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THE EFFECTS OF DIGITAL TEXTS WITH TRANSITION TO LITERACY FEATURES ON THE SIGHT WORD RECOGNTION SKILLS OF YOUNG CHILDREN WITH DISABILITIES

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ABSTRACT

Acquiring sight words aids children in developing phonemic awareness and phonics skills, and supports participation in early reading activities. Previous research has indicated children with disabilities can successfully acquire sight words using flashcards and time delay procedures. However, such activities may not be viewed as socially valid as they do not incorporate developmentally appropriate practices such as utilizing authentic reading materials and including interactions with peers. To meet this need, digital texts were created based on I-spy books with "Transition to Literacy" (T2L) features in which a target word is dynamically presented in spoken and written form when the matching picture is touched. These digital texts were then incorporated into shared reading activities with dyads of a child with a disability and a typically developing peer. A multiple probe design across dyads was used to evaluate the effects of this intervention. Participants with disabilities acquired an average of 73.3% of the words to which they were exposed, a gain of 4.25 words above the baseline average of 1.68 correct responses. Intervention averaged 6.2 weeks, with 65.1 minutes of intervention for each dyad. The results of study provide support that incorporating digital texts with T2L features into inclusive shared reading activities can be an effective and socially valid method to develop the sight word recognition skills of young children with disabilities.
Keywords: digital texts, shared reading, sight word recognition, peer interaction

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Chapter 1

Introduction

Early literacy skills serve as the foundation for conventional reading skills, and are an important component of early intervention activities for children with disabilities (Benedek-Wood, McNaughton, & Light, 2015; Chai, Vail, & Ayres, 2015; Lee & Vail, 2005; Mucchetti, 2013). Key early skills include the development of a large expressive vocabulary, identification of letter-sound correspondences, and fluency in word recognition (National Early Literacy Panel [NELP], 2009). These early skills aid children in becoming proficient readers and writers, and enjoying the benefits of literacy in academic, community, and leisure activities (NELP, 2009; Paratore, Cassano, & Schickedanz, 2011).

Although the importance of these early skills is widely recognized, children with disabilities often demonstrate delays in learning these skills (Dynia, Lawton, Logan, & Justice, 2014; Justice & Ezhell, 2001; Lanter, Watson, Erickson, & Freeman, 2012), and are at risk for failure to acquire conventional literacy skills (Mirenda, 2003; Nation, Clarke, Wright, & Williams, 2006; Sturm & Clendon, 2004). Intervention research has identified a variety of early literacy activities that provide benefit for young children with and without disabilities, including phonemic and phonological awareness instruction, sight word recognition instruction, and shared reading (Benedek-Wood et al., 2016; Chai et al., 2014; Lee & Vail, 2005; Hudson & Test, 2011; NELP, 2009).

Sight word recognition skills are frequently included as a key early literacy goal in preschool programs both for young children with disabilities (Ahlgrim-Delzell et al., 2016; Lane, Gast, Shepley, & Ledford, 2015) and children without disabilities (Bierman

et al., 2008; Nix et al., 2017). Development of a sight word vocabulary can provide children with confidence in reading and writing activities (Frijiters et al., 2017; McMurry & McVeigh, 2014), and serve as a foundation for developing phonemic awareness and phonics skills such as understanding letter-sound correspondences (Ehri, 1992; McArthur et al., 2013; Price-Mohr & Price, 2018; Ryder, Tunmer, & Greaney, 2008).

In providing literacy intervention for young children with disabilities, it is important to develop activities that not only address an area of need, but that make use of developmentally appropriate practice for young children (National Association for the Education of Young Children [NAEYC], 2009). For example, drill-and-practice with flash cards in one-to-one and small group instruction has been demonstrated to have a positive impact on the sight word recognition skills of young children with disabilities (e.g., Ledford, Gast, Luscre, & Ayres, 2008), however there is a need to develop activities that not only provide multiple opportunities for a child to learn new skills, but are developmentally appropriate (Neuman & Roskos, 2005).

NAEYC (2009) identified 12 principles of child development and learning that should guide developmentally appropriate practice. Especially important for the area of literacy instruction are two principles: all instruction, including literacy, should be embedded in meaningful experiences across the developmental domains, and all instruction should support positive interactions with peers and caring adults (NAEYC, 2009). Research has demonstrated that cooperative learning in small groups has positive effects on word recognition and other early literacy skills (Slavin, Lake, Chambers, Cheung, & Davis, 2009). Shared reading, which occurs when an adult and children interact while reading a text together, is one example of a developmentally appropriate

intervention (Zvenburgen & Whitehurst, 200) that involves embedded instruction across multiple developmental domains as well as interactions with adults and often peers. In a shared reading activity, learning in the domains of cognitive development (e.g., learning vocabulary and print concepts), communication development (e.g., listening to and talking about a story), social-emotional development (e.g., interacting with an adult or other children during the story), and motor development (e.g., helping turn the pages, touching an image on an electronic storybook) are all supported. In addition, a systematic review of shared reading interventions for children with severe disabilities completed by Hudson and Test (2011) concluded that there was a moderate level of evidence to support the use of shared reading activities to promote literacy development for students with severe disabilities. The challenge for researchers, therefore, is to develop similar literacy interventions for young children with disabilities that adhere to principles of developmentally appropriate practice, while incorporating principles of effective instructional design (Archer & Hughes, 2011; Fosset & Mirenda, 2006), including support for the acquisition of new skills, multiple opportunities for exposure to new content, and the organization of instructional content in order to support mastery learning (e.g., new items are only introduced when previously introduced items have been mastered).

Recent advances in technology have provided new opportunities for literacy intervention incorporating developmentally appropriate practice and effective instructional design. For example, use of digital texts with features that allow for presentation of audio and visual effects (e.g., words presented in spoken form, dynamic presentation of text, etc.) provides an opportunity to address sight word recognition

within small group shared reading activities. The use of such texts in shared reading activities thus provides an opportunity to learn new sight words while also creating an authentic literacy experience, and supporting interaction with peers.

Previous sight word recognition interventions with young children with disabilities have investigated the use of flashcard instruction delivered by adults, using either a constant time delay procedure (sometimes with observational learning opportunities) or simultaneous prompting in one-to-one or small group instruction with other children with disabilities (Alig-Cybriwsky, Gast, & Wolery, 1990; Appleman, Vail, & Lieberman-Betz, 2014; Birkan, McClannahan, & Krantz, 2007; Fosset & Mirenda, 2006; Lane et al., 2015; Ledford et al., 2008; McGee, Krantz, & McClannahan,1986; Winterling, 1990). In addition, Cazzell et al., (2017) and Lee & Vail (2005) made use of computer-based instruction to provide flash card training for children with disabilities. Although these interventions have had positive effects on sight word recognition for young children with disabilities, they did not provide experiences with authentic reading activities and materials (e.g., Zvenburgen & Whitehurst, 2003) or opportunities for interaction with typically developing peers. Thus, there is still an unmet need for effective and efficient sight word instruction within authentic and inclusive literacy activities for young children with disabilities.

Recent research has examined the impact of incorporating Transition to Literacy (T2L) features (Light, McNaughton, Jakobs, & Hershberger, 2014) on sight word recognition learning. T2L features provide support for four processes that facilitate reading: orthographic (i.e., knowledge of letter patterns), phonological (i.e., identification of speech sounds), meaning (i.e., knowledge of word meaning), and contextual (i.e., use

of background knowledge) (Adams, 1994). The presentation of text is dynamic, which supports orthographic processing and draws visual attention to the text (Jagaroo & Wilkinson, 2008; Light et al., 2014). The written word is paired both with the spoken word and an image of the word to support phonological and meaning processing (Light et al., 2014). In addition, the written word originates from the image to support contextual processing (Light et al., 2014).

Thus, in a T2L approach, photographs and other images are programmed with hotspots in a digital text; when the hotspot is selected, the reader is provided with a dynamic presentation of the text, and speech output (see Figure 1). For instance, when a child touches a hotspot programmed on an image of a duck, the child sees the printed word "duck" appear on the tablet screen and hears the word "duck" simultaneously.

Mandak, Light, and McNaughton (2018) investigated the use of T2L features to adapt a digital text (*Brown Bear, Brown Bear, What Do You See?*) to dynamically present 10 target sight words to three young children with ASD within a shared reading context (i.e., the researcher and the child). In contrast to other sight word instructional procedures, no feedback was provided to participants during either instructional or probe sessions as the purpose of the study was to investigate the impact of T2L features on sight word recognition. The addition of feedback would have made it impossible to attribute the results of the study to the use of T2L features alone. Two participants acquired all 10 sight words in 26-27 instructional sessions, while one participant acquired 9 (of 10) in 11 sessions. The mean total length of the intervention was 106.7 minutes (Range = 55 – 135 minutes). In addition, the mean exposure time to the words was six minutes (Range = 4.75 – 6.75 minutes.

In another study, Boyle, McCoy, McNaughton, and Light (2017) examined the use of the T2L feature in an adapted digital text of *Pete the Cat: Rockin' in My School Shoes.* In this pilot study, four young children with language delays were paired with typically developing peers for an inclusive shared reading activity. Researchers adapted the digital text of *Pete the Cat: Rockin' in My School Shoes* and read the text to dyads consisting of a child with a language delay and a typically developing peer. As in Mandak et al (2018), the children saw the T2L feature as the book was read and feedback was not provided to participants during either instructional or probe sessions. Within six 10-minute sessions, three of the four participants with language delays could identify at least three of the six target sight words that were introduced, while 1 participant did not identify any. The mean total length of the intervention was 50 minutes (Range = 40 – 60 minutes). In addition, the mean exposure time to the words was 12.6 minutes (Range = 9.6 – 14.4 minutes. The mean Tau-U effect (Parker, Vannest, Davis, & Sauber 2011) for this intervention was calculated 0.83, which can be interpreted as a medium to high effect.

In addition, three out of four participants with language delays as well as all the typically developing peers indicated that they enjoyed the activity. Lastly, the children's teachers, who had observed the intervention, indicated they thought the activity was enjoyable for both children with language delays and their peers, and that the activity was feasible for use in their classrooms (Boyle et al., 2017).

While the Boyle et al (2017) study provided initial evidence that using digital texts with T2L features in inclusive shared reading activities could have positive effects on sight word recognition of young children with disabilities, and that such activities are

considered enjoyable by children and teachers, there were four major limitations to this pilot study. First, the participants participated in only 4 - 6 intervention sessions before exiting as study took place at the end of the school year. It is possible that participants could have acquired more sight words if more intervention sessions had been offered. Second, some participants did not demonstrate a clear understanding of the behavioral expectations for the reading activity, and demonstrated off-task behavior, impacting both instruction and assessment. All participants might have benefited from instruction in the behavioral expectations for the activity. In addition, all six words were introduced at once instead of in sets of two as in Mandak et al. – this may have made it more difficult for participants to retain the sight words. Lastly, no information on the effect of the intervention on the sight word recognition skills of the typically developing peers was collected. As this was an inclusive activity, quantifying the effects on literacy learning for both young children with disabilities and typically developing partners would provide valuable information for researchers and educators.

Purpose

The current study provides an examination of the impact of sight word instruction using digital texts with T2L features in an inclusive shared reading activity. The current study provides an extension of Boyle et al (2017) in three main ways: (a) the children with disabilities had a diagnosis of developmental delay; (b) all children received instruction in the expectations for participation; (c) instructional vocabulary was introduced in two sets of five words each (set two was not introduced until set one was mastered). More specifically, the current study provides an investigation of the effectiveness of providing shared reading activities using digital texts with T2L features:

(a) on the number of sight words identified correctly by young children with disabilities on probe activities;

(b) on the number of sight words identified correctly by young children with disabilities under the generalization condition (e.g., images of target vocabulary photographed from different orientations);

(c) on the number of sight words identified correctly by typically developing peers on probe activities.

Lastly, the researchers explored the perceptions of stakeholders (teachers, children with disabilities, and typically developing peers) on the social validity of the intervention and its results.

