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An Examination of the Effectiveness of Systematic and Engaging Early Literacy (SEEL) with Children with ASD

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ABSTRACT

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One population with challenges in learning to read is children with autism spectrum disorder (ASD). The purpose of this study was to examine the effects of using Systematic and Engaging Early Literacy (SEEL) intervention activities to improve phonological awareness and phonics skills with three children with ASD. Previous studies have looked at the effectiveness of using SEEL with other young children with diverse backgrounds; however, this is the first study to focus on using SEEL intervention with children with ASD. The study used a single-subject, multiple-baseline-across-behaviors design to compare performance on phonic patterns before and after intervention. Three young, male students who had a diagnosis on the autism spectrum and delays in literacy skills participated in the study. A number of different, yet comparable literacy targets were selected for each of the participants and assessment tasks were created to probe the participants' ability to demonstrate reading and phonological awareness for these target patterns. Baseline assessment data were collected prior to participants receiving individualized intervention, and performance on each task was monitored using the same assessment each subsequent session. SEEL instruction focusing on one target at a time was used to teach participants to read or decode the target words and give appropriate responses to phonological awareness tasks.

Intervention sessions were held once a week and lasted approximately 30-45 minutes. Each SEEL lesson was adapted to meet the needs of the individual child; however, all sessions contained SEEL principles of contextualized play, frequent auditory and visual exposures to the targets, explicit teaching using the target words, and engaged and reciprocal participation with opportunities to create original oral and written phrases. An analysis of the results show marked improvement in performance with the selected targets for two of the participants. This study provides further insight into the efficacy of using SEEL with different populations in need of early literacy intervention, especially those with multiple behavioral and skill-based variables to consider. It also discusses some additional factors and challenges to consider for future research in using SEEL with children with ASD.

Keywords: Systematic and Engaging Early Literacy Intervention, autism spectrum disorders, reading, single-subject design, phonological awareness, phonics

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DESCRIPTION OF THESIS CONTENT

This thesis follows a similar structural format and design as other previous student theses using SEEL intervention with young children. General references to previous SEEL studies were made without going into specific detail about each of their respective results and findings. Additional information about SEEL principles and the research behind the program is available on the published website. Some of the results and discussion of this study may be used in related writings or presentations of SEEL. The body of this thesis follows APA formatting guidelines.

Introduction

Children who are typically achieving tend to leave kindergarten with a strong foundation of fundamental literacy skills. These beginning skills are often linked to students' potential for academic success and support personal expression and development of social relationships (Cunningham & Stanovich, 1997; Juel, 1988; Lanter, Watson, Erickson, & Freeman, 2012; Light, McNaughton, Weyer, & Karg, 2008). However, some students find it very challenging to master fundamental skills and often require additional supports and more intense instruction than provided in regular classroom settings. One population with challenges in learning to read is children with autism spectrum disorder (ASD). To address the literacy needs of children with ASD it is important to understand the nature of their literacy problems, the types of literacy interventions that have been tried, and intervention principles that have the potential to address the unique language learning needs of children with ASD.

One early literacy intervention program that has been implemented with other groups of struggling readers is Systematic and Engaging Early Literacy (SEEL). The purpose of this study was to evaluate the effectiveness of SEEL in teaching and improving phonological awareness and phonics-based skills, specifically in children with ASD. The present study looks at three case-studies of young children with ASD and their unique personalities, behaviors, and skill-levels and how such variables may have contributed to their experience receiving SEEL intervention to increase their performance on phonological awareness and decoding skills.

Review of Literature

The following section discusses some of the research that has been published related to how children with ASD learn literacy skills and what interventions have been used with this population, as well as introducing the research and support for using SEEL intervention.

Nature of Literacy Learning Challenges in Children with ASD

Research on the literacy learning challenges of children with ASD has identified potential variables that may interfere with children's learning to read and write. However, it is important to note that children with ASD have very individual profiles of abilities and performances, despite some potential commonalities. With this in mind, difficulties that children with ASD may exhibit include the following: (a) a tendency to decode without comprehension (hyperlexia), (b) shallow decoding, (c) poor oral language skills, (d) underlying deficits in cognition, and (e) delays in the development of precursor skills.

Hyperlexia: Decoding without comprehension. Some children with ASD have been found to have exceptional levels of decoding and word recognition abilities (Davidson & Weismer, 2014; Nation, Clarke, Wright, & Williams, 2006). However, reading is a complex skill that involves both word recognition and comprehension processes (Gabig, 2010; Nation et al., 2006). Several researchers have reported that children with ASD may develop decoding skills due to a preoccupation with the smaller units of letters and words (Gabig, 2010; Randi, Newman, & Grigorenko, 2010). However, many children with ASD have difficulty shifting their attention from word-level reading to text comprehension despite being able to recognize printed words (Gabig, 2010; Randi et al., 2010). Recent studies have supported this finding; even though some children with ASD can decode accurately, they can have severely impaired reading comprehension (Davidson & Weismer, 2014; Gabig, 2010; Nation et al., 2006; Randi et al., 2010). These students rely heavily on their memory of learned-words and do not give sufficient attention to the meaning of the text to permit actual encoding of the print to retrieve and integrate meaning (Gabig, 2010; Mirenda, 2003).

The tendencies of children with ASD to have preoccupations with words are often attributed to hyperlexia. Nation (1999) defined *hyperlexia* as "advanced word-recognition skills in individuals who otherwise have pronounced cognitive, social, and linguistic handicaps" (p. 338). Some view hyperlexia as a primary disorder characterized by impaired comprehension, exceptional word recognition, and the seemingly spontaneous early development of reading with little or no direct instruction (Nation, 1999). Others describe hyperlexia more generally as having word-recognition skills that are substantially ahead of comprehension and other cognitive skills (Gabig, 2010; Nation, 1999). Hyperlexia is often associated with autism, yet not all children with ASD are hyperlexic, and other struggling readers without identified disabilities may have similar decoding-comprehension discrepancies (Davidson & Weismer, 2014; Nation et al., 2006; Randi et al., 2010). Therefore, it is recommended that the term *hyperlexia* be used for individuals with developmental disorders characterized by an unusual preoccupation with words as well as other cognitive and social deficits (Randi et al., 2010).

Hyperlexic characteristics in children with ASD can be attributed to typical areas of strength, such as strong visual-spatial skills, that give some the narrow skill of associating particular visual patterns with sound patterns (Mirenda, 2003; Nation et al., 2006). However, some professionals consider these unusual decoding abilities to be merely "splinter skills" without a basis for further instruction because there is not a deeper understanding of phonological rules before introducing more complex patterns and rules (Mirenda, 2003).

Shallow decoding: Failure to generalize. While the majority of references to decoding suggest that the recognition of words in children with ASD is less challenging than overall text comprehension, some children with ASD do have difficulty with decoding. Some of these children have excellent short and long term memory for particular patterns or high-frequency

words, making it appear like they have good word recognition skills, but they still struggle to generalize symbolic patterns for the purpose of decoding (Mirenda, 2003). These individuals acquire shallow decoding skills rather than deep, generalizable skills that allow for word recognition in different contexts (Mirenda, 2003; Whalon, Al Otaiba, & Delano, 2009). Other children with ASD have such limited decoding skills that they can read some words in context but are unable to decode non-words or are unable to read any words in general (Nation et al., 2006).

Oral and receptive language deficits. One of the diagnostic characteristics of ASD is a deficit in oral language skills. Such a deficit may be seen in an atypical language profile with expressive language performance appearing to be higher than receptive abilities (Davidson & Weismer, 2014). There is substantial research that supports the fact that oral language skills of students with ASD parallel their reading development in that the difficulty children with ASD have with learning to read is related to their poor oral language skills (Davidson & Weismer, 2014; Lanter & Watson, 2008; Nation et al., 2006).

Some children with ASD may have the ability to decode words and identify letters by name but lack understanding of why people read and write (Lanter et al., 2012) and therefore miss all meaning embedded in the words they read. These children often struggle to realize that written text is another form of communicating, as their ability to use language effectively to express their own thoughts in meaningful and conventional ways is often limited (Broderick & Kasa-Hendrickson, 2001). Some children with ASD may actually have better word recognition than comprehension because they exhibit this underlying deficit in receptive language comprehension or oral language. They may not have the oral language base for learning to read, since reading is a visual representation of oral language and reading in general is accepted to be a

highly linguistic task (Davidson & Weismer, 2014). Thus some researchers suggest that the comprehension deficit (or the discrepancy between word recognition and reading comprehension) is due to a general problem with receptive language comprehension that is not limited to reading comprehension (Mirenda, 2003).

Although relatively strong decoding skills in children with ASD may be seen as a valuable skill-set, in the absence of language skills, there is little motivation to read or no meaning and purpose associated with reading (Davidson & Weismer, 2014; Lanter et al., 2012). Language skills allow children to be able to talk about and retell what they read, as well as make higher-level predictions, inferences based on characters' feelings, or applications of the text to other situations (Lanter et al., 2012). Mirenda (2003) makes the argument that all readers require background knowledge and a general understanding of language in order to draw meaning from text.

Even older children or higher-functioning children with ASD, who have developed some understanding for the purpose of reading and have basic reading and writing skills, may still struggle with narratives and reading comprehension due to their underlying language deficits (Davidson & Weismer, 2014; Lanter et al., 2012). Misunderstanding the different contexts of language (figurative and literal meanings) and a limited knowledge of vocabulary and words with multiple meanings can be very challenging for children with ASD (Carnahan, Williamson, & Christman, 2011).

Deficits in cognition. The difficulty children with ASD tend to have in understanding the purpose and functions of print, comprehending texts, and making meaningful connections between texts and their own lives may be related to some underlying cognitive deficits. Different levels of cognitive processing will be manifested in each child due to the fact that individuals

with ASD exhibit a range of intellectual strengths and weaknesses from above to below average (Davidson & Weismer, 2014; Randi et al., 2010). While there is copious research related to the study of cognitive functioning of students with ASD, only the insights of a few authors that relate cognitive deficits to literacy functioning will be highlighted.

A group of researchers attempted to explain the cognitive processing style seen in individuals with ASD, and how it affects their development of literacy skills, in regard to the notions of Theory of Mind, central coherence, and executive function (Carnahan et al., 2011). Children with ASD generally have poor Theory of Mind, meaning they do not understand that others may have different thoughts, feelings, and perceptions than they do (Carnahan et al., 2011; Randi et al., 2010). This makes it difficult for them to understand characters' motivations and actions or to relate things that they have read to themselves (Carnahan et al., 2011). Without any personal connection to the text, there may be little motivation or desire for these individuals to read (Lanter et al., 2012).

Children with ASD are believed to have weak central coherence. *Central coherence* is the ability to focus on the whole, rather than getting caught up in the details; however, children with ASD have a hard time connecting details for overall text comprehension and integration with existing knowledge (Carnahan et al., 2011), again, making it difficult to stay engaged and focused on reading texts.

Executive function is related to organizational, planning, and self-monitoring skills, helpful for carrying out multi-step processes (Carnahan et al., 2011). Deficits in executive functioning in children with ASD leads to problems regulating attention, generalizing skills, and integrating new information, which may make it more difficult to monitor comprehension, among other things, while reading (Carnahan et al., 2011).

Vacca (2007) also mentions how students with ASD often exhibit difficulties with attention and motivational factors when learning to read. These areas of difficulty affect not only the desire and ability to focus on the immediate task of decoding but also on the ability to focus on the global meaning of the text, inferences being made, identifying story structure and determining character motives and emotions (Randi et al., 2010).

Delays in precursor reading skills. Along with the varying levels of cognitive abilities, another challenge with literacy instruction for children with ASD is the uneven profile of early literacy skills (Lanter & Watson, 2008). While different skill sets have been discussed in the literature as being predictors of typically-developing students' reading ability, few studies have been conducted to examine if these same skills are accurate predictors of reading abilities in children with ASD (Davidson & Weismer, 2014; Gabig, 2010; Lanter et al., 2012). Potential precursor skills include more traditional literacy areas such as print awareness, alphabet knowledge and phonological awareness (Lanter & Watson, 2008), as well as other skills such as overall oral language abilities (including expressive and receptive skills), vocabulary, and discourse skills (Lanter & Watson, 2008).

Some researchers speculate that children with ASD have inconsistent levels of achievement in early-predictor skills (Lanter et al., 2012) and may not acquire substantive precursor skills to use as accurate predictors of their future reading abilities. For example, two different stages have been described as occurring prior to a typically-developing student being able to read independently (Ehri, 1995; Lanter & Watson, 2008). In the first stage, the pre-alphabetic stage, students identify words based on visual features without any concept of connecting graphemes (letters) to their corresponding phonemes (Lanter & Watson, 2008). Some authors refer to this method of word recognition as "sight word" reading (Lanter & Watson,

2008; Mirenda, 2003). The second stage, the partial alphabetic stage, is when students begin to apply the alphabetic principle of connecting graphemes to phonemes in words (Lanter & Watson, 2008). The alphabetic principle is considered a necessary precursor to decoding and higher-level reading (Lanter & Watson, 2008). However, there is not supportive evidence that children with ASD develop and progress through these same stages, which contributes to their uneven profile of skills (Davidson & Weismer, 2014). As mentioned previously, some students with ASD are able to decode even without an understanding of grapheme-phoneme relationships (Mirenda, 2003). Despite these varying levels of precursor skills, there is substantive research with children with ASD that has shown their receptive language is highly correlated with their emergent literacy skills (Lanter et al., 2012) and is more of an accurate predictor of their reading abilities than emergent literacy skills alone.

Variable performance and individual differences. While some particular types of literacy learning problems tend to be exhibited in children with ASD, not all children with ASD display the same profile of strengths and weaknesses. As suggested in the earlier section on cognition, a variety of factors influence the literacy skills of children with ASD. This is in part because autism is a spectrum disorder and the contributing symptoms (deficits in communication and social interactions as well as cognitive processing deficits) (Randi et al., 2010) occur in many different forms and with varying degrees of intensity (Kluth & Darmody-Latham, 2003). This is especially important to keep in mind when attempting to characterize early literacy skill development in children with ASD. It is nearly impossible to develop a single profile of the reader with ASD because of the complicated nature of autistic symptoms and varying degree of impairment that may be present in each individual (Lanter et al., 2012; Randi et al., 2010). Rather than deficits in literacy arising from one particular cognitive, social, or attitudinal

weakness, a number of tendencies have been noted that can interfere with literacy learning in children with ASD. The spectrum of characteristics and tendencies of children with ASD exemplifies the heterogeneous nature of reading skills that may be encountered with ASDs given the wide variation of cognitive and linguistic skills seen in such individuals (Nation et al., 2006).

Summary. There is a large amount of research describing the characteristics of children with ASD. There is still a need for research to describe how these characteristics impact development of early literacy skills in children with ASD. Although children with ASD share many characteristics, it is important to remember that they are a highly heterogeneous group. Competency in early literacy skills for children with ASD should not be determined by any one factor, rather, a variety of skills should be measured, such as expressive and receptive language, story comprehension, print concepts, and phonological awareness (Lanter et al., 2012). Despite the different literacy skill levels that may be seen in children with ASD, there are some general reading characteristics that are important to consider when planning literacy interventions for this population. Some of the challenges that children with ASD face are an uneven development and shallow early literacy skills; cognitive, attentional, and oral language deficits; as well as overall limitations in world knowledge and limited opportunities for literacy learning (Light et al., 2008). All individuals will need to be considered for their strengths and weaknesses (Randi et al., 2010). Implementing the best literacy instruction for children with ASD requires an understanding of individual children's underlying deficits and knowledge of relevant instructional principles.

Literacy Interventions Used with Children with ASD

Despite some debate about the complexity or nature of the literacy learning problems in children with ASD, educators and researchers agree these children need high quality intervention

programs. The No Child Left Behind Act of 2001 (NCLB) and the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA) requires that all children, including those with ASD, be taught to read according to evidence-based best practices (Whalon et al., 2009). Just as there is an array of literacy interventions applied to typically-achieving children, various approaches have been implemented with children with ASD. The following section highlights a few traditional literacy intervention approaches that have been used with children with ASD, including emphasizing phonological awareness and phonics instruction and establishing a language-rich learning environment for these students.

Many reading interventions for children with ASD emphasize the drill-and-practice of isolated skills, attempting to capitalize on their interest in words and letters by focusing on teaching sight word recognition (Kluth & Darmody-Latham, 2003) or letter-sound associations. However, these approaches can lead to limited word recognition without comprehension and the development of splinter or shallow-based skills rather than well-developed foundational skills, as discussed previously. In contrast, there have also been a few reading instruction models used in the past that created the false belief that students with ASD were unable to become proficient readers and actually hindered them from acquiring higher literacy skills (Mirenda, 2003). Two of these models have been the reading readiness model and the functional curriculum model.

Reading readiness programs. Mirenda (2003) suggests that for a long time children with ASD were thought to not be "ready" for literacy instruction. She attributes this to the fact that research on literacy development in typical children was being applied to children with ASD, even though they had unique learning needs (Mirenda, 2003). Children with ASD were required to have prerequisite skills before receiving further literacy instruction, according to the "readiness model" (Mirenda, 2003). They were often being dismissed from the general literacy

instruction in the classroom that was full of the rich, meaningful experiences they needed to be successful (Kluth & Darmody-Latham, 2003). Initial instruction was often so decontextualized that children with ASD were not able to really develop the skills that had been deemed necessary for them to receive further literacy instruction (Mirenda, 2003). As a result, they were then viewed as not being ready to learn to read, when in reality, the most appropriate strategies and methods were not being used in their behalf.

Functional curriculum: Sight word approach. During the 1970s and 1980s research suggested that the best literacy intervention for students with ASD was a "sight word recognition" approach (Mirenda, 2003). This has also been referred to in more recent literature as the functional curriculum model (Mirenda, 2003). This was often selected for children with disabilities as the teaching strategy before they were expected to actually engage in reading (Mirenda, 2003). Functional skills instruction focuses on teaching students to recognize sight words that are considered necessary for independence in the community (Lanter et al., 2012; Mirenda, 2003). However, simply learning letters and isolated words as a whole entity did not help individuals with ASD better communicate in non-instructional settings (Mirenda, 2003) or develop more advanced literacy skills like their peers that actually have opportunities to experience literature (Kluth & Darmody-Latham, 2003). Some have suggested that this approach leaves individuals behind as they are given fewer options to move beyond strictly functional or life skills purposes for reading and writing and are never taught higher-level processes such as critical thinking or interacting with literacy (Kliewer & Biklen, 2001)

Proponents of the sight word approach suggest that children with ASD will find it easier and more efficient to learn to read if they learn to recognize whole words (Broun, 2004). The thought is that letters and sounds may be too abstract for children with ASD, so trying to teach

letters in isolation is meaningless (Broun, 2004). The proposal is to teach sound and symbol associations by using familiar words (to give the letters a meaningful context) rather than trying to teach letters as the building blocks of words (Broun, 2004). Some even suggest teaching words with flash cards so whole words are associated with pictures, to draw upon the visual strengths of many with ASD (Vacca, 2007).

Despite some arguments for the sight word approach, these models of instruction have fallen out of popularity in recent years. After legislations such as the Individuals with Disabilities Education Improvement Act of 2004 was passed, which encouraged more children with disabilities to participate in the literacy curricula (Lanter et al., 2012), different approaches have been adopted that emphasize teaching to the needs of children with ASD and providing more meaningful, content-rich strategies.

Direct instruction. Another traditional approach that has been used to teach literacy skills (including sight words) to children with ASD is direct instruction (DI). DI has been found to be effective in teaching oral language skills and some propose that it may even be used to address reading comprehension for children with ASD (Randi et al., 2010). The most effective literacy interventions involve direct, explicit teaching of specific skills where the goals and objectives are clearly stated, modeled, and practiced (Justice & Kaderavek, 2004). Teaching literacy skills in this manner, where goals are clearly communicated and the students are aware of what they are learning helps maintain their attention and facilitates more effective learning and retention (Justice & Kaderavek, 2004).

The DI approach allows for specific cognitive processes to be taught explicitly while scaffolding their function in overall comprehension (Randi et al., 2010). An example of this is teaching children to use a carrier phrase to identify letter-sound correspondences, such as “b says

buh" (Lanter et al., 2012). The carrier phrase provides some scaffolding to prompt a verbal response, even if memorized (Lanter et al., 2012). One specific direct instruction method discussed in the literature relating to literacy instruction for children with disabilities (and has recently been suggested for use with those with ASD), is referred by one author as the "Oelwin Method" (Broun, 2004). This method combines visual, auditory, kinesthetic, and spoken aspects to teaching decoding at the word level (Broun, 2004). However, even this method is recognized to be problematic in providing contextually-rich, meaning-based opportunities if used independent of other methods or without functional uses (Lanter et al., 2012) and is recommended as an alternative way to help students that have been unable to develop skills with other approaches (Broun, 2004).

Two of the fundamental literacy skills that are encouraged in explicit instruction of early literacy are phonological awareness and phonics.

