



Reading and writing performances of children 7–8 years of age with developmental coordination disorder in Taiwan

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ARTICLE INFO

Article history:

Received 17 June 2011

Received in revised form 25 June 2011

Accepted 28 June 2011

Available online 15 August 2011

Keywords:

Developmental coordination disorder

Learning disorder

Reading

Writing

Academic achievement

ABSTRACT

Developmental coordination disorder (DCD) refers to a delay in motor development that does not have any known medical cause. Studies conducted in English speaking societies have found that children with DCD display a higher co-occurrence rate of learning difficulties (e.g., problems in reading and writing) than typically developing (TD) children. The present study examined the reading and writing performance of school-aged children with DCD and TD children in Taiwan to determine whether reading and writing difficulties also co-occur with DCD in a non-English speaking society. The Chinese Reading Achievement Test and the Basic Reading and Writing Test were administered to 37 children with DCD (7.8 ± 0.6 years) and 93 TD children (8.0 ± 0.7 years). Children with DCD had significantly lower writing composite scores than TD children on the Basic Reading and Writing Test (105.9 ± 20.0 vs. 114.4 ± 19.9). However, there were no significant differences between children with DCD and TD children in their scores on the Chinese Reading Achievement Test and in their reading composite scores on the Basic Reading and Writing Test. These results contrasted interestingly with those obtained from English-speaking children: English-speaking DCD children showed poorer reading and poorer writing than English-speaking TD children. The possibility that the logographic nature of the Chinese script might have protected the DCD children against additional reading difficulty is discussed.

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1. Introduction

Developmental coordination disorder (DCD) refers to a marked impairment in the development of the motor coordination of a child that interferes with his or her academic performance and daily activities, and this impairment cannot be explained by any medical cause (American Psychiatric Association [APA], 2010). The prevalence rate is around 6% in children between the ages of 5–11 years (APA, 2010). The rate is estimated to be 3–12% in Taiwan (Cheng, Chen, Tsai, Chen, & Cherng, 2009; Lin & Wu, 2002).

Studies in Western countries have noted that children with DCD are at a high risk of a co-occurring reading difficulty or learning disorder (Alloway & Archibald, 2008; Dewey, Kaplan, Crawford, & Wilson, 2002; Jongmans, Smits-Engelsman, &

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Schoemaker, 2003; Kadesjö & Gillberg, 1999; Lingam, Golding, Jongmans, Hunt, & Ellis, 2010). Kadesjö and Gillberg (2001) noted that DCD was associated with reading comprehension problems in 10-year-old children. Dewey et al. (2002) noted that both children with DCD and children suspected of having DCD displayed significant difficulties in reading, writing, and spelling relative to comparison children, even when their intelligence (Full Scale IQ of WISC-III) was controlled. Children with DCD and children suspected of having DCD also showed significant problems in attention and psychosocial adjustment (Dewey et al., 2002). Alloway and Temple (2007) also noted that children with DCD are not only characterized by motor deficits but also by cognitive problems in visuospatial working memory, verbal working memory, literacy learning and mathematics learning. A recent report from a population-based cohort longitudinal study showed that DCD in children was associated with difficulties in attention, social communication, reading and spelling. The odds ratios for these difficulties were 1.94, 1.87, 3.35 and 2.81, respectively (Lingam et al., 2010).

Co-occurrence of DCD with learning difficulties has not been systematically studied in non-English speaking children. We were interested in examining this co-occurrence particularly with respect to reading and writing among Chinese-speaking children. The English and the Chinese scripts are very different: the English script is alphabetic, whereas the Chinese script is logographic. This orthographic difference has been shown to result in different cognitive demands in reading and writing tasks and probably gives rise to different reading and writing problems (Chung & Ho, 2010; Rozin, Poritsky, & Sotsky, 1971; Siok, Niu, Jin, Perfetti, & Tan, 2008; Siok, Perfetti, Jin, & Tan, 2004). Accordingly, the co-occurrence of DCD with reading and writing problems might display a different pattern among Chinese-speaking children than was previously found among English-speaking children.

Many studies have also observed a high co-occurrence of DCD with other developmental disorders such as attention-deficit/hyperactivity disorder (ADHD) (Dewey, Wilson, Crawford, & Kaplan, 2000; Fliers et al., 2008; Gillberg et al., 2004; Landgren, Kjellman, & Gillberg, 1998). Because ADHD is associated with learning difficulty (Dennis & Cantwell, 1991; Riccio, Gonzalez, & Hynd, 1994), the observed co-occurrence of DCD with reading and writing difficulties may, in part, be due to the co-occurrence of DCD with ADHD, which was not ruled out in previous studies.

The purpose of this study was to examine the reading and writing performance of children with DCD but without ADHD in Taiwan, a Chinese-speaking society, and to compare them with those of TD children. We hypothesized that the children with DCD would show poorer writing performance but probably not poorer reading performance than the TD children. The motor ability of the children with DCD would be more strongly correlated with their writing performance than with their reading performance because writing involves more motor components than reading.

2. Methods

2.1. Participants

Thirty-seven children with DCD (7.8 ± 0.6 years) and 93 TD children (8.0 ± 0.7 years) participated. The children with DCD were recruited from local primary schools and were free from any other developmental delay or physiological impairment, except for known motor difficulty. TD children were also recruited from the same primary schools and were free from any developmental delay or physiological impairment. ADHD was ruled out in both groups of children by the Children Activity Questionnaire (Hsu, Lin, & Kuo, 1982). All the parents gave their written informed consent before their children entered the study, which was approved by the institutional review board.

2.2. Clinical assessment and measurement

2.2.1. IQ tests

The mental status of the children was assessed with the Chinese version of the Peabody Picture Vocabulary Test Revised (C-PPVT-R) and the Chinese version of the Tony Nonverbal Intelligence Test (C-TONI, 3rd ed.). The C-PPVT-R is a revision of the PPVT-R (Dunn & Dunn, 1981) based on 886 children between the ages of 3–12 years (Lu & Liu, 2005). It has been widely used in Taiwan as a standard measure of receptive vocabulary and as a screening test of verbal ability due to its high reliability (split-half reliability, $r = 0.90$ – 0.97 ; test–retest reliability, $r = 0.84$ – 0.90), objectivity and quick administration. The C-TONI, 3rd ed. was translated from the third version of TONI (Brown, Sherbenou, & Johnsen, 1982) and standardized for children between the ages of 4–16 years and 5 months in Taiwan (Wu et al., 2007). It has been used as a nonverbal IQ test.

2.2.2. Motor test

The Movement Assessment Battery for Children (Movement ABC) was used to examine the motor ability of the children and to identify children with DCD (Henderson & Sugden, 1992). The Movement ABC consists of eight items categorized into three subtests of manual dexterity, ball skills, and balance. Each item produces an impairment score ranging from 0 to 5. The sum of the impairment scores yields the total impairment score, which can be converted into a percentile-equivalent score based on the norm. The higher the subtest score and total impairment score, the worse the motor skill performance (Henderson & Sugden, 1992). The higher the Movement ABC total percentage rank score, the better the motor skill performance. In this study, DCD was identified when the percentile rank score of a child was lower than 15.

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