Chapter 2

Method

This study made use of a single subject multiple probe design (Horner & Baer, 1978) across one set of three dyads, with a concurrent replication across an additional set of three dyads. The independent variable was the introduction of the digital text with T2L features. The dependent variable was the number of words correctly matched to the corresponding image by the participant with disability from the 10 sight words introduced during the intervention.

Participants

Participants were recruited from a preschool center in Pennsylvania via letters sent home to all parents/guardians in the classrooms. Ethics approval was obtained from the Pennsylvania State University Office of Research Protection and informed consent was provided by the parents/guardians of each participant before the study began. All children recruited in this study were from English-speaking homes and used speech to communicate. Participants with disabilities met the following criteria: a) identified as having a developmental disability as a result of testing by early intervention personnel; b) had an Individual Educational Plan (IEP) or Individual Family Services Plan (IFSP); c) were between 3 and 6 years old; d) were able to match pictures of a similar image (e.g., two pictures of a duck) at adult request; e) had vision and hearing within normal limits (with or without correction); f) had motor skills sufficient for reading and touching a 9-by-11 inch tablet screen; and g) demonstrated engagement in a preferred play activity for at least five minutes.

Typically developing participants met the following criteria: a) were 3-6 years old, b) were classmates of children with disabilities, c) had no history of negative interactions with their partner at school, d) had vision and hearing within normal limits (with or without correction), and e) had no identified disability.

A participant was determined to meet criteria based on a) school records (i.e., disability and IEP/IFSP criteria); b) teacher reports (i.e., age, vision/hearing, motor skills, no history of negative interactions); and c) researcher observation and interaction (i.e., ability to match similar pictures, ability to sustain interest in play activity).

Participant demographics. The characteristics of the children with disabilities are summarized in Table 1. Four participants were female and two participants were male. Their ages ranged from 3;10 to 5;4 (months; years) at the start of the study. All six participants were White/Non-Hispanic. The children received a variety of therapies while attending the preschool, including speech-language therapy and occupational therapy.

All children with disabilities were tested using the Peabody Picture Vocabulary Test, Edition 4 (PPVT-4) (Dunn & Duun, 2007) to assess their receptive vocabulary and the Expressive Vocabulary Test (EVT) (Williams, 2007) to assess their expressive vocabulary. They were also assessed using the Test of Preschool Early Literacy (TOPEL) (Lonigan, Wagner, & Torgesen, 2007), which tests print knowledge, definitional vocabulary, and phonological awareness and provides a total score as the Early Literacy Index. Testing took place in a quiet place in the preschool center and was conducted by the two members of the research team (special education doctoral students with master's degrees).

Typically developing peers. Demographic information for the typically developing peers is summarized in Table 2. Two peers were female and four peers were male. Their ages ranged from 3;11 to 4;11 at the start of the study.

Participating dyads. Pseudonyms have been used to identify all children in this study. Children were paired based on a) being part of the same classroom and b) teacher report of a history of positive interactions with each other.

Dyad 1: Cathy and Cemal. Cathy was 4;8 at the start of the study, and was identified as having a developmental delay with autism features. At the time of the study, she was receiving speech-language therapy as well as being evaluated to determine her kindergarten placement. Cathy frequently engaged in conversation with adults and peers. Preferred topics of conversation included animals (particularly cats and dogs), and preferred activities included dramatic play and storytelling.

On standardized tests of language and literacy performance, Cathy received a near-average score (47th percentile) on a test of expressive vocabulary (EVT), however she scored between the 25th and 27th percentile on tests of receptive vocabulary and early literacy skills.

Cathy's partner was Cemal, who was 3;10 at the start of the study. His interests included playing with blocks, interacting with classmates in the dramatic play center, and sharing books.

Dyad 2: Mira and Madia. Mira was 4;9 at the start of the study and was identified as having Down Syndrome. At the time of the study, she was receiving occupational therapy and speech-language therapy as well as being evaluated to determine her kindergarten placement. Mira's interests included playing with art

materials and interacting with classmates at the dramatic play center as well as playing outside.

On standardized tests of language and literacy performance, Mira scored between the <1st percentile and 2nd percentile.

Mira's partner was Madia, who was 4;10 at the start of the study. Her interests included interacting with classmates at the dramatic play center and playing outside.

Dyad 3: Ed and Eli. Ed was 4;8 at the start of the study and was identified as having a developmental delay. He was receiving speech-language therapy as well as behavioral interventions which included the presence of an 1-to-1 aide while the study was conducted. Ed's interests included playing with blocks, cars, and puzzles as well as playing outside.

On standardized tests of language and literacy performance, Ed scored at the 30th percentile on a test of early literacy skills (TOPEL), however he scored between the 2nd and 9th percentile on tests of expressive and receptive vocabulary.

Ed's partner was Eli, who was 4;9 at the start of the study. His interests included playing with blocks and playing outside.

Dyad 4: Tara and Tom. Tara was 3;11 at the start of the study and was identified as having a developmental delay. She was receiving speech-language therapy while the study was on-going. Tara's interests included creating art, interacting with her classmates at the dramatic play center, and playing outside.

On standardized tests of language and literacy performance, Tara scored between the 9th and 30th percentile.

Tara's partner was Tom, who was 4;6 at the start of the study. His interests included playing with blocks and playing outside.

Dyad 5: Bren and Bastian. Bren was 5;4 at the start of the study and was identified as having a developmental delay. He was receiving speech-language therapy as well as being evaluated to determine his kindergarten placement while the study was on-going. Bren's interests included playing with cars and blocks as well as playing with classmates outside.

On standardized tests of language and literacy performance, Bren scored between <1st percentile and 2nd percentile.

Bren's partner was Bastian, who was 4;10 at the start of the study. His interests included singing as well as playing with blocks and cars.

Dyad 6: Susie and Sasha. Susie was 3;10 at the start of the study and was identified as having a developmental delay. She was receiving speech-language therapy while the study was on-going. Susie's interests included creating art, playing outside and sharing books.

On standardized tests of language and literacy performance, Susie scored between the 1st percentile and 10th percentile.

Susie's partner was Sasha, who was 4;5 at the start of the study. Her interests included creating art, interacting with classmates at the dramatic play center, and sharing books.

Setting

This study took place in two inclusive classrooms in a preschool center in rural Pennsylvania. Both the child with a disability and the peer in the dyad were students in

the same classroom and had interacted with each other throughout the year (the study took place in the spring, near the end of the school year). Three dyads were drawn from Classroom 1 and the other three dyads were drawn from Classroom 2.

The context of the intervention was a shared reading activity with another child and an adult who provided prompts and expansions. This context was meant to reflect adult-child shared reading with traditional books, which is a common center and group activity in preschool classrooms (Mol et al., 2008; Zvenburgen & Whitehurst, 2003).

Probe sessions (i.e., baseline, intervention, and generalization) took place in a quiet area outside the classroom with only the researcher and one child present. Instructional sessions (i.e., intervention) were presented as a center activity and occurred at a table in each classroom during center play. Both children in the dyad participated in instructional sessions with the researcher. All sessions were videotaped.

Materials

For the intervention, digital texts with T2L features (Light et al., 2014) were created. The digital texts were based on the characteristics of the "I-Spy" books (e.g., Scholastic, 2018) - children's books in which children look for an identified item (e.g., a tiger) in a photograph containing multiple images (e.g., a tree, a bicycle, a road). In one digital text, images of school and community settings (e.g., a playground, a local square, etc.) were programmed on a Samsung tablet using EasyVSD software (InvoTek, 2018). In other digital texts, images of popular children's media characters were programmed using the same software and hardware to promote child interest. On each page of the digital text, one image (e.g., a duck) was programmed as a hotspot; when touched, using the T2L features in EasyVSD, the hotspot produced both a recording of the spoken label (e.g.,

"duck") and the word in text form, presented as yellow font on a black background (see Figure 1). Text to direct the child to look for the target image/word was added on the bottom of the page. For example, the text "Where is the pig?" accompanied a photo of a pig (which was programmed as a hotspot) hiding behind a pumpkin in a field (see Figure 2). Six digital texts (three per word set) were created for each dyad.

For the probe sessions, participants were presented with one 1.25-inch by 3.5-inch card with a yellow background and a target word printed in black Arial 60-pt font. One 8.5-inch by 11-inch white page with four 3-inch by 3-inch color images of animals were placed in front of them in order to provide a method of response.

Sight Word Selection and Screening

The target images/words were selected based on animals that commonly appear in early childhood curricula (Epstein, 2012). Animal vocabulary was selected because a) research on eye gaze suggests that typically developing children as well as children with developmental disabilities spend the most time looking at human figures and animals (Wilkinson & Light, 2014); b) animals are easily imaged nouns; and c) farm and zoo animals are commonly found in early childhood curricula (Epstein, 2012).

The sight word vocabulary chosen for each dyad was based on the results of a screening activity, in which each participant with developmental disability was screened on 15 possible words for instruction. The researcher presented the participant with a prepared sheet with four images representing the targeted sight words and a card representing one of the target sight words in text form. The researcher then directed the participant to read the word and match the word to the correct picture. The participant with a disability was tested on the 15 words on two separate testing trials (typically

developing peers did not participate in this testing activity). Ten instructional vocabulary items were drawn from those words for which the participant with a disability did not make a correct match on either of the two separate testing trials.

The ten target words were then separated into two sets of five words for each dyad. The first set consisted of farm animal words (e.g., cat, pig, etc.) and the second set consisted of zoo animal words (e.g., fox, tiger, etc.). Each set was also designed to meet the following criteria: a) all words were between three and five letters, and b) no words in the same set started with the same initial letter sound. For example, one list of words consisted of Set 1: cat, duck, horse, pig, sheep and Set 2: bear, fox, lion, snake, tiger.

Individualized "books" (i.e., a series of pages on the tablet with T2L features) were then assembled for each dyad using the EasyVSD software, with each of the target images/words (e.g., "tiger") appearing on at least two "pages". Each book thus consisted of 10 pages in which 5 target images/words were repeated twice. Each dyad was provided with three books with the same five Set 1 target images/words, however each book had a different theme (e.g., a book with pictures of the target vocabulary placed into pictures of school activities, a book with pictures of the target vocabulary placed into pictures of characters from popular children's TV shows, etc.).

Once the participant with a disability demonstrated mastery on the first set of words (i.e., correct answers in three consecutive probe sessions for four out of the five Set 1 words), three more books with similar themes but with five Set 2 target images/words (e.g., zoo animals) were introduced to the dyad. Dyads reviewed Set 1 words periodically during exposure to Set 2 words (see information on study design below for details). Participants were introduced to a set of five words at a time to reduce load on

their working memory, which can be a concern for children with developmental disabilities.

Design

This study made use of a single subject multiple probe design (Horner & Baer, 1978; Horner et al., 2005) across one set of three dyads, with a concurrent replication across an additional set of three dyads. Multiple probe design involves systematic introduction of an intervention across three or more participant groups and is a variation on multiple baseline design (Horner & Baer, 1978). In a multiple baseline design, there is continuous baseline measurement, while in multiple probe design probes are completed at intermittent intervals (Horner & Baer, 1978). Multiple probe design was selected for this study due to the impracticality of conducting probes daily with each participant with his or her busy classroom and therapy schedules.

The independent variable was the introduction of the digital text with T2L features. The dependent variable was the number of words (from the 10 sight words introduced during the intervention) matched to the corresponding correct image by the participant with disability.

The study involved two main phases, baseline and intervention, with one generalization probe (which consisted of matching sight words to a corresponding image in a different orientation) conducted during each phase. Dyads participated in sessions approximately three times per week across a period of thirteen weeks. Baseline sessions included a probe. Intervention sessions included a probe and then an instructional session.

Before intervention occurred for any dyads, a minimum of five baseline phase

data points were collected for the participant with a disability in that dyad. Baseline sessions continued until an acceptable level of variation (i.e., an average score at or below chance levels, 25%), and no evidence of an increasing trend, was observed for the dependent variable (Kazdin, 2011). Trend was assessed through visual analysis of the data. The average baseline score for each of the six participants with a disability was below chance levels (0.25).