Direct instruction in phonological awareness. Phonological awareness is a metalinguistic skill that involves working at the syllable and phoneme level of spoken words (Gabig, 2010; McBride-Chang, 1995). It is the specific awareness that words are composed of smaller units of sound and the ability to manipulate those sounds in spoken words into syllables and phonemes (Gabig, 2010). This ability is an intellectual skill that is distinct from using and understanding spoken language in conversation (Gabig, 2010). Phonological awareness is an important skill to learn while developing word recognition and decoding skills. A child needs to be aware that words are made up of sounds that are represented by letters, known as the alphabetic principle, in order to have the knowledge and skills to decode and read unfamiliar words and have proficiency and accuracy in spelling (Gabig, 2010). Phonological awareness skills include alliteration, rhyming, sound identification, blending and segmenting onset and

rime, and manipulating parts of words (Ukrainetz, Cooney, Dyer, Kysar, & Harris, 2000). Having the ability and confidence in these auditory components and skills can help developing readers associate sounds to letters in print, which is why the development of phonological awareness skills is strongly correlated with reading acquisition and is a strong predictor of later literacy achievement levels (Stanovich, 1986).

Direct instruction in phonics. Another important skill that is central to learning to read is phonics. Phonics is the ability to attach sounds to printed letters, decode words by sounding out phonemes, and use written letters to create words (Ehri, Nunes, Stahl, & Willows, 2001). Children generally have a more natural ability to hear and use phonemes orally; however, they typically require more direct phonics instruction in order to correctly associate letters with the sounds they represent and to blend the sounds together (de Graaff, Bosman, Hasselman, & Verhoeven, 2009), incorporating their knowledge of spoken language with that of written language (Ehri et al., 2001).

Effective phonics instruction requires planning, structure, and organization to explicitly teach the phonics elements sequentially (Ehri et al., 2001). The ability to convert print into language, to apply phonetic decoding strategies to sound out unfamiliar words to then comprehend what is being read is crucial for overall reading proficiency (Gabig, 2010). Phonetic decoding can occur with either lexical or non-lexical processing (Gabig, 2010). Lexical processing refers to the whole word, or sight word reading, while non-lexical processing is the procedure of applying knowledge of sound-letter correspondence to sound out syllables and phonemes (Gabig, 2010). Children progress in their reading skills by applying more sophisticated phonetic decoding strategies to read a word that is not automatically recognized, initially in a "sounding out" strategy and then with more exposure, they are more quickly able to

generate approximate pronunciations (Gabig, 2010). Skilled readers are able to access the meaning of unfamiliar words by successfully phonologically recoding a printed spelling pattern to its pronunciation (Gabig, 2010).

Different approaches have been used to systematically teach phonics (Ehri et al., 2001). Some of these include synthetic, analytic, embedded, analogy, and onset-rime phonics, as well as teaching phonics through spelling (Ehri et al., 2001). Synthetic phonics uses a part-to-whole approach, blending and segmenting words and converting graphemes into phonemes (Ehri et al., 2001). The downside to this approach is that sounds are taught in isolation and then blended together so reading is not being taught with a focus on meaning and purpose. In contrast, analytic phonics uses a whole-to-part approach that encourages students to identify words first and then identify sounds within those words (Ehri et al., 2001). The whole-to-part approach aims to help students learn sight words and relevant phonic patterns to then generalize and apply to other words, looking for similarities among other words (Harris & Hodges, 1995). Advantages of this approach are that it teaches children how reading works in a broad sense (putting known words together) which increases their confidence by giving them a sense of real reading as well as provides fast access to meaning. The other approaches to phonics instruction emphasize different skill areas and different contexts to teach phonics; however, no single approach should be used exclusively (Harris & Hodges, 1995).

Language and print-rich programs. Still other programs for children with ASD support using strategies that promote both oral language and reading skills by indirectly participating in different activities. Such activities may include engaging in shared book readings, story retelling, creating dialogue around storybooks, teaching literacy in a variety of naturalistic contexts, labeling objects and pictures to promote sight word reading, and reading and writing about

language experience activities (Lanter & Watson, 2008). While there are programs that may attempt to interact with books and other texts, some of these are so oral-based that they may not place enough attention on teaching underlying print, phonic, and phonological awareness skills or on integrating meaning with skill-based instruction.

General strategies. As more attention and focus has been given to researching effective instructional methods and approaches for use with children with ASD, some general strategies have been identified as being beneficial for supporting the literacy learning styles of these children. As emphasized previously, there is no one recipe or formula to fit the needs of every student with ASD (Kluth & Darmody-Latham, 2003). The needs of each student should be considered when deciding which strategies to implement in their intervention program.

Kluth and Darmody-Latham (2003) provide the following suggestions to use while designing literacy lessons for children with ASD: (a) recognize all literacies to build on the existing skills of the students, (b) capitalize on students' interests, (c) use a range of visual supports simultaneously with verbal instruction, (d) read aloud to promote language development and literacy skills, and (e) use and encourage different types of communication across activities allowing students to talk, share, and act in different situations.

Carnahan et al. (2011) have provided a similar list of suggestions about using students' special interests and connecting literacy instruction to other content and activities throughout the day. They also emphasize the need to make explicit connections to students' prior experiences and materials they have already read, to modify and adapt the text to meet each learner's needs (such as varying passage length or adding a picture), and to teach specific strategies students may use to help with comprehension (such as asking and answering questions throughout or identifying the main idea) (Carnahan et al., 2011). Varying the type of instruction, from small

group and large group to partner reading and individualized lessons, may be particularly helpful for children with ASD as well (Carnahan et al., 2011).

The SEEL Program: An Integrated Skill and Meaning-Based Approach

Although there is evidence suggesting that several types of instructional approaches may be beneficial for children with ASD, including direct and explicit instruction (Ehri et al., 2001; Flores & Ganz, 2007), naturalistic instructional interactions using authentic materials, and the use of various supplemental materials (Randi et al., 2010), no single approach used independently addresses all children's needs. Failure to implement a multi-faceted approach in intervention, regardless of the specific skills being taught, is the real problem when teaching children with ASD. For example, utilizing only a narrow-phonics approach with children with hyperlexic characteristics who already do well in traditional phonics programs is going to deepen their "splinter skills" instead of targeting their underlying deficits in comprehension and may not help them generalize skills to other contexts (Mirenda, 2003).

It would be advantageous for literacy programs to capitalize on the relative strength of many students with ASD to learn words and patterns while simultaneously addressing their weaker comprehension skills. The diverse strengths and abilities of students with ASD combined with the preferences for contextualized and engaging learning situations make it necessary to look beyond traditional literacy programs to meet these unique needs. Children with poor or limited early literacy skills need intense literacy instructions emphasizing explicit, skill-based instruction along with meaningful involvement (Bingham, Hall-Kenyon, & Culatta, 2010). Involving students in a variety of content-rich activities helps to increase motivation (Guthrie, Wigfield, & VonSecker, 2000), maintain attention, and provide numerous encounters with literacy targets and skills (Justice & Kaderavek, 2004) while engaging children in the learning

process (Bingham et al., 2010). Such integration can lead to systematic decoding and phonological awareness instruction along with reading targeted phonic patterns for meaning and purpose. Research has shown that a systematic and integrated functional approach to literacy instruction that balances reading, writing, and phonics practice with theme-based lessons is the most effective for students with ASD (Carnahan et al., 2011; Lanter et al., 2012).

One program that draws upon this type of intense, meaningful instruction is SEEL (Becker, McElvany, & Kortenbruck, 2010; B. Culatta, Aslett, Fife, & Setzer, 2004; B. Culatta, Hall, Kovarsky, & Theadore, 2007; B. Culatta, Kovarsky, Theadore, Franklin, & Timler, 2003; B. Culatta, Setzer, Wilson, & Aslett, 2004). SEEL may be an effective way of teaching early literacy skills to children with ASD because it uses a variety of learning approaches to meet the needs of all types of learners. Young children are introduced to literacy in meaningful and interactive activities that focus on developing skills in phonological and phonemic awareness, alphabetic knowledge, and phonic patterns within authentic and engaging reading and writing experiences.

SEEL has incorporated several important principles that have been identified throughout the literature as being effective in early literacy instruction. These principles include (a) creating meaningful and contextualized instruction, (b) providing explicit teaching, (c) ensuring engaging and playful instruction, (d) providing intense exposure to targets, and (e) having reciprocal conversational exchanges between the teacher and the students.

Meaningful and contextualized instruction. Meaningful and contextualized instruction incorporates the students' likes and interests into the activities being used. Meaningful activities may include things like songs, games, dances, stories, plays, and other child-oriented activities that can have literacy concepts intertwined throughout. Learning is more effective for young

children when skills and content relate to what they already know, have experienced, and are thinking about because it helps them remember what they learn (B. Culatta, Aslett, et al., 2004). SEEL lessons emphasize activities that are based on experiences and interests that most young children have, or a situation that is easily created for the students to experience themselves. When the children participate in an activity related to a particular target, there is added meaning and enhanced understanding of that target. For example, when students get to pull, pinch, press, and pound pink and purple play-dough, the initial */p/* sound is emphasized. There is a lot of research to support that when instruction and intervention is conducted in meaningful and contextualized ways it can further advance phonological awareness, spelling and overall literacy acquisition for children (Craig, 2006; Ehri et al., 2001; Ukrainetz et al., 2000). For children with ASD, it is especially important to relate literacy instruction and materials to their own experiences as they generally have a more limited experience-base. (Broun, 2004). In the past, students with ASD and/or hyperlexic characteristics were discounted as being potential readers due to their lack of ability to draw meaning from what they were reading (Carnahan et al., 2011); however, a program like SEEL helps to emphasize and add meaning and teach students how to access relevant background knowledge.

Explicit teaching. Children learn more easily and retain more if they know what they are going to learn, why it is important, and how it will be presented (B. Culatta, Aslett, et al., 2004). As mentioned briefly in an earlier section, explicit instruction involves a logical sequence of instruction, clearly stating goals, modeling targets, and providing support as the skill is practiced. SEEL instruction uses explicit teaching throughout the lessons as the instructor states the target, refers to the target frequently, and models and highlights the target throughout instruction. Explicit teaching has long been recognized as being an effective teaching method for children

with ASD (Fallon, Light, McNaughton, Drager, & Hammer, 2004; Flores & Ganz, 2007; Randi et al., 2010; Whalon et al., 2009).

Explicit and systematic instruction is especially important in teaching phonemic awareness and phonics skills. Instruction not only needs to be clear and direct but it also needs to be engaging and meaningful to students (Gates & Yale, 2011), which is one reason SEEL has incorporated a more analytic phonics approach, as it facilitates faster access to meaning while still explicitly teaching specific targets.

Engaging and playful instruction. Engaging children in the learning process allows them to be more involved in reading which helps with retention and application of what they have read. SEEL stories, lessons, and activities attract children's attention, motivate them to participate, and hold their interest (B. Culatta, Aslett, et al., 2004). Another strength of SEEL is that it teaches metalinguistic components of language without putting such high demands on the child because the child believes they are playing rather than feeling like they are "working."

Research has also looked at levels of motivation and found that less motivated students read about one third as much on their own as do their highly motivated peers (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). Two main types of motivation, intrinsic and extrinsic motivation, are especially important in respect to literacy instruction. Children who are only extrinsically motivated to read tend to have poorer reading skills than those children who are intrinsically motivated to read (Becker et al., 2010). Many intervention approaches for children with ASD use extrinsic motivation to achieve gains, encouraging the students to work to earn something outside of the activity itself (Shea, Millea, & Diehl, 2013). Even though the play involved in SEEL is highly structured and focuses on specific literacy targets, the playful activities used to teach and practice the targets are child-friendly and help to facilitate a

motivating learning environment. Therefore, a real strength of SEEL is that the motivation is embedded within the engaging activities themselves.

Intense exposure to target. Providing intense and frequent exposure to target phonemes and plenty of opportunities to practice has long been recognized as being an effective strategy for emerging readers (Carlin, 1970). Implementing systematic, explicit, meaningful, and engaging interventions provides frequent and varied opportunities to practice different targets in different contexts all throughout the day. These contexts include both oral and written practice as students are able to see, hear, read, and interact with each target. The teacher uses target words repeatedly throughout the SEEL lessons, doing such things as, making playful statements, making comments about actions and objects, asking questions, and offering choices and turns in ways that naturally incorporate the targets. Students are also given numerous opportunities to respond using the target. Students are also given opportunities to read and write the targets as part of the activities. Varying the exposure to the targets and relating instruction to other content areas throughout the day is especially helpful for students with ASD to learn to generalize the targets (Carnahan et al., 2011).

Reciprocal conversational exchanges. Although the playful instruction of SEEL lessons is orchestrated and led by an adult, the conversational exchanges between teacher and students, or the reciprocal exchanges, are especially important. Teachers using SEEL need to be particularly sensitive and aware of student responses in order to validate them, build on what they say, and increase use and understanding of the targets. This component of SEEL is extremely beneficial for children with ASD as they have weaker conversational skills to begin with (Lanter & Watson, 2008). Conversational and oral language difficulties may interfere with the interactions students with ASD have around literacy. As a result, these limited or non-

reciprocal interactions may negatively influence the level of understanding and purpose of literacy for students with ASD which also minimizes the level of support the environment would provide for them to deepen their literacy skills. SEEL provides a great structure for children with ASD to incorporate turn taking skills and making personal connections along with oral language skills of interacting and talking about the texts.

Purpose of Study

While favorable results have suggested that SEEL is effective in teaching early literacy skills, the use of SEEL has not yet been explored with children with ASD to increase phonological awareness and decoding. Various research studies on the SEEL approach have been conducted with different at-risk target audiences (dual language kindergarteners, English speaking kindergarten, pull-out paraprofessional supplemental instruction, and preschoolers from low income and linguistically diverse backgrounds; B. Culatta, Aslett, et al., 2004; B. Culatta et al., 2007; B. Culatta, L. A. Setzer, et al., 2004; R. Culatta, Culatta, Frost, & Buzzell, 2004). The study was designed to answer the following question: Is SEEL instruction effective in increasing reading or decoding of trained, comparable phonic patterns in students with ASD?

Method

Participants

The participants were three English-speaking, Caucasian male students between the ages of 5 and 7 who had a diagnosis on the autism spectrum and delays in literacy skills. Pseudonyms for each of the boys are being used to refer to the children to maintain their confidentiality.

The participants were invited to participate in the study because of previous affiliations with members of the research committee. At the time of the study, the three participants were in early childhood classrooms (two in kindergarten and one in first grade), two had received official

diagnoses of ASD and one of PDD-NOS (with qualifying characteristics of ASD on a rating scale), and all three demonstrated difficulty in literacy skills on the basis of the kindergarten or first-grade levels of the Phonological Awareness Literacy Screener (PALS-K and PALS-1-3). A letter outlining the purpose and procedures of the study was signed by the parents of each participant (Appendix A). Information about the participants' diagnoses and educational backgrounds as well as literacy performance on the literacy screening follows.

Brandon. Brandon, age 6;7, was a first grader receiving special education resource services in his public school setting at the time the study began. He had a younger sister and lived with both of his parents at home. His mother was a native Spanish-speaker, but spoke English proficiently and English was reported to be the only language spoken in the home.

Language and educational evaluations and services. Brandon was referred to and evaluated by the local early intervention program when he was 30 months old due to overall developmental delays. He was evaluated using the *Mullen Scales of Early Learning*, as well as the *Vineland Adaptive Behavior Scales-II*. He showed deficits in all developmental areas, especially expressive and receptive language, cognition and social and emotional sub-areas. He began receiving early intervention services at that time. After his third birthday, Brandon continued receiving speech and language services and was enrolled in a special education preschool. He was diagnosed as having a moderate social communication disorder and severe articulation disorder using the *Preschool Language Scale-IV* (PLS-4), scoring in the 10th percentile for receptive language and in the 2nd percentile for expressive language, *Social Communication Emotional Regulation Transactional Support (*SCERTS) assessment, and *Goldman-Fristoe Test of Articulation-II* (GFTA-2).

When Brandon was 4 years 6 months, he began receiving services at Brigham Young University's Speech and Language Clinic for speech and language delays. His parents reported at that time that Brandon was only responding in one or two word-phrases and was only understood about half of the time. After receiving occasional speech and language services both at the university clinic and with the public school SLP for nearly two years, Brandon's parents reported significant improvements were made in his intelligibility and in Brandon's ability to attend to tasks for longer periods of time. Brandon's educational goals in kindergarten focused on following directions in complex sentences, initiating and responding to conversations in simple sentences and reading consonant-vowel-consonant (CVC) words independently. The *Clinical Evaluation of Language Fundamentals-IV* (CELF-4) was administered when Brandon was 6 years, 6 months old and Brandon had a standardized score of 104, placing him in the 61st percentile.

Diagnosis. Brandon was originally given a diagnosis of PDD-NOS when evaluated by a licensed psychologist at the age of 4;3. However, at the beginning of his participation in the study, the *Social Communication Questionnaire (SCQ)* was completed by Brandon's mother. According to her ratings, he scored a 15, which falls in the category of autism spectrum disorders. Some of the indicators from the questionnaire that Brandon scored positively as being on the autism spectrum were using socially inappropriate questions or statements, using made-up words or phrases, being particular about how certain things are done, having odd interests, being more interested in parts of a toy than playing with the toy itself, being unusually interested in sensory aspects of people and objects, and not reciprocating smiles and facial expressions when younger. The clinicians, research assistants, and behavior specialist working with this study also observed these same behaviors consistently throughout Brandon's intervention.

Literacy screening. The PALS-1-3 screener was administered during the first two sessions of working with Brandon for this study. Brandon scored 26/42 on the spelling inventory task. He did well identifying the initial and final consonants in words and was using correct short vowels. Brandon struggled using digraphs (1/4 correct), blends (4/7 correct) and long vowel patterns (0/7 correct) in words. Brandon was given the word recognition in isolation task at the primer level and scored 3/20. He was then given the pre-primer level words in isolation and scored 13/20. On the first reading task at the pre-primer level, Brandon read 26/44 words correctly, and read 30/41 words correctly on the second reading task at the same level. Based on these areas that were assessed, some general observations were made about deficits in Brandon's literacy skills prior to beginning the study. Brandon guessed on the majority of words, relying on pictures (if available) or first sounds of words to say the first word that came to mind. He did not pay attention to context clues or attempt to implement any decoding strategies. Brandon scored within the "frustration reading level" on the literacy screener, which correlated with his weak comprehension and lack of motivation to read during the various tasks. Brandon was generally compliant during the various tasks of the screener; however, he did require occasional prompts to complete a task. He needed additional encouragement during the reading tasks to try his best and not guess or make silly noises or nonsense words. Brandon displayed some avoidance behaviors by trying to change the subject or asking irrelevant questions during a task, but could be redirected with minimal verbal prompting.

Coleton. Coleton, age 6;4, was a kindergartener receiving special education services in a small-group classroom in his public school setting at the time the study began. He had one older brother and two younger brothers and lived with both of his parents at home.

Language and educational evaluations and services. When Coleton was 3 years 2 months old, he was evaluated and qualified for special education preschool services due to concerns with significant delays in several areas of his development (scoring in the first percentile on several subtests). At that time Coleton was receiving both speech and occupational therapy services and a behavioral intervention plan (BIP) was instated as part of his individualized education program (IEP). Coleton qualified for special education services to continue during the summer months both years he participated in the special education preschool program.

According to school reports from Coleton's kindergarten teacher, Coleton was working on recognizing a few sight words but was not blending any CVC words independently at the time the study began. Coleton's classroom teacher also reported that Coleton often had behaviors that interfered with his ability to complete a task and did not like fine motor tasks. The occupational therapist performed an in-depth evaluation on Coleton's sensory needs and reported Coleton as being a sensory seeker with high sensitivities to touch, sound, and proprioceptive factors. The school SLP reported that Coleton would occasionally answer yes/no questions or respond to other question formats; however, he frequently needed to be redirected and given verbal prompting to respond due to his lack of attention and distractible behavior. It was also reported that Coleton was not expressing his frustrations verbally; instead, he was having tantrums and would hide under tables. Coleton still had a BIP as part of his IEP at school. Coleton had also participated in another study related to behavioral instruction with kids with autism with another professor at BYU prior to this study.

Diagnosis. Coleton received an educational classification of ASD when he was three years, five months old from the public school district's autism specialist. The *Autism Diagnostic*

Observation Schedule (ADOS) was administered to Coleton at that time, on which he scored within the autism range, with noted deficits in the areas of communication and social. At age 5;8, Coleton was evaluated by a licensed psychologist and re-administered the ADOS. According to his performance at that time, Coleton was given a clinical diagnosis of moderate autism.

Literacy screening. The PALS-K screener was administered during the first session of working with Coleton for this study. Coleton could accurately name 20/26 letters and 17/26 letter sounds. During the individual rhyme awareness task, he was asked to say whether two words rhymed, but he got very distracted and did not complete the task. He was also asked to identify the initial sounds of words from the beginning sound awareness task, but was not responsive to the task and no reliable score could be obtained. From the areas that were assessed, some general observations were made about Coleton's literacy skills prior to beginning the study. He appeared to have an emerging skill of letter knowledge and of the alphabetic principle that letters represent sounds. However, Coleton had no blending skills and did not attend to any print awareness or phonics-based tasks. Coleton's poor language and communication skills (needing help to put words together to make a request or using words incorrectly) made it difficult for him to express himself in appropriate ways, especially when he needed a break or was frustrated with a task. He also struggled significantly with joint attention and being able to complete the task at hand without frequent verbal promptings and redirection. Coleton was very responsive and showed more engagement and motivation to participate when we transitioned from the tasks specifically on the literacy screener to doing more playful phonological awareness activities. He willingly repeated words that rhymed during a specific activity and repeated the initial sounds of words that all started with the same letter.

