

April 2016

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### Recommended Citation

Plavnik, Joshua B. and Bak, M.Y. Savana (2016) "Description of a Computer-Based Reading Program for Children with Autism Spectrum Disorder," *Michigan Reading Journal*: Vol. 48 : Iss. 3 , Article 10.  
Available at: <https://scholarworks.gvsu.edu/mrj/vol48/iss3/10>

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# Description of a Computer-Based Reading Program for Children with Autism Spectrum Disorder



by Joshua B. Plavnick  
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One child in 68 is diagnosed with an autism spectrum disorder (ASD), which is a neurodevelopmental disorder that manifests in social communication deficits and repetitive behavior or restricted interests (Baio, 2014). Across the spectrum, individuals with ASD have very poor postsecondary outcomes, even when compared to individuals with other disabilities (Shattuck et al., 2012). Although higher literacy levels have been associated with successful post-secondary outcomes for individuals with ASD (Fleury et al., 2014), estimates suggest that at least 50% of children diagnosed with ASD lack the reading skills needed to achieve independence (Buescher, Cidav, Knapp, & Mandell, 2014). These are concerning outcomes, especially as costs associated with caring for older individuals with ASD rise (Buescher et al., 2014).

Recent advances in instructional and computational technologies create new opportunities for teaching children with ASD to read, though these approaches may not yet be broadly known in many educational service agencies. The purpose of the present paper is to describe a computer-based early reading program, Headsprout® Early Reading, and supplemental procedures that facilitate its implementation with children with ASD. We will discuss the potential this computer-based program has when used with supplemental procedures and the feasibility of implementing the program in schools.

## **Teaching Children with ASD to Read**

Educators face unique challenges in the delivery of effective and comprehensive reading instruction

to children with ASD. These include problem behaviors that interfere with active engagement and attending (Leekam, Prior, & Uljarevic, 2011), language deficits that limit children's ability to demonstrate acquisition of reading skills (Mirenda, 2003) and comprehend auditory or textual stimuli (Davidson & Weismer, 2014), and tendencies to focus on irrelevant stimuli (Ploog, 2010). Further complicating the reading instruction process, children with ASD vary dramatically in the symptomology they present, requiring individualized adaptations to off-the-shelf curricula. Because of these challenges, many educators might 'wait' to teach reading to children with ASD until interfering behaviors are sufficiently addressed and children demonstrate the expressive and receptive language abilities associated with 'readiness for reading instruction' (Mirenda, 2003). However, it is critical to provide reading opportunities to children with ASD during their first years in school, regardless of interfering behavior, to maximize their communicative and literacy development (Mirenda, 2003).

The challenges of prerequisite skill deficits, interfering behavior, and individualization are not unique to children with ASD and have been an

area of difficulty in providing effective academic instruction to children with learning delays and disabilities more broadly (Fuchs & Fuchs, 2006). Response to intervention (RTI) is a multi-tiered approach that was developed to meet diverse learning needs and improve academic outcomes for individuals with mild to moderate disabilities (Fuchs & Fuchs, 2006). In an RTI approach, students who struggle to reach predetermined learning criteria are provided with a precise level of necessary support for each child to make gains. Children with ASD may require more specific and specialized types of support and individualization to meet academic goals than most children with mild or moderate disabilities, though the data-based decision making and progressive application of intervention components in an RTI approach also aligns with evidence-based interventions for individuals with ASD (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010).

### **Computer assisted instruction**

Computer assisted instruction is an evidence-based practice for children with ASD (Wong et al., 2015) and offers several features that can ease the task of teaching reading to this population. Many children with ASD are particularly responsive to computers and appear to prefer the consistent and predictable instruction computers offer over instruction from teachers (Fletcher-Watson, 2014). Well-developed computer assisted reading instruction can reduce distractions by presenting learning targets clearly and repeatedly, and children may find the animation and audio engaging (Fletcher-Watson, 2014).

From the teacher's perspective, a benefit of using a computer to deliver reading instruction is that it can allow the teacher to focus on other requirements, such as behavioral supports necessary to sustain motivation and potential instructional supports necessary to supplement the computer-based instruction (Ramdoss et al., 2011). In addition, the computer program can consistently deliver instruction with a high degree of fidelity (Heiman, Nelson, Tjus, & Gillberg, 1995) and

can automatically record student responses (Layng, Stikeleather, & Twyman, 2004). Finally, pre-programmed algorithms for adaptive instruction can support moment to moment adjustments to student performance that are delivered instantly and flawlessly, ensuring individualized instruction at the precise level of support needed for each student.

