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Predictive validity of kindergarten assessments on handwriting readiness

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ABSTRACT

We investigated the predictive value of a new kindergarten assessment of handwriting readiness on handwriting performance in first grade as evaluated by the Systematic Screening for Handwriting Difficulties (Dutch abbreviation: SOS). The kindergarten assessment consisted of the Writing Readiness Inventory Tool In Context (WRITIC), the Beery-Buktenica Developmental Test of Visual-Motor Integration (Beery^{TM}VMI) and the Nine-Hole Peg Test (9-HPT). The WRITIC evaluates in kindergarten children (aged 5–6 years) prewriting skills, the Beery^{TM}VMI and 9-HPT evaluate visual motor integration and fine-motor coordination, all elements important for handwriting readiness. In kindergarten, 109 children (55 boys; mean age 70 months, SD 4.8 months) were tested with the WRITIC, Beery^{TM}VMI and 9-HPT and one year later in first grade (mean age 85 months, SD 4.5 months) with the SOS. A multivariable linear mixed model was used to identify variables that independently predict outcomes in first grade (SOS): baseline scores on WRITIC-TP, Beery^{TM}VMI, 9-HPT, 'sustained attention,' 'gender,' 'age' and 'intervention' in the intermediate period. The results showed that WRITIC-TP, Beery^{TM}VMI, and 9-HPT, 'sustained attention,' 'gender' and 'intervention' had all predictive value on the handwriting outcome. Thereby WRITIC-TP was the main predictor for outcome of SOS-Quality, and Beery^{TM}VMI and 9-HPT were the main predictors of SOS-Speed. This kindergarten assessment of WRITIC-TP, Beery^{TM}VMI, and 9-HPT contributes to the detection of children at risk for developing handwriting problems.

1. Introduction

Despite the increased availability of computers, tablets, and smartphones, handwriting still remains an important tool for written communication and knowledge assessment for students (Cahill, 2009). Skilled handwriting is vital for children to

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learn during the first years at school because writing is learned multimodal and is strongly related to reading and spelling (Longcamp et al., 2008; Longcamp, Zerbato-Poudou, & Velay, 2005). Therefore, early detection of possible problems in the learning process of handwriting is important for the prevention of handwriting problems at a later age.

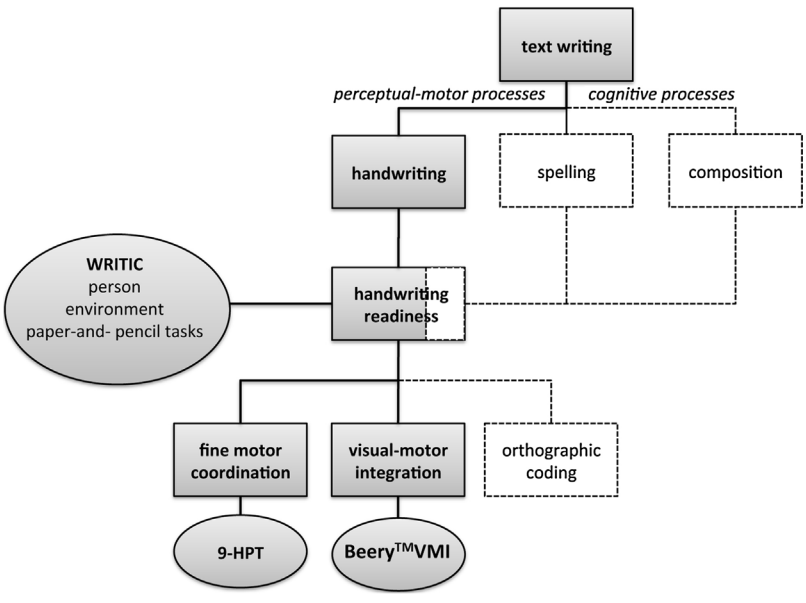
Handwriting problems are related to poor writing legibility, low speed and complaints as experiencing pain, strain or discomfort during writing. The prevalence of handwriting problems in children from 6 to 12 years ranges between 12% and 33% (Overvelde et al., 2011). Handwriting problems have a negative effect on a child's academic performance and self-esteem (Ratzon, Efraim, & Bart, 2007). Therefore, early evaluation of prewriting skills is of major importance to indicate the need for tailored advice and intervention (Ratzon et al., 2007). These prewriting skills are predominantly trained during the kindergarten period, and therefore, this period seems the most efficient period for intervention (Heckman, Stixrud, & Urzua, 2006).

Children learn prewriting skills in kindergarten (in The Netherlands at the age of 5–6 years). In this phase, they learn to produce different writing patterns with an appropriate dynamic pencil grip and an adequate sitting posture. After this period, children start in grade one with un-joined cursive script and later on with joined cursive script. Although in different countries children start at different ages with learning handwriting skills, the order of the skills to be learned is the same. Children learn first the prewriting skills (letter like patterns like garlands) and later the handwriting skills in manuscript or (un) joined cursive script.

In Fig. 1, we describe the conceptual model used to identify the factors related to writing readiness. This model displays that in learning 'text writing' two main processes are involved: the perceptual-motor process 'handwriting,' and the cognitive processes of 'spelling' and 'composition' (Berninger, 2009; Overvelde et al., 2011; Richards et al., 2011). If handwriting skills are not fluent and automated, the use of higher-level cognitive skills in the working memory can be attenuated, which can negatively influence text writing (Peverly, 2006; Wallen, Duff, Goyen, & Froude, 2013).

In this study, we focus on the perceptual-motor processes of 'handwriting readiness' (Marr, Windsor, & Cermak, 2001; Schneck & Amundson, 2010). Handwriting readiness is defined as a developmental stage at which a child has the capacity to profit satisfactorily from the instruction given in the teaching of handwriting (Marr et al., 2001). In this study handwriting readiness is measured as having a proper seating posture (Pollock et al., 2009; Schneck & Amundson, 2010), a mature pencil grasp (Schwellnus et al., 2012, 2013) and performing age-appropriate coloring, writing patterns, writing own name and copying letters and numbers. Children who are taught handwriting before they are ready may become discouraged and develop poor writing habits that may be difficult to correct later, e.g. a static pencil grip that leads to cramp or forced handwriting (Benbow, 2006).

Two performance components are identified by the literature related to the perceptual-motor process of handwriting (readiness): fine motor coordination (Berninger, 2009; Feder et al., 2005) and visual-motor integration (Daly, Kelley, & Krauss, 2003; Marr et al., 2001; Volman, van Schendel, & Jongmans, 2006). Fine motor coordination or 'fine hand use' (d 440) according to the International Classification for Functioning, Disability and Health, is defined as "performing the coordinated



WRITIC - Writing Readiness Inventory Tool In Context; Beery™VMI - Beery-Buktenica Developmental Test of Visual-Motor Integration; 9-HPT - Nine-Hole Peg Test

Fig. 1. Adjusted conceptual model of handwriting readiness and its relation to handwriting, text writing and performance components (Berninger, 2009; Marr, Windsor, & Cermak, 2001; Overvelde et al., 2011; Richards et al., 2011; Schneck & Amundson, 2010; van Hartingsveldt, Cup, et al., 2014; van Hartingsveldt, de Vries, et al., 2014; Volman, van Schendel, & Jongmans, 2006).