Research in Developmental Disabilities 30 (2009) 1237–1247

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Memory profiles in children with mild intellectual disabilities: Strengths and weaknesses

Mariët J. Van der Molen [a,b,*], Johannes E.H. Van Luit [a], Marian J. Jongmans [c,a], Maurits W. Van der Molen [d]

[a] Department of General and Special Education, Utrecht University, The Netherlands
[b] 's Heeren Loo Zorggroep, Ermelo, The Netherlands
[c] Department of Pediatric Psychology, Wilhelmina Children's Hospital, University Medical Centre Utrecht, The Netherlands
[d] Department of Psychology, University of Amsterdam, The Netherlands

ARTICLE INFO

Article history:
Received 6 April 2009
Accepted 28 April 2009

Keywords:
Working memory
Mild mental retardation
Special education
Cognitive profiles
Behavioral problems

ABSTRACT

Strengths and weaknesses in short-term memory (STM) and working memory (WM) were identified in children with mild intellectual disabilities (MID) by comparing their performance to typically developing children matched on chronological age (CA children) and to younger typically developing children with similar mental capacities (MA children). Children with MID performed less well on all measures compared to the CA children. Relative to the MA children, especially verbal WM was weak. Subsequent analyses yielded distinct MID subgroups each with specific memory strengths and weaknesses. These findings hold implications for the demands imposed on children with MID in education and daily life.

Working memory (WM) deficits are known to exist in children and adults with moderate or severe intellectual disability (IQ below 55; see for a recent review Gathercole & Alloway, 2006). The literature on WM functioning in children with mild intellectual disabilities (MID; IQ 55–85), however, is relatively scant.[1] The aim of the present study was to identify WM strengths and weaknesses in children with MID and to explore whether subgroups exist with unique WM profiles within this heterogeneous population.

* Corresponding author at: University of Amsterdam, Department of Psychology, Roetersstraat 15, 1018 WB Amsterdam, The Netherlands. Tel.: +31 20 5256830; fax: +31 20 6390279.
E-mail address: M.J.vanderMolen@UvA.nl (M.J. Van der Molen).

[1] In this study we adopted the 55–85 IQ range for mild intellectual disabilities. This IQ range is used in Dutch governmental policy for special education and special services rather than the DSM-IV-TR (American Psychological Association, 2000) classifications for mild mental retardation (IQ 50–70) or borderline intellectual functioning (IQ 70–85).

0891-4222/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ridd.2009.04.005

Working memory, which refers to the ability to temporarily store and manipulate information simultaneously (Baddeley, 1986), has been studied extensively during the past decennia (Jarrold & Towse, 2006). WM is considered a central construct in cognitive psychology (Cowan, 1999; Engle, Kane, & Tuholski, 1999; Shah & Miyake, 1999) and plays an important role in scholastic activities, including language comprehension (e.g. Daneman & Merikle, 1996) and arithmetics (e.g. Bull & Sceriff, 2001). WM should be differentiated from short-term memory (STM) as WM involves both the active maintenance of verbal or visuo-spatial information (respectively, verbal STM and visuo-spatial STM) and at the same time the manipulation of information. Besides a conceptual difference, performance on STM and WM tasks relies on different neurophysiological processes in the brain. This is illustrated by the activation of the ventrolateral prefrontal cortex when STM tasks are carried out versus the activation of the mid-dorsolateral prefrontal cortex when WM tasks are being performed (e.g. Crone, Wendelken, Donohue, Van Leijenhorst, & Bunge, 2006).

Verbal STM is usually indexed by the number of items (digits or nonwords) that are reproduced in the same order as they were presented (Baddeley, 1986). An example of a visual STM test is the Corsi in which three-dimensional blocks have to be tapped in the same order as was shown (Baron, 2004). Verbal WM can be assessed by using Listening Recall (Pickering & Gathercole, 2001), in which people have to decide if a sentence is true or false (e.g. 'pigs drive cars'), and at the same time have to remember the last word ('cars'). Visual WM, finally, can be examined using the Odd-One-Out test (Henry, 2001; adapted from Hitch & McAuley, 1991). This test presents three symbols, one of which is slightly different, and the participant has to decide which one is different while at the same time remembering the position of the odd-one-out.

Assessment of performance of children with intellectual disabilities usually involves a comparison to typically developing children of the same chronological age (CA) or to younger typically developing children having the same mental age (MA). MA can either be calculated or derived from raw scores on intelligence tests.[2] When children with intellectual disabilities perform less well than CA control children, it is assumed that they show a developmental delay. When they also perform less well than MA control children, it is assumed that they have a structural deficit (Bennet-Gates & Zigler, 1998).

Several studies have focused on WM and STM functioning in individuals with specific developmental disorders, including Down syndrome (e.g. Jarrold, Baddeley, & Hewes, 2000; Lanfranchi, Cornoldi, & Vianello, 2004) or Williams syndrome (e.g. Devenny et al., 2004). Reviewing this literature, Gathercole and Alloway (2006) discussed the patterns of specific strengths and weaknesses characterizing different populations with neurodevelopmental disorders. Individuals with Down syndrome, for example, consistently show a verbal STM deficit while their visuo-spatial STM is relatively intact. In contrast, individuals with Williams syndrome show visuo-spatial STM deficits, while their verbal STM is relatively intact (Gathercole & Alloway, 2006).

To date, studies of WM functioning in individuals with developmental disorders of non-specific origin focused primarily on persons with moderate to severe intellectual disabilities (i.e., mean IQ scores below 55; e.g. Bayliss, Jarrold, Baddeley, & Gunn, 2005; Henry & Maclean, 2002; Numminen, Service, & Ruoppila, 2002). As indicated above, studies examining WM functioning in children with MID are relatively rare. This is rather unfortunate, as children with MID represent the largest group within the total population of disabled children. An international review indicated that the prevalence of children with an IQ score between 50 and 70 is estimated to be about 3% compared to 0.4% for children with an IQ score below 50 (Roeleveld, Zielhuis, & Gabreëls, 1998).

To the best of our knowledge, only three studies examined WM functioning in children with an IQ score between 55 and 85. Henry (2001) compared a group of children with an IQ score between 70 and 85 and a group of children with an IQ score between 55 and 70 to a typically developing CA control group on a variety of tests measuring STM (Word Recall, Digit Recall, Spatial span, Pattern span) and WM (Listening Recall, Backward Digit Recall, Odd-One-Out test). The group in the lower IQ range showed delays on all the administered STM and WM tasks compared to the CA group. The group in the higher IQ range showed delays on verbal STM tasks compared to the control group, but their visuo-spatial STM and verbal WM appeared to be intact. A recent study, reported by Hasselhorn and Mähler

[2] Mental age = (IQ score × chronological age)/100. The chronological age at which the mean raw score of a group of people with intellectual disabilities indicates an IQ score of 100 is the mental age.