Once the first dyad met criteria for transitioning out of baseline, intervention began for that dyad. The second and third dyads remained in baseline. When an intervention effect was established with the first dyad, intervention began with the second dyad (as long as the second dyad had met criteria for ending baseline). An intervention effect was defined as two consecutive data points that were above the highest point seen in baseline. Because of the variability acceptable in baseline, an intervention effect could be small (i.e., if the highest point in baseline was 3, two consecutive data points of 4 in intervention would be considered an intervention effect). The third dyad began intervention when an intervention effect was observed for the second dyad.

When the participant with a disability in the dyad identified four out of five Set 1 words in three consecutive sight word probe sessions, the dyad was provided with Set 2 books for the next four instructional sessions and then the Set 1 books for an additional (fifth) session, which served as a review session for Set 1 words. If the participant then scored four out of five for Set 1 words, the participant returned to books featuring Set 2 vocabulary. If they scored three or below, the participant resumed use of Set 1 books until he/she once again identified four out of five Set 1 words in three consecutive sight word probe sessions.

Measures

The researcher conducted a sight word probe with a participant with a disability before each instructional session. The probe session thus served as an assessment of what the participant had retained from the previous instructional session, which had occurred a mean average of 3.5 days previously (range = 0 - 15).

Sight word probes were conducted twice with typically developing participants, once before instruction began and once at the end of instruction. Each sight word probe contained one trial for each of the dyad's ten target words, in which the participant was asked to match the written word to one of four pictures in a field in which the one image depicted the written word (e.g., cat) and three other images depicted other words in the child's 10-word instructional set (e.g., dog, fox, pig), including both Set 1 and Set 2 words.

Dependent Variable and Response Definitions

The dependent variable was the number of words identified correctly by the participant**.** A correct response was defined as the participant touching an image that represented the target sight word, or speaking the correct word, within 5 s of being shown a word in text form by the researcher. Three possible responses were recorded: (a) a *correct response* when the participant pointed to the target image, touched the target image, released the target word card onto the target image or said the target word within 5 s; (b) an *incorrect response* when the participant pointed to an incorrect image, touched an incorrect image, released the target word card onto the incorrect image or said an incorrect word (including "I don't know" or similar phrase) within 5 s; and (c) a *no response* when the participant failed to point to any image, touch any image, release the

target word card onto an image, or say a word after two consecutive requests, each allowing 5 s of wait time.

Procedures

The study included three phases: baseline, intervention, and generalization. Probe procedures remained consistent across phases.

Probe procedures. Each probe targeted each of the ten sight words in the dyad's instructional set once in random order after showing one word to the participant. The researcher then prompted the participant to read the word and match the word to the correct picture (i.e., "Match the word to the picture."). If the participant did not respond within 5 s, the researcher repeated the prompt. When the participant responded, the researcher thanked and encouraged the participant with a neutral statement (e.g., "Thank you", "Good job following directions!", etc.), but did not provide corrective feedback. In addition, once participants had completed the entire sight word probe, they played an educational game (e.g., a puzzle, a matching game, etc.) for 60 seconds on a small tablet device.

Baseline. Each participant with a disability completed at least five sight word probes during baseline. Typically developing participants completed one sight word probe during baseline.

Intervention. The intervention phase consisted of instructional sessions in which the researcher guided both members of the dyad in using and sharing the digital texts (created using EasyVSD software) on the tablet. Probe sessions were conducted before each instructional session for participants with disabilities and once at the end of the phase for typically developing participants, to assess the effect of the instructional

sessions. For 69 of the total of 73 instructional sessions (95%), both partners in a dyad participated in the instructional session. For four instructional sessions (5%) of the instructional sessions, the typically developing partner was absent, and the researcher chose a typically developing participant from a different dyad in the same classroom to participate in the instructional session with the partner with a disability. If the partner with a disability was absent, probe and instructional sessions were suspended for that dyad until he or she returned to school. Due to classroom, school, and therapy schedules, not all participants could be seen in each time the researcher visited the preschool center.

During the intervention phase, the researcher read the digital text (with five of the 10 target words as hotspots, each appearing on two separate pages) with each of the six dyads of children an average of 2.1 times per week (range = 1 - 3). Each instructional session was approximately 5 minutes in length (range = 4 – 6), and was a center activity in the two inclusive preschool classrooms. The children participated in the intervention for an average of 6.2 weeks (range = 2 - 10) for a mean average of 13.02 sessions (range = 6 – 21) and a mean average of 65.1 minutes of intervention for each dyad (range = 24 – 126 minutes).

At the beginning of an intervention session, the researcher first asked a participant to choose a book on the tablet, alternating between the children in the dyad. Expectations for behavior were set by stating "When we read, one person will touch the picture. If it's your partner's turn to touch the picture, please wait until I tell you it's your turn."

The researcher then read the text (e.g., "I see the…"), held the tablet in proximity to the first participant, and paused for up to 5 seconds. This provided an opportunity for the first participant to activate the hotspot of the word. An activation consisted of

touching the image (resulting in the target word appearing for 3 s while being spoken by the device simultaneously). The researcher remained silent during all activations, and positioned the tablet so that both children could see it.

If the participant did not activate the hotspot of the word within 5 seconds, the researcher implemented a least-to-most prompting hierarchy:

1. The researcher first provided a verbal prompt (e.g., the researcher said "Find the picture of the cat").
2. If the participant did not activate the hotspot, an additional verbal prompt and a visual cue was provided (e.g., the researcher said "Find the picture of the cat" while pointing towards the image of the cat on the tablet).
3. If the participant still did not activate the hotspot, a verbal cue (e.g., "Let's find the picture of the cat together") and a hand-over-hand prompt was provided (e.g., The researcher said "Let's find the cat together" while lightly guiding the child's hand towards the hotspot.).

The prompting hierarchy was discontinued when the participant had activated the hotspot once (i.e., one activation).

The researcher then provided a prompt to the second participant to activate the hotspot (e.g., "Now it's your turn. Find the picture of the cat"). If the second participant did not activate the hotspot within 5 s, the researcher again implemented the least-to-most prompting hierarchy until he or she activated the hotspot once (i.e., one activation).

Next, the researcher followed the same procedures to have the first participant activate the hotspot again. Lastly, the researcher provided an expansion using a

descriptive word (i.e., a color, size, or emotion) before asking the second participant to activate the hotspot again (e.g., “That’s a yellow duck”, “That’s a big lion”, “That’s a happy cat”, etc.).

If needed, the researcher provided brief verbal praise for on-task behavior (e.g., “Good job waiting for your turn!”, “I like how you looked for the duck right away”). Additionally, if the participants commented after activating the hotspot (e.g., “Oink! Oink!”), that comment was acknowledged and expanded by the researcher (“Yes, the pig goes oink!”) These procedures were repeated for each target image/word on each page of the digital text. Since each target image/word occurred on two pages and was activated for 3 s of exposure four times each on every page, each target image/word was activated for a total of eight activations (24 s of exposure) per intervention session.

Generalization. Participants with disabilities completed one generalization probe during the baseline phase and another generalization probe at the end of the intervention phase. These generalization probe sessions followed the same procedures as the sight word probe sessions in baseline and intervention conditions with the exception of the picture cards. The generalization picture cards used images of the same target animals used in the sight word probe sessions during baseline and intervention conditions, but viewed from a different orientation (i.e., flipped images).

Procedural Integrity and Interobserver Agreement

Probe, instructional, and generalization sessions were videotaped to provide information on the accuracy and consistency of both the integrity of the procedures and the scoring of the data. To calculate procedural integrity, the third member of the research team (a special education doctoral student) used an experimenter-created

checklist to check a randomly selected 20% of probe and instructional sessions. The checklist provided a listing of the steps for both the probe and intervention activities. The percentage of probe and instructional steps completed correctly equaled 99%. To calculate interobserver agreement for data scoring, the third member scored the participants' responses in a randomly selected 20% of sight word probes. Interobserver agreement averaged 99.5% for scoring of sight word responses on probes across all conditions.

Data Analysis

Data were graphed and analyzed visually for trend, level, and variability (Kazdin, 2011). The mean number of correct responses were calculated for each phase. In addition, the percentage of sight words acquired out of total number of sight words to which the participant with disabilities was exposed was calculated by dividing the number of words correctly identified in the last probe session by the number of sight words to which the participants had been exposed.

Data were also analyzed to calculate Tau-U (Parker et al., 2011), an effect size measure of data overlap that accounts for both level changes across phases as well as any positive baseline trends (Rakap, 2015). With multiple-baseline designs, including multiple-probe, Tau-U is calculated separately for each baseline-intervention contrast and effect sizes across participants are calculated by averaging those separate Tau-U scores together (Rakap 2015). For this study, Tau-U scores were calculated using an online calculator (Vannest, Parker, & Goen, 2011). Tau-U scores can be interpreted using the following criteria: 65% or lower, a weak or small effect; between 66% and 92%, a

medium to high effect; and 93% to 100%, a large or strong effect (Parker, Vannest, Davis, & Sauber, 2011).

Lastly, in order to examine an aspect of the efficiency of the intervention, the amount of exposure to participants' target words was calculated by multiplying the seconds of exposure to a target word set (i.e., 120 seconds) by the number of sessions. Total time spent in intervention was calculated by multiplying mean session length by the number of instructional sessions completed. Mean word learning rates were then calculated by using two methods: a) dividing exposure time by number of sight words acquired and b) dividing total time in intervention by number of words acquired.

Social Validity

Social validity was assessed at the completion of the study by asking teachers and participants to rate the validity of the goals, methods, and outcomes of the intervention (Wolf 1978).

The two preschool teachers (Teacher A and Teacher B) were individually shown a video of the children participating in an instructional session, and the data for their students' performance. Teachers were asked to rate five statements that referred to different components of the intervention on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5): (a) I would use the tablet technology in my classroom, (b) Teaching students sight words is an important early literacy skill, (c) It's important to include both children with and without disabilities in activities, (d) Students seemed to enjoy the instructional activity, and (e) Students seemed to benefit from the instructional activity. In an open-ended response activity, teachers were also asked if implementing a similar intervention would be feasible for them; what, if any, changes

they would make if they were implementing a similar intervention; and to share any other comments of perceived strengths or challenges with the intervention.

Participants with disabilities as well as typically developing peers were also asked to use Talking Mats (Rabiee, Sloper, & Beresford, 2009) to answer the following questions: (a) Did you like reading on the tablet? and (b) Did you like reading with your partner? Following procedures described in the literature (Rabiee, Sloper, & Beresford, 2009), the Talking Mat was a 8.5x11inch sheet of paper with a photograph of a child looking happy on the top left side and a photograph of a child looking unhappy on the top right side. The researcher modeled use of the Talking Mat with photographs of preferred and non-preferred activities and food (e.g., placing a photograph of ice cream on the left side and saying "I like ice cream" or placing a photograph of picking up toys on the right side and saying "I don't like picking up my toys"). Participants' understanding of the use of the Talking Mats were validated by asking them (i.e., "Do you like….") to place photographs of three preferred activities or foods and three non-preferred foods or activities (as reported by parents and/or teachers).

Chapter 3

Results

All six participants with disabilities demonstrated an increase in the total number of correct responses to sight word probes. Four typically developing peers participated in pre- and post-intervention probes (two were unavailable for post-intervention probes) and all four also demonstrated an increase in the total number of correct responses. Additionally, three participants with disabilities (three were unavailable) participated in pre -and post-intervention generalization probes and all demonstrated an increase in total number of correct responses. Figures 3 and 4 present the graphs representing the correct responses during baseline and intervention phases. Table 3 presents information on generalization data for participants with disabilities. Table 4 presents information on sight word identification data for typically developing participants.