Dan. The third participant, Dan, was a kindergartner, age 5;5, when the study began. Dan was receiving language therapy services and was attending a private lab-school kindergarten program through Brigham Young University. He had both an older and younger sister and lived with both parents at home.

Language and educational evaluations and services. Dan's parents reported that he met early developmental milestones and was even speaking in complete phrases just after 18 months of age. However, Dan was evaluated for early intervention services at about the age of two, due to concerns with his social and emotional development. His parents reported Dan was frequently having tantrums and did not interact with or show interest in his peers. According to his performance on the *Bayley Scales of Infant Development-III*, given at that time, he did not qualify for early intervention services. When Dan was almost four years old, his parents were concerned with Dan's difficulty with fine motor tasks, but Dan never received any intervention services in that area. Dan's parents continued to be concerned with Dan's tantrums and lack of what they thought to be age-appropriate conversations and communication abilities.

Dan began attending the private preschool available through Brigham Young University at the age of 4 years 4 months. In school reports from Dan's preschool teacher, it was reported that Dan was very smart and worked well in structured environments; however, he often had inappropriate reactions to others and became frustrated with his peers in the class. It was also noted at that time that Dan was frequently fixated on objects and others' comments and was not engaging in conversation but would just repeat phrases continually.

Diagnosis. When Dan was 4 years 7 months old, he was evaluated by a licensed psychologist and received an official diagnosis on the autism spectrum. The ADOS test was given at that time. The *Behavior Assessment System for Children-II* (BASC-2) and the *Vineland*

Adaptive Behavior Scales-II, a set of rating scales, were given to Dan's parents at that time to complete as well. According to those rating scales at that time, Dan showed significant deficits in social communication, self-regulation, and extremely narrow interests and rigidity of thought with frequent episodes of aggression, anxiety, and maladaptive behavior.

Literacy screening. The PALS-K screener was administered during the first two sessions of working with Dan for this study. Dan correctly named 24/26 letter names and 23/26 letter sounds. Dan scored a 3/10 on the rhyme awareness task, where he was asked to identify the correct word out of three choices that rhymed with the given word. Dan was then asked to sort pictures of objects by their beginning sounds, and correctly did so in 8/10 attempts. When Dan was presented with a list of 15 words to read in isolation, he got very agitated and resisted looking at the words while he continuously repeated "I don't know." Based on the areas that were assessed, some general observations were made about Dan's overall literacy skills prior to beginning the study. Dan seemed to enjoy playing with words and sounds, and seemed to have a good foundation of letter sounds. Dan did better with phonological awareness tasks, even attempting to make up his own nonsense words to continue a rhyme pattern. However, he was very resistant to any task that required him to focus on written text. Dan needed frequent verbal prompts to stay on task and substantial verbal praises before and after responding. Dan continually tried to change the subject or got fixated on a word or a phrase that he would repeat multiple times. Dan did not like sitting at the table for the reading task. Instead of expressing his frustrations verbally, Dan quickly displayed avoidance and noncompliant behaviors when asked to do something he did not want to do, such as reading words. This behavior quickly escalated from simply refusing to almost irrational crying and saying he was scared. Dan was able to be

redirected and consoled when a new task was presented and he was told what was expected of him before he could move on to the next activity.

Design

A single-subject, multiple-baseline-across-behaviors design (Baer, Wolf, & Risley, 1968) was employed to examine the effects of SEEL instructional activities with children with ASD. This design was selected because experimental control could be achieved using a small number of students, as they each acted as their own control. Performance on trained phonics patterns was compared with performance on comparable untrained targets. A number of different, yet comparable literacy targets were selected for each of the participants and assessment tasks created to probe the participant's ability to demonstrate reading and phonological awareness for these target patterns. SEEL was used to teach participants to read the target words and give appropriate responses to phonological awareness tasks. The implementation of SEEL activities each session was the independent variable of this study. A description of how the targets were selected and the intervention sequence for each participant follows.

Selection of targets. As previously outlined, at least one session with each participant was spent using the literacy screener that corresponded to each participant's grade-level at the beginning of the study. Individual targets were chosen for each participant based on (a) the performances and areas of weakness during the individual literacy screenings, (b) initial therapeutic diagnostics of targets anticipated to be "trainable" for each participant, and (c) age-appropriate literacy benchmarks. The targets were also selected based on the SEEL curriculum found on the website that corresponded to kindergarten or first grade. The individuality and specificity of targets for each participant in this study further exemplifies the need to evaluate

and understand the strengths and weaknesses as well as the literacy profiles of each student with ASD rather than trying to follow a pre-prescribed, age-based curriculum.

Brandon. During the screening process, Brandon displayed age-appropriate awareness of short-vowel patterns, but made consistent errors with long-vowel patterns, which were phonic patterns he was encountering in first-grade-level texts. Brandon seemed to get frustrated and became unmotivated to read due to his inability to decode unfamiliar words. He then resorted to guessing, which negatively impacted comprehension of what he was reading, further disinteresting him in reading tasks. Therefore, it seemed appropriate to target common long-vowel patterns, in both reading and writing, to help Brandon recognize new words and increase his confidence in his reading abilities (Tables 1 and 2). The words for each of the long-vowel patterns were methodically selected based on highly-generated words containing each respective pattern; however, they were also strategically filtered to be contextually and age-appropriate and usable in meaning-based activities. The target words were then randomly assigned to either the reading or spelling task. It is important to note a few words were used for both tasks due to a limitation of contextually-meaningful words fitting each pattern. The words selected for the list entitled "generalization target words" followed the same selection process, that is, contextually appropriate and fairly common words containing each target pattern; however, they were not specifically addressed during instructional sessions. The purpose of this list was to see how well Brandon was learning the patterns to apply to similar words that had not been directly taught and encountered during intervention.

Table 1

Target Words for Brandon

Long -a words	*Long -i* words	*-ea* words	*Long -o* words	*-ee* words
cake	dime	cream	rose	weed
bake	mice	neat	hope	feet
tape	hike	dream	tore	week
name	fine	beach	note	seed
base	nice	peas	core	feed
face	kite	cheap	pose	beep**
hate	time**	bean	bone**	need**
stake*	rise*	beak**	cone**	
case*	hide*	seat**	wore*	
came*	bike*		nope*	
wake*				

*Indicates words used for the spelling task. **Indicates words used for both spelling and reading tasks.

Table 2

Generalization Target Words for Brandon

Long -a words	*Long -i* words	*-ea* words	*Long -o* words	*-ee* words
rake	wise	peak	rope	peel
came	rice	peach	pope	sleet
lace	mine	beat	hose	beet
rate	slide	speak	gore	
sake	lime	mean	tone	

Coleton. Coleton displayed emerging skills in letter naming and letter-sound associations during his screening, but did not seem to have deeper phonological awareness skills typically seen in kindergarteners, such as sound blending and manipulating or rhyme awareness. Coleton's

additional deficits in the areas of engagement and attention contributed to the decision to focus on a just a few common, short-vowel targets through more phonological awareness-based tasks (Table 3). Beginning with short-vowel pattern word families followed kindergarten curriculum. The goal was to gradually increase Coleton's tolerance for more phonics-focused activities and lengthen the amount of time he would attend to and engage in a literacy-based activity while also increasing Coleton's expressive vocabulary. The words in each word family were strategically selected based on age-appropriateness, familiarity, and likelihood of generating them in a variety of context-based activities.

Table 3

Target Words for Coleton

-*ack* words	-*at* words	-*ap* words
back*	cat	nap
stack*	pat	tap
sack*	bat	lap
snack*	fat	rap
pack*		
jack*		
track*		
crack*		
smack*		

*Indicates words used for blending task.

Dan. During the screening sessions, Dan displayed a sound understanding of letter-sound associations and a beginning ability to perform other phonological awareness tasks such as rhyming or blending words. Dan did not display any skill or tolerance for phonics-based tasks of decoding or recognizing words, even in isolation. As described earlier, when Dan was presented with a decoding task, he either refused to look at the words or said random words without trying

to decode or recognize the word. Appropriate targets for Dan, therefore, seemed to be a few common, short-vowel word families that would highlight onset and rime patterns (Table 4). The selected word families both aligned with typical kindergarten benchmarks as well as allowed for beginning decoding skills to be emphasized in both phonological awareness and phonics-based tasks. The words in each word family were strategically selected based on age-appropriateness, familiarity, the ability to contrast words in each family with other word families, and the likelihood of generating them in different contextually-based activities.

Table 4

Target Words for Dan

-*at* words	-*op* words	-*ap* words	-*ack* words	-*an* words
hat	hop	lap	back*	can*
cat	cop	cap	sack*	dan*
mat	mop	map	tack*	fan*
sat	shop	sap	jack*	man*
rat	top	rap	rack*	pan*
bat	drop	nap	pack*	tan*
fat	flop	gap	black*	ran*
pat	pop	tap	track*	van*
			snack*	

*Indicates words used for blending task.

Sequence of intervention. Baseline assessments were conducted the first three sessions of meeting individually with each participant. During these sessions SEEL lessons focusing on age-appropriate, non-target skills were implemented to further probe for participant's tolerance of different activities and to assist in planning future intervention sessions. The specific tasks that would be used in subsequent sessions to assess the performance on each of the targets selected for the participants were presented during these initial sessions to collect a baseline performance

level. Following baseline data collection, the students were taught one target pattern at a time, using SEEL lessons and activities, while the other patterns remained untreated. Each participant had specific targets that were selected for them individually, therefore, they followed their own intervention sequence that corresponded to grade-level curriculum and aligned with SEEL curriculum for teaching each of the respective targets.

Brandon. Brandon received 20 one-on-one intervention sessions (three weeks were for baseline data collection) over a 24-week period of time, with approximately one treatment session per week (we did not meet some weeks). The amount of instruction for each target varied from three to five weeks, depending on when an acceptable criterion-level (at least 70% correct) had been reached during the reading task. Once the determined criterion-level had been reached for one target, intervention began on the following target and continued in this manner through four of the five different target patterns (Note: formal instruction with the *-ee* pattern was not given as part of this study as mastery level had already been achieved while working on other targets). Instruction began with the *long -a* (with silent e) target while the others remained untreated and measured in baseline. After intervention was completed with *long -a*, instruction began on the *long -i* (with silent e) target, with *long -a* measured for maintenance and *-ea*, *long -o* (with silent e), and *-ee* remained untreated in baseline. Following *long -i*, *-ea* was addressed (with *long -a* and *-i* measured for maintenance and *long -o* and *-ee* remained untreated in baseline) and then lastly Brandon received intervention with the *long -o* target, after which all of the targets were assessed a final time.

Coleton. Coleton received four one-on-one intervention sessions, (three weeks were for baseline data collection) over a six-week period of time, with approximately one session per week (we did not meet some weeks). Instruction began with the *-ack* target; however, as will be

discussed in a later section, intervention was discontinued with him after only one actual instructional session due to several complicating factors with scheduling, noncompliant behaviors, and inconsistent performance. It is necessary to note that although Coleton did not receive further intervention for this study, valuable information and observations were obtained during his short participation. Therefore, his limited data and other observations are still included in the following sections, but it is important to keep in mind there are obvious exceptions and limitations as to how his performance is compared to the performances of the other participants.

Dan. Dan received 20 one-on-one intervention sessions (three weeks were for baseline data collection) over a 25-week period of time, with roughly one treatment session per week (we did not meet some weeks). Again, the amount of instruction for each target varied, from two to seven weeks, depending on when an acceptable level of achievement (at least 70% correct) had been reached, specifically for the reading task. The determined criterion-level for Dan changed slightly throughout the study, as will be further discussed in the measures and discussion sections, due to inconsistent performance and noncompliance with the specific task used to measure his mastery of the targets. However, despite the modifications that were made to the task to assess his performance, still only one target was taught at a time. Once the acceptable achievement level had been reached, intervention began on the following target and continued in this manner for all five of the targets.

Dan's instruction included two separate instructional phases, the first phase focused on the onset rime blending task and the second phase focused on the reading task. Therefore, instruction began with the *-ack* target while *-an* remained untreated and measured in baseline. After intervention was completed with *-ack*, instruction emphasized the *-an* target, with *-ack* still being measured for maintenance. Following *-an*, instruction changed to the *-at* target, while *-op*

remained untreated and measured in baseline. The -*ap* target remained untreated as well but was only periodically being measured in baseline, as the task was specifically looking at the contrast of only two targets at a time and the task had to be modified during the -*at* intervention to help facilitate better compliance and accurate performance measures. After intervention was completed with -*at*, explicit instruction began on -*op*, with -*at* and -*op* now being measured and -*ap* remaining untreated in baseline. Following -*op*, Dan received instruction with -*ap* and all three (-*at, -op, -ap*) were ultimately assessed altogether.

Procedures

The procedures used throughout this study can be divided into two conditions or phases. The first condition was assessment, including baseline assessment and ongoing performance monitoring after each intervention. The second condition was the actual implementation of the intervention. This section describes the procedures involved in assessment and implementation of the intervention.

Assessment. The effects of the intervention were assessed by the participant's ability to perform specific tasks consisting of multiple trials. These tasks varied from spelling, reading words in isolation, blending, and recognizing words containing particular target phonic/phonological patterns chosen for each participant individually. The specific assessment tasks and rationale for each participant will be further discussed in the measures section. Each task was administered the same way during the baseline assessment and performance monitoring for all participants, with the exception of slight modifications being made during Dan's intervention during the reading phase (an explanation for which is detailed in the discussion section).

The results from each assessment were recorded during the session on a data sheet and an Excel spreadsheet shortly after the assessment had taken place. Additionally, each assessment was video recorded and the researchers later viewed 30% of assessment sessions for each participant to ensure reliability in assessment practices and agreement in results. The researcher and research assistant had identical data sheets containing each of the target words that were used during the assessments (Appendix B). The number of times the researcher and research assistant agreed that the participant read, spelled, or blended a word correctly or incorrectly was counted to determine the number of agreements. Inter-judge reliability was calculated by dividing the total number of agreements by the total number of words and multiplying by 100. Inter-judge reliability for the assessments was calculated to be 100%. This level of agreement on responses was possible because of the objective nature of the assessment tasks in producing either correct or incorrect responses.

Baseline. As previously mentioned, for three weeks prior to the introduction of intervention on the specific targets, baseline assessments of participants' entering performances were conducted in order to establish a baseline performance level and measure any changes in performance levels throughout the intervention process. During these three baseline sessions for each participant, different SEEL lessons were used to target individually-relevant skill-sets that did not contain the selected targets. Further details about the structure and organization of the intervention sessions will be provided in a later section. Brandon showed almost no improvement in his ability to read the words for the first three targets during baseline, and was fairly inconsistent in his performance with the *long -o* target during baseline. Brandon did show significant improvement during baseline with the fifth target, *-ee*, therefore, it was not addressed explicitly in intervention. Coleton did not show any improvement in his ability to perform the

tasks related to his target words during baseline. However, the degree of inconsistent performance during this phase contributed to the ultimate decision to discontinue intervention with Coleton for this particular study. Dan did not show improvement throughout his baseline assessments in his ability to read or blend the target words.

Performance monitoring and maintenance. In addition to baseline probes, tasks were presented to monitor performance and evaluate maintenance of trained targets. Continued assessment on the selected targets took place immediately after each intervention session. Participants were assessed in the same manner each session to keep conditions the same. However, as mentioned, some modifications to task presentation were necessary and will be discussed later.

Implementation of the intervention. The intervention, which occurred at the BYU Speech and Language Clinic or in a research room connected to the campus kindergarten facility, implemented SEEL principles and lessons drawn from the SEEL website (http://education.byu.edu/seel/). Each weekly session lasted approximately 60 minutes, with some of that time being spent on assessment tasks and setting behavioral expectations. The actual instructional and activity portion of each session ranged from 30-45 minutes long. The instruction was provided individually to each participant by a graduate student under the direct supervision of one of the developers of the SEEL program.

Components of a session. The instruction consisted of blending hands-on experiences and activities with opportunities to practice blending and rhyming target words, as well as reading and writing with different modalities (e.g., poster paper, white board, word strips). The hands-on portion of instruction exposed the participants to frequent and salient models of the

target they were learning. The clinician used the target words in a variety of contexts as they helped engage the participants in meaningful activities and play related to the target words.

All of the participants were explicitly taught to read and or recognize target words belonging to the phonic pattern through shared and interactive reading relating to the activity and were given multiple authentic opportunities to read and write during the interactions (e.g., to make signs and labels, read directions) to achieve various functions (e.g., express feelings, give commands, make comments, request information). After experiencing the activity, the clinician facilitated discussing and reading a controlled target text about what the child experienced that highlighted the target pattern.

An example of an interactive activity from the SEEL lesson plan library that was used to teach the *long -a* pattern with the first participant, Brandon, will be described to highlight the principles evident in all SEEL lessons. Brandon was told explicitly at the beginning of the lesson what he would be learning and what phonic pattern to listen for during the activity. He was then given an opportunity to pretend to wake to make a cake, take and shake in ingredients into a bowl, make a cake by mixing in the ingredients, bake the cake, take the cake out of the oven, shake chocolate flakes on top of the cake, and rake up cake crumbs. The activity was meaningful to Brandon because he was familiar with the concept of making a cake and enjoyed participating in the steps to "make" a cake. Brandon's awareness of the target was increased during the intense exposure to *long -a* words during the activity. Throughout the session, Brandon was actively engaged, as he was given opportunities to perform the actions, hear the target words used playfully but in context, repeat the phrases using the target words, and come up with original phrases of his own with the target words. He was given opportunities to read target words throughout the activity, such as reading the directions of the "recipe" specifically created for this

lesson to make a cake. Brandon then participated in shared reading and writing activities, writing about his experience and reading a prepared text containing target words that outlined what he had just completed.

All SEEL lessons used in intervention for the other target patterns and those used with the other participants also contained similar elements of meaningful play, auditory bombardment of the target, word play hearing and using the target words, engaged participation, opportunities to create original oral and written phrases, and intense exposure to the target patterns in written text. Participants were first introduced to the activity, connections made to their prior knowledge, and the target pattern was explicitly taught to them. There was a great deal of flexibility with SEEL lessons as to the number of times an activity could be repeated or if the participants showed a particular interest in doing something a little differently, they could do so, as long as target words could be incorporated and the activity was meaningful. Each intervention session using SEEL was slightly adapted for the participants (further described in the discussion section) in order to address their individual needs and emphasize the target patterns while also incorporating appropriate behavior management strategies. Even with individual considerations being made, the five principles of SEEL were always incorporated into the instruction.

Outline of a session. As previously discussed, each participant had individualized targets and specific tasks selected to measure their performance and understanding of each target. There were also different strategies implemented with each participant to help keep them engaged and participating in the activity. However, despite these considerations, the same general outline was incorporated into each intervention session.

With each of the three participants, a written schedule was displayed to show them the order of activities planned. A few minutes were given at the beginning of the session to hear

about their week and anything else they wanted to discuss. They were then told about the activities planned for the day and what targets to be listening and looking for during the session. Brandon started his session with a spelling task, but then the specific target to be highlighted that session was introduced to him as well. At this time in the session, the participants could select a reward they could receive at the end of the session if they completed the activities and stayed on task. Rewards varied from extra time to play a favorite game, some type of small snack, or a small toy or book. The clinician then modeled target words and helped engage the participants in whatever activities were planned for that session that corresponded to the selected SEEL lesson. After completing the activities, including reading and writing during the lesson, the participants were presented with their specific tasks to measure their performance on the trained and untrained targets (with the exception of Coleton, whose assessment tasks were incorporated as part of the session activities). After completing the assessment portion of the session, the participants received their pre-selected reward item, and the session activities were briefly reviewed and discussed with the participant's parents.

Verbal prompts to stay on task or to simplify directions were given as needed throughout the session. Strategies such as giving appropriate time for the child to respond or one direction at-a-time were also implemented. A lot of verbal reminders of "first this, then that" were used to help remind the participants of what was expected of them. As necessary, occasional, short breaks were also given if the child was becoming agitated or too frustrated to be redirected back to the activity. However, maximal efforts were made to keep each child focused on the activities and to help facilitate reasonable turn-taking and appropriate interactions while still following the child's general lead and balancing their interests with the target-focused activities.

Treatment fidelity. All intervention sessions were video recorded. Sessions were observed for treatment fidelity in order to verify the instruction that was implemented faithfully followed the SEEL procedures and principles outlined, including meaningful and contextualized activities, the explicit modeling of the target, playful and engaging interaction, intense exposure to the target, and reciprocal interactions. Treatment fidelity was measured using a SEEL treatment scale, a check sheet (Appendix C), containing questions regarding each of the principles.

Two research assistants were trained to analyze 30% of the recorded sessions (approximately 20-25 minutes of instruction and activity) using the check sheet to determine the level at which SEEL principles were present in intervention sessions. They were asked to rate the first two principles of *meaningfulness* and *explicitness* by answering yes or no to questions, with several behavioral examples provided for clarification. These questions included, "Did the instructor link the activity to student's prior knowledge and experience?" and "Did the instructor model, restate, or repeat the target throughout the activity?" Both of these principles needed to have been answered with "yes" in order to satisfy SEEL fidelity for this study.