### **Headsprout Early Reading**

It is now acknowledged that all areas of reading identified within the National Reading Panel (2000) report can be effectively taught to children with ASD (Browder, Ahlgrim-Dezell, Courtade, Gibbs, & Flowers, 2008; Cihak, 2007). However, most of the existing research involves instruction of isolated components as opposed to a comprehensive reading repertoire. Headsprout® Early Reading (hereafter Headsprout® or HER) is a computer-based reading program that incorporates all five areas of reading discussed in the National Reading Panel (2000) report. Its conceptualization and design is based on an integration of good literacy instruction and applied behavior analytic principles (Layng, Twyman, & Stikeleather, 2003), the latter of which represent the gold standard for teaching children with ASD (Wong et al., 2015). Headsprout® consists of 80 early reading episodes, all delivered online, as well as supplemental materials such as flashcards and printable stories children learn to read. A placement assessment allows teachers to determine the optimal reading level for children to begin the Headsprout® program, and benchmark assessments can be administered by teachers to ensure the child can read the sounds, words, and sentences taught over a series of episodes. Finally, the Headsprout® content is aligned to the Common Core Standards, as well as the Fountas and Pinell Reading Levels.

As thoroughly described by Layng et al. (2004), children progress through Headsprout® episodes at an individualized pace. Each episode is designed to ensure the learner masters target reading skills before building on those skills in subsequent

episodes. The instructional design built into Headsprout® requires that children respond correctly (e.g., select a correct sound, word, picture, or sentence) before moving on to more difficult content. The program scaffolds learning by providing instructional cues such as text highlighting, and it gradually fades those cues to promote independence. Each learning opportunity is followed by immediate feedback, and errors lead to repeated practice at a slightly easier level to ensure a high rate of correct responding. Headsprout® builds in cumulative review to ensure that previously taught skills are retained and exercised in various textual combinations. The software collects data during Headsprout® interaction and uses it to tailor the program to meet individual needs by offering moment-to-moment and lesson-to-lesson adaptations based on each student's prior response (e.g., rate of responding, ratio of corrects and errors), and by employing subroutines with branching capabilities to ensure that each student masters the concepts that lead to reading success. HER is readily available via Learning A-Z (<https://www.learninga-z.com/index.html>), at a cost of approximately \$200 per classroom of 36 children.

### **Using Headsprout with Struggling Readers**

Children who do not demonstrate reading delays can complete the 80 Headsprout® episodes and read up to 80 separate stories in approximately 30 hours of early reading instruction (Twyman, Layng, & Layng, 2012). Completion of the Headsprout® program aligns with a second-grade reading level. Although struggling readers might require additional instructional time to complete the program, the impressive results have been extended to children of diverse ages and backgrounds, including those with ASD (Grindle, Hughes, Saville, Huxley, & Hastings, 2013; Huffstetter, King, Onwuegbuzie, Schneider, & Powell-Smith, 2010; Twyman et al., 2012). A benefit of Headsprout® is that it can be used with non-vocal students who cannot articulate phonemes aloud because they can still interact with the reading program by selecting answers

when instructed, while potentially developing oral language by listening to cartoon characters model sounds, words, and sentences. Further, Headsprout® can be delivered via tablet (Windows or Google platforms), thereby allowing children to interact via touch interface so they need not learn to use a mouse or trackpad—devices that can be barriers to computer access for some children with ASD.

In an investigation examining Headsprout® for pre-school aged children identified as at-risk for reading failure, Huffstetter and colleagues (2010) found promising results for the early reading program. Sixty-two children attending Head Start centers were randomly assigned to either an experimental group that received Headsprout® or a control group that received access to a computer-based math program called Millie's Math House. After eight weeks of supplemental instruction, children in the Headsprout® group made significantly greater gains in early reading skills, as measured by the *Test of Early Reading Ability – Third Edition*, as well as oral language skills, per the *Test of Language Development – Primary*. These were very positive results considering the age of the participants and the fact that they only completed 40 of the 80 episodes.

