Research in Developmental Disabilities 35 (2014) 512–519

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Factor analysis of the Contextual Fine Motor Questionnaire in Children

Chin-Kai Lin [a], Ling-Fu Meng [b,1,*], Ya-Wen Yu [c], Che-Kuo Chen [d], Kuan-Hua Li [e]

[a] Program of Early Intervention, Department of Early Childhood Education, National Taichung University of Education, Taichung, Taiwan
[b] Department of Occupational Therapy and Graduate of Institute of Behavioral Science, Chang Gung University, Taoyuan, Taiwan
[c] Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, Omaha, NE, USA
[d] Division of Occupational Therapy, Endeavor Rehabilitation Clinic, Taipei, Taiwan
[e] Department of Physical Medicine and Rehabilitation, Chung Shan Medical University Hospital, Chung Shing Branch, Taichung, Taiwan

ARTICLE INFO

Article history:
Received 21 June 2013
Received in revised form 4 November 2013
Accepted 6 November 2013
Available online 25 December 2013

Keywords:
Typical development
Psychometric properties
Hand skills
Tool-use

ABSTRACT

Most studies treat fine motor as one subscale in a developmental test, hence, further factor analysis of fine motor has not been conducted. In fact, fine motor has been treated as a multi-dimensional domain from both clinical and theoretical perspectives, and therefore to know its factors would be valuable. The aim of this study is to analyze the internal consistency and factor validity of the Contextual Fine Motor Questionnaire (CFMQ). Based on the ecological observation and literature, the Contextual Fine Motor Questionnaire (CFMQ) was developed and includes 5 subscales: Pen Control, Tool Use During Handicraft Activities, the Use of Dining Utensils, Connecting and Separating during Dressing and Undressing, and Opening Containers. The main purpose of this study is to establish the factorial validity of the CFMQ through conducting this factor analysis study. Among 1208 questionnaires, 904 were successfully completed. Data from the children's CFMQ submitted by primary care providers was analyzed, including 485 females (53.6%) and 419 males (46.4%) from grades 1 to 5, ranging in age from 82 to 167 months ($M = 113.9$, $SD = 16.3$). Cronbach's alpha was used to measure internal consistency and explorative factor analysis was applied to test the five factor structures within the CFMQ. Results showed that Cronbach's alpha coefficient of the CFMQ for 5 subscales ranged from .77 to .92 and all item-total correlations with corresponding subscales were larger than .4 except one item. The factor loading of almost all items classified to their factor was larger than .5 except 3 items. There were five factors, explaining a total of 62.59% variance for the CFMQ. In conclusion, the remaining 24 items in the 5 subscales of the CFMQ had appropriate internal consistency, test-retest reliability and construct validity.

1. Introduction

1.1. Background

A student spends as much as 30–60% of his or her school day performing fine motor tasks. In some classrooms, the predominate learning venue is fine motor activities (McHale & Cermak, 1992) Fine motor is a necessary component for good

* Corresponding author at: Department of Occupational Therapy and Graduate of Institute of Behavioral Science, Chang Guang University, 259 Wen-Hwa 1st Road, Kwei-Shan, Taoyuan, Taiwan. Tel.: +886 3 2118800x5471; fax: +886 3 2118700.
E-mail addresses: linchinkai97@gmail.com (C.-K. Lin), lfmeng@mail.cgu.edu.tw (L.-F. Meng), yawenyu@unomaha.edu (Y.-W. Yu), chekuochen@gmail.com (C.-K. Chen), parallel-line@hotmail.com (K.-H. Li).
[1] Author contributed equally to the first author.

0891-4222/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ridd.2013.11.007

eye–hand coordination, handwriting, and daily activities at school. Poor fine motor proficiency could then adversely affect student performance. Fine motor difficulties can have a negative effect on various fields of social and emotional development in daily life and academic performance (Jackman & Stagnitti, 2006). In the USA, it was estimated as high as 20% of the prevalence of fine motor difficulties for children at the primary school level (Hammerschmidt & Sudsawad, 2004). In a class of 22 school aged students in Australia, there were roughly 2–3 students with fine motor difficulties (Jackman & Stagnitti, 2006). Understanding children's fine motor skills assists a therapist to promote student's performance in academic pursuits, daily living activities, and table work. Thus, a comprehensive evaluation to know the performances of different activities in family and school is essential for children to grow and develop.

1.2. The three types of tests for evaluating fine motor

Currently, in situations combining developmental domains, there are 3 categories of fine motor assessment: (1) tests designed to measure fine motor with gross motor domains, (2) tests designed to measure fine motor with other non-motor domains, and (3) tests designed to only measure fine motor.