The third principle of *playful and engaging*, was rated through four questions on a four-point scale (none of the time, some of the time, most of the time, or all of the time) to indicate the level at which student enjoyment and involvement as well as instructor playfulness was evident. Again, behavioral examples were given for clarification on what to look for in these interactions. It was determined prior to the rating scales being completed that it would be acceptable for the ratings to include either "most of the time" (approximately 75-90%) or "all of the time" (90-100%) to satisfy SEEL fidelity requirements.

The fourth principle, *intense exposure to targets*, was determined by the number of times the instructor used target words and sounds during the activity. Although SEEL does not specify the number of times to use target words throughout a lesson, the principle is to provide copious opportunities to hear and use the targets. However, targets are used more frequently during activity portions of the lesson compared to writing; therefore, the principle is focusing on an average of target word use. For this study, and purposes of treatment fidelity, it was decided that if the instructor used the target at least an average of 5 times per minute, or approximately 100 times during a 20-minute segment of the lesson, this qualified as multiple exposures and the principle being met.

The fifth principle, *reciprocal exchanges*, was rated with a four-point scale (none of the time, some of the time, most of the time, or all of the time) for how often specified behaviors were evident. Due to the nature of deficits of the participants of this study, it was predetermined that "some of the time" (approximately 25-75%) or higher was an adequate rating for this measure.

The research assistants were trained through in-depth discussion, video examples, and thorough demonstrations of how to measure each principle. Then the research assistants independently watched the same videos of each participant and rated each SEEL principle. As the check sheet was much more subjective than checking for agreement on responses during the assessment tasks, inter-rater agreement needed to be established between the two research assistants completing the check sheet. This was accomplished by comparing their responses on the check sheet after they independently rated the same three sessions. Each of the five SEEL principles were given 20% of the total rating. If the two rated the principles differently, a fraction of the 20% was subtracted from the total score. For example, if the principle had four questions,

each question was worth 5%. Therefore, if the research assistants had different ratings for one of the questions, 5% would be removed from the overall score. If the research assistants rated or answered the question the same, nothing was subtracted from the score. For the intense exposure to targets section, there was a considerable amount of variability possible, depending on where the raters began counting targets during the session. Therefore, it was determined to be acceptable for the research assistants to be within 20 occurrences (hearing the target used) of each other (approximately a difference in one word every minute). An average score of 87% agreement was obtained initially after three videos, but after further discussion and examples of desired behavior were given to clarify some of the more subjective portions of the rating sheet, the research assistants watched two more videos and agreement scores of 94% and 95% were obtained.

After an acceptable level of inter-rater reliability had been achieved, the research assistants each viewed 13 more sessions (six sessions each of Brandon and Dan and one of Coleton), selected at random (representing 30% of the 44 total lessons taught during intervention with all participants). The research assistants were allowed to select their own sessions to view for each participant, which resulted in a total of 20 different sessions being viewed. Of the 20 different lessons that ultimately were observed and analyzed, all of them were considered to have meaningful and appropriate activities as well as explicitly-taught targets. There was agreement among the research assistants that the different aspects of playfulness and engagement were evident either most of the time or all of the time in the lessons they rated. Individual engagement and levels of participation for each participant will be discussed further in the discussion section. The principle of intense exposure to targets was also met in all of the analyzed sessions. The instructor said the target, on average, at least five times per minute, with a mean exposure to

targets over 140 times during a 20-minute segment of the lesson, across all the observed sessions. The researchers also agreed that the students were given opportunities to use the target in all of the activities and adequate reciprocal exchanges were evident either "some of the time" or "most of the time" during each of the activities. In summary, it was concluded that intervention for each participant faithfully incorporated all five SEEL principles in each lesson and activity.

Measures

Each of the three participants had specific assessment tasks and procedures created in order to better assess their individual performances on the different phonological awareness and or phonic patterns selected for them. Their respective assessment tasks to measure performances throughout intervention and rationale for each are described in the section that follows. A summary of participant information, targets and tasks for each participant is included in Table 5, to serve as a quick reference as the different participants are discussed.

Brandon. Brandon was assessed using two different tasks: spelling 16 words representing all of the five targets patterns and reading a total of 38 words, with at least seven words from each target pattern. Both tasks were measured as number of correct responses out of the total number of words. Brandon was given the spelling task at the beginning of each session and given a small reward upon completion, before beginning other activities. He was seated at a table with a piece of paper with 16 lines and numbers on it. He was then told to write the word he heard the clinician say on his paper. The words were dictated one-at-a-time and were repeated as many times as necessary for Brandon to write a response before moving on to the next word. The same 16 words were presented each week.

Table 5

Comparison of Participant Information, Targets, and Tasks

	Brandon	Coleton	Dan
Age and Grade	6;7/ First	6;4/ Kindergarten	5;5/ Kindergarten
SpEd Services	Resource	Small-group K class (Speech and OT)	Language services at BYU K
PALS Screening	1. Spelling: 26/42 2. Primer-level word recognition: 3/20 3. Pre-primer-level word recognition: 13/20 4. Pre-primer-level reading: 56/85 -guessing -avoidance behaviors during reading	1. Naming letters: 20/26 2. Letter sounds: 17/26 3. Rhyming: no response 4. Beginning sound awareness: no response -no blending or print awareness skills -poor joint attention	1. Naming letters: 24/26 2. Letter sounds: 23/26 3. Rhyming: 3/10 4. Beginning sound awareness: 8/10 5. Word recognition: no response -very resistant to written text
Targets	Long-vowel patterns: *Long-a, Long-i, Long-o, -ea, -ee*	Short-vowel patterns: *-ack* *-at* and *-ap*	Short-vowel patterns: *-ack, -an* *-at* vs. *–op* & *-at* vs.*-ap*
Tasks and Measures	*Focus on vowel patterns & phonics patterns for decoding* 1. Spelling 16 words 2. Reading a target word presented one at a time (38 total)	*Phonological awareness, print awareness, comprehension* 1. Rhyming: decide if 2 words rhyme or not 2. Onset-rime blending with comprehension: ask him to carry out a task but first he must blend the word to know what to do (9 *-ack* words) 3. Selecting specific word from 2 choices	*Some phonological awareness, phonics patterns for decoding* 1. Blending (17 words) 2. Decoding/Reading: Presented with 3 words to contrast between vowel and consonant endings with a distractor (32 different word groups)

Following all of the intervention activities, including other reading and writing activities, Brandon was asked to read words, presented randomly, one-at-a-time, on a PowerPoint presentation. The slides were advanced forward by the clinician after Brandon responded, not allowing for any slide repetitions. Each week the word order was randomized and presented in a slightly different order. All 38 words were presented each week, regardless of the target being addressed that intervention session. After completing this task he was also given an opportunity

to pick a final prize or small reward. Four different times during progress monitoring (sessions 6, 9, 13, and 20) a separate word list of 23 words was presented, also randomized, one word per slide, on a PowerPoint presentation for Brandon to read. This list contained words representing all five target patterns; however, as previously described, these words were not specifically used in intervention activities and were meant to evaluate if Brandon's skills with the target patterns were generalizing to less-familiar words. This task was presented immediately following the reading of the other 38 words, prior to Brandon receiving his final reward.

These tasks were selected for Brandon because they were grade-level appropriate and gave a fairly accurate depiction of Brandon's ability to use the pre-selected target patterns, both in writing and reading. The spelling task was used to evaluate Brandon's recall and application of target patterns in words, especially without other contextual information. The reading task focused specifically on Brandon's ability to recognize learned patterns and apply phonetic rules to decode words correctly. During screening sessions and initial assessments, Brandon resorted to guessing with unfamiliar words. Intervention focused on helping him reduce guessing, therefore, his specific tasks were designed to evaluate any change in his performance given specific phonic-pattern knowledge. Although Brandon needs to be able to read words in context for overall comprehension purposes, reading (and writing) words in isolation helped facilitate more compliance and accurate performance on specific word-knowledge and understanding his ability to learn phonetic rules and patterns.

Coleton. During initial screening sessions, Coleton had inconsistent performance which made it difficult to obtain an accurate overview of his early literacy skills. One of the main focuses of SEEL intervention with Coleton was to help him attend to and appropriately participate in a literacy-focused task for longer periods of time. However, as this specific study

was looking at how effective SEEL was with students with ASD in learning specific phonic patterns, several different tasks were selected to gather data on his performance in different phonic-related areas. These tasks were presented during the lesson, as Coleton showed a lot of resistance and noncompliance transitioning to tasks separate from the actual activity. The tasks were not presented in any specific order during the sessions; instead, they were presented as they could be interwoven into the activity, sometimes interspersed with each other.

One of the tasks was a rhyming task, where Coleton was told to listen to two words and asked to respond "yes" or "no" if they rhymed. Different combinations of the three different target-pattern words (*-ack, -at, -ap*) were used for this task. It was left up to the clinician to present a randomized selection of rhyming and non-rhyming pairs throughout the activity. The words were said with over-emphasis, to purposefully draw attention to the rime endings of the words. One of the purposes of this task was to assess Coleton's phonological awareness abilities without pressuring him to come up with a correct rhyme on his own. Although Coleton had a 50/50 chance of giving the correct response, this task encouraged responding in general to a direct question. This task was measured as either correct or incorrect, or no response.

Another task used with Coleton was an onset-rime blending task, where he was asked to perform a task, such as stacking cups, with the direction of "st-ack the cups, please." There were nine possible *-ack* target words to use when giving directions, either using the word as the action or direct object. Only one word to blend was given per direction (eg: "cr-ack the snack" would be appropriate but the direction to "put the tr-ack b-ack in the p-ack" would not be). This task not only focused on another aspect of Coleton's phonological awareness, but it also helped evaluate his receptive language comprehension skills. This task was measured as either correct (if Coleton

said the correct word (blended) and did the task that was asked of him), or incorrect (if he did not do the task correctly or did something other than what he was asked) or no response.

The last task selected for Coleton was to focus on his print awareness and phonic pattern recognition abilities by having him select a specific written word from two choices. The words for this task could be any combination from those representing the three target patterns. The clinician randomly selected two words representing different patterns. The words were shown to Coleton on separate notecards and he was asked to point to a specific word (chosen and said aloud by the clinician). This task was measured as either correct or incorrect, or no response. Again, Coleton had a 50/50 chance of choosing the correct word; however, it introduced him to seeing words in print and also encouraged responsivity to a specific attending task.

Dan. Dan also was assessed using two different tasks, depending on the specific target being focused on during intervention. Initially, Dan had displayed some inconsistent phonological awareness skills during screening; therefore, he was given the task to blend words after hearing the onset and rime of the word with the -*ack* and -*an* patterns (nine -*ack* words and eight -*an* words, for a total of 17 words). Dan was presented with this task at the end of the session, after all other activities had been completed. He was seated at a table and told to listen to the sounds that made up a word. He then was to combine the sounds and say the word to the clinician. This task was measured as number of correct responses out of the total number of words presented. This task focused on assessing Dan's emerging phonological awareness skills as well as his receptive language abilities in following directions and staying with a task through completion. This task was discontinued after six sessions; however, when Dan showed more consistent abilities and the focus of intervention shifted to assessing Dan's decoding skills.

The main task that Dan was presented with during each remaining session was that of selecting the correct word when presented with three choices on a PowerPoint presentation. During screening sessions, Dan displayed a lot of resistance to reading and decoding and often got very distracted and off-topic during such activities. This task was designed to facilitate Dan's emerging phonics skills without putting too much pressure on him to be able to decode at this stage of his reading development. The goal was that after intervention, Dan would be able to at least recognize the targeted rime pattern in the words. The three words were presented on a single slide, and Dan was asked to point to a specific word. The slides were then advanced forward by the clinician after Dan had responded. Each week the order of the slides was randomized, as well as the layout of the three words on the individual slides.

The word recognition task for Dan was divided into two phases: the first focused on the contrast between -*at* and -*op* (a different vowel and final consonant) while the second phase focused on the contrast between -*at* and -*ap* (same vowel, so added emphasis given to paying attention to more of the word to make the distinction). Each slide contained two of the contrasting patterns as well as a third, non-target-specific distractor word. The purpose of the distractor word was to reduce the probability of Dan selecting the correct word through 50/50 chance. There were eight different word combinations with each contrasting phase, for a total of 16 word combinations. However, each word combination was presented twice during assessment, one time asking for the -*at* word and one time asking for the -*op* word (or -*at* and -*ap* in the second phase). During baseline assessments, both contrasting patterns were presented (32 slides); however, in subsequent sessions, only the specific contrast group was presented per session (for a total of 16 word combinations). This task was measured as number of correct

words selected over the total number of choices presented. After completing this task, Dan was given the opportunity to pick a final prize or small reward.

It should be noted that for a few sessions the word recognition task was modified so that Dan was only presented one word at a time due to the fact that he was having significant difficulty focusing on the task and was just randomly selecting a word with no effort or refusing to respond all together. More information on this modification will be presented in the next section. During this period, the task transitioned into a reading task and was measured as number of words read correctly over the total number of words presented. However, Dan was able to return to the original task of being presented with three choices for the last three sessions.

Data Analysis

Each participants' performance during baseline, treatment, and maintenance conditions was plotted on individual graphs displaying baseline assessment and intervention assessment information in order to analyze the data. Graphs have a y-axis, displaying the number of words read correctly (or other specific task being measured for accuracy), and an x-axis, displaying the intervention sessions implemented in chronological order. The graphs were analyzed visually to determine the effectiveness of the intensive SEEL intervention in teaching young children with varying degrees of ASD to read the targeted phonic patterns and perform the specific phonological awareness tasks. Different components of the graphs were analyzed including the following: (a) the trend or rate of increase (or decrease) of data points in each phase of the study (baseline, intervention-while maintaining baseline on the untrained target, and maintenance); (b) the variability of data in each phase; (c) overlapping data points between baseline and other phases (or other indicators of generalization of skills occurring across targets); and (d) overall patterns of acquisition and levels of word attainment, including the amount of time taken for

participants to reach criterion level. Mean scores, standard deviation, and range for each phase of each target were calculated for all participants.

Results

This section includes the data for each participant, presented both graphically and qualitatively with a written description of the participant's performance throughout intervention. Also contained in this section are descriptions of overall trends of the data points, overlapping data points between different phases, and the accuracy and rate of attainment of the targets. Descriptive statistical analysis of the data includes the mean, standard deviation, and range for each phase of the intervention.

Each of the three participants received individualized, one-on-one intervention sessions, including three baseline sessions to measure performance levels on phonological and phonics-based tasks prior to structured intervention. Progress monitoring was conducted throughout intervention, as previously described. Each participant had individualized targets, tasks, and criterion levels to reach. The following sections contain data for each participant.

Brandon

Data were collected for Brandon on two different tasks: spelling 16 words representing all of the five targets patterns and reading a total of 38 words, with at least seven words from each target pattern (see Table 1). Initially, Brandon was consistently unable to read the target words in the baseline condition (had less than 30% accuracy) for three of the five targets; *long -a*, *long -i*, and *-ea*. This was also true of the *long -o* target for seven weeks of baseline conditions, but then there was somewhat variable performance demonstrated, showing overall increasing abilities. However, he did not consistently perform at criterion level, despite the improvement over baseline. Brandon was able to achieve the criterion level of at least 70%

correct for these four target patterns (*long -a, long -i, -ea, and long -o*) following intervention and into the maintenance phases. Brandon continued to show improved ability to read the four targets at criterion level or better during each respective maintenance phase, even though the focus of instruction was on a different target. Brandon's baseline performance with the fifth target, -*ee*, was already at 43% accuracy and continued to increase after the fourth session, even during baseline conditions. Therefore, this target was never specifically addressed in intervention. His mean score across the four targets (excluding the -*ee* target) for the baseline condition with the reading task was 1.65. This increased to 5.22 during the intervention phases and 6.17 during the applicable maintenance phases. Brandon's mean score across the five targets using the generalization list words was 2.0 for the four sessions those words were assessed. However, it is important to make the distinction that there were between seven and nine words for each target being assessed during the main task, and only three to five words for each target during the generalization assessment.

During the spelling task, Brandon consistently misspelled most (18 of 20) of the target words in the baseline condition (refer to the words with an asterisk in Table 1). There were one or two words Brandon started regularly spelling correctly in three of the patterns (*long -i, long -o*, and -*ee*) before direct instruction had been introduced with each of those patterns (e.g., *time, bone, cone,* and *beep*). However, his overall performance remained consistent in that he showed the most general improvement the more instruction and exposure he received with the different long-vowel target patterns, excluding the –*ea* pattern, in which he never showed improvement.

Brandon's results during the reading and spelling tasks for each target and each phase are described below and are presented in Figures 1, 2, and 3. Following the discussion of each

individual target, the mean scores, standard deviation, and range for all targets and conditions with the reading tasks are found in Tables 6 and 7 and in Table 8 for the spelling task.

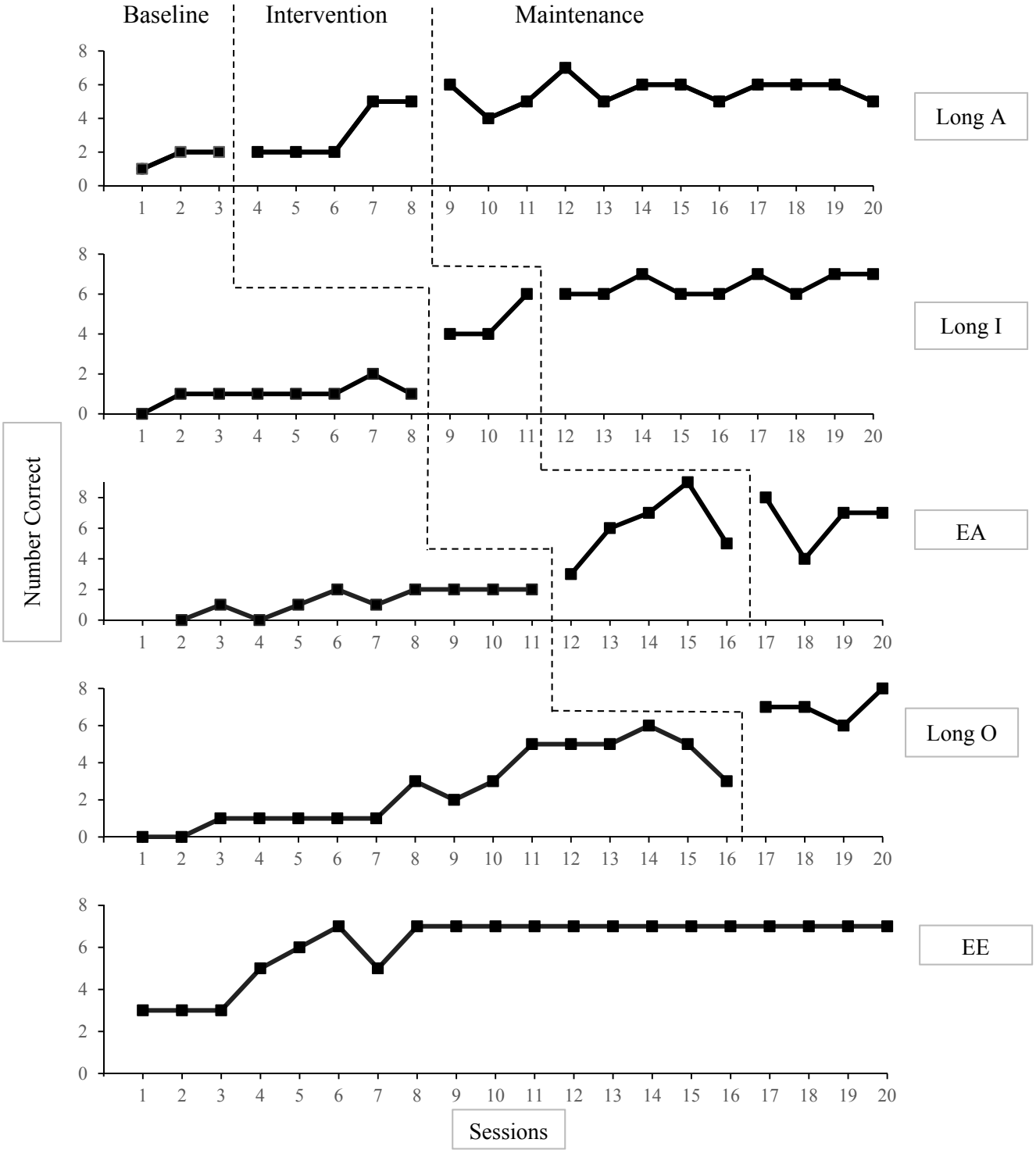

Figure 1. Brandon's reading results for *long -a*, *long -i, -ea, long -o*, and *-ee* targets.

