

Comparing iPad[®] and Paper Assessments for Children With ASD: An Initial Study

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Abstract

iPad[®] and paper versions of a receptive vocabulary assessment were administered to 4- to 6-year olds with a diagnosis of autism spectrum disorder (ASD). No differences were found between scores on the two assessments. Standardized testing for children with ASD can be challenging; however, testing using the iPad[®] may offer a different avenue as it provides visual input that appears to be motivating. Findings suggest iPad[®] assessments offer an efficient format for itinerant speech-language pathologists (SLPs) and SLPs providing telepractice when creating individualized evaluation plans.

Keywords

assessment, autism, other pervasive developmental disorders, exceptionalities, vocabulary, technology iPad

Introduction

In today's society, there are many opportunities for children to use technology because of the availability of smartphones and tablets. One group of children who are particularly interested in mobile technology is children with autism spectrum disorder (ASD). Evidence has shown children with ASD process information better when it is paired with corresponding visual stimuli (Grandin, 2006; Lanter & Watson, 2008; Lanter, Watson, Erickson, & Freeman, 2012; Zenko, 2014), and technology provides visual input that appears to motivate children with ASD (Shane & Albert, 2008). In response to the preference to engage with technology, speech-language pathologists (SLPs) are including mobile technology tools such as the iPad[®] into assessment and intervention. Furthermore, children with ASD have an interest in electronics, demonstrate the ability to "tune out" (Shane & Albert, 2008, p. 1504) other distractions while engaged in electronic media, and operate the iPad[®] without instruction (Caron & Shane, 2014). These factors have been cited as influencing selection of the iPad[®] as a tool to conduct assessments, but few empirical studies exist.

Empirical Studies Utilizing Technology Assessment Formats for Children With ASD

Research regarding the use of iPad[®]s for children with ASD is in its infancy; however, some comparable research exists using computers. One such study was completed by Alt and Moreno

(2012) using the *Receptive One Word Picture Vocabulary Test, 2nd edition* (ROWPVT-2; Brownell, 2000b) and the *Expressive One Word Picture Vocabulary Test, 2nd edition* (EOWPVT-2; Brownell, 2000a) to examine differences between test presentation using traditional paper test plates and scanned test plates on a computer. Participants included 18 typically developing children and 18 children with high functioning ASD (as reported by parents) aged 5 years to 13 years. No difference was found between the two test formats for either participant group, and researchers found no advantage or disadvantage to using a static, traditional paper assessment or scanned traditional assessment displayed on the computer. Therefore, the researchers suggest scores from either the paper-based or computer-based ROWPVT-2 or EOWPVT-2 are considered reliable, but when selecting formats, professionals should consider the individual's needs.

Lin, Chang, Liou, and Tsai (2013) investigated the use of computers for an Internet-based literacy assessment. Participants included children who were typically developing and children diagnosed with ASD (as verified by pediatric psychiatrists). Lin et al. (2013) assessed early literacy skills. Of the 300 participants, 35 were diagnosed with ASD and all participants were 4- to 6-year olds. The researchers

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noted participants received visual reinforcement for correct answers through a picture of an apple displayed in the top right corner of the screen. Each time a child earned three apples, an animation occurred.

Results of Lin et al.'s (2013) study indicated participants with ASD scored higher than typically developing children on decoding, homographs, and the visual vocabulary subtests, but scored significantly lower on the auditory sentence comprehension subtest. These results imply children with autism perform better with visual as compared with auditory stimuli.

As technology has advanced from computers to mobile devices, standardized assessments are becoming available in iPad® format using apps such as Q-interactive® (NCS Pearson, 2015a). This system provides availability of several of Pearson Publishing Company's assessments in tablet format. Research from the publisher includes an equivalency study of the *Clinical Evaluation of Language Fundamentals, fifth edition* (CELF-5; Wiig, Semel, & Secord, 2013) on paper and Q-interactive® format with typically developing participants. Pearson also examined engagement of individuals with autism using the Q-interactive® format of the *Wechsler Intelligence Scale for Children, 5th edition* (WISC-V; Wechsler, 2014). In addition, research conducted by individuals not affiliated with Pearson (Jones, Stricklin, Buhr, & Nyquist, 2016) investigated the administration and scoring time of the Q-interactive® version of the *Goldman-Fristoe Test of Articulation, 3rd edition* (GFTA-3; Goldman & Fristoe, 2015), when assessing primarily typically developing children.

