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Research in Developmental Disabilities



The development of a multimedia online language assessment tool for young children with autism



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ARTICLE INFO

Article history:

Received 7 May 2013

Accepted 27 June 2013

Available online 22 August 2013

Keywords:

Autism

Computer-assisted technology

Language assessment

Hyperlexia

ABSTRACT

This study aimed to provide early childhood special education professionals with a standardized and comprehensive language assessment tool for the early identification of language learning characteristics (e.g., hyperlexia) of young children with autism. In this study, we used computer technology to develop a multi-media online language assessment tool that presents auditory or visual stimuli. This online comprehensive language assessment consists of six subtests: decoding, homographs, auditory vocabulary comprehension, visual vocabulary comprehension, auditory sentence comprehension, and visual sentence comprehension. Three hundred typically developing children and 35 children with autism from Tao-Yuan County in Taiwan aged 4–6 participated in this study. The Cronbach α values of the six subtests ranged from .64 to .97. The variance explained by the six subtests ranged from 14% to 56%, the current validity of each subtest with the Peabody Picture Vocabulary Test-Revised ranged from .21 to .45, and the predictive validity of each subtest with WISC-III ranged from .47 to .75. This assessment tool was also found to be able to accurately differentiate children with autism up to 92%. These results indicate that this assessment tool has both adequate reliability and validity. Additionally, 35 children with autism have completed the entire assessment in this study without exhibiting any extremely troubling behaviors. However, future research is needed to increase the sample size of both typically developing children and young children with autism and to overcome the technical challenges associated with internet issues.

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1. Introduction

There is good evidence that computer-aided learning is well accepted by children with autism and is of great potential benefit to them. Numerous assistive technology options are available to support learning and communication for children with autism and related disorders. For example, Colby (1973) demonstrated the effectiveness of a computer program for increasing the voluntary speech of 13 children with autism with limited communication skills. Moore, McGrath, and Thorpe (2000) described how computer-assisted instruction (CAI) might serve to ameliorate the social deficits that are a cardinal feature of autism spectrum disorders (ASD) through the use of multimedia programs. Self, Scudder, Weheba, and Crumrine (2007) have used virtual reality technology to teach appropriate social responses to children with autism within the context of computer-controlled formats.

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Moore et al. (2000) suggested that individuals with ASD might benefit from the incorporation of preferred stimuli into multimedia programming. Individuals with ASD have been shown to be more motivated and exhibit fewer inappropriate behaviors during CAI than during traditional one-on-one instruction (Chen & Bernard-Opitz, 1993; Moore & Calvert, 2000). Additionally, these students have expressed enjoyment and exhibited increased compliance and decreased disruptive behavior during CAI (Bosseler & Massaro, 2003; Heimann, Nelson, Tjus, & Gillberg, 1995).

Despite its widespread availability, the literature related to technology applications was sparse, especially in the field of the assessment of young children with special needs. Due to the limited communication and behavior problems during the test, it is always challenging for professionals to conduct early assessments of young children with special needs. Some young children with autism are even classified as *untestable*, and the test results always focus on the communication and social deficits of young children with autism, not on their unique learning strengths, such as *hyperlexia*.

Silberberg and Silberberg (1967) coined the term *hyperlexia* to describe children with superior word recognition skills, usually in the presence of poor reading comprehension and deficits in linguistic or cognitive functioning. Following Silberberg and Silberberg (1967), the term *hyperlexia* has been used to refer to an unusually well-developed ability to read single words in children with comprehension deficits and behavior abnormalities. In the literature published to date on the studies of hyperlexia, we found that a higher proportion of older (aged 6–12) hyperlexic children participated in these studies. However, as suggested by Needleman (1982), one of the criteria for *hyperlexia* was the early manifestation of single-word reading/decoding skills (as early as age 2, but usually by age 5). Previous researchers were hardly able to recruit *hyperlexia* children as young as age 5 for their studies, partially because of a lack of assessment instruments targeting younger children with ASD. For example, Nation, Clarke, Wright, and Williams (2006) investigated reading skills in 41 children with ASD. Sixty-eight families of children with ASD aged between 6 and 15 years of age were invited to take part in the study. A total of 40 families, 41 children (36 boys and 5 girls), participated in the study. The mean age of the sample was 10.33. Newman et al. (2007) compared the reading-related skills of children with ASD who have hyperlexia (HPL) with age-matched children without ASD and with single-word reading-matched typically developing children. In this study, the ASD + HPL group included 18 male and 2 female probands, aged 3.0–19.75 (mean = 10.41, SD = 4.65).

Perfetti, Landi, and Oakhill (2005) described two major classes of processing events that are necessary for successful reading comprehension: (1) the identification of words and (2) the engagement of language-processing mechanisms that assemble words into messages. Successful reading comprehension demands that both sets of processes operate accurately. Nation et al. (2006) study demonstrated the heterogeneous nature of reading skills in children with ASD. Some children with ASD read accurately but showed very poor comprehension, consistent with a hyperlexic profile. However, some children with ASD were poor at reading words and nonwords, whereas others were unable to decode nonwords.

Traditionally, children begin their formal literacy instruction before their 5th birthday, and by 6 years of age, their reading skills are becoming reasonably well established in the normal population. Therefore, most decoding or reading comprehension assessments start at age 6. However, due to the unusual learning characteristics of young children with ASD, the current project proposes a more comprehensive and detailed computer-aided language assessment system using multimedia technology. Both visual and audio subtests are utilized to measure the discrepancy between responses between subtests and for the early identification of the children's language-learning characteristics (i.e., visual or auditory). The test results can be stored, through the internet, in a remote database, which then becomes accessible to early childhood special education professionals. Future updates of the assessment software are also readily downloadable via the internet. This multi-media, web-based online assessment system aims to assist professionals in the early detection of the unique language learning characteristics of young children with ASD.

2. Methods

2.1. Participants

The normal group comprised 300 valid samples. The samples were collected from the 4 geographic areas of the North, South, Mountainside and Seaside in Tao-Yuan County of Taiwan. The method of stratified random sampling was employed in accordance with the population size of each geographic area. Based on the sample size of each area, the number of samples needed for the groups of four-, five-, and six-years-old was determined. One hundred participants were recruited for each of the three age-level groups. The ratio was approximately even for both sexes. Table 1 shows the sample sizes of the groups across geographic areas, age, and gender.

An atypical group, 35 young children with ASD aged 4–6, was also included in this study: 5 four-year-olds, 7 five-year-olds and 23 six-year-olds. They were all referred by the Department of Pediatric Psychiatry at the Chang Gung Memorial Hospital, Tao-Yuan, Taiwan. Each one was diagnosed with ASD by pediatric psychiatrists.

2.2. Instruments

2.2.1. Peabody picture vocabulary test-revised

The Taiwanese version of the Peabody Picture Vocabulary Test (PPVT-R) was translated and standardized by Lu and Liu in 1994. It includes two alternative forms, each with 125 test questions. The split-half reliabilities for the two alternative forms

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