Correct Responses Demonstrated by Participants with Disabilities

Cathy. During the baseline phase, Cathy demonstrated an average score of 1.8 correct responses (18% accuracy), below chance levels ([.25 * 10 = 2.5] or 25%) for the probe set of ten words (i.e., five Set 1 words and five Set 2 words). She demonstrated a treatment effect (i.e., an increase of at least two points above her highest point in baseline for two sight word probe sessions) after six instructional sessions. After nine instructional sessions, Cathy reached criterion on Set 1 words (i.e., identified four out of five words in three probe sessions) and use of the Set 2 books were incorporated into instructional sessions for her dyad. Cathy displayed continuous improvement until a drop at her 13th session, which occurred after she returned from spring break (during which time she was absent for thirteen days in total). At that session, she only correctly

identified one Set 1 sight word and thus the use of Set 1 books was incorporated again for her dyad. After that change had been made, she then made continuous improvement and attained her previous level at her 17th session.

Cathy demonstrated an average score of 7.3 correct responses (73% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Cathy's correct responses was 0.91, indicating a medium to high effect. In the last probe session, Cathy correctly identified eight out of the ten sight words (80%) to which she had been exposed. In the pre-intervention generalization probe, Cathy demonstrated a score of 1 correct responses (10% accuracy) during the pre-intervention generalization probe, below chance levels. For the post-intervention generalization probe, Cathy demonstrated a score of 6.0 (60% accuracy), five points higher.

Cathy had a total of 2,280 s (38 minutes) exposure to her total instructional set (Set 1 and Set 2) of words and correctly identified eight of those ten words during her last session. This is a mean word learning rate of 4.75 minutes per word calculated using exposure time. She had 19 instructional sessions of approximately 5 minutes, for a mean word learning rate of 11.875 minutes per word calculated using total time in intervention.

Mira. During the baseline phase, Mira demonstrated an average score of 1.3 correct responses (13% accuracy), below chance levels (i.e., 25%). She demonstrated a treatment effect after three instructional sessions and displayed continuous improvement afterwards. Mira was withdrawn from the study after her 6th instructional session due to scheduling concerns; Mira also was receiving occupational, feeding, and speech therapy at the time of the study, and only attended the classroom program for 1.5 hours per day. Thus, Mira did not reach criterion on Set 1 words and did not transition to Set 2 books.

Mira demonstrated an average score of 5.0 correct responses (50% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Mira's correct responses was 1.0, indicating a large or strong effect. In the last probe session, Mira correctly identified five out of the five sight words (100%) to which she had been exposed. Mira was withdrawn from the study before a post-intervention generalization probe could occur.

Mira had a total of 720 s (12 minutes) exposure to her instructional set of words (Set 1 only) and correctly identified five of those words during her last session. This is a mean word learning rate of 2.4 minutes per word calculated using exposure time. She had 6 instructional sessions of approximately 5 minutes, for a mean word learning rate of 6 minutes per word calculated using total time in intervention.

Ed. During the baseline phase, Ed demonstrated an average score of 2.0 correct responses (20% accuracy), below chance levels. He demonstrated a treatment effect after six instructional sessions and maintained similar levels above the highest point in baseline until the end of the intervention phase. However, Ed did not reach criterion on Set 1 words and thus did not transition to Set 2 before intervention ended due to the end of the school year.

Ed demonstrated an average score of 5.0 correct responses (50% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Ed's correct responses was 0.93, indicating a large effect. In the last probe session, Ed correctly identified three out of the five sight words in Set 1 to which he had been exposed (60%). In the pre-intervention generalization probe, Ed demonstrated a score of 2.0 correct responses (20% accuracy) during the pre-intervention generalization probe,

below chance levels. For the post-intervention generalization probe, Ed demonstrated a score of 4.0 (40% accuracy), two points higher.

Ed had a total of 840 s (14 minutes) exposure to his instructional set of words (Set 1 words) and correctly identified three of those words during his last session. This is a mean word learning rate of 4.67 minutes per word using exposure time. He had 7 instructional sessions of approximately 5 minutes, for a mean word learning rate of 11.67 minutes per word calculated using total time in intervention.

Tara. During the baseline phase, Tara demonstrated an average score of 1.4 correct responses (14% accuracy), below chance levels. She demonstrated a treatment effect after seven instructional sessions. Tara then maintained this level until a drop at her 10th session, which occurred after she returned from spring break (an absence of eleven days in total). She then maintained a level above her highest point in baseline for the remaining sessions. Additionally, Tara reached criterion on Set 1 words after eighteen instructional sessions. The use of the Set 2 books were then incorporated into instructional sessions for her dyad.

Tara demonstrated an average score of 6.7 correct responses (67% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Tara's correct responses was 1.0, indicating a large effect. In the last probe session, Tara correctly identified seven out of the ten sight words (70%) to which she had been exposed. In the pre-intervention generalization probe, Tara demonstrated a score of 2.0 correct responses (20% accuracy), below chance levels. For the post-intervention generalization probe, Tara demonstrated a score of 8.0 (80% accuracy), six points higher.

Tara had a total of 2,640 s (44 minutes) exposure to her instructional set of words (Set 1 and Set 2 words) and correctly identified seven of those words during her last session. This is a mean word learning rate of 6.29 minutes per word using exposure time. She had 22 instructional sessions of approximately 5 minutes, for a mean word learning rate of 15.7 minutes per word calculated using total time in intervention.

Bren. During the baseline phase, Bren demonstrated an average score of 2.4 correct responses (24% accuracy), slightly below chance levels. He demonstrated a treatment effect after eleven instructional sessions and maintained a level above the highest point in baseline until the end of the intervention phase. Bren also reached criterion on Set 1 words after eleven instructional sessions. The use of the Set 2 books were thus incorporated into instructional sessions for his dyad.

Bren demonstrated an average score of 5.3 correct responses (53% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Bren's correct responses was 0.84, indicating a medium or high effect. In the last probe session, Ed correctly identified five out of the ten sight words to which he had been exposed (50%). Bren was not available to participate in a post-intervention generalization probe.

Bren had a total of 1,920 s (32 minutes) exposure to his instructional set of words (Set 1 and Set 2) and correctly identified five of those words during his last session. This is a mean word learning rate of 6.4 minutes per word using exposure time. He had 16 instructional sessions of approximately 5 minutes, for a mean word learning rate of 16.0 minutes per word calculated using total time in intervention.

Susie. During the baseline phase, Susie demonstrated an average score of 1.2 correct responses (12% accuracy), below chance levels. She demonstrated a treatment

effect after five instructional sessions and maintained a similar level above the highest point in baseline until the end of the intervention phase. However, Susie did not reach criterion on Set 1 words and thus did not transition to Set 2 before intervention ended to due to the end of the school year.

Susie demonstrated an average score of 6.3 correct responses (63% accuracy) for the last three probe sessions, above baseline levels. The Tau-U effect size for Susie's correct responses was 0.97, indicating a large effect. In the last probe session, Susie correctly identified four out of the five sight words in Set 1 (80%) to which she had been exposed. Susie was not available to participate in a post-intervention generalization probe.

Susie had a total of 720 s (12 minutes) exposure to her instructional set of words and correctly identified four of those words during her last session. This is a mean word learning rate of 3.0 minutes per word using exposure time. She had 5 instructional sessions of approximately 5 minutes, for a mean word learning rate of 7.5 minutes per word calculated using total time in intervention.

Correct Responses Demonstrated by Typically Developing Peers

Cemal. Cemal demonstrated a score of 9.0 correct responses (90% accuracy) during the pre-intervention probe, above chance levels. For the post-intervention probe, Cemal demonstrated a score of 10.0 (100% accuracy), one point higher.

Madia. Madia demonstrated a score of 2.0 correct responses (20% accuracy) during the pre-intervention probe, below chance levels. Madia was not available to participate in a post-intervention probe.

Eli. Eli demonstrated a score of 4.0 correct responses (40% accuracy) during the pre-intervention probe, above chance levels. For the post-intervention probe, Eli demonstrated a score of 7.0 (70% accuracy), three points higher.

Tom. Tom demonstrated a score of 5.0 correct responses (50% accuracy) during the pre-intervention probe, above chance levels. Tom was not available to participate in a post-intervention probe.

Bastin. Bastian demonstrated a score of 3.0 correct responses (30% accuracy) during the pre-intervention probe, slightly above chance levels. For the post-intervention probe, Bastian demonstrated a score of 5.0 (50% accuracy), two points higher.

Sasha. Sasha demonstrated a score of 2.0 correct responses (20% accuracy) during the pre-intervention probe, below chance levels. For the post-intervention probe, Sasha demonstrated a score of 5.0 (50% accuracy), three points higher.

Social Validity

Participants. All participants participated in the social validity activity using a Talking Mat (Rabiee et al., 2009) with a picture of a happy child on the left side and a sad child on the right side. All participants with disabilities and all typically developing participants first demonstrated their understanding of the task by placing images representing preferred activities and items on the left side with the happy child and placing images representing non-preferred activities and items on the right side with the sad child. Participants were then asked to place a picture of the tablet in response to the question "Did you like reading on the tablet?" on the side that best represented their answer. Participants were then asked again to place images representing preferred and non-preferred activities and items on the side that represented their reaction to the activity

or item. Lastly, participants were asked to place a picture of his or herself and his or her partner in response to the question "Did you like reading with your partner?" on the side that best represented their answer.

All participants with disabilities and all typically developing participants placed both pictures under the happy child on the Talking Mat. Participants also offered unprompted verbal responses. For example, Cathy stated the tablet was "All fun things!" while her partner Cemal stated that "Yes! I like it." when asked about reading with Cathy.

Teachers. Both Teacher A and Teacher B participated in answering a social validity questionnaire during one-to-one interviews with the first author, rating statements on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). The first statement was "I would use the tablet technology in my classroom". Teacher A indicated that she strongly agreed with a rating of 5, while Teacher B indicated she was neutral with a rating of 3. Teacher A also stated that she would use the tablet technology in her classroom, saying that "I think it's especially important nowadays when kids need to know technology". Teacher B stated that she would use the tablet technology if "given training, if it fits into what I'm doing in the classroom, and if the kids are interested".

The next statement was "Teaching students sight words is an important early literacy skill". Both teachers indicated that they agreed with ratings of 4. Teacher B added that she thought letter sounds were more important.

The third statement was "It's important to include both children with and without disabilities in activities". Both teachers indicated that they strongly agreed with ratings

of 5. Teacher A stated that "I just think it's sad that people think it's a hindrance on typical peers, when really it's positive for both," while Teacher B exclaimed "It's common sense! Regardless of their abilities, they still need essential reading skills."

The fourth statement was "Students seemed to enjoy the instructional activity". Both teachers indicated that they agreed with ratings of 4.

The last statement was "Students seemed to benefit from the instructional activity". Both teachers indicated that they strongly agreed with ratings of 5. Teacher A stated that she thought it worked because the activity was "kind of teacher-led, but also using the children's interests with the choice of books" while Teacher B replied "they got more words, learned more words".

In the open-ended response activity, Teacher A and B agreed that implementing a similar intervention would be feasible for them, especially in small groups and particularly for the children in their classes going to kindergarten next year. Teacher A would make no changes to the intervention, stating "it's nice that it is based on what the kids want [to read]". Teacher B was interested in incorporating "more or different words like safety and shape words or family and classmate names…[and] letter sounds." as well as engaging children in the intervention while they were "learning other reading skills".

Lastly, both teachers had positive responses to the intervention as a whole. Teacher A summarized her feelings as "I'm really impressed with the results. Here's proof that they are just as able to learn as other kids!"

Chapter 4

Discussion

The goal of this study was to investigate the effects of providing sight word instruction using digital texts with T2L features in an inclusive shared reading activity to dyads of young children with disabilities and typically developing peers. The results provide evidence that this activity was an effective and efficient method of teaching sight words to young children with disabilities and their typically developing peers, and that it was viewed as enjoyable by the children, and useful by their teachers.