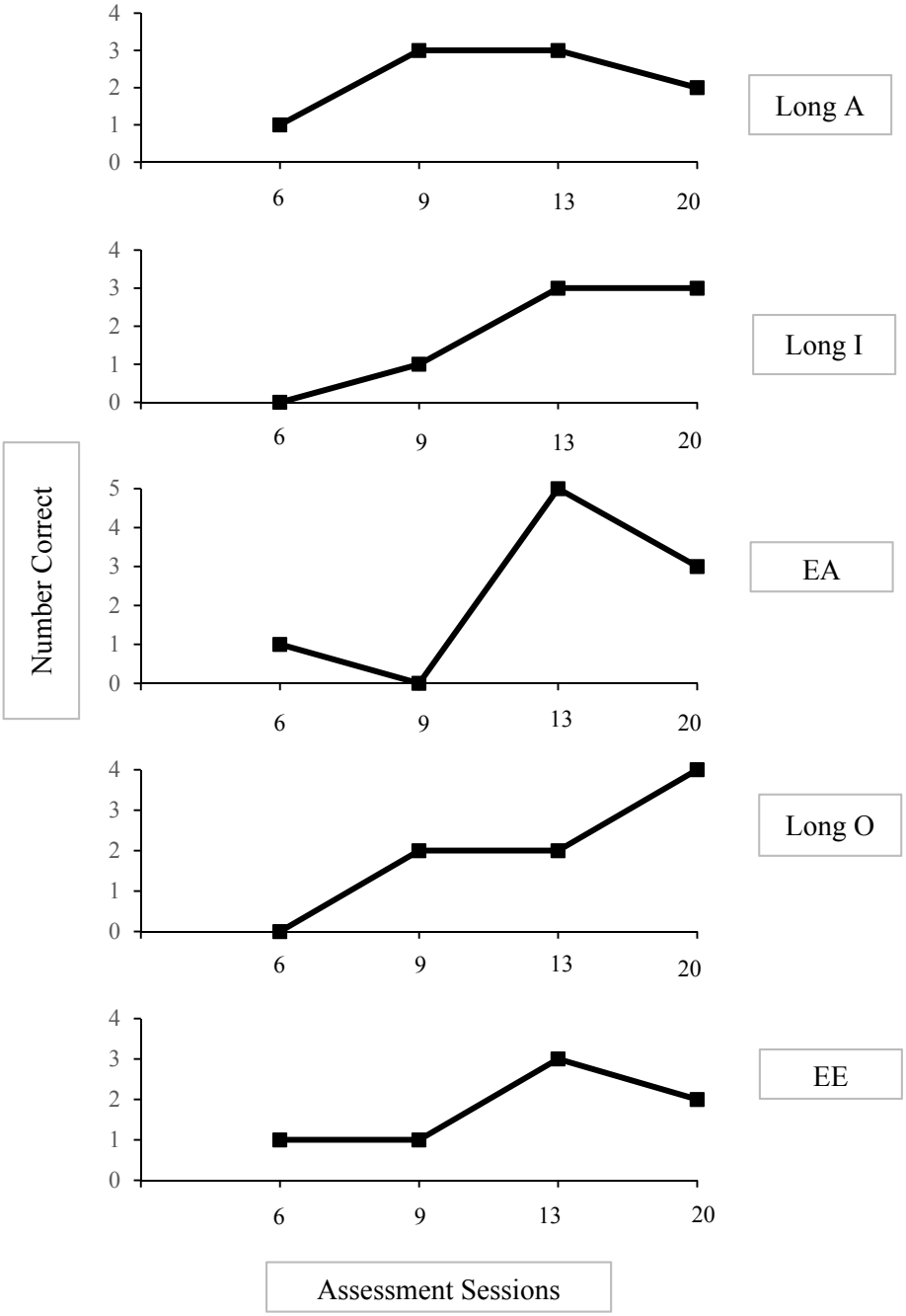

Figure 2. Brandon's reading results for all targets using the generalization list.

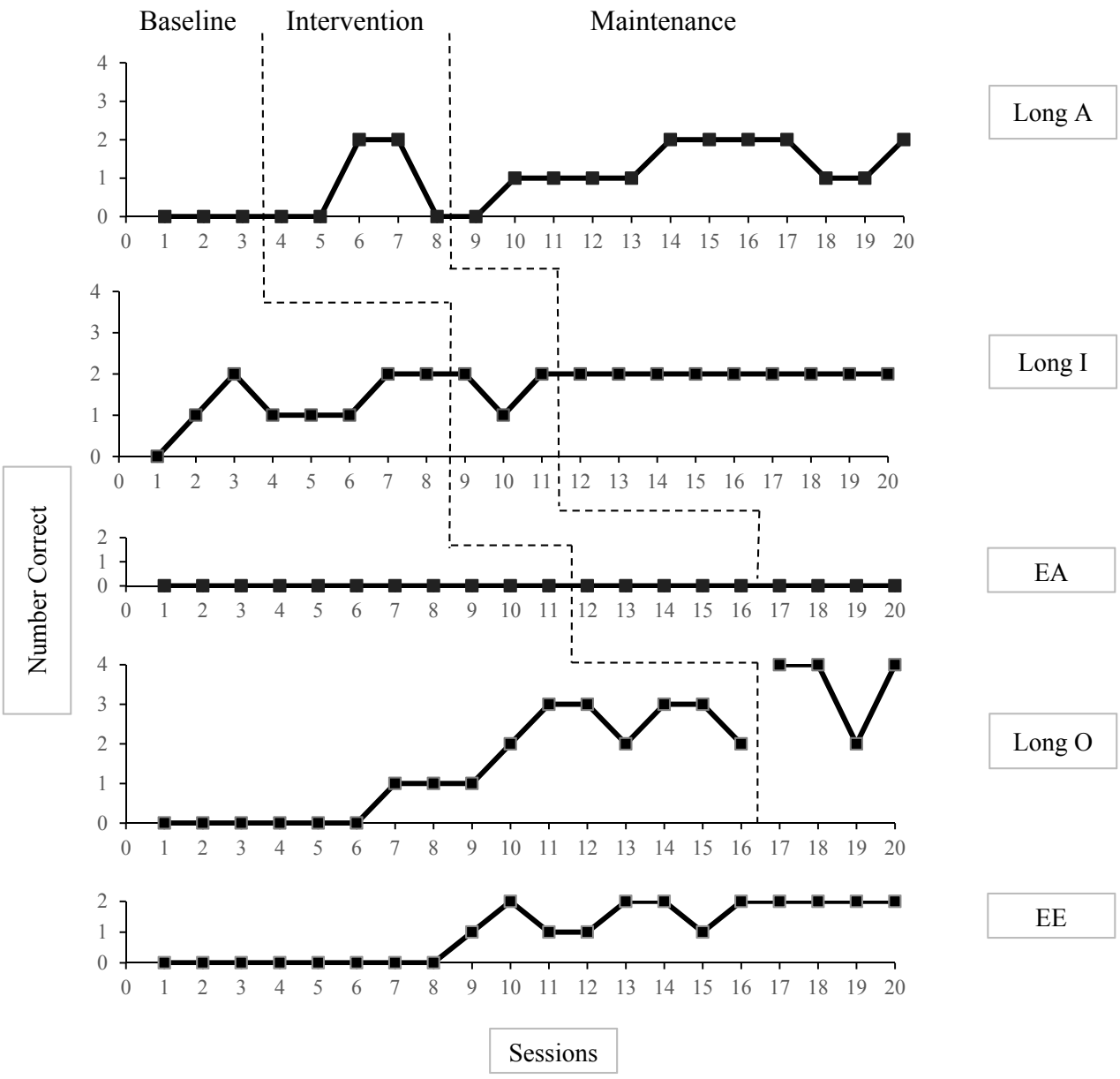

Figure 3. Brandon's spelling results for *long -a, long -i, -ea*, *long -o*, and *-ee* targets.

Target: long -a (with silent e). In the baseline condition, Brandon correctly read two words with the *long -a* pattern in two of the baseline sessions. During the intervention phase, his ability to read words with the *long -a* pattern increased to a mean of 3.20 with a range of two to five words correctly read. Brandon reached the criterion level of at least 70% correct (5/7 words)

during the intervention phase (five sessions). He then continued to read at least five words correctly during the maintenance phase (the 12 sessions following intervention), except for one session when he only read four words correctly (the one data point that overlapped between maintenance and intervention). He read six words correctly six different sessions and even reached 100% accuracy (7/7 words) one session. Brandon's mean words read correctly increased from baseline to maintenance from 1.67 to 5.58. In reference to the generalization word list, Brandon read between one and three *long -a* words correctly of the five used in assessment.

Brandon did not spell any of the *long -a* target words correctly during baseline. He did spell two target words correctly during the intervention phase, but did not maintain consistent accuracy with those *long -a* words during the maintenance phase. Of the 12 maintenance sessions, he did spell at least one of the four *long -a* words correctly 11 of the sessions.

Target: long -i (with silent e). For the first six sessions of the baseline phase for the *long -i* target, Brandon read zero to one words. He then had a session of reading two words correctly, but was back at one word for the last baseline session. During the three sessions of intervention, his mean increased to 4.67, with Brandon surpassing the criterion level during the third intervention session, reading six words correctly. He maintained this accuracy during the maintenance phase (the nine subsequent sessions), reading at least six words correctly, and read all seven words four different sessions. Brandon's mean words read correctly increased from baseline to maintenance from 1.00 to 6.44. Using the generalization list, Brandon first was unable to read any of the five *long -o* target words but then read three words during the third and fourth assessments of those words.

Brandon varied between spelling one or two *long -i* words correctly during the baseline and intervention phases of this target. However, he consistently spelled two *long -i* words correctly during the nine maintenance sessions.

Target: -ea. During the first week of baseline conditions, the -*ea* target words were not included in the assessment. However, they were added by the second week (to help control for the apparent familiarity with the -*ee* target). Brandon read zero to two -*ea* words (out of nine) during the remaining ten sessions in baseline condition, with a mean of 1.30. His mean increased to 6.00 during the intervention phase. He reached the criterion level of at least 70% (7/9 words) during the third intervention session, and then reached 100% accuracy the following session. However, he unexpectedly dropped in accuracy the next session, to only reading five words. Intervention shifted to a new target despite the drop, with hopes that Brandon would show more consistent performance. Brandon maintained a mean of 6.50 during the maintenance phase, but was still displaying some variance with a range of four and eight words. Brandon's mean words read did increase from 1.30 to 6.50 from baseline to maintenance, with one overlapping data point between intervention and maintenance. Brandon's performance with the -*ea* target words on the generalization list also showed variability, ranging from zero to five words.

Despite his variable performance with the -*ea* target during the reading tasks, Brandon consistently was unable to spell the -*ea* target words correctly during any phase. However, it should be noted there were only two (instead of four) words with this target pattern used in the spelling task.

Target: long -o (with silent e). For the first seven sessions of the baseline phase for the *long -o* target, Brandon read zero to one words. However, in the subsequent sessions, Brandon's performance began generally increasing without direct intervention; and yet he only reached the

criterion level of at least 70% (6/8 words) once and then dropped in performance the following two sessions still in baseline conditions. There was overlap between data points with the *long -o* target in baseline and the target being focused on by that time in intervention, *-ea*. In fact, there was more improvement with the *long -o* target still in baseline, prior to the commencement of intervention with the *-ea* target. However, despite the overall increase, the mean number of *long -o* target words read correctly during baseline was only 2.63. The *long -o* target was still taught during intervention because Brandon had only reached the criterion level once (during the 16 sessions in baseline condition). Brandon achieved criterion levels during the four sessions of intervention, achieving 100% accuracy the last session of intervention. Brandon's mean words read increased from 2.63 in baseline to 7.00 during intervention. There was no maintenance phase for the *long -o* target as it was the last target taught. In regards to the generalization list, Brandon first read zero words, then read two words correctly, but did not read four of the five correctly until the last assessment, after he had received direct instruction with the *long -o* target.

Brandon was unable to spell any of the *long -o* target words correctly at the beginning of baseline. However, he did start showing more improvement in his spelling abilities, coinciding with the general improving abilities seen in the reading task during the same time. He ranged from zero to three words correct prior to intervention with the *long -o* target; however, he did spell the four words correctly three of the four sessions during intervention.

Target: -ee. Brandon began baseline reading three words correctly with the *-ee* target. He had already achieved the criterion level of at least 70% (5/7 words) by the fourth session, without direct intervention. Due to the overlapping data points between baseline condition for this target and intervention phases for other targets, and his consistent performance, the *-ee* target was not addressed in formal instruction during intervention. Brandon consistently read all seven words

correctly for the last 13 sessions and had a mean of 6.15 over the 20 sessions. There were only three *-ee* words included in the generalization assessment, and he ranged from one to three words correctly read.

Brandon did start baseline for the spelling task not spelling any *-ee* target words correctly; however, there were only two words being assessed. He spelled both of the words correctly seven of the last eight sessions.

Table 6

Brandon's Reading Performance Data for Each Phase of Intervention

Target	Phase	Mean	SD	Range
Long -a	Baseline	1.67	0.58	1-2
	Intervention	3.20	1.64	2-5
	Maintenance	5.58	0.79	4-7
Long -i	Baseline	1.00	0.53	0-2
	Intervention	4.67	1.15	4-6
	Maintenance	6.44	0.53	6-7
-ea	Baseline	1.30	0.82	0-2
	Intervention	6.00	2.24	3-9
	Maintenance	6.50	1.73	4-8
Long -o	Baseline	2.63	2.03	0-6
	Intervention	7.00	0.82	6-8
	Maintenance	_	_	_
-ee	Baseline	6.15	1.50	3-7
	Intervention	_	_	_
	Maintenance	_	_	_

Note. There was no maintenance phase for the *Long -o* target as this was the last target taught and the *-ee* target was never addressed in intervention.

Table 7

Brandon's Generalization List Performance Data

Target	Mean	SD	Range
Long -a	2.25	0.96	1-3
Long -i	1.75	1.50	0-3
-ea	2.25	2.22	1-5
Long -o	2.00	1.63	0-4
-ee	1.75	0.96	1-3

Table 8

Brandon's Spelling Performance Data for Each Phase of Intervention

Target	Phase	Mean	SD	Range
Long -a	Baseline	0.00	0.00	0-0
	Intervention	0.80	1.10	0-2
	Maintenance	1.33	0.65	0-2
Long -i	Baseline	1.25	0.71	0-0
	Intervention	1.67	0.58	1-2
	Maintenance	2.00	0.00	2-2
-ea	Baseline	0.00	0.00	0-0
	Intervention	0.00	0.00	0-0
	Maintenance	0.00	0.00	0-0
Long -o	Baseline	1.31	1.25	0-3
	Intervention	3.50	1.00	2-4
	Maintenance	_	_	_
-ee	Baseline	1.00	0.92	0-2
	Intervention	_	_	_
	Maintenance	_	_	_
All Targets	All Phases	5.40	3.28	0-10

Note. There was no maintenance phase for the *Long -o* target as this was the last target taught and the *-ee* target was never addressed in intervention.

Summary of performance. Brandon's reading results for the *-ee* target suggest he may have already had some familiarity with the *-ee* pattern, especially some of the words selected for the assessment, prior to the commencement of this study. Brandon's ability to read *-ee* words increased and stayed the most consistent of any of the targets, even as intervention focused on the other targets. Brandon's ability to apply the *-ee* pattern in spelling was also displayed consistently during the later sessions of intervention, even without direct instruction with the *-ee* pattern. It is also possible, given the 20-session duration of the study with Brandon, some skills were generalized to target patterns emphasized later in intervention. Brandon's reading and spelling results for the *long -o* target indicate he was either generalizing some learning from the previous targets of intervention or there was some external factor influencing his ability to read more of these words prior to direct intervention. Considering what was displayed with the *-ee* pattern and the similarity between the *long -o* pattern words and previous targets that focused on a long vowel sound with a silent "e" (*long -a* or *long -i*), it is very probable Brandon generalized some learning throughout intervention.

In an attempt to minimize the effects of external factors during the course of the study, the generalization list of words was used periodically during assessment with Brandon (see Table 2). This was done in order to better account whether there was actual learning of the five long-vowel target patterns following direct instruction or if some words were just becoming more familiar and memorized with repeated exposure. Generally, Brandon's ability to read words from the generalization list (which consisted of words that had not been specifically used during intervention sessions) improved after that particular target had been taught in intervention. However, Brandon's performance with the *-ee* target improved with the generalization words, just like the main assessment, without direct instruction, again supporting the likelihood that

Brandon had more familiarity with that pattern and/or was receiving instruction with that pattern outside the study parameters. However, even if there was some generalization of skills, Brandon required direct instruction with the four patterns (excluding -*ee*) to consistently achieve the criterion levels for each of the targets. He also showed the most dramatic and steady improvement in performance following intervention, with both the reading and spelling tasks.

Brandon achieved the reading criterion level for each target multiple times during the study; he reached *long -a* 13 times, *long -i* ten times, -*ea* five times, *long -o* five times, and -*ee* 17 times. His overall range in reading scores for the five targets was zero to nine and the trend of his data was an increase in performance from baseline to intervention to maintenance conditions. He was able to mostly maintain his performance during the maintenance phases following intervention for the four applicable targets, with a little more variable performance with the -*ea* target words. The data from the four generalization assessments also suggest overall improvement in performance following intervention. The trend of the data for the spelling task was also an increase in performance from baseline throughout intervention for all but the -*ea* target, which showed no improvement. The mean scores for the intervention and maintenance phases for the targets in both tasks were substantially larger than the scores during baseline, suggesting that Brandon benefitted from participation in the study.

Coleton

Short-vowel targets. Three different tasks were presented during intervention with Coleton: rhyming, blending and comprehension, and word recognition with short-vowel patterns (see Table 3). Coleton displayed variable performance and challenging behaviors with all tasks during baseline conditions. When the rhyming task was presented during the first two baseline sessions, Coleton did not give any response. He was very distracted and was inattentive to verbal

cues or responses, despite multiple attempts to redirect him or ask the questions at different points during the session. During the third attempt at collecting a baseline performance level, Coleton at least acknowledged the question being asked (verbally repeating it), but did not give any appropriate responses (rather than answering "yes" or "no", he just moved on to another activity or repeated the words). After the first session of intervention, Coleton again acknowledged the question but did not initiate any response.

Coleton was a little more willing to participate in the blending and comprehension task, as it was more easily incorporated into the activity already in place, rather than needing to be presented as a separate task or question. Coleton's baseline performance ranged from one to three correct responses, which included blending (saying the word aloud) and then doing the task described with the target word. However, it is important to note that the trials marked as "incorrect" were not that he incorrectly blended the word or did the task incorrectly. The "incorrect" trials were due to Coleton's lack of responsivity or needing additional prompting to carry-out and perform the task. He needed frequent cues and reminders to stay on-task and to listen for the target word, as well as verbal instruction in order to complete the task.

The third task, word recognition (given two choices), also provided inconclusive performance levels. During the first two sessions of baseline, Coleton correctly identified two words then one word, respectively. However, as will be further discussed in another section, he required pre-teaching of the task as well as frequent breaks and little rewards between each trial. By the third week of baseline, Coleton gave no response when presented with the two words, and became upset and agitated when attempts were made to redirect him back to the task. This same behavior occurred after the first intervention session.

Coleton's results during the different tasks are presented in Figure 4. Mean scores, standard deviation, and range for the targets and conditions are found in Table 9.

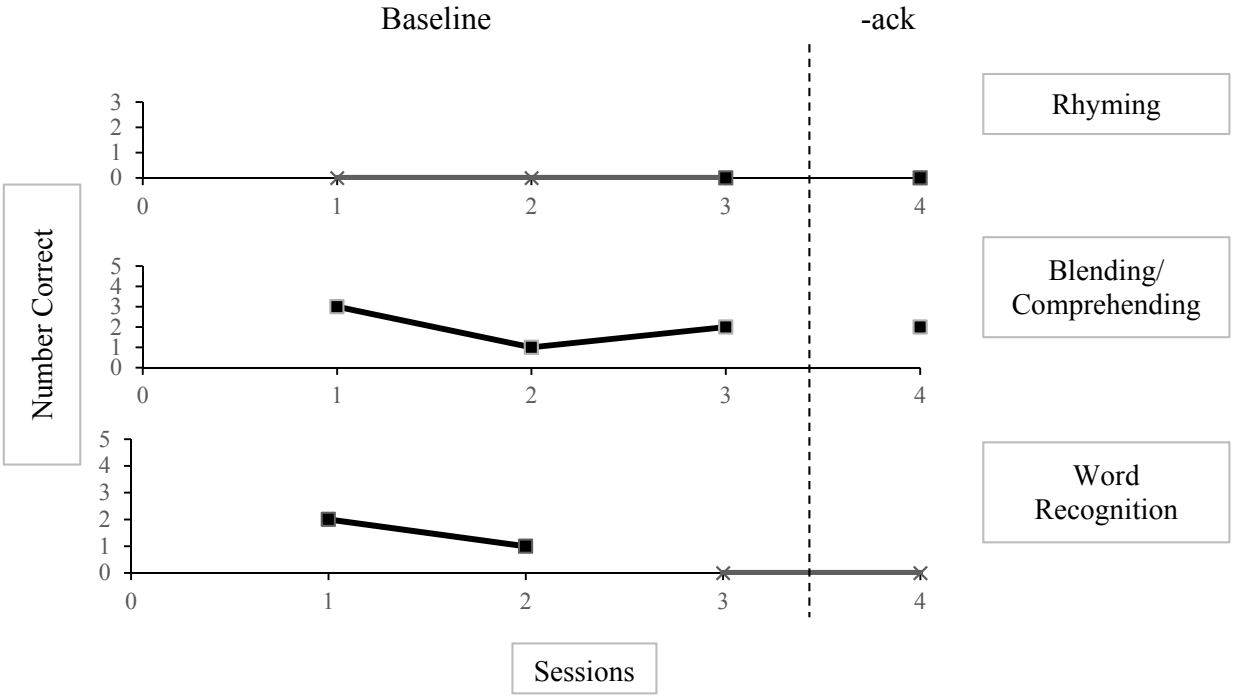

Figure 4. Coleton's results for rhyming, blending/comprehending, and word recognition.