Researchers have recently extended Headsprout® to evaluate its efficacy when used with children with more severe disabilities, such as ASD. (Grindle et al., 2013; Plavnick et al., 2014; Plavnick, Thompson, Englert, Mariage, & Johnson, 2016; Whitcomb, Bass, & Luiselli, 2011). A particularly positive finding was noted by Grindle and colleagues (2013), who showed that after completing the 80 Headsprout® episodes, children with ASD demonstrated gains in reading as indicated by scores on the first grade Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good, Kaminski, & Dill, 2002) and the Word Recognition and Phonics Skills Test (WRaPS; Carver & Moseley, 1994). However, across studies investigating Headsprout® for children with ASD,

participants required adult support in the form of prompts, reinforcement, and adult-delivered pre-requisite skill training to access and complete the computer-based reading program.

Behavioral supports are used to increase motivation and engagement during academic instruction and have extensive empirical support for individuals with ASD (Wong et al., 2015). Derived from early dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968), and now commonly referred to as positive behavior supports (Carr et al., 1999), core procedures include delivery of reinforcement for behaviors that promote learning (e.g., attending to instruction) and prompts to guide children to engage in those behaviors. Once children begin to contact the naturally occurring reinforcers in a given educational environment, the contrived reinforcers delivered by adults can be reduced. Prompts are very similar to the concept of a scaffold, where learners are provided just enough support to progress in learning (Wood, Bruner, & Ross, 1976). As the learner increases in her ability to perform the behaviors of interest, the prompts are removed until they are needed again for subsequent steps.

Although behavioral supports are built into Headsprout®, some children with ASD will require additional adult-delivered behavioral supports when first introduced to the program. For example, some children may attempt to select a response before the program gives them a complete instruction (e.g., touch the word “see”). The Headsprout® program does not register an interaction until the instruction is finished, and for children with ASD, this could lead to selecting a different response option even though they may have been correct on their initial attempt. Such responding can slow learning and requires a mediating intervention to teach children to “wait for instructions” before responding. A prompt that can help teach children with ASD to wait until the instruction is delivered is for an adult to gently place a hand over the child’s hands on the table in front of the tablet and

for the adult to remove her hand once the instruction is complete. This prompt might be paired with a visual picture of hands resting on a table and the adult instruction “wait.” Over time, the adult can gradually reduce the amount of physical contact with the child while lightly blocking attempts by the child to interact with the program before the instruction is delivered. This process can successfully teach some children with ASD to wait to respond to the complete instruction.

Literature on tiered systems of supports (e.g., Fuchs & Fuchs, 2006) provides a framework that can be useful in the administration of behavioral supports in conjunction with Headsprout® for children with ASD. Because some children with ASD might be able to use and progress through Headsprout® independently, it is helpful to consider the program alone as a first tier of good reading instruction for this population. When children do not respond to Headsprout® alone, researchers have demonstrated that blocking interfering behavior and reinforcing attending or engagement behavior is sufficient for some of these children to learn to interact successfully and progress through the program while supports are faded (Plavnick et al., 2016). Some children continue to demonstrate difficulty progressing through certain parts of the Headsprout® program despite the use of behavioral supports. For these children, it may be possible to teach pre-requisite skills through intensive, adult-delivered instruction that teaches the skills within the Headsprout® segment that are problematic for a specific student (see Grindle et al., 2013; Plavnick et al., 2016). It might also be possible to skip some segments that have proven particularly difficult for children with ASD because of the receptive language requirements of the program (e.g., “select the one that is not...”). Children with ASD can still make reading gains when a small sample of segments are skipped because Headsprout® includes several learning routines that target each skill. By administering the minimal amount of support necessary for each child to progress through Headsprout®, educational teams

can potentially provide differentiated instruction to a broad group of children, including those with more severe disabilities.

Given the clear importance of learning to read for individuals with ASD, combined with the difficulty of teaching reading to this population, educators are in need of empirically supported curricula and curricular supplements that assist in this process. Headsprout® Early Reading offers promise as a supplemental reading curriculum that can be beneficial for all children, including those with ASD. The program utilizes intelligent design to ensure individualized programming in all areas of reading, produces individual and class-level data for educator review and reporting, and includes numerous tangible supplements to further support literacy development.

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## Critical Issues - Description of a Computer-Based Reading Program for Children With Autism Spectrum Disorder

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