Effectiveness

Participants with disabilities. As in past research by Mandak et al (2018) and Boyle et al (2017), the use of digital texts with T2L in a shared reading activity resulted in increases in sight word recognition for young children with disabilities. The mean Tau effect across participants with disabilities during the intervention phase was 0.94, which indicates a large effect. In their last three probe sessions, participants with disabilities provided an average of 5.93 correct responses (range = 5.0 – 7.3), which is a 59.3% accuracy rate. This is a gain of 4.25 words above the baseline average of 1.68 correct responses (range = 1.2 – 2.4).

Participants with disabilities acquired an average of 73.3% of the words to which they were exposed (range = 50% - 100%), which is higher than the 37.5% reported by Boyle et al (2017). However, it is lower than percentages calculated for previous sight word interventions utilizing flashcards and time delay procedures mediated by adults or computers (91.4%; 86%). In the studies utilizing flashcards and time delays (e.g., Cazzell et al., 2017; Lane et al., 2015, etc.), participants were given feedback during

instructional sessions about whether they had identified the correct sight word while participants in the current study on digital texts with T2L features were not given such feedback, but only exposed to the active pairing and dynamic presentation of written and spoken word during the shared reading activity. Providing children with opportunities to demonstrate sight word skills and receive feedback during additional more formally structured instructional activities in the current study may have boosted the number of words acquired by participants with disabilities.

Generalization. Three participants with disabilities (Cathy, Ed, and Tara) participated in both pre- and post-intervention generalization probes. The mean score on the pre-intervention generalization probes was 1.67 words correctly identified (range = 1.0 -2.0). For the post-intervention generalization probes, the mean score was 6.0 (range = 4.0 - 8.0), a gain of 4.33 words. These results provide evidence that these participants displayed the ability to match the words they acquired when presented with pictures that differed in orientation from those presented in the intervention phase.

Typically developing peers. Four typically developing peers participated in both pre- and post-intervention probes. Cemal had a gain of one word, having identified all ten words in the set correctly. Bastin had a gain of two words. Eli and Sasha had a gain of three words each. These results indicate that the intervention had a small positive effect on the sight word recognition for four of the typically developing participants.

The intervention had positive effects on the sight word recognition of young children with disabilities and four of the six children without disabilities (no data was available for two children). A number of factors may have contributed to the effectiveness of the intervention. These include the use of evidence-based principles of

instructional design such as providing multiple opportunities for exposure to the words and supporting mastery learning by not introducing a 2nd set of words until a majority of the 1st set was mastered (Archer & Hughes, 2005). Additionally, recent technological innovations allowed for active visual and spoken pairing of the referent (picture of item) with the target (printed and spoken word) (Fosset & Mirenda, 2006;) using the T2L features of the EasyVSD software to support orthographic, phonological, and context-based processing (Light et al., 2015).

Efficiency

Participants' mean word learning rates when calculated by exposure time (e.g., number of minutes exposed to words divided by number of words identified in final probe session) varied (range = 2.4 – 6.4), with an average time of 4.59 minutes/word. This is comparable to the mean word learning rates calculated for Boyle et al (2017) (5.33 minutes/word) and for Mandak et al (2018) (5.67 minutes/word).

In addition, mean word learning rates when calculated by total time in intervention (e.g., instructional session length in minutes divided by number of words identified in final probe session) also varied (range = 6 – 15.7), with an average time of 11.5 minutes/word. These rates are similar to or more efficient than the mean word learning rates with the use of constant time delay in sight word instruction, which ranged from 10 minutes (Ledford et al. 2008) to approximately 70 minutes per word (Alig-Cybriwsky et al. 1990). They are also more efficient than word learning rate reported for the use of stimulus prompting, which ranged from 32 minutes (Birkan et al 2007) to 75 minutes per word (McGee et al., 1986). Lastly, the rates are somewhat higher than those using time delay in combination with computer-based procedures, which ranged from 1.2 to 7.5

minutes per word (Lee & Vail, 2005; Cazellel et al., 2017). By this metric, the current study is as efficient or more efficient than studies using traditional adult-mediated forms of sight word instruction, although somewhat less efficient for studies using other computer-based interventions with young children with disabilities. For young children with disabilities, who often present with delays in multiple domains, efficient interventions allow them to more rapidly build the skills they need for success in academic and social endeavors. Time is only one measure of efficiency; the current study also addressed skills associated with shared reading activities (e.g., vocabulary development, interactions with typically developing peers, etc.) that have not been included in traditional adult-mediated or other computer-based sight word interventions for young children with disabilities.

Social Validity

The results of the participant and teacher questionnaires revealed that both children and teachers perceived the use of digital with T2L features in shared reading activities to be a socially valid method of reading instruction. Specifically, both participants with disabilities and their typically developing peers indicated that they liked "reading on the tablet" and "reading with [their] partner", validating the method of incorporating technological supports and indicating that goal of providing an inclusive shared reading activity resulted in an enjoyable literacy experience for both sets of children. Additionally, both teachers agreed that both sets of participants benefited from the activity, resulting in improved sight word recognition and more peer interaction. They also agreed providing such inclusive activities were important for both students with and without disabilities.

Teacher A and Teacher B favored implementing a similar intervention in their classrooms, if given support and training on how to use the technology. Shared reading activities are common in early childhood classrooms because of well-documented positive effects on oral language, print concepts, and vocabulary (NELP, 2009; Zvenburgen & Whitehurst, 2003) and both teachers engaged students in shared reading during circle time and center play. Teachers in inclusive early childhood classrooms could use digital texts with T2L features to provide sight word instruction within a shared reading activity to produce positive effects on a number of early literacy skills for all of their students. The adaptive nature of T2L software, which have been used to create individualized high-interest scenes (Holyfield, Knudston, Light, & McNaughton, 2017) as well as digital texts, could allow individual teachers to create scenes and texts that best match their students' literacy needs and interests.

It is important to note, however, that this intervention is meant as supplement to early literacy instruction, not as a replacement. Literacy instruction for young children of all ability levels should encompass a variety of communication, reading, and writing skills (Colozzo, McKeill, Petersen, & Szabo, 2016; Light & McNaughton, 2009; NELP, 2009).

Implications for Practice

The results of this study have implications for educators who teach young children with and without disabilities. Incorporating sight word instruction into authentic reading activities has positive effects on sight word identification for both children with disabilities and their typically developing peers. Such activities can help promote peer interaction as both sets of children enjoyed the activities. The fact that all children

reported enjoying this activity provides promise that similar reading activities might be enjoyed by children with disabilities, their typically developing peers, and teachers. Using such activities, teachers could provide inclusive developmentally appropriate experiences that engage children with peers and adults in high-interest materials (NAEYC, 2009) while also providing sight word instruction. As the activity is inherently inclusive (i.e., requiring no special supports for most children with disabilities to participate in), shared reading activities utilizing digital texts with T2L features are excellent candidates for the inclusive early childhood classroom, allowing young children with and without disabilities to benefit from inclusive activities while gaining literacy skills.

Limitations and Future Research

The study has several limitations which should be considered in an examination of the results. Primarily, the target sight words were displayed on the texts as well being activated by hotspots in the T2L features (i.e., a text beneath the image read "Where is the pig?" and the image of pig acted as a hotspot for the word "pig" which was visually and orally presented). It is thus possible that participants matched target words to the corresponding images because of this presence of the target word in the text as well the use of T2L features in pairing the target word with the image. In addition, the intervention was ended before any of the participants had achieved criterion on their total word list (eight out of ten target words): Mira was withdrawn early because of behavior and scheduling concerns, the other five participants stopped receiving intervention because of the end of the school year. Maintenance data were also not collected as a result of not achieving criterion. Future research should investigate the impact of books

in which the target word is not presented in text form beneath the image, a longer intervention period, and the collection of maintenance data to better evaluate the intervention's effects on participants. Additional generalization and maintenance data for all participants would also aid in that evaluation, as well as replications of the study to ensure validity with other young children with disabilities.

Conclusion

The use of digital texts with T2L features in inclusive shared reading activities had a positive effect on sight word recognition for young children with disabilities and their typically developing peers. The participants correctly identified sight words following exposure to the T2L feature (dynamic presentation of the written word, the picture, and the spoken word) during a story book reading activity. The social validity findings highlight that this was an enjoyable, inclusive activity for young children with disabilities and their typically developing peers. Additional research is needed to more fully evaluate the effect of the intervention on sight word recognition for both sets of participants as well as investigating teacher implementation of similar activities. In conclusion, the positive results reported for this study contributes to the literature on sight word instruction for young children with disabilities.

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Appendix A

Figures

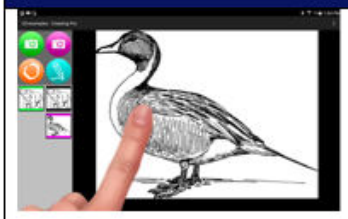
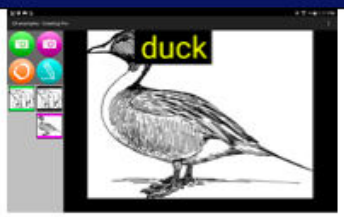
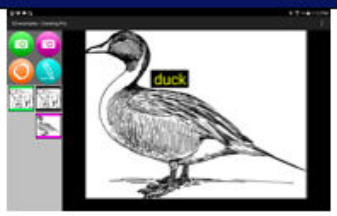
Hotspot activated	Dynamic text activation	
		
The hotspot is selected	The text label appears and grows, while the text is spoken	After a 3-second pause, the text recedes

Figure 1. Hotspot activation.

Figure 2. Sample page of digital text with T2L features.