Table 9

Coleton's Performance Data for All Tasks

Task	Phase	Mean	SD	Range
Rhyming	Baseline	0.00	_	0-0
	Intervention	0.00	_	0-0
Blending/	Baseline	2.00	1.00	1-3
Comprehension	Intervention	2.00	_	2-2
Word Recognition	Baseline	1.50	0.71	1-2
	Intervention	0.00	_	0-0

Summary of performance. Further observations and discussion regarding Coleton's performance and ultimately, his participation in the study will be given in the discussion section. However, as indicated by the sparse and inconclusive data included in this section, Coleton discontinued instruction for this study following one week of formal intervention, due to several factors. Scheduling sessions became challenging with the family, and Coleton's noncompliant behaviors made it difficult to accurately measure performance levels throughout intervention sessions. Thus, it was a mutual agreement between the clinicians and Coleton's family to discontinue intervention and assessments.

Therefore, the numbers and data points that are included are purely reflective of the attempts made to gather data and do not necessarily represent reliable ability levels for the different tasks. Coleton's data are a representation of his variable performances and how challenging it was to measure skill levels using the tasks and measures chosen for Coleton. Despite the challenges encountered and discontinued intervention sessions, it would be inaccurate to assume Coleton did not benefit from participating in the study or show improvement in other areas not measured. Even with sparse quantitative data, valuable qualitative data were gathered that is not represented in this section but will be discussed in more depth in a later section.

Dan

Data were collected for Dan on two different tasks: blending and word recognition with different short-vowel patterns (see Table 4). Dan started intervention with the blending task. During the first three sessions in baseline condition, Dan blended zero to three words correctly with the -*ack* target and zero to one word with the -*an* target. However, once the intervention phase began, Dan made significant increases in his performance with both targets. Intervention

for -*ack* was only two sessions and only lasted for one session for the -*an* target. However, despite the fact there were few intervention sessions devoted to this task, Dan showed improvement in his blending skills. His mean score across both targets in the baseline condition was 1.67 which increased to 13.33 during the intervention phases. The blending task was discontinued with Dan after only six sessions due to his rapid improvement. It was apparent Dan just needed more familiarity with the task and after minimal instruction with the target words and blending, he showed great gains. Once Dan showed more aptitude with a phonological awareness task, the focus of intervention switched to more phonics-based and it did not seem beneficial to keep assessing Dan on a skill in which he was already proficient.

Dan's results during the blending task for both the -*ack* and -*an* targets are presented in Figure 5. Mean scores, standard deviation, and range for these targets and conditions are found in Table 10. Dan's results during the word recognition task for each target and each phase are described below, with the results for the word recognition task with the two contrasting groups: -*at* and -*op* as well as -*at* and -*ap* presented in Figure 6. Following the discussion of the two contrasting groups, the mean scores, standard deviation, and range for the two groups are found in Table 11. As a reminder, the use of contrasting groups for the decoding task was initially meant to help measure if Dan did better distinguishing between similar or different rime patterns. However, when Dan did not respond well to the task and modifications were made, comparing contrasting groups was no longer very effective. It should be noted that careful attention to the different phases for the targets and groups needs to be made when interpreting the data, as the different phases did not remain clearly distinguished while modifications were made to the assessment task. The rationale for making modifications to the task is explained in more detail below.

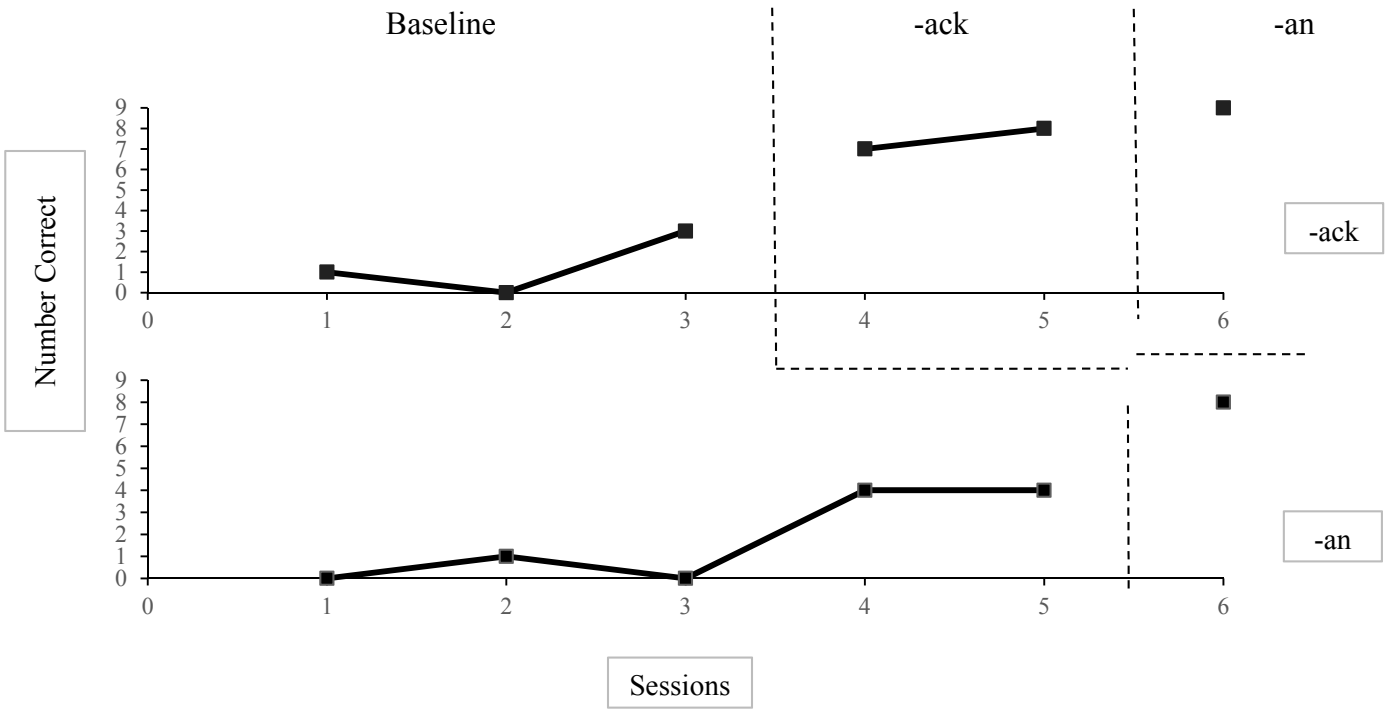

Figure 5. Dan's results for blending with *-ack* and *-an* targets.

Table 10

Dan's Blending Performance Data

Target	Phase	Mean	SD	Range
-ack	Baseline	1.33	1.53	0-3
	Intervention	7.50	0.71	7-8
	Maintenance	9.00	_	9-9
-an	Baseline	1.80	2.05	0-4
	Intervention	8.00	_	8-8
	Maintenance	_	_	_

Note. There was no maintenance phase for the *-an* target as this was the last target taught.

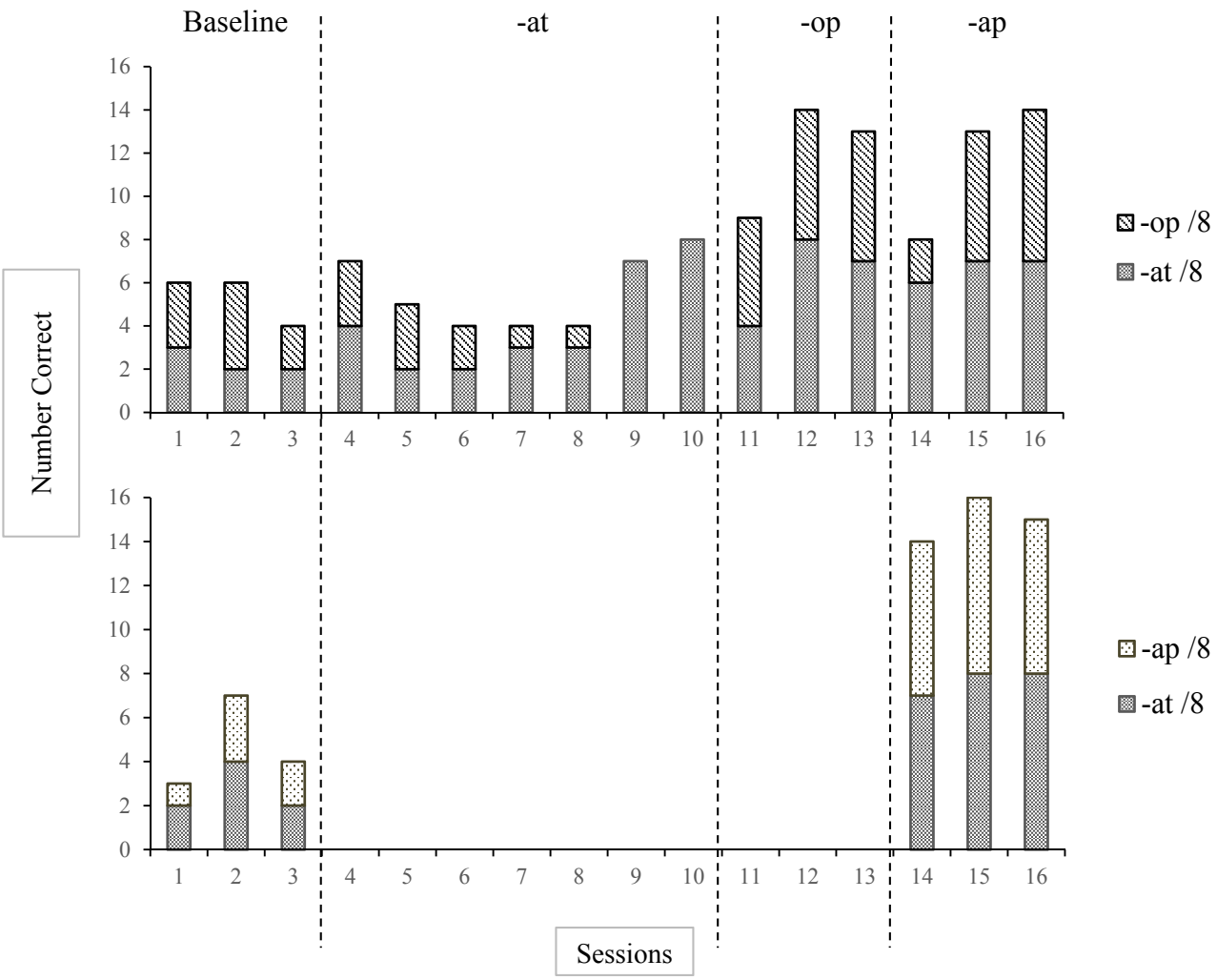

Figure 6. Dan's results for word recognition for -*at* vs. -*op* and -*at* vs. –*ap*.

Target: -at vs. -op. Dan demonstrated more variable performance with the word recognition task. Initially, Dan was asked to select the correct word from three choices. Data were recorded in two groupings: one contrasting the -*at* and -*op* targets and the other group contrasting the -*at* and -*ap* targets, with 16 responses required for each group. During the first three sessions in baseline condition, Dan had a range of four to six correct responses in the -*at* vs. -*op* group (mean of 5.33) and a range of three to seven correct responses in the -*at* vs. -*ap* group (mean of 4.67). However, even in those initial sessions, Dan showed a lack of effort and

resistance to the task as he randomly selected a word without looking in order to get through the task.

Since Dan protested participating in the assessment task, the task was shortened in an attempt to reduce the element of guessing and lessen the demands placed on Dan to remain focused on a print-task. Dan was only assessed on the group of targets containing the target of intervention, the -*at* vs. -*op* group. During the next five intervention sessions, (only being assessed using 16 trials instead of all 32, with the -*at* target transitioning to the intervention phase and the -*op* target remaining in baseline condition), Dan had a mean score of 4.80 with the targets combined. Looking specifically at Dan's accuracy with the -*at* target during those five sessions, he only had a mean score of 2.80 compared to a mean of 2.00 with the -*op* target, even with direct instruction with the -*at* target. It was determined at this point in the intervention phase there was still too much guessing involved with the task and it was not accurately measuring Dan's true word recognition skills, as the combined data points actually displayed a decrease in performance levels.

Therefore, for the next two sessions, with the -*at* target still in the intervention phase (and -*op* in baseline), Dan was asked to actually read the words, instead of selecting from three options. Dan was able to reach the criterion level of at least 70% (6/8 words) both of those sessions with the -*at* target and read zero -*op* words. Those two sessions were acknowledged to be a better representation of Dan's true word recognition and reading skills than previous data points had shown. The -*at* target was then moved to maintenance phase and the -*op* target moved to the intervention phase. However, in an attempt to restore some stability with the data, Dan continued to be assessed with only one word at a time. Dan again showed unexpected performance when, with the first maintenance phase data point for the -*at* target, he showed a

decline in performance. But then Dan surpassed criterion levels again the following two sessions with -*at* and he achieved criterion level with the -*op* target. Dan's mean score for reading one word at-a-time was 6.80 for the -*at* target, with two sessions in intervention and three sessions in maintenance phase. Dan's mean score for the -*op* target during the same sessions was 3.40, with two sessions in baseline condition and three sessions receiving direct instruction.

Target: -at vs. -ap. Intervention then shifted to the second group of words: -*at* vs. -*ap*. However, the assessment measure returned to how the task was presented to Dan initially, selecting the correct word from three choices. Dan had a range of 14 to 16 correct responses with the -*at* vs -*ap* group during the three intervention sessions focused on -*ap* instruction. The other two targets, -*at* and -*op*, were in maintenance phase. (The -*at* target was assessed two different times, once with each grouping of words, in order to have a better comparison between the relationships of the two pairs of targets.) Dan had a mean score of 7.67 with the -*at* target and a mean of 7.33 with the -*ap* target the last three sessions of intervention. This had significantly increased from the mean scores of this group during baseline (a mean of 2.67 for -*at* and a mean of 2.00 for -*ap*). There was not a maintenance phase for the -*ap* target because it was the last target taught in intervention.

Table 11

Dan's Word Recognition Performance Data for Each Phase of Intervention

Target	Phase	Mean	SD	Range
-at vs. -op	Baseline	5.33	1.15	4-6
	Intervention	7.50	3.44	4-14
	Maintenance	11.67	3.21	8-14
-at	Baseline	2.33	0.58	2-3
	Intervention	4.14	2.23	2-8
	Maintenance	6.50	1.38	4-8
-op	Baseline	1.90	1.30	0-4
	Intervention	5.67	0.58	5-6
	Maintenance	5.00	2.65	2-7
-at vs. -ap	Baseline	4.67	2.08	3-7
	Intervention	15.00	1.00	14-16
	Maintenance	_	_	_
-at	Baseline	2.67	1.15	2-4
	Intervention	_	_	_
	Maintenance	7.67	0.58	7-8
-ap	Baseline	2.00	1.00	1-3
	Intervention	7.33	0.58	7-8
	Maintenance	_	_	_

Note. There was no maintenance phase for phase two: *-at* vs. *-ap* as *-ap* was the last target taught.

Summary of performance. Although unanticipated changes needed to be made to the assessment measures used with Dan throughout intervention, an overall increase in performance abilities can be seen following intervention with the different target groups. The specific challenges with the task itself will be further discussed in a later section. Dan did reach the criterion level, at least 70% (6/8 words) for each of the three target patterns, as well as in the two groups of contrasting pairs (12/16 words). In the first group: *-at* vs. *-op,* Dan reached criterion

level six times with the -*at* target, four times with the -*op* target, and four times with the two combined. In the second group: -*at* vs. -*ap*, Dan reached criterion level three times with the -*at* target, three times with the -*ap* target, and all three times with the two combined. (The second group was only assessed a total of six times though; three times during baseline conditions and three times during intervention.)

Despite the fact that it is difficult to interpret actual data trends due to the changing nature of the assessment itself, an increase in not only word recognition but also general decoding skills is evidenced with Dan's results. The mean score of the -*at* vs. -*op* target group was just 5.33 during baseline, 7.50 during intervention, and increased to 11.67 by the last three sessions. The mean score of the -*at* vs. -*ap* target group was 4.67 during baseline, but increased to 15.00 during intervention. There were numerous instances of overlapping data points; however, because of the modifications to the assessment and needing to factor in Dan's early behavior of just guessing, trying to analyze those data points does not give an accurate representation of Dan's performance abilities. There were a lot of challenges with Dan's resistance to the task that will also be described later; however, once those were overcome and Dan was more cooperative during assessments, he showed great gains, suggesting he benefitted from participation in the study.

Discussion

This study examined the effects of providing playful, engaging, and contextual literacy instruction individually to students with ASD. This discussion reflects on key observations and findings related to the integration of SEEL intervention with children with ASD, specifically the different experiences with the three participants of this study. There is discussion about student performances and behaviors, as well as highlighting specific characteristics of the different participants that needed to be considered and addressed while implementing their individualized

interventions. There is also discussion as to the strengths of using SEEL and limitations of the study as well as recommendations for future research.

Factors Impacting Student Performance

A number of variables appeared to impact the students' engagement and performance. These are important to consider given the individual differences the participants displayed.

SEEL lesson content. Although the participants of this study had different targets and tasks presented throughout their intervention, the gains Brandon and Dan made in their respective phonics and phonological awareness skills were greatly impacted by the intervention using SEEL lessons and activities. The data illustrate that Brandon and Dan made substantial improvements from their baseline performance to the end of the intervention sessions. Both Brandon and Dan reached the specified criterion level for each of their targets during their specific tasks. Even though Brandon showed some improvement with two of the targets during the reading task without direct intervention, it is likely the skills emphasized in the intervention with the other targets influenced his reading ability and helped him generalize what he was learning about the patterns to the other targets. He also showed more consistency and accuracy in applying the patterns during the spelling task at the conclusion of intervention. Dan started intervention not even looking at print, and was not decoding any words, which is why his task started as word recognition. Although the task measuring performance had to be modified for Dan several times during intervention, improvement in not only word recognition but actual decoding abilities can still be seen following intervention.

Coleton's participation in the study was too limited to show gains with the selected performance measures after intervention; however, he did make other positive affective improvements that were noted through direct observation and interaction with him. Prior to the

intervention, Coleton was highly distracted and would not attend to specific tasks, such as rhyming or blending, or even playful activities initiated by the clinician without frequent redirection and prompting. With each subsequent intervention session, Coleton increased his ability to attend to and meaningfully participate with more reciprocal interactions and voluntary repetition and use of the playful phrases being used in the activities. He stayed engaged for longer amounts of time with less prompting and followed instructions more readily, rather than trying to sabotage the activities or change them to how he wanted them done. Although Coleton still struggled to give appropriate responses to specific task questions, which contributed to his dismissal from receiving further instruction, he showed more tolerance for literacy-based activities and improvement in his general phonemic awareness skills (more awareness of initial word sounds and similar sounds in words as evidenced by more independently-produced responses) after several SEEL intervention sessions. Therefore, his resistance and noncompliance really did seem to stem from being asked to perform specific assessment tasks rather than participating with SEEL activities.

SEEL lesson structure. The structure of the SEEL intervention sessions directly supported the development and skill acquisition required for each of the tasks for the participants as well as assisted in the further development of early literacy skills. The intervention incorporated SEEL principles, such as meaningful activities, explicit goals, playful and reciprocal interactions, and intense exposure to targets. Each session began with an explicit introduction of the specific target and explanation of the activities to take place. This helped the participants identify the pattern they were learning and better understand it, listen for it, and use it throughout the different activities. Each session included intense exposure and many opportunities to see, hear, and play with the target patterns.

After introducing the activities, the clinician was able to follow the participants' lead in play and interaction while still providing enough support to focus on the selected targets. The clinician was able to decide how quickly to move through the lesson, depending on how the child responded to a particular activity. An activity could be repeated multiple times if it was determined to be beneficial for practicing a specific pattern or task or multiple activities could be introduced in a short amount of time if that better matched the pace of the child. The different reading, writing, and play tasks were easily intermixed throughout the lesson when they seemed the most appropriate, again, according to how the child was responding. Depending on the specific targets and tasks for each participant, the children were able to blend and segment target words; isolate target sounds; combine patterns with different letters to make new words; write the patterns, associating letters with the sounds; read the target words in different contexts; select words that rhymed with the pattern; and compare and contrast target words with non-examples of the pattern. The structure and strategies that were incorporated throughout SEEL activities helped the participants develop stronger phonemic awareness and phonics skills as concepts were modeled and ample guided practice opportunities were provided in each session. Participants' awareness of and ability to identify target patterns was significantly increased as specific emphasis was added each time a target was used throughout the activities. This heightened awareness was evidenced in their verbal and written responses and ability to complete their individualized phonic and phonemic awareness tasks with increasing accuracy.