1.2.1. Tests designed to measure fine motor and gross motor domains

Most instruments fall into this category: Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) (Bruininks, 2005), Movement Assessment Battery for Children (Movement ABC) (Henderson & Sugden, 1992), the Peabody Developmental Motor Scales (PDMS) (Folio & Fewell, 2000a, 2000b), Pediatric Evaluation of Disability Inventory (PEDI) (Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992), Developmental Coordination Disorder Questionnaire for parents (DCD-Q) (Cairney, Missiuna, Veldhuizen, & Wilson, 2008; Nakai, Miyachi, & Okada, 2011; Rihtman, Wilson, & Parush, 2011; Schoemaker et al., 2006; Tseng, Fu, Wilson, & Hu, 2010), and School Function Assessment (SFA) (Coster, Deeney, Haltiwanger, & Haley, 1998). Additionally, the Bruininks-Oseretsky Test of Motor Proficiency for the assessment of gross and fine motor skills has four factors: gross and fine motor skills, eye–hand coordination, balance-coordination and speed, and visual-motor coordination (Hassan, 2001). Moreover, some factor analysis studies (Cairney et al., 2008; Schoemaker et al., 2006; Tseng et al., 2010) for DCD-Q have been conducted. The results of these studies found that factors that were inconsistent from three studies, but in general, factors including general coordination, fine motor/writing, control during movement, and gross motor control/planning were consistent (Schoemaker et al., 2006).

1.2.2. Tests designed to measure fine motor combined with gross motor and other non-motor domains

Sensory Profile (Dunn & Brown, 1997), Yale Children's Inventory (YCI) (Olafsen & Sommerfelt, 1999), Children's Perception of Motor Competence Scale (CPMCS) (Perez & Sanz, 2005) and McHale & Cermak's (1992) four categories are examples containing fine motor and other non-motor domains. Factor analysis for the Sensory Profile revealed nine discreet factors which indicate sensory modulation and responsiveness: sensory seeking, emotionally reactive, low endurance/tone, oral sensory sensitivity, inattention/distractibility, poor registration, sensory sensitivity, sedentary, and fine motor/perceptual (Dunn & Brown, 1997). For the YCI scale, there are four factors (attention, activity, tractability, and fine motor) produced to support theoretical constructs (Olafsen & Sommerfelt, 1999). Through exploratory and confirmatory factor analysis for the CPMCS, factors consisted of one scale of Perceived General Motor Competence and two subscales: Perceived Gross Motor Competence and Perceived Fine Motor Competence (Perez & Sanz, 2005). McHale and Cermak (1992) presented four categories: (1) fine motor tasks (requiring a major use of one's hands, such as writing and using scissor); (2) integrated fine motor tasks (performing fine motor and other academic activities simultaneously, such as completing work sheets instructed by teacher); (3) other academic tasks (not requiring frequent use of one's hands, such as reading), and (4) non-academic activities (performing functional or transitional movements, such as collecting lunch money, moving from one place to another). McHale and Cermak's original work provided the scope to consider contextual and activity factors when assessing fine motor skills. However, those four categories have to be observed in the classroom carefully by trained evaluators and much time are needed to complete the evaluation. Moreover, there is no factor analysis to see if the construct is four-dimensional.

1.2.3. Tests designed to only measure fine motor

This type of instrument was developed for adults. The Test of Fine Motor Functions (TFMF) evaluates the functions of fine motor in patients with idiopathic Parkinson's disease (Ringendahl, 2002). The TFMF is not a suitable as a measuring tool for children. However, some tests have been designed to measure fine motor in children but were not developed to conduct the factor analysis (e.g. the Preschool Fine Motor Scale, PFMS). Items in the PFMS included 9 tasks: (1) cut light card; (2) pick up and insert beans into a bottle; (3) thread beads on a lace; (4) construct a pyramid with blocks; (5) construct towers with blocks; (6) trace an angular path; (7) pencil grasp, (8) operate finger opposition, and (9) perform successive finger opposition. Marr, Cermak, Cohn, and Henderson (2003) observed the fine motor activities for 40 children with 4-year-old in Head Start classrooms. Head Start is a federally funded preschool program that provides comprehensives services to both low-income children and their families. They categorized fine motor activities into 2 categories: fine motor activities with no academic purpose and fine motor activities with academic purpose (Marr et al., 2003). The activities of fine motor with no academic purpose consisted of art activities, manipulative play, hygiene, and daily living. The activities of fine motor with academic purpose involved handwriting, cutting, or gluing paper.