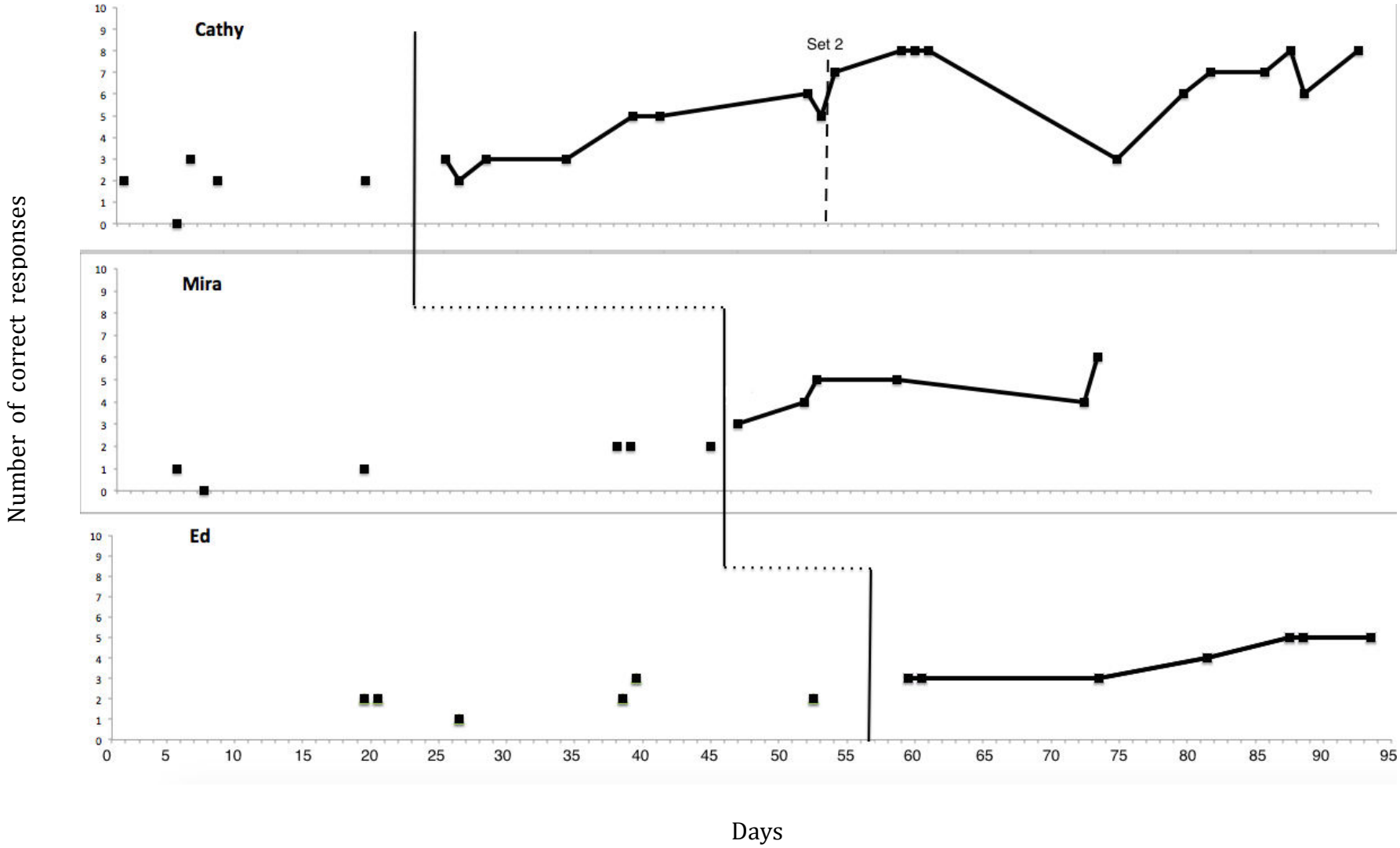


Figure 3. Number of correct responses for Cathy, Mira, and Ed

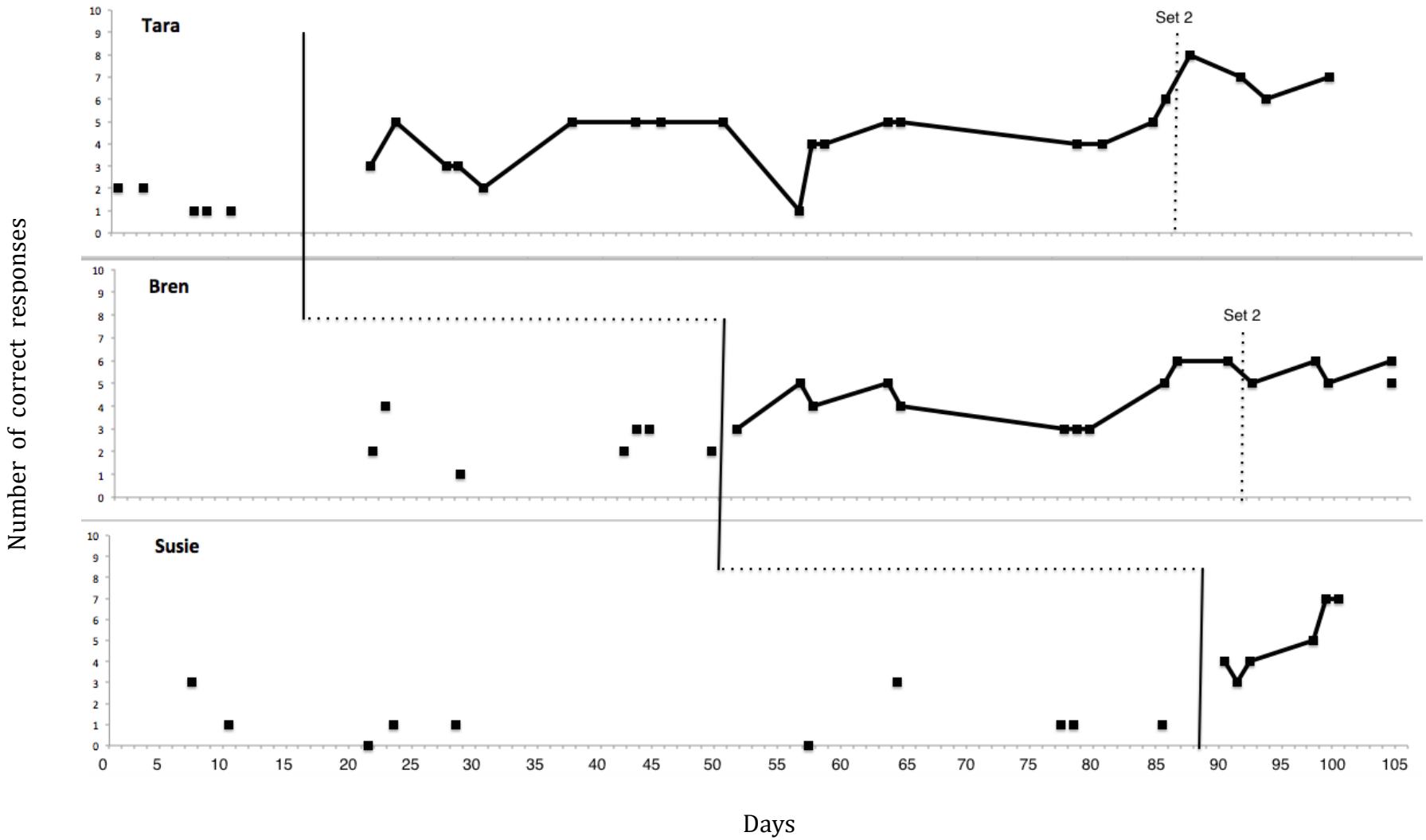


Fig 4. Number of correct responses for Tara, Bren, and Susie

Appendix B

Tables

Table 1

Characteristics of Children with Disabilities

Characteristics	Cathy	Mira	Ed	Tara	Bren	Susie
Age	4;8	4;9	4;8	3;11	5:4	3;10
Gender	F	F	M	F	M	F
Race/Ethnicity	White/Non-Hispanic	White/Non-Hispanic	White/Non-Hispanic	White/Non-Hispanic	White/Non-Hispanic	White/Non-Hispanic
Disability	Developmental delay (with autism features)	Down Syndrome	Developmental delay	Developmental delay	Developmental delay	Developmental delay
PPVT-4	27	4	9	25	2	1
EVT	47	21	2	30	1	10
TOPEL Early Literacy Index	25	<1	30	9	<1	2

Note: Scores are reported as percentiles; *Peabody Picture Vocabulary Test, Edition 4*; *Expressive Vocabulary Test*; *Test of Preschool Early Literacy*

Table 2

Characteristics of Typically Developing Peers.

Characteristics	Cemal	Madia	Eli	Tom	Bastian	Sasha
Age	3;10	4;10	4;9	4;6	4;10	4;5
Gender	M	F	M	M	M	F
Race/Ethnicity	Asian/Non-Hispanic	White/Hispanic	White/Hispanic	White/Non-Hispanic	White/Non-Hispanic	White/Non-Hispanic
Partner	Cathy	Mira	Ed	Tara	Bren	Susie

Table 3

Correct Responses During Generalization Probes

Participant	Pre- intervention probe	Post-intervention probe
Cathy	1	6
Mira	3	N/A
Ed	2	4
Tara	2	8
Bren	4	N/A
Susie	1	N/A

Note: N/A = participant not available to participate in probe.

Table 4

Correct Responses by Typically Developing Peers.

Participant	Pre- intervention probe	Post-intervention probe
Cemal	10	9
Madia	2	N/A
Eli	4	7
Tom	5	N/A
Bastin	3	5
Susie	2	5

Note: N/A = participant not available to participate in probe.

Appendix C

Review of the Relevant Literature

Four areas of critical research have informed my dissertation and are discussed in this extended literature review: sight word recognition as a critical early literacy skill, peer interaction, authentic reading activities, and technological supports for early literacy instruction.

Importance of Sight Word Recognition

One critical early literacy goal is sight word recognition. Sight word recognition is important because the ability to read words quickly from memory is the most efficient way to read text (Ehri, 2005). When a reader encounters a word they know from memory (i.e., a sight word), they can recognize its meaning and pronunciation without any effort at sounding out letters (LaBerge & Samuels, 1974). Such automatic recognition without need for decoding means that readers can read familiar sight words at a faster rate than unfamiliar words that they need to decode (Ehri & Wilce, 1983). While decoding unfamiliar words may momentarily distract from comprehending text, sight word recognition allows readers to focus solely on comprehending the meaning of text (Ehri, 2005). Thus, the development of a large sight word vocabulary will also support reading comprehension.

Many children acquire sight word recognition skills as a result of instruction in alphabetic systems and exposure to sight words (Ehri, 2005; Ehri, 2014) as part of early literacy experiences (e.g., shared reading). However, children with disabilities in a range of areas (e.g., cognition, language, etc.) often fail to acquire sight word skills despite intervention. For example, Justice and Ezhell (2001) found that 4-year-old children with

language delays displayed delayed acquisition of word and print awareness even after intervention designed to improve their language skills. Boudreau and Hedberg (1999) reported that preschool children with language impairments performed poorly as compared to typically developing children on literacy skills such as print concepts, phoneme and letter identification, and segmentation. Similarly, there is evidence that children with developmental disabilities do not develop literacy skills at the same rate as their typically developing peers (Sturm & Clendon, 2004). Lanter, Watson, Erickson, and Freeman (2012) investigated the literacy skills of 41 young children with ASD, and reported that the children demonstrated delays in early literacy skills (e.g., language comprehension, expressive communication, and print awareness) as compared to their typically developing peers.

Recognizing this instructional need, researchers have investigated the use of interventions to develop sight word recognition skills for young children with disabilities. all studies involved adult-mediated instruction with children with disabilities using paper materials. However, they did vary by instructional method, group size, and content of instruction.

Several of those past studies have utilized constant time delay to teach sight words to participants. Alig-Cybriwsky, Gast, and Wolery (1990) presented 4 and 5-year-old children with developmental delays with a stimulus card and asked “What word?”. In the first session, the instructor provided the correct response immediately; in following sessions, the instructor waited 3 seconds for a response from the child. Correct responses were reinforced verbally and with an edible reinforcer; incorrect or no responses resulted in the instructor modeling the correct response for the child. These instructional

procedures occurred in a group setting with four children who were presented with differing target words during sessions averaging 16 minutes in length. All children were able to identify their six target words independently within 26 intervention sessions (approximately 70 minutes per word). Although Alig-Cybriwsky et al. concluded their use of constant time delay was effective in teaching their participants sight words, they recognized that further research on improving efficiency was needed. Winterling (1990) used a similar constant time delay procedure in a group setting to teach 9 words each to 2 seven-year-old children with intellectual disabilities and 1 seven-year-old child with learning disability. All of the participants were able to identify their target words independently within 3 to 8 intervention sessions that were 20-30 minutes in length (approximately 7 to 27 minutes per word), indicating that Winterling's use of constant time delay procedure to teach sight word recognition was both effective and efficient.

More recently, Ledford, Gast, Luscres, and Ayres (2008) used similar constant time delay procedures to teach 5-8-year-old children with ASD 12 target words within 4 to 12 intervention sessions that were 15 minutes in length (approximately 5 to 15 minutes per word), maintaining the effectiveness of this sight word recognition intervention procedure as well as continuing to improve on efficiency. In addition, Ledford et al.'s use of constant time delay procedure was effective in teaching more words (i.e., 12 instead of 6 or 9) to participants than attempted in previous studies (Alig-Cybriwsky et al., 1990; Winterling, 1990). Similarly, Appleman, Vail, and Lieberman (2014) used constant time delay to teach four 5-6-year-old children with mild delays 12 target words within 10 to 17 intervention sessions that were 5 to 10 minutes in length (approximately 4 to 14 minutes per word). Lastly, Lane, Gast, Shepley, and Ledford (2015) also used constant time

delay to teach six 4-5-year-old children with developmental delays 12 target words within 37 to 47 intervention sessions that were 15 minutes in length (approximately 46 to 59 minutes per word).