The lessons worked well in the individualized settings so that each participant received immediate, one-on-one feedback throughout the activities and tasks. Reading, writing, and engaging in meaningful play with each of the respective target patterns helped not only provide intense exposure to specific patterns in a variety of learning modalities, it also helped each

participant have additional practice opportunities for using language in different contexts. This in turn helped address the participant's inter-personal skills with turn-taking, topic-specific discussions, and shared play. With each intervention session, the participants were expanding their vocabularies not only by repeated opportunities to hear and use different words but also by learning the words in very contextually-rich and meaningful activities.

Coexistence of ASD and contributing characteristics. The data that were collected for the participants of the study, both quantitative and observational, supports the fact that the three participants benefited in some way from their participation receiving SEEL intervention. However, as important as it is for this study to recognize the impact SEEL lessons had on participants' performance, it is also important to discuss the possible impact on performance measures the accompanying deficits associated with the participants' spectrum disorders had. All three participants displayed inconsistent and variable performance at times during their individual interventions, despite attempts to control for contributing external factors. During the reading task, Brandon showed a few unexpected dips and peaks in his ability to read the target words from week to week. This was also observed with his spelling; after spelling a word correctly for a few sessions, he sometimes would go back to using incorrect spelling. Coleton's performance was so inconsistent that it was not possible to accurately conclude where his baseline levels were with different phonic and phonemic awareness tasks. Dan also displayed such variable performance decoding, necessitating several modifications to be made to his task.

It is not uncommon for children with ASD to have inconsistent performances, especially on such isolated academic tasks, when any number of outside factors may be contributing to their performance on a particular day. These factors are also closely related to levels of motivation and how willing individuals may be to participate in an activity. Varying levels of motivation,

cooperation, and general behavioral attitudes were observed in all participants throughout the sessions. Such variability and inconsistent performances, as previously mentioned, could have been triggered by a number of external factors, such as a change in participants' sleep patterns, not feeling well on a particular day, extra anxiety from a recent change in routine, or a change in medication or diet, to name a few possibilities.

It is frequently discussed how sensitive individuals with ASD can be to incoming stimuli, and how many have better success with established routines and schedules. Each session attempted to follow a general routine for each participant; however, the sessions still had some variability within the general routine as activities were different each time and the sequencing of reading, writing, and responding varied with each lesson. Some lessons had more visual or hands-on components than others, which may have also created a degree of unpredictability for the participants. Because some lessons had more activities associated with them, the time allotted for each activity changed continually. Many children with ASD are noted to have difficulty transitioning between activities, especially when it is not on their terms. Even with behavior supports in place, such as verbal cues and written schedules, transitioning to different activities was still difficult at times for the participants. These challenges of varying routines and activities, along with the frequent desire to take over an activity and do it how they wanted, sometimes led to escalated, noncompliant behaviors, which in turn decreased participants' motivation and desire to participate at times. Therefore, these factors during the session may have also impacted the participants' performance on their individual tasks.

Children with ASD are often described as having difficulty with sit-down tasks, as they may struggle with following directions, sequentially processing information, and focusing on a particular task, not of their choosing, for extended periods of time. These challenges may even

extend to struggling to respond to even verbal requests. This attentional deficit can make it challenging to complete a task without proper supports in place. All three participants had difficulty focusing on the tasks measuring their performance abilities, despite attempts to intersperse the tasks throughout the session, offer breaks between, or make the tasks as concise as possible. Each participant required substantial prompting, redirection, and reminders of what type of behavior was expected of them (for example, whether a verbal or written response was needed or a selection to be made). Some tasks and requests elicit anxious behavior for individuals with ASD, especially when it has been challenging for them, they have been unsuccessful at it in the past, or it was an unpleasant experience. The presentation of the task itself can affect the individual's attitude and response. This was observed in all participants at different times during intervention: Brandon's silly, off-task behaviors increased when asked to read, Dan got emotional and very distracted any time he was invited to look at printed text, and Coleton displayed more avoidance behaviors (trying to do another activity or not looking at the person talking to him) when asked to give a response.

Factors Influencing Student Behaviors

Despite the challenges associated with assessing the participants, the flexibility of the lesson structure, the interactive and engaging nature of the activities, and ability to select individualized skill sets to target with each lesson was especially beneficial while also addressing different behavioral variables with the participants. As previously mentioned, modifications to the lessons for each participant were able to be made without compromising the fidelity of SEEL principles throughout intervention. Some general modifications were incorporated into the sessions for all three participants that followed common, best-practice teaching strategies to use with individuals with ASD. The use of "wait-time" was utilized (consciously waiting several

seconds to repeat or provide prompting after a question was asked or invitation to respond was made) in order to give additional time for processing and decision-making. When appropriate, many activities were presented in a choice-format, allowing for the participants to have some control of aspects of the activity. For example, they could choose between the red or the blue mixing bowls, choose to write on the whiteboard or on paper, or if they wanted to do activity "A" or activity "B" first. Frequent modeling with a detailed narration of the break-down of steps or procedures was provided. Attempts to simplify directions were made, such as using simplified language, short-phrases, or giving one direction at a time. The clinician also used frequent verbal praising for on-task and appropriate behaviors. Although the schedule of activities for each session was dependent upon the specific lesson topic, a general routine was implemented from the very beginning of intervention with each participant to help establish some regularity. This helped each participant know a little of what to expect each session, in that there would be time for reading, playing, writing, as well as times to perform specific tasks, as detailed in an earlier section about performance measures.

Additional strategies and adaptations were also implemented, such as verbal redirection, pausing an activity, or waiting to offer additional turns if the child was losing focus or becoming distracted with the activity. The expectation for the children to engage in reciprocal turn-taking during the activities was adapted, depending on the activity and how much additional prompting and cueing was necessary to keep each child participating. At times it was acceptable for the child to take multiple turns in a row or to have a few moments of independent play if they were engaged in the activity in a meaningful way that facilitated simultaneous target-focused comments or narration from the clinician. This varied from lesson to lesson, depending on if the child was independently using target words and creating original phrases during play. The

clinician was able to follow each participant's lead, inserting more or less support as needed, to provide intense exposure to target patterns throughout each lesson.

In addition to these general modifications and adaptations, each of the participants had further behavior management strategies incorporated into their individualized intervention.

Brandon. A written schedule listing the outline of the lesson and activities was posted each time for Brandon, and the different tasks and activities were crossed off as they were completed. Brandon also had less off-task and silly behaviors when he selected a prize or reward at the beginning of the session that he could work to earn when all the specified activities were done. This usually entailed a small treat or toy, unrelated to the lesson, but made available each session. His on-task behavior was tracked with a small chart with ten squares. After successfully completing an activity, the clinician prompted Brandon to fill in a specific number of squares on his chart, as agreed upon by Brandon and the clinician prior to beginning the activity. If all the squares on the chart were filled in by the end of the session, Brandon earned his pre-selected reward. Brandon required occasional verbal promptings to "try your best," specifically during the spelling and reading tasks measuring his performance with his selected target patterns, otherwise he was observably less focused and would try talking about unrelated topics.

Brandon responded better to reading tasks that were interspersed throughout the lesson, had text that was larger than average font size, and was presented with few printed words per page or was only shown one line at a time. Brandon also showed more compliant behavior while reading when the clinician would first model reading a passage, then read the same passage with him, followed by Brandon's turn to read the passage independently. Brandon liked being able to take the lead in most tasks, from numbering the paper himself, to deciding how many turns each person received, to telling the clinician what role they would have in a particular activity. This

was allowed as long as Brandon followed other activity-specific directions and was not sabotaging the activity with his play. Most of the sessions with Brandon occurred in the late afternoon, after he had finished school. This could have contributed to him being more tired or distracted some days; however, overall, Brandon readily participated in most activities with only occasional need for redirection or reminders of appropriate behavioral expectations.

Coleton. Coleton's mother was present at most of his sessions. He seemed more comfortable having his mother in the session, as she was a familiar person he could interact with during the lesson, especially as the clinician built rapport with him. Coleton responded very well to his mother's prompting and verbal cues during activities and she was able to help redirect Coleton back to the task at hand. Coleton's mother was already using a lot of the previously mentioned strategies with Coleton, such as wait time, simplifying directions, and lots of verbal prompting and praising. She continued to implement such strategies along with the clinician during the sessions.

Coleton was easily overwhelmed when presented with too much stimuli at one time, both visual and auditory. It was very important to only give one direction at-a-time to Coleton, and only have one activity going on, with others out of sight, otherwise Coleton became very distracted and preoccupied with trying to do different activities. It was also important to have a balance between breaks and work time; however, we tried to avoid calling any task "work" because of how quickly Coleton showed resistance to tasks labeled as work. Coleton needed frequent, intermittent "rewards" for completing tasks. Such rewards were selected prior to beginning an activity and consisted of earning a few minutes of an activity of his choosing or a small treat. He responded better when clear expectations were verbally explained to him, such as, "first this activity, then this reward." Coleton required a lot of support following directions and

needed explicit models and pre-teaching of any task that was asked of him. For example, one of his performance measures was presenting him with two word choices, so the concept of choosing between two choices was specifically taught to him prior to this task. He was presented with two objects to first attend to, then choose one with a specific characteristic (e.g., "Hand me the blue cube").

Coleton showed a lot of energy and excitement for many activities, and with prompting, he would repeat phrases and target sounds. However, one of the biggest challenges with Coleton was helping him move between activities, as he had a very difficult time transitioning to different tasks. He often became fixated on one aspect of an activity and after a few minutes of being heavily prompted through different steps, he would start doing the activity his own way and became resistant to attempts to redirect back to the lesson. Even when he would engage in an activity, it was difficult to elicit appropriate responses to specific tasks. As previously mentioned, it was challenging selecting performance measures that would accurately represent Coleton's abilities, due to the fact he required such frequent prompting and cueing to stay with a task. A lot of effort was spent on attempts to teach Coleton the general routine of a session and overall behavioral expectations of when to listen, watch, do, or say things throughout the lesson. However, so much time was spent each session trying to redirect Coleton and help him engage in clinician-led activities in order to incorporate some type of performance measurement, which ended up taking away from the context and flow of the lessons. The lessons became so broken up with redirecting and behavioral prompting that it was difficult to effectively attend to phonemic awareness tasks that highlighted a particular pattern.

Coleton's behavior during the sessions was also largely impacted by several other external factors, such as whether or not he had taken his medication that day, the time of day we

met, and whether or not his brothers came to the clinic with him and how easily he separated from them when they were involved in other activities. We tried meeting with Coleton at different times to hopefully address some of these factors; however, new scheduling challenges arose between clinician and participant availability. Coleton did show some improvement in levels of engagement, following directions, and overall language interactions during lessons; however, despite the attempts to present the different performance measures at different times during the session, reliable data were unable to be gathered. This, in combination with the scheduling conflicts, time constraints of the study, and how long it would have taken to effectively implement a more structured behavior management system, it was decided by both Coleton's mother and clinician that he discontinue participation in the study after the fourth intervention session.

Dan. At the beginning of each session with Dan, a brief verbal overview of the lesson and activities was given. Dan easily became anxious when he did not know what activities were coming next, so discussing the activities before we started helped him anticipate what was next and decrease his visible anxiety. Dan required occasional breaks throughout a lesson. Before starting an activity or specific task, Dan was allowed to choose a small prize or reward that he could work to earn, usually unrelated to the lesson. The reward was either a small treat or a toy that he could play with for a specified amount of time. If Dan selected the toy, a timer was set to go off when it was time for Dan to be done playing. This helped Dan have a defined ending to the break and helped him have less resistance to returning to lesson activities. Dan really enjoyed quoting lines from favorite television shows and he often wanted the clinician to repeat lines with him. In order to prevent frequent interruptions throughout the lesson with these off-topic requests, the clinician gave Dan a few minutes at the beginning of the session to quote a few

lines and then they would repeat a few back and forth. Dan needed to be given a countdown of how many times he could repeat a line; otherwise he tried repeating the line all throughout the session and often did require verbal reminders to stay on-topic with his comments.

Dan was usually eager to participate in the different activities and only needed occasional verbal prompting to follow directions. However, if there was an activity that Dan really enjoyed, he often struggled to transition to new activities, even when multiple turns had been given with the first activity. Dan would get emotional and visibly upset when he was asked to do something he did not want to do, such as ending a turn or moving on to a new activity, but usually could be redirected with verbal prompts and cues and reminders of what he was working to earn.

Dan did very well with verbal word play and rhyming. He also enjoyed repeating phrases and target words in silly voices or in a song, which is a strategy that was implemented to increase Dan's participation on multiple occasions. Dan did well with auditory directions and tasks, and enjoyed listening to stories or having passages read to him. However, he showed a lot of resistance and anxiety whenever he was presented with a task involving written text or words. He required frequent verbal reminders to "try his best" and "look at the words" during such tasks, otherwise he would just make up phrases based on related activities or repeat a phrase he recently heard. Dan responded better when he was presented with only a few words at-a-time and when he had a clear expectation of how many words he needed to decode before he earned a break.

However, it was a continual challenge to help motivate Dan to look at the words and attend to the patterns, instead of saying random words or repeating things from memory. This is why the task measuring Dan's decoding performance had to be modified multiple times throughout intervention. Dan was visibly guessing when he was asked to select one word from

three choices, as he often was not looking at the computer screen and was more occupied with attempting to push the buttons to advance the slides or asking how many more he had to complete. He received verbal praise for each response he gave, but this seemed to be rewarding him for making quick choices rather than motivating him to try to select the correct word. After a few sessions trying to prompt Dan to make real attempts, Dan remained distracted and in fact, was getting more agitated with each subsequent session just being presented with the task. His resistance to the task itself prompted modifications to be made in an effort to decrease his agitation in order to not jeopardize his willingness to participate in the rest of the literacy activities. The task was changed so that he was only shown half the slides at-a-time, with a break in between. However, he still struggled to attend to the task and display real effort, so the task was modified again and he was asked to actually decode the words, one at-a-time. When presented with less stimuli per slide while continuing to receive verbal praise for responding (whether correct or not), Dan did much better with the task. It was during this time period of intervention that Dan's confidence in his abilities seemed to significantly increase and his motivation to read also increased once he realized he was actually decoding and reading words related to the activities he was completing. This change in attitude translated to less verbal prompting being required throughout the session, especially during reading and decoding tasks, and faster, yet more accurate completion of the decoding task itself. Therefore, for the final sessions with Dan, the task was reverted back to how it was originally presented, when Dan was asked to select the correct word out of three choices, in order to have a better comparison of his change in performance from start to finish of intervention. An observable difference in Dan's attention to the task was noted, as Dan was actually looking at the screen and going through the choices before making a selection.

Initially, sessions with Dan were held before he attended his kindergarten class. However, part way through the study, we had to start meeting after his class. This notably affected Dan's motivation and overall compliance during the sessions, as he showed more fatigue and verbal distress and desires to be done and go home when we were meeting after his kindergarten class. Additional efforts to help motivate Dan during the later sessions were made, such as providing a numbered list of activities for each lesson that Dan could cross off as he completed them, using a chart that showed what he was working for and how much more needed to be done before he earned his reward, more frequent breaks throughout the lesson, and implementing more opportunities to decode target words as part of the actual activity.

Strengths of the SEEL Program in Teaching Early Literacy to Children with ASD

The present study suggests that using SEEL lessons in early literacy instruction can increase performance in several areas for young children with ASD. Intervention using the SEEL program provided a nonthreatening, yet supportive environment for the children to participate in a variety of literacy activities with fun and engaging opportunities to hear and practice specific target patterns while indirectly also working on language and interpersonal skills. While the results of the study showed literacy as well as more general language gains for the participants, there are several factors to consider when implementing SEEL with children with ASD for it to be the most effective and beneficial.

It is important to remember there is not one literacy program or approach that is going to meet all the unique needs of all individuals with ASD. One of the strengths of the SEEL program is that it offers a lot of flexibility and adaptability to meet different needs, depending on how the lessons are implemented. Specific literacy patterns can be targeted, either simultaneously or sequentially, while also getting practice in multiple skill areas and with different modalities. For

example, a lesson targeting long-vowel patterns can use one specific target pattern, such as *long -a with silent e*, or a combination of several targets (any long-vowel with silent e) while incorporating a variety of reading, writing, rhyming, blending, or segmenting tasks. Deciding which tasks to incorporate depends on the skill-level of the child and what level of prompting they need in order to be successful with a task. The lessons can be adapted to emphasize individual strengths, focusing more on visual components or hands-on activities or repeating patterns aloud, depending on what works best for each individual.

An important principle to address in any literacy intervention with children with ASD is comprehension and application of the text. SEEL teaches specific skills without sacrificing meaning and comprehension. As the previous review of literature of children with ASD discussed, this population is often taught skills in isolation, without deeper purpose and meaning associated with the task or skill. This makes it difficult for these children to connect skills and apply their learning to other contexts. Teaching literacy in a very comprehensive style and context helps facilitate deeper skill attainment and increases the likelihood of generalizing skills. While naturally incorporating meaning and comprehension in the activities, more emphasis can be given to the purpose of decoding and reading tasks, also helping increase motivation to participate in reading tasks. SEEL lessons can really be beneficial for individuals when activities are related to personal experiences and prior knowledge, which is especially important for effectively teaching students with ASD.

SEEL is appealing for individuals who have a hard time with sit-down, "paper and pencil tasks." Literacy tasks are presented in fun, very manageable ways. Students are able to practice patterns and skills while playing, so it does not feel like "work" to them. Staying focused on academic tasks is something that many with ASD find challenging. Students are able to actively

participate, and even lead many activities with SEEL, rather than just following directions. This helped the individuals with ASD who participated in the study have less resistance to literacy tasks as well as have more motivation and desire to engage in appropriate ways, rather than taking over an activity. However, a careful balance of adult direction and support and child-led activities needs to be incorporated. The adult may need to be more involved in activities when working with children with ASD, providing more explicit examples, using exaggerated play, and inserting more narration or comments throughout the activities, especially to compensate for oral language deficits of the children and to model and facilitate more reciprocal exchanges and interactions. SEEL lessons are often able to have a semi-loose structure, naturally unfolding as children engage and participate in the lesson. More structure may need to be incorporated and directly stated throughout the lesson (e.g., "first this, then that"), in order to help participants with ASD stay on task as well as know what to anticipate. Individuals with ASD may already struggle transitioning between activities, so it is especially important when working with these children to have clear expectations and defined start and finish times to activities in order to be able to move on to new things throughout the lesson.

Children with ASD tend to perform better with familiarity, both in regards to routines and contexts. SEEL lessons are structured similarly, so children can expect a combination of activities, reading, writing, and play, no matter what lesson is being used. Another strength of SEEL is that the lessons can be repeated to focus on multiple skills, just by emphasizing different tasks. For example, the first time using the "bake a cake" lesson (focusing on *long -a with silent e* patterns), the child may be asked to think of words that rhyme with "bake" and "cake" before adding ingredients to the cake. The same lesson could be used at a later time, so there is some familiarity, with focus on a new skill, such as asking the child to segment and blend the words

with the *-ake* pattern while following a recipe to make a cake. SEEL lesson components are so easily adapted that even repeating an activity multiple times (which may be necessary for many individuals with ASD to effectively learn a pattern); the activity does not become redundant or monotonous.

Study Limitations

As beneficial as SEEL was in helping the participants show improvement in different literacy tasks and areas of interpersonal skills, there were also several limitations associated with this study that need to be discussed. One limitation was noted in the tasks selected to try to effectively and reliably measure performance levels for the participants. Although efforts were made to control for individual circumstances and behaviors, it quickly became apparent that some behaviors were still conflicting with the accuracy of the measurement tasks. Initially, the thought was that it would be easier to collect data and would be more accurate of actual ability levels to have a separate assessment task from the activity. That way the skill being assessed would be measured using the same words and the same protocol each time, to better track changes in performance while also seeing if the participant could retain, recall, and apply what they had learned. However, all three participants showed resistance when presented with a separate task, even when they had been very engaged and eager to participate earlier in the session. As was the case with Dan, his noncompliance with the task made it necessary to modify the task throughout data collection in order to have any degree of accuracy of what he was capable of doing; however, that made it extremely difficult to track progress. It was challenging to keep the participants on task without providing too much prompting or cueing that would influence their responses. The prompt to “do your best” or the promise of a reward following completion of a task was still not enough to ensure the participants were actually using effort and

really trying their best with the tasks. Assessing performance as a separate task also meant that the skill was isolated, rather than monitoring ability levels in a more natural or contextual setting. It would have been beneficial to have taken into account the responses elicited during activities in order to compare performance of in-context and isolated skills. The assessment tasks also got lengthy, especially when trying to assess targets that were untreated or in maintenance phases, which made it particularly challenging to maintain attention and focus throughout the whole task.

With Coleton's more challenging behaviors, it was difficult to decide on which areas would be most beneficial for him and with which he would be able to have success. Therefore, his tasks were selected as more of a trial-and-error attempt to probe for what was most appropriate for him and target patterns were selected that corresponded to grade-level patterns, not necessarily his areas of weakness. Had there been indefinite time available to keep trying different approaches and strategies and more flexibility with scheduling, we would have been able to keep working with Coleton as a participant, yet unfortunately, that was not the case. This study was focused on collecting objective, quantitative data on target patterns and assessing specific literacy skills using SEEL, thus the targets selected for Coleton were trying to incorporate the goals of the study while still being beneficial goals for him. If his assessment tasks focused less on isolated skills and more on interaction styles, levels of engagement or overall language usage, while also looking at specific phonic patterns, more reliable data might have been able to be collected in regards to how his performance in all these different areas changed after receiving SEEL intervention.