Pearson Publishing Company indicated examinees complete the CELF-5 in a similar fashion to the *Peabody Picture Vocabulary Test, fourth edition* (PPVT™-4; J. Henke, personal communication, August 25, 2015). However, no equivalency information concerning Q-interactive® and paper versions of the PPVT-4 (Dunn & Dunn, 2007) exist, prompting the current study.

Method

The aim of this study was to determine differences between paper and iPad® presentation of receptive vocabulary assessment, and the hypothesis being tested was children with autism would score better on the iPad® than on paper.

Participants

After approval from the institutional review board, participants were recruited from a university speech-language clinic, community advocacy groups for families of children with ASD and local school districts in a metropolitan area. Children in this study participated in a larger study using the iPad® as a means of assessment. A total of 15 children with a diagnosis of ASD met study requirements.

The chronological age of the children ranged from 4 to 6 years. Three participants were female and the other 12 were male. Eligibility requirements included (a) medical diagnosis of autism verified through school/medical record and the use of the *Childhood Autism Rating Scale, Standard Version, second edition* (CARS-2-ST; Schopler, Van Bourgondien, Wellman, & Love, 2010b) for children younger than 6 years old and the *Childhood Autism Rating Scale, High Functioning Version, second edition* (CARS-2-HF; Schopler, Van Bourgondien, Wellman, & Love, 2010a) for children 6 years of age, (b) hearing and vision within normal limits (or the participants wore corrective lenses) based on parent report, (c) English-speaking (not learning English as a second language), (d) verbal communication without the use of an augmentative alternative communication device as verified by the parents, (e) ability to independently attend to stimuli on a tablet device, (f) motor and physical abilities to manipulate a tablet device, and (g) receptive vocabulary score $\pm 1.5 SD$ from the mean on the paper PPVT in the larger study. The researchers selected the criteria of a receptive vocabulary score of $\pm 1.5 SD$ from the mean on the paper PPVT to assure no participants presented with co-occurring cognitive impairments.

Testing Sessions

Parents of potential participants completed a preliminary phone interview with the first author to confirm their child's eligibility for the study prior to attending testing sessions at the university clinic. All participants attended two testing sessions.

At the university clinic, the participant was seated in a child-sized chair at a table with the examiner in the seating arrangement outlined in the PPVT manual (Dunn & Dunn, 2007). Testing sessions were video-recorded using a Sony Handycam™ HDR-CX405 HD flash memory camcorder. The paper PPVT-4, Form A, was administered to all participants in the first session according to the procedures listed in the manual to assess receptive semantic language skills. The first author matched participants with ASD to participants who were typically developing for the larger study using the paper PPVT-4. The current study only focused on the participants with ASD. Therefore, random assignment to paper and iPad® versions of the assessment was not possible. The first author, a licensed and certified SLP, administered the PPVT-4 for both the first and second testing sessions.

During the second testing session, all participants were given the same receptive vocabulary test via the iPad® using Q-interactive® Form B. The setting and procedures of the second testing session mirrored the setting and procedures for the first session. With Q-interactive®, two iPad®s are used—one for the participant to respond and one for the administrator. Simultaneous test administration and scoring

Table 1. Descriptive Statistics of PPVT Scores of Children With Autism ($N = 15$).