Stimulus prompting (i.e., changing materials to help a student learn) is another common instructional design of sight word recognition interventions for young children with language delays or CCN. McGee, Krantz, and McClannahan (1986) presented preferred play items to a 5-year-old child with ASD and required her to correctly identify the matching sight word on a stimulus card. The number of stimulus cards (i.e., response options) presented increased from 1 to 5 as the child became more proficient with the task. The participant correctly identified 9 sight words with 93% accuracy after 27 sessions that were 25 minutes in length (approximately 75 minutes per word). Although the number of 25 minute sessions needed for the participant to reach this level of accuracy indicates that this use of stimulus prompting may not be as efficient as constant time delay procedures utilized in shorter and less numerous sessions, McGee et al.'s 1986 intervention seems to be as effective as earlier constant time delay procedures (Alig-Cybriwsky et al., 1990; Winterling, 1990) in teaching sight words. Researchers in a later investigation used stimulus prompting (in this case, superimposition of text over pictures with the pictorial cues fading) were successful in teaching a 6-year-old child with ASD 14 (out of 15 total) sight words with 100% accuracy in 30 sessions that were 15 minutes in length (approximately 32 minutes per word) (Birkan, McClannahan, & Krantz, 2007), maintaining effectiveness while increasing efficiency.

As well as varying in instructional methods, studies on sight word recognition in young children with delays or disabilities have varied in instructional group size.

Intervention is usually conducted either one-to-one with a teacher and a student (Birkan et al., 2007; McGee et al., 1986) or in small groups with a teacher and two to four students with similar delays or disabilities (Alig-Cybriwsky et al., 1990; Ledford et al., 2008; Winterling, 1990).

When studies were conducted with small groups, researchers also examined the rate of observational learning. Such observational learning is usually investigated by examining the number of non-targeted words learned by students in the groups (i.e., each participant has a different list of target words in which they participate in learning trials for, but they are also present when other participants engage in learning trials for their own targeted words). Observational learning rates of non-target words were reported as 42% (Appelman, et al., 2014), 67% (Alig-Cybriwsky et al., 1990; Winterling, 1990) and 91% (Ledford et al., 2008). This evidence of observational learning suggests that young children with delays or disabilities can learn to identify at least some sight words by observation alone without individualized feedback.

The content of such learning also differed across studies. For example, sight words were chosen based on Dolch word lists in one study (Winterling, 1990). In two other studies, words were chosen based on teacher and/or parent consult based on their potential for functional or everyday use (Birkan et al., 2007; Ledford et al., 2008).

The results of past investigations provide evidence that young children with disabilities can be effectively taught to identify 6 to 14 sight words by use of various instructional procedures and group sizes. It is worth noting that all instructional procedures did, however, include direct active pairing of the referent (picture and/or spoken word) with the targeted written sight word. Such active pairing has been

observed to be effective in supporting the learning of sight words with other students with disabilities (Browder & Xin, 1998; Fossent & Mirenda, 2006). In the set of studies examined here, this learning may occur at varying rates of efficiency with some participants showing evidence of learning an average of two sight words or more per session (Birkan et al., 2007; Ledford et al., 2008; Winterling, 1990) while others displayed evidence of learning a sight word every 2-3 sessions (Alig-Cybriwsky et al., 1990; McGee et al., 1986). Efficiency also varied in rates of minutes per word from a minimum of 4 minutes per word to a maximum of 75 minutes per word. Furthermore, evidence of observational learning in studies with small group instruction resulted in additional non-target sight words being learned by participants without individualized feedback in those words.

Importance of Supporting Peer Interactions

Both the NAEYEC and the Division for Early Childhood (DEC) recommend that young children with disabilities be given appropriate supports to encourage full participation in activities with typically developing peers (2009). Yet, small group instruction in the previous studies only involved children with delays and/or disabilities and did not include any interaction with typically developing peers.

Thus, there is a need for a new approach for teaching sight word recognition to young children with delays and disabilities that incorporate interactive and inclusive practices as well as being effective and efficient. Sight word instruction for young children with delays or disabilities should incorporate interaction with young children without disabilities in authentic, developmentally appropriate activities with any necessary supports provided.

Researchers have examined the effects of participation of both young children with and without disabilities in a number of contexts. One common finding is that typical developing peers serve as models of typical language and social development for young children with disabilities or delays. For example, social experience with peers and peer observation may influence academic engagement and social competency among young children as in a study of Head Start children (Delay, Hanish, Martin & Fabes, 2015). Peer effects have also been found for preschoolers' language skills as the presence of higher-skilled peers are associated with positive effects on preschoolers with low language skills (Justice, Petscher, Schatschneider, & Mashburn, 2011). In addition, cognitive outcomes of young children with ASD in inclusive classrooms were found to be better than outcomes of young children with ASD in self-contained classrooms (Nahmias, Kase, & Mandell, 2012). Thus, it is possible that young children with delays or disabilities who interact more frequently with typically developing children will increase their academic, cognitive, language and social skills within a preschool setting.

Providing activities in which both young children with and without disabilities participate can also promote interactions among children – however, such activities often have to be set up intentionally to include both children with disabilities and typically developing children. For instance, Brown and Bergen (2002) observed that children with disabilities tend to spent less time with peers in cooperative play and more time in teacher-directed activities. When teachers provide supports to the children, interactions between typically developing children and children with delays or disabilities can be enhanced and increased. For example, Kwon, Elicker, and Kontos (2011) reported that teacher verbal facilitation (e.g., prompting communication between children, inviting

children with and without disabilities to interact together, etc.) of interactions between peers resulted in children with disabilities interacting more frequently with their typically developing peers. In addition, Stanton-Chapman and Snell (2011) observed that teaching young children with disabilities turn-taking strategies increased their initiation of interactions and play with both other children with disabilities and typically developing peers.

Importance of Using Authentic Reading Materials and Activities

As well as being inclusive, sight word instruction should ideally also occur within authentic reading activities that engage children across the developmental domains. Shared reading is a common early childhood activity in which an adult reads a text to a child or children while making use of a number of specific linguistic devices (e.g., asking questions, following the child's lead, and expanding on the child's utterances) in order to engage the child or children (Sulzby, 1985; Whalon, Delano, & Hanline, 2013; Whitehurst, 1988). This activity may also involve a number of other interactive behaviors, such as encouraging the child to talk about the book, providing feedback on the child's spoken turns, and adapting the interaction to the child's level of understanding (Mol, Bus, de Jong, & Smeets, 2008). Shared reading thus involves the domains of cognitive development (e.g., learning vocabulary and about print concepts), communication development (e.g., listening to and talking about a story), social-emotional development (e.g., interacting with an adult or other children during the story), and motor development (e.g., helping turn the pages, touching an image on an electronic storybook).

The use of shared reading approaches has been reported to have positive effects on receptive language, expressive communication, print awareness, and vocabulary development for young children with typical development (NELP, 2008), with both teachers and parents as partners (Kaderavek et al., 2013; Mol et al., 2008). Similar effects have been observed in young children with language delays (Desmarais, Nadeau, Trudeau, Filiatrault-Veilleux, & Maxès-Fournier, 2013; Hargrave & Sénéchal, 2000). Hudson and Test (2011) completed a systematic review of shared reading interventions for children with severe disabilities and concluded that there was a moderate level of evidence to support the use of shared story reading activities to promote literacy development for students with severe disabilities. In addition, evidence from a recent systematic review (Boyle, McNaughton, & Chapin, 2017) suggests that dialogic reading, a specific form of shared reading, can have large positive effects on the engagement and listening comprehension of young children with ASD as well as small positive effects on their expressive communication.

Despite the benefits of interactive shared reading activities, sight word instruction typically consists of constant time delay or stimulus prompting procedures that do not occur within an authentic early childhood activity. At present there is an unmet need for sight word instruction that occurs within authentic early childhood activities such as shared reading experiences.

Importance of Providing Technological Supports

Lastly, young children with developmental delays may need additional supports to fully benefit from literacy activities. Such supports can include technological applications such as allowing children to respond via speech-generating applications,

using computer-based flashcard reading procedures, and embedding interactive sight word displays within digital texts (Ahlgrim-Delzell et al., 2016; Cazell et al., 2017; Boyle et al., 2017; Mandak et al., 2018; van de Meer et al., 2014).

Lee and Vail (2005) designed a program titled Word Wizard which combined constant time delay, computer-based flashcard procedures, and the presentation of four written choices on the screen. Four young children with developmental delays (ages 6-7 years) participated in the study with the researchers training them on the program. The participants were presented with a video segment with a verbal description that corresponded to one of their target sight words (there were four sets of two target sight words for each child) and then a screen with four written choices (one target word and three distractors). Participants were then verbally directed to click on the target word choice and given 5 s to do so. A correct response resulted in the target word moving to the center of the screen and verbal praise given by the program. An incorrect or no response similarly resulted in the target word moving to the center of the screen and verbal correction given by the program. All participants acquired their eight target words within 20-40 instructional sessions (sessions were 1.5 minutes). This word learning rate was approximately 3 to 7.5 minutes per word. Similarly, Cazell and colleagues (2017) utilized a computer-based flashcard procedure as well as a time delay prompt to teach three sets of ten sight words to 3rd grade student (age 9 years) with intellectual disability. The participant was presented one of his target sight words on a Powerpoint slide and a researcher taught her to read the word out loud, then the press space bar to hear word and then repeat the word. The participant acquired 25 words within fourteen instructional

sessions (sessions were 1.5 minutes). Thus, the word learning rate was 1.2 minutes per word.

Although these are only two studies, the results provide preliminary evidence that technological supports can be used to effectively teach 8 to 25 words to young children with disabilities. As in other sight word instruction studies, the authors utilized direct active pairing between the referent and the sight word to produce these results. In addition, compared to traditional adult-mediated sight word instruction (i.e., word learning rates of 5-75 minutes per word), the use of technological supports such as computer-based flashcards and speech-generating applications may be more efficient for young children with disabilities (i.e., with word learning rates of 1.2-7.5 minutes per word).

Also of note is a larger-scale investigation of the *Early Reading Skills Builder (ERSB)* curriculum, which combined time delay procedures with the use of the speech-generating application GoTALK Now (GTN) on the iPad (Ahlgrim-Delzell et al., 2016). In that study, 17 participants with developmental delay, intellectual disabilities, or autism spectrum disorder participated in early literacy adult-mediated instruction, including sight word identification. For the sight word portion of the curriculum, students were instructed to read target nondecodable words that were visually presented and voiced on the GTN application and then choose one of four pictures that were also presented on the application (i.e., one picture representing the target word and three distractors) using a time delay procedure. In the event of an incorrect or missing response, a teacher provided physical guidance to the correct word choice. A similar protocol was enacted for decodable words. Although sight words were not one of the dependent variables

probed, a statistically significant increase in decodable words was reported. As the instruction for both categories of words were similar, this suggests that the use of a speech-generating application along with adult support could be effective for increasing word recognition for children with various disabilities.

Though these studies provide evidence that using technological supports for sight word instruction with young children with disabilities can be effective and efficient, that instruction consists of similar flashcard and time delay procedures utilized in traditional adult-mediated sight word instruction, just translated onto the various technological platforms. There is still an unmet need for sight word instruction within authentic reading activities for young children with disabilities.

Use of Visual Scene Displays (VSDs) to create digital texts can be one step towards fulfilling that need. A VSD is created by taking a digital photograph using a tablet computer, and then, using specialized software, programing "hotspots" in the picture (Light et al., 2004; Light & Drager, 2011). The hotspots will then produce recorded speech or sound effects when touched. VSDs were first developed as a support for augmentative and alternative communication (AAC) interventions with beginning communicators (Light & Drager, 2011) and they have been demonstrated to provide important communication supports for children and adults with a wide variety of disabilities (Beukelman et al 2015; Ganz et al, 2015; Therrien & Light 2016).

However, the use of VSDs can also enable the creation of digital texts for use in shared reading activities that incorporate both the child's interests and features that support literacy skills development. A VSD for use in a shared reading activity is created by taking a photograph or screenshot of a book page, and then programming selected

images in the text as hotspots on the tablet screen. The vocabulary for the hotspot can be the spoken label for the item (e.g., “cow”), a sound effect (“moo, moo, moo”) or a short phrase (“the hungry cow eats the grass!”). The programmed hotspots act as supports to literacy learning within the shared reading activity. As an example, Therrien and Light (2016) reported the use of VSDs in shared reading activities that both young children with ASD and typically developing peer participated resulted in increases in communicative turn-taking for both sets of participants.

