and might indicate that they have difficulty joining in. Higher frequencies of negative affect and involvement in aggressive incidents point to difficulties with social interaction. These findings support those of Bar-Haim and Bart (2006),
who found an association between motor skill and social interaction, with the children with motor difficulties more likely to experience difficulty in social interaction than their typically developing peers. Bar-Haim’s and Bart’s (2006) study was conducted with 5-year-olds; however, the results of the current study indicate that different patterns of engagement are already clear with children as young as 4 years.

While psychosocial issues have previously been identified largely in older children with DCD (Schoemaker and Kalverboer 1994, Rasmussen and Gillberg 2000, Skinner and Pick 2001, Green et al 2006, Poulsen et al 2008, Chen et al 2009), these preliminary results support emerging evidence that preschool-aged children with motor difficulties may also be experiencing social problems (Pick et al 2008). The early identification of these difficulties may suggest a potential direction for intervention with young children with DCD; however, this needs to be more fully explored.

**Limitations of the study**

The results from this preliminary study are limited by several factors, including the small sample size and the absence of a formal diagnosis of DCD. While care was taken to fulfill Criteria A, B and C of the DSM-IV-TR guidelines (APA 2000), Criterion D was not formally assessed (see Table 1). Given the nature of the German health and education systems, where children are screened from a very early age for both physical and intellectual disabilities and subsequently separated into either mainstream or special preschools and schools, it was decided to recruit only from mainstream preschools and so spare the child participants from the extra burden of formal cognitive testing. A further limitation is that neither of the play measures has been translated into German. Although it would have been preferable to use German-language measures, to our knowledge none exists. This limitation was addressed by the use of raters fluent in both languages and, therefore, able to use the measures and to understand the children’s conversation and interactions observed on video.

**Conclusion**

These results indicate that preschool children with DCD are already engaging in different play behaviours from, and with lower frequencies than, their typically developing peers. This is likely to minimise their opportunities to develop these motor and play skills. Difficulties in social interaction seem to be evident at a younger age than has previously been described. A further study with a larger sample size is needed to confirm these findings, and this is currently under way in early childcare settings in Germany.

**Acknowledgements**

Thank you to Anja Junkers for assistance with rating the films and establishing interrater agreement. Thank you also to the children, their families and the kindergartens for taking part in this study.

**Conflict of interest:** None declared.

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**Key findings**

- Preschool children with DCD demonstrated less mature gross and fine motor play than their typical peers.
- Higher incidence of negative affect, aggression and onlooker behaviour was observed in children with DCD, suggesting social interaction difficulties.

**What the study has added**

This preliminary study expands what is known about the play of young children with DCD.

**References**


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**Thesis abstracts**

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**Jennifer Lindsey Wenborn**

**Occupational therapy and people with dementia in care homes.**

University College London, 2010. PhD.

**Background:** Lack of activity within care homes decreases quality of life. Staff often lack the knowledge and skills to provide meaningful activity at an appropriate level for residents with dementia.

**Aim:** To assess if occupational therapy intervention for people with dementia in care homes improves quality of life.

**Study 1:** The validity and reliability of the Pool Activity Level (PAL) checklist was assessed. A survey of activity providers demonstrated good content validity. When completed with 60 people with dementia, it showed: strong criterion, construct and concurrent validity with other measures; good internal consistency; and adequate inter-rater and test-retest reliability.

**Study 2:** This was a matched pair design cluster randomised controlled trial. Eight care homes (n = 104 residents) received the intervention, and eight (n = 106) continued usual care. The intervention comprised: environmental assessment; education sessions and individual coaching for staff who used the PAL checklist to assess and provide meaningful activities with two residents each. Primary outcome was quality of life. Measures were completed at baseline; 4 and 12 weeks post-intervention. Assessors were blinded to allocation and intervention content. Data from 159 residents at final follow-up were analysed by intention to treat. Quality of life, cognition, dependency declined; challenging behaviour increased; and symptoms of depression and anxiety reduced significantly in both groups. Multi-level modelling, adjusted for baseline, found no significant differences between groups on the primary outcome (quality of life) or other outcome measures.

**Conclusion:** Compliance to the intervention programme varied, so not all residents received enhanced activity provision. Homes with strong management commitment reported better quality of life for their residents. Future studies should consider alternative implementation and programme fidelity strategies, and more sensitive outcome measures to capture fully the potential impact of occupational therapy interventions. [Author abstract]

**Robert Workman**

**An examination of meaningful activity and retirement transition in a period of population ageing in Wales.**

Swansea University, 2010. MSc in Ageing Studies.

This qualitative study is an examination of meaningful activity and retirement transition in a period of population ageing in Wales. Semi-structured interviews were used to gather data from six older people regarding the changes in their activity patterns following retirement, their own perceptions of the benefits of engaging in meaningful activity, and whether differences in gender or marital status impact on activity engagement. Data were analysed by thematic analysis and seven main themes were identified.

Results suggest that the participants exhibit continuity of activity following retirement to maintain daily structure, social status, social contacts, and feelings of value, satisfaction and enjoyment. Gender roles were found to have an impact on activity choice but the participants in this study did not cite marital status as a significant factor.

The study concludes that while further research is required into the role that activity planning can have on the retirement transition process, there are possible implications for policy and occupational therapy practice in developing such formal planning as a health promotion intervention. [Author abstract]