Assessment Format	<i>M</i>	<i>SD</i>
iPad [®]	99.07	15.89
Paper	100.07	13.74

Note. PPVT = Peabody Picture Vocabulary Test.

occurred with Bluetooth connection technology between the two iPad[®]s. Test information was encrypted and stored on a secure server owned by Q-interactive[®]'s publisher (NCS Pearson, 2015b). The Q-interactive[®] platform scored and interpreted results for each test item based on the participant's responses. In addition, Q-interactive[®] calculated the raw score and standard score; therefore, the administrator's judgment was not a factor in the assessment. The authors obtained permission from Pearson to utilize Q-interactive[®], and none of the authors received financial compensation.

Procedures to Facilitate Participant Motivation

Participants used a work system (Hume, Loftin, & Lantz, 2009) on both days to assist them with understanding what tasks would be completed, how many tasks would be completed, and when the participants would be finished (Hume & Reynolds, 2010). In the current study and the larger study, the work system was structured in a left-to-right progression with assessment tasks contained in bins. The child was provided with a visual strip with icons. Each icon matched a bin containing a work task to be completed. The first author instructed the child to pick up an icon and match it to the icon on the corresponding bin. Once the child completed the work, the child placed it in a finished basket. This continued until the child removed all icons, which signaled to the child he or she had completed the work and he or she received a preferred reinforcer.

Results

Table 1 displays the mean and standard deviation of the iPad[®] and paper PPVT scores of the participants. Statistical analyses were performed using IBM SPSS Statistics Version 24 predictive analysis software. To test whether the children would perform significantly differently depending on the format, a paired samples *t* test was conducted. Differences between scores of children with autism on the iPad[®] PPVT and the traditional, paper PPVT were not significant, $t(14) = .580, p = .571, ns$. The effect size was small, $d = 0.15$.

A Pearson correlation was conducted between scores from each format. This produced a strong and significant correlation, $r = .91, p < .01$.

Discussion and Implications

Previous studies by Pearson have shown no significant differences between paper and iPad[®] test presentations using assessments other than the PPVT available in the SLP portion of Q-interactive[®]. The results of the current study concur with their findings. It should be noted there are no interactive features (sounds, visual effects, etc.) on Q-interactive[®], rather, it is an iPad[®] format of the standard, paper test. Interactive features may influence performance.

Standardized testing for children with ASD can be challenging; however, testing using the iPad[®] offers a different avenue as it provides visual input that appears to be motivating. The current study demonstrates the PPVT Q-interactive[®] format and paper format are potentially equivalent test forms, supporting Pearson's claims that no differences exist between the test formats. Children with ASD responded similarly to assessments on the iPad[®] as they did to assessments on paper. Therefore, when SLPs are selecting assessment tools, the Q-interactive[®] platform is one format to consider. In particular, an assessment battery that is portable with the iPad[®] is more preferable to carrying around multiple testing materials. Therefore, itinerant SLPs may find the option of having assessments available on the iPad[®] beneficial. For the examinees, the Q-interactive[®] version of the assessment may be highly motivating to children with autism and/or other groups of children, but this has not been widely researched by individuals not associated with Pearson. Finally, assessments available via the iPad[®] have the potential to support SLPs providing telepractice.

Limitations

The small sample size may have limited statistical analysis. Given the requirements of the study for participants with ASD to be verbal, pass a language screening, and score no more than one and a half standard deviations below the mean on the PPVT, the pool of possible participants for the study was narrow. It is unknown how participants not meeting the study requirements would perform on iPad[®] tasks, particularly children who are not verbal, but who could complete a test for receptive vocabulary. Furthermore, it is unclear whether or how experience with both the iPad[®] and paper testing materials influenced these results as all participants had some prior experience with the iPad[®].

Future Studies

This study compared paper and iPad[®] assessment of receptive vocabulary. Future studies should continue to analyze differences between paper and iPad[®] formats, but investigate other vocabulary comprehension skills. Much of the available research using iPads[®] focuses on children with ASD who are older than the participants in the current study

(Alt & Moreno, 2012). Furthermore, as suggested in the “Discussion and Implications” section, the interactive features (sounds, visual effects, etc.) of iPad® assessments warrant examination. Assessing other groups of children and expanding the sample size would allow for generalization of results to the population.

Declaration of Conflicting Interests

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