Another major limitation was in the actual selection of target patterns and target words for the participants. Brandon's target words were selected to fit his target patterns; however, in attempts to choose words that Brandon could encounter in contextually-appropriate activities,

some other contributing factors were neglected. Brandon appeared to begin intervention with some degree of familiarity with the *-ee* target (which is why the *-ea* target was added by the second session). Within a few sessions, he had shown significant improvement with the *-ee* target, despite not receiving direct instruction during the study with that target. Some spontaneous generalization may have occurred very quickly; however, a more likely explanation is that Brandon either had other exposure to that particular pattern in other settings or that the words were just already more familiar to him. He also showed some improvement with the *long -o* pattern prior to direct instruction, which is more likely to be impacted by skills generalizing from the other patterns during the study than with the case of the *-ee* target. There was not any reasonable way to control for additional exposure to the targets outside of the sessions, and some of the words were just more common than others (e.g., time, need, name) and would more naturally be encountered in other settings. Other target words may not have been the best examples of the pattern when there were other phonetic rules to consider. For example, several of the long-vowel words had "r's" in them that slightly changed how the vowel sounded (e.g., wore, core) or were homophones (different spelling and meaning, but same pronunciation, such as wore or week). Any one of these factors related to the actual selection of target words could have contributed to Brandon's somewhat variable reading and spelling performances.

Related to these challenges of selecting appropriate tasks and target-words that most accurately measured participants' performance and literacy skill competency, another limitation of this study was not including any kind of follow-up assessment. A task to measure if skills were being applied to non-targeted words was attempted with Brandon, but even that did not provide sufficient data to make broader generalizations of his proficiency with long-vowel patterns in multiple contexts. There was not any type of assessment administered to assess for

more general literacy gains following intervention. The appropriate levels of the PALS assessment could have been administered again to the participants, following a predetermined period of time following completion of their intervention, to gain some insight into what areas were impacted after receiving individualized literacy instruction. This also would have provided another source of information as to how the skills were generalizing and transferring to other areas as well as being retained and recalled when not being assessed directly after an intervention session.

Another type of follow-up assessment that would have provided valuable insight would have been to ask each participants' classroom teachers if they noticed any improvement in the participants' specific skills in other literacy contexts or general academic functioning following individualized SEEL intervention. Both Brandon and Dan displayed more confidence and overall ability to accurately complete their specific tasks after completing intervention; however, this was just based on subjective observations. The mothers of all three participants commented at various times during intervention on the general improvements they were noticing in their sons' literacy awareness and performance with such tasks at home, but again, no formal measure or questionnaire was implemented to be able to incorporate such observations in the results, as valuable as they may be.

A large portion of Coleton's gains from his short participation in the study were based on informal observations of increased use of language and improved interactions and levels of engagement. Unfortunately, another limitation of this study was not implementing a more quantifiable measure of student engagement and level of participation, with any of the participants. This would have been especially beneficial to measure when one of the common, defining characteristics of the participants' disorder is impaired social interactions and limited

participation in play contexts. It would have been valuable to have more than just subjective observations from the clinician and research assistants as to what type of interactions were occurring, how much eye contact took place, how frequently each participant used language containing target patterns, how much redirection or prompting was needed to keep the child engaged, or how much time was child-directed rather than clinician-directed, etc. Unfortunately, a lot of energy was spent trying to accurately conduct performance assessments while maintaining on-task behavior, so these other important behavioral aspects were not measured throughout intervention. The fidelity check sheet did not ask for the number of times participants needed to be redirected or what additional behavior management strategies were implemented each session, which also would have added valuable information and insight about what worked best during intervention with this specific group of participants.

Perhaps the most important limitation to recognize with this study is that it looked at three very different individuals on different points of the spectrum and with very different literacy abilities, and in so doing, the results are not generalizable. Each participant had their own set of strengths, weaknesses, personalities, and motivation that influenced their performance and how they responded to the intervention. The purpose of the study was to observe if SEEL intervention could effectively help improve specific literacy targets with individuals with ASD. However, it was quickly acknowledged in the literature related to this population and in working with these three participants, that each individual with ASD is unique and no one approach will work for all. The results of this study give a small sampling of just how individualized effective intervention may need to be for such children and what factors and even profiles of abilities need to be considered. Although valuable information was learned from each participant, the

interpretation of the results is limited to the direct impact of intervention on their individual literacy success.

Future Research

While this study offers valuable insight into the effectiveness of using SEEL intervention with young children with ASD to increase reading and decoding of trained phonetic patterns, there are still many opportunities and a great need for future research concerning literacy intervention with this population. There is extensive research continually being done to evaluate effective teaching strategies and techniques to use with children with ASD as well as to better understand the learning styles of these children. There are many schools of thought and theories as to what works and does not work, with this population in particular, thus further research is necessary to continue to make the best, current evidence-based decisions while implementing interventions.

One factor to consider in additional studies related to literacy instruction with children with ASD is the influence of not just the specific intervention itself, but also the impact of practicing the skills in different contexts and with different people. It would be useful to conduct even a similar study to the one discussed here, but incorporating a family and home component. Children with ASD do considerably better with familiarity, therefore, if they were able to practice skills in different, yet comfortable-to-them contexts, while following SEEL principles, it would be interesting to note if there is faster or more general improvements made. Incorporating SEEL at home would also increase frequency of exposure to the targets, which is another valuable factor that could be evaluated. This could also be expanded to include a sibling component (if possible with the participants) to see the difference in interaction styles and language used when working with different people. Another variation of this would be to include

typical peer support during different lessons and activities to evaluate if same-age peers offer enough of a model during literacy activities for students with ASD to effectively learn from.

As previously mentioned in other areas of discussion, another element of the present study that would be beneficial to expand on is incorporating specific measurements of engagement and interaction. There are challenges associated with quantifiably describing levels of engagement or what exactly "on task" behavior looks like; however, these measurements would be invaluable as to just how effective SEEL intervention is with children with ASD. Deficits in these areas of interpersonal skills are so often what interferes with children with ASD participating in academic activities in other settings, and thereby they miss getting meaningful experiences with different learning modalities. Measuring levels of participation or interactive styles and exchanges could really be beneficial to better understand how to address these skills in intervention and how they in turn interact with learning other literacy skills. Different tasks measuring performance levels in different contexts could also be implemented to understand the most efficient way to evaluate skills with this specific group of children and how best to control for variability and inconsistent performances. As also previously mentioned, perhaps the most effective and reliable performance measures would be those used during the activity or lesson itself, including spontaneous and voluntary productions, responses, and elicitations of the target patterns, rather than trying to use separate assessment tasks. This would also help maintain focus on using contextually-meaningful situations rather than switching to isolated tasks, which would more effectively study the benefits of using engaging and interactive literacy interventions with this specific population.

One of the benefits of SEEL intervention is the flexibility and adaptability of the lessons. However, in studies such as this one, where modifications are understandably necessary, there

still needs to be some standardization of the intervention, even for different individuals, in order to better draw conclusions about what factors were really influencing student performance. This could include keeping the length of time of each session consistent, using the same behavior management strategies, standardizing how much "wait time" to give for each response, or making sure to implement equal amounts of time of different activities (including reading and writing tasks). Although the fidelity check sheet was used to ensure all SEEL principles were present in the sessions, there was still a lot of variability in how the intervention was implemented that could be controlled for in future studies. Such variables to consider in future implementation would be the clinician's personality, including their level of enthusiasm and interaction, as well as how much and what type of prompting or cueing is acceptable.

Future research needs to include more students with ASD with different backgrounds and literacy strengths and weaknesses in order to strengthen the validity of the effectiveness of using SEEL with students with ASD. There are admittedly many variables to consider with both the implementation of interventions and what affects individual performance with each child. However, with more research, we can better understand how to help children with ASD develop and apply early literacy skills.

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Appendices

Appendix A

Informed Consent

Systematic and Engaging Early Literacy Intervention
Consent to be a Research Subject

Participant Consent

Introduction
Faculty members at Brigham Young University; Barbara Culatta-Phd, Kendra Hall-Kenyon-Phd, and Blake Hansen-Phd; are conducting a research study to evaluate the effectiveness of using Systematic and Engaging Early Literacy intervention for students needing extra literacy support.

Procedures
Your child will participate in SEEL activities 1 or 2 days per week for approximately 8-10 weeks. Each session will last approximately 50 minutes. Your child will be assessed on his/her ability to read words approximately 4 times before the intervention on reading particular phonic patterns begins and after intervention some of the sessions. Intervention sessions will be video recorded and 30% of them will be watched by 2 research assistants, to determine accuracy of SEEL teaching by the therapist. Similarly, assessment sessions will be video recorded and 30% of them will be watched by 1 research assistant to ensure reliability in assessment practices and agreement in scoring. Video recordings of the assessment sessions will not be used for future purposes and will be destroyed following data collection. However, video recordings of the intervention sessions may be used for future training and professional development. If you are willing to allow the video footage of the intervention sessions to be used for this purpose, please sign your name here:

_____

Immediately following each intervention session, your child will be asked what he/she thought about the activity by circling a picture that most accurately describes how she or he feels.

Risks/Discomforts
There are minimal risks for participation in this study. However due to repeated assessments, your child may experience assessment fatigue and/or frustration. During baseline assessment it is anticipated that your child will not be able to read all words and may feel a little uncomfortable. To counteract these possible risks your child will be told that he/she may not be able to read the words yet and it is okay to say, "I don't know!"

Benefits
There are no direct benefits to the participants. However, the literacy intervention has been shown to be effective in increasing other children's literacy skills and may help your child in learning to read.

Confidentiality
All information provided will remain confidential and will only be reported using pseudonyms. All data will be kept in a secure place and only those directly involved with the research will have access to them.

Questions about the Research
If you have questions regarding this study, you may contact Barbara Culatta at (801) 422-6456 or Barbara_Culatta@byu.edu.

Questions about your Rights as Research Participants
If you have questions regarding your rights as a research participant, you may contact IRB Administrator, Brigham Young University, A-285 ASB Campus Drive; Provo, UT 84602; (801) 422-1461; irb@byu.edu.

Participation
Participation in this research study is voluntary. You have the right to withdraw your child at any time or refuse to allow him/her to participate entirely without any consequence.

I have read, understood, and received a copy of the above consent and desire of my own free will to allow my child to participate in this study.

Signature:_____Date:_____

Appendix B

Assessment Check Sheet- Brandon (1 of 3)

Reading: (*Each word is presented individually on a PowerPoint presentation for Brandon to read aloud)* Directions: "Do your best to read each word you see on the screen."

Week of:	**Response**	**Correct/Incorrect (+/-)**
peas		
cone		
hate		
neat		
name		
hope		
bake		
tore		
time		
weed		
mice		
cake		
week		
seed		
bean		
feed		
face		
kite		
cheap		
dime		
tape		
dream		
beep		
core		
pose		
seat		
beak		
feet		
hike		
beach		
note		
nice		
need		
rose		
base		
bone		
cream		
fine		

__/38

(2 of 3)

Reading (Generalization List): (*Each word is presented individually on a PowerPoint presentation for Brandon to read aloud immediately following the presentation of the other PowerPoint- containing 38 words)* Directions: "Do your best to read each word you see on the screen."

Week of:	**Response**	**Correct/Incorrect (+/-)**
mean		
pope		
cane		
rice		
peak		
lime		
rake		
sleet		
peel		
gore		
rope		
slide		
sake		
mine		
lace		
rate		
wise		
tone		
beet		
peach		
speak		
hose		
beat		

___/23

(3 of 3)
Spelling: Read each word aloud and wait 5-7 seconds before repeating the word. (No limit on how many times the word can be repeated).
Directions: "Listen carefully to the word I read and do your best to spell the word correctly."

Word to read aloud	Response	Correct/Incorrect (+/-)
1.Seat		
2.Rise		
3.Wore		
4.Need		
5.Stake		
6.Bike		
7.Beep		
8.Beak		
9.Cone		
10.Case		
11.Bone		
12.Came		
13.Time		
14.Nope		
15.Hide		
16.Wake		

____/16

Assessment Check Sheet- Coleton

Rhyming: Directions: "Listen to these two words" (say 2 words). "Do ____ and ____ rhyme?"
(*Present different rhyming and non-rhyming combinations of words)*

Words to Present	Trial #	Words Presented	Response (Y/N or No Response: N/R)	Correct/Incorrect (+/-)
back stack sack snack pack jack track crack smack cat pat bat fat nap tap lap rap	**1**			
	2			
	3			
	4			
	5			

___/5

Blending/Comprehension: Directions: "I am going to say the sounds that are in a word and I want you to put all the sounds together and tell me what the word is. Then do what the directions say to do."
(*Give different combinations of –ack words in direction form. Only segment 1 word/direction).*

Words to Present		Trial #	Direction	Blended (Y/N)	Completed Task (Y/N)
track	back	**1**			
sack	pack	**2**			
snack	crack	**3**			
stack	smack	**4**			
jack		**5**			

___/5 **___/5**

Word Recognition: (*Place two words in front of Coleton from 2 different target patterns)*
Directions: "Point to the word that says ____" (*Select different combinations).*

Words to Present			Trial #	Words Presented	Target Word	Correct/Incorrect (+/-)
-ack	**-at**	**-ap**	**1**			
sack	cat	nap	**2**			
back	pat	tap	**3**			
pack	bat	lap	**4**			
jack	fat	rap	**5**			
track						**____/5**
crack						

Assessment Check Sheet- Dan (1 of 3)

Reading: Contrast –at with –op
Present Dan with 3 words at a time on a PowerPoint presentation and ask "which word says ___"

Words Presented	Target Word	Response	Correct/Incorrect (+/-)
hat, hop, here	hat		
cat, cop, come	cop		
mat, mop, me	mop		
sat, shop, see	sat		
rat, top, ride	top		
bat, drop, blue	drop		
fat, flop, for	fat		
pat, pop, play	pat		
hat, hop, here	hop		
cat, cop, come	cat		
mat, mop, me	mat		
sat, shop, see	shop		
rat, top, ride	rat		
bat, drop, blue	bat		
fat, flop, for	flop		
pat, pop, play	pop		

_____/16

(2 of 3)
Reading: Contrast –at with –ap
Present Dan with 3 words at a time on a PowerPoint presentation and ask "which word says ___"

Words Presented	Target Word	Response	Correct/Incorrect (+/-)
hat, lap, here	lap		
cat, cap, come	cap		
mat, map, me	mat		
sat, sap, see	sat		
rat, rap, run	rap		
bat, nap, blue	bat		
fat, gap, get	get		
pat, tap, play	pat		
hat, lap, here	hat		
cat, cap, come	cat		
mat, map, me	map		
sat, sap, see	sap		
rat, rap, ride	rat		
bat, nap, blue	nap		
fat, gap, for	for		
pat, tap, play	tap		

_____/16

(3 of 3)

Blending: Segment the word into the onset + rime and read it aloud in two parts (as shown). Directions: "I am going to say the sounds that are in a word and I want you to put all the sounds together and tell me what the word is"

Target	**Response**	**Target**	**Response**
B-ack		C-an	
S-ack		D-an	
T-ack		F-an	
J-ack		M-an	
R-ack		P-an	
P-ack		T-an	
Bl-ack		R-an	
Tr-ack		V-an	
Sn-ack			

____/9 ____/8

Appendix C

SEEL Treatment Fidelity Check Sheet

Meaningful **Yes/No**

a.	*Was the activity appropriate for kindergarten age children?* (Did the activity permit or require active involvement, deal with content that was relevant for young children, incorporate hands-on materials and interesting props?)	
b.	*Did the instructor link the activity to students' prior knowledge and experience?* (Did the clinician comment on how the content or theme related to the child's previous experiences, ask questions about what the child knew or liked about the content/activity, acknowledge child's remarks about the content or prior experiences with the content or activity?)	
c.	*If necessary did the instructor illustrate the meaning of target words to students?* (Did the clinician provide examples, give simple explanations, and illustrate meaning with gestures or intonation?)	

Explicit **Yes/No**

a.	Did the instructor explicitly state the target at the beginning of the lesson?	
b.	Did the instructor model, restate, or repeat the target throughout the activity? (Was the goal of the session clear?)	

Playful and Engaging

a. Was the instructor playful with the students? (Did the clinician produce exaggerated actions, demonstrate positive affect, present the tasks in an amusing way, create spectacles or demonstrate interesting actions on objects?)

None of the time	Some of the time (25-75%)	Most of the time (75-90%)	All of the time (90-100%)

b. Did the instructor encourage the students to be playful? (Did the clinician provide the child with at least some time to explore an object or engage in actions on objects, model role playing and interest in the materials/activities, demonstrate interesting ways to act on objects, interact with the child in a playful way?)

None of the time	Some of the time (25-75%)	Most of the time (75-90%)	All of the time (90-100%)

c. Was the student actively involved and engaged in the activity? (Did the student have opportunities to act on objects and engage in motor acts? Did the student maintain focused of attention on the activity and materials? Were the student's ideas and contributions accepted and incorporated into the activity?)

None of the time	Some of the time (25-75%)	Most of the time (75-90%)	All of the time (90-100%)

d. Did the students appear to enjoy the activity? (Did the student demonstrate positive affect by laughing and smiling, express positive emotions through comments or sounds, demonstrate the desire or willingness to continue the activity, direct attention toward the activity?)

None of the time	Some of the time (25-75%)	Most of the time (75-90%)	All of the time (90-100%)

Intense exposure to targets

How many times did you hear the instructor use the target words and sounds each minute of the activity?

1 min	2 min	3 min	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Were students given frequent opportunities to use the target words and sounds, e.g., through conversation, songs, chants, reading, and writing? _____

Reciprocal exchanges

a. Did the clinician listen to the student and respond to the student's actions and comments? (Did the clinician acknowledge student's remark (intent or emotion), repeat and/or elaborate/expand on the content in the student's utterances?)

None of the time	Some of the time (25-75%)	Most of the time (75-90%)	All of the time (90-100%)

Appendix D

Raw Data

Brandon Spelling

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total Times Correctly Spelled
Wake						x	x														**2**
Hide									x												**1**
Time		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**19**
Bone											x	x	x	x	x	x	x	x	x	x	**10**
Case														x	x	x	x			x	**5**
Rise											x	x	x	x	x	x	x	x	x	x	**10**
Came										x	x	x	x	x	x	x	x	x	x	x	**11**
Bike			x				x	x													**3**
Beep									x	x	x	x	x	x	x	x	x	x	x	x	**12**
Seat																					**0**
Cone							x	x			x	x	x	x	x	x	x	x	x	x	**12**
Nope									x	x	x	x		x	x		x	x		x	**9**
Stake						x	x														**2**
Need										x			x	x		x	x	x	x	x	**8**
Beak																					**0**
Wore										x							x	x		x	**4**
Total Correct	**0**	**1**	**2**	**1**	**1**	**3**	**5**	**3**	**4**	**6**	**7**	**7**	**7**	**9**	**8**	**8**	**10**	**9**	**7**	**10**	

Long -a Intervention: Sessions 4-8
Long -i Intervention: Sessions 9-11
-ea Intervention: Sessions 12-16
Long -o Intervention: Sessions 17-20

Raw Data

Brandon Reading

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total Times Correctly Read
cake		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**19**
bake							x	x				x		x	x			x	x		**7**
tape							x	x	x		x	x	x	x	x	x	x	x	x	x	**13**
name	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**20**
base									x			x					x				**3**
face									x	x	x	x	x	x	x	x	x	x	x	x	**12**
hate							x	x	x	x	x	x	x	x	x	x	x	x	x	x	**14**
dime							x	x	x	x	x	x	x	x	x	x	x	x	x	x	**14**
mice									x	x	x	x	x	x	x	x	x	x	x	x	**12**
hike									x		x	x	x	x	x	x	x	x	x	x	**11**
fine											x	x	x	x		x	x		x	x	**8**
nice										x	x	x	x	x	x	x	x	x	x	x	**11**
kite														x	x		x	x	x	x	**6**
time		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**19**
cream										x				x	x	x	x	x	x	x	**8**
neat											x		x	x	x	x	x		x	x	**8**
dream													x	x	x		x		x	x	**6**
beach						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**15**
peas														x	x	x		x	x	x	**6**
cheap			x			x		x							x	x	x				**6**
bean													x		x		x				**3**
beak					x							x	x	x	x	x	x		x	x	**8**
seat									x			x	x	x	x		x	x	x	x	**9**
rose																	x	x		x	**3**
hope					x			x		x	x	x	x	x	x	x	x	x	x	x	**13**
tore			x	x							x			x					x	x	**6**
note											x	x	x	x	x	x	x	x		x	**9**
core								x							x	x	x	x	x	x	**7**
pose												x	x	x				x	x	x	**6**
bone						x	x	x	x	x	x	x	x	x	x		x	x	x	x	**14**
cone									x	x	x	x	x	x	x		x	x	x	x	**11**
weed				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**17**
feet	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**19**
need	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**19**
week				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**17**
seed						x		x	x	x	x	x	x	x	x	x	x	x	x	x	**14**
feed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	**20**
beep					x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	**15**
Total Correct	**4**	**6**	**8**	**9**	**11**	**13**	**14**	**18**	**21**	**20**	**25**	**28**	**29**	**33**	**33**	**27**	**34**	**30**	**33**	**34**	

Raw Data

Brandon Reading