To further support the development of literacy skills, Light, McNaughton, Jakobs, and Hershberger (2014) have suggested the incorporation of Transition to Literacy (T2L) features in AAC systems (including VSDs). These T2L features can support sight word recognition by providing dynamic presentation of the text with speech output when a hotspot of the corresponding picture is selected. The hotspots on the VSD thus produce both speech and written output of the corresponding sight word when activated by touch. For instance, when a child touches a hotspot programmed on a VSD of a duck, the child sees the printed word "duck" (in 240pt font) appear on the screen and hears the word "duck" simultaneously. The text then expands, pauses for three seconds when the word takes up approximately 10% of the screen, and then recedes, drawing the child’s attention towards the word.

Such a technological feature addresses critical issues in literacy learning, as noted by Light et al (2014):

> If AAC systems are going to support the transition to literacy (T2L), they should be grounded in current theories of literacy learning and instructional design. Specifically, they should support the learner’s engagement in the processes that are required for successful reading: (a) *orthographic processing* (i.e., knowledge of letters and letter patterns); (b) *phonological*

processing (i.e., identification, manipulation, and memory of the sound structure of speech); (c) *meaning processing* (i.e., knowledge of words and their meanings); and (d) *contextual processing* (i.e., use of background knowledge to derive meaning from text) (cf. Adams, 1990).

AAC apps with features to support the transition to literacy (T2L) should include: (a) animation of text (i.e., dynamic text) upon selection of the graphic symbol to draw the learner's visual attention to the written word and thus support orthographic processing by the learner; (b) pairing of speech output with the appearance of the text to support phonological processing to connect the written text to its spoken referent; (c) incorporation into the learner's AAC graphic symbol displays to ensure that the target concepts are known and that the written words are linked to known graphic symbol referents to support meaning processing; and, (d) infusion of the T2L supports into meaningful daily communication exchanges that will support contextual processing and enhance understanding.

Previous sight word recognition research suggests that direct active pairing supports learning of the association between the written word and the referent (picture and/or spoken word) within the varied contexts of constant time delay, stimulus prompting, and observational learning (Alig-Cybriwsky et al., 1990; Birkan et al., 2007; Bowder & Xin, 1998; Ledford et al., 2008; McGee et al., 1986; Winterling, 1990). In addition, there is preliminary evidence of such direct active pairing in sight word instruction proving similarly effective when translated onto computer platforms (Cazall et al., 2017; Lee & Vail, 2005).

The T2L feature also supports direct active pairing between the referent (picture *and* spoken word) and the target sight word as well as providing two important components: a) movement to visually attract the student to the dynamically presented text (Wilkinson & Jagaroo, 2004) and b) ability to be incorporated in VSDs, thus allowing for the presentation of sight words within digital texts. For example, as part of a series of studies

by the RERC on AAC, a federally funded research and development center, Mandak, Lamb, and Light (2017) investigated the use of VSDs with T2L features to adapt a digital text (*Brown Bear, Brown Bear, What Do You See?*) to dynamically present ten target sight words to three young children with ASD (3-5 years of age) within a shared reading context. The researchers read the adapted digital text to a participant one-on-one and prompted the child to activate the hotspot that spoke and presented the targeted word simultaneously. If the child did not activate the hotspot, the researcher did so instead. In probe sessions, participants were asked to match the target sight word to one of four picture choices (with one depicting the target word and the other three serving as distractors). In contrast to other sight word instructional procedures, no feedback was provided to participants during either instructional or probe sessions. Two participants acquired all ten sight words in 26-27 instructional sessions, while one participant acquired nine in 11 sessions. This is a mean word learning rate of 10.9 minutes per word, comparable to traditional adult-mediated as well as computer-based sight word instruction. Similarly promising results have been obtained with individuals across a wide range of ages and disabilities when the T2L feature has been used to support sight word instruction in personalized and high-interest VSD as well as grid-based systems (Caron, Holyfield, Knudtson, Light, & McNaughton, 2016; Holyfield, Pope, Light, McNaughton, & Drager, 2016).

As part of this series of studies Boyle, McCoy, McNaughton, and Light (2017) examined the pilot use of VSD with the T2L feature with young children with language delays, paired for an inclusive shared reading activity with typically developing peers (all children attended the same preschool center and were within 3 to 5 years old).

Researchers adapted the digital text of *Pete the Cat: Rockin' in My School Shoes* and read the text to dyads consisting of a child with a language delay and a typically developing peer. To prompt activation of the hotspots by the participants, they used shared reading techniques such as asking questions (e.g., "Where is Pete?") and providing repeated storyline prompts (e.g., "Pete likes to read ____"), while encouraging the children to take turns commenting on the picture and touching the hotspot. Probe sessions similar to Mandak and colleagues' (2018) were conducted with each participant with a language delay before each instructional session. Within 4 to 6 10-minute sessions, three out of the four participants with language delays could identify three target sight words, which is a mean word learning rate of 16.67 minutes per word (R = 13.3-20). While this word learning rate is higher than reported for Mandak et al. (2018), it should be noted the number of sessions is lower (as the end of the school year prevented any additional intervention from occurring). The one participant who did not show growth displayed a variable performance during both instructional and probe sessions and may have benefited from a text aligned more to his interests as well as explicit instruction in expectations for the activity. In addition, three out of four participants with language delays as well as all the typically developing peers indicated that they enjoyed the activity. Lastly, the children's teachers, who had observed the intervention, indicated they thought the activity was enjoyable for both children with language delays and their peers and that the activity was feasible for use in their classrooms (Boyle et al., 2017).

This pilot study thus provided preliminary evidence that the adaptation of digital texts using VSDs with T2L features, provided in an inclusive shared reading context, can have positive effects on the sight word identification of young children with language delays.

Participants with language delays, typically developing peers, and their preschool teachers all rated such activities as enjoyable. However, participants may benefit from a larger number of intervention sessions and more explicit instruction on activity expectations. Additionally, research by Mandak et al. suggests young children with disabilities can also benefit from shared reading activities incorporating adapted digital texts using VSDs with T2L features.

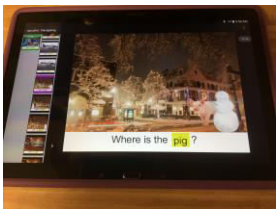
Appendix D

Recruitment Letter

January 12, 2017

Hello Parents, Guardians, and Family Members,

We're conducting a research study at Matternville Preschool to investigate the use of a new literacy activity, **reading story books on a tablet computer**, as a way to help children learn to read sight words.



Your child would read a I-spy book on the tablet with Susannah Boyle, a Penn State doctoral student, for approximately 10 minutes, 3 times per week. He or she would also be asked to match sight words to pictures (for about 3-4 minutes). We are interested in finding out whether this activity would help your child learn sight words like "pig" and "tiger"!

If you choose to have your child participate, you can fill out the consent form attached.
If you have questions about the study, you can also call or email Susannah Boyle at (225) 485-6386 or asb246@psu.edu . If you prefer, we can also contact you to answer any questions.

Thank you so very much for your help! Your participation will help us learn more about supporting young children in early literacy skills. We hope to hear from you very soon!

Sincerely,

Susannah Boyle, M. Ed.
Penn State Doctoral Candidate

David McNaughton, PhD.
Penn State Supervising Faculty

___ I want more information about the study:
Name: _____ Phone: _____ Best time to call:_____
Email: _____

___I want my child to participate:
Please sign & return the next page in your child's folder!

Appendix E

Assessment Materials

Dependent Variable Measurement

T2L Preschool Group DD Probe Data Collection Form 1A

Student's name:
Researcher:
Date: _____
Circle one: Baseline Intervention Generalization

Trial	Target	+/-
1.	fox	
2.	bear	
3.	duck	
4.	cat	
5.	horse	
6.	lion	
7.	zebra	
8.	pig	
9.	tiger	
10.	mouse	

Summary of student performance:

Number correct/10: _____

Procedural Integrity and Reliability Checklists

Transition to Literacy- T2L Group DD
Treatment Fidelity: **Sight Word Probes**
Participant: Session: Date (of reliability): Name:

A total of 1 forms completed per word probe session

Mark: + =if behavior occurred
- = if behavior did not occur

Behavior of Researcher or Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. **Researcher** places array of 4 visuals in front of child										
2. **Researcher** names the visuals										
3. **Researcher** gives child orthographic card,										
4. **Researcher** says "Read the word. Match" or "Read the word. Match the word to the picture" or equivalent phrase										
5. If **child** responds within 5 seconds, **researcher** acknowledges provision of response (thank you, OK, lets do another one) or is silent*										
6. If **child** does not respond within 5 seconds, **researcher** delivers prompt again, as needed ("Read the word, Match the word to the picture")										
7. If **child** responds then as above										
8. If **child** does not respond within 5 seconds after second prompt, **researcher** proceeds to next step										
9. **Researcher** removes sight words and images										

CHILD RESPONSES: The first response given by the child will be counted towards correct/incorrect identification of the sight word. A response from the child could be:

- Placing the sight word on or below the image and removing their hand
- Reading the word aloud

* If child's response is unclear (e.g., places the card between 2 visuals, is unintelligible, etc.c), researcher may ask the child to clarify response by pointing to the desired visual or saying the word out loud

Transition 2 Literacy- Group Fidelity Exposure: **Intervention Session**
Participant: Session: Date: Name:

Directions: Mark + if behavior occurred and – if behavior did not occur.
Notes:
Partner = adult;
Child = either of the two children
Partner/child: the partner or the child touches the hotspot
FZA = Farm or zoo animal (each animal occurs twice in the VSD book)

	FZA 1	FZA 2	FZA 3	FZA 4	FZA5	FZA 6	FZA 7	FZA 8	FZA 9	FZA 10
Partner turns to appropriate page on VSD										
Partner reads text at the bottom of the page										
Partner/child touches HS (hotspot)										
• Orthographic feedback is visible										
• Speech activation is heard										
Partner provides prompt (e.g., "Where is the duck?", "That is a white___", "____, it's your turn."										
Partner/child touches HS										
• Orthographic feedback is visible										
• Speech activation is heard										
Partner provides prompt										
Partner/child touches HS										
• Orthographic feedback is visible										
• Speech activation is heard										
Partner provides prompt										
Partner/child touches HS										
• Orthographic feedback is visible										
• Speech activation is heard										

Social Validity Materials

Teacher Social Validity Questionnaire

From 1 to 5, where 1 is strongly disagree and 5 is strongly agree, how would you rate the following statements (write any comments in spaces provided):

(a) I would use the tablet technology in my classroom

(b) Teaching students sight words is an important early literacy skill

(c) It's important to include both children with and without disabilities in activities

(d) students seemed to enjoy the instructional activity

(e) students seemed to benefit from instructional activity

Would implementing a similar intervention would be feasible for you?

What, if any, changes you would make if you were implementing a similar intervention?

Any other thoughts you had about the intervention?

Talking Mat Sample Layout

VITA

Aisling Susannah Boyle

EDUCATION

Ph.D. Pennsylvania State University	Special Education	August 2018
M.Ed. University of New Orleans	Early Intervention	2013
B.S. Louisiana State University	Biological Sciences	2004
B.A. Louisiana State University	English	2004

PROFESSIONAL EXPERIENCES

Millersville University
Assistant Professor — August 2017 - present
Special Education

Pennsylvania State University
Instructor — Summer 2016
Assistive Technologies for Persons with Disabilities

Co-Instructor — Fall 2015
Assistive Technologies for Persons with Disabilities

Practicum Supervisor — Fall 2014; Spring 2015; Spring 2016
Supervision of Preservice Teachers in Exceptional Settings

East Baton Rouge Parish School System
Special Education Teacher

Teacher, Elementary Resource and Self-Contained Settings	2008 – 2010
Teacher, Inclusive Pre-Kindergarten Classes	2010 – 2014

PUBLICATIONS

Boyle, S., McCoy, A., McNaughton, & Light, J. (2017). Using digital texts in Interactive reading activities for children with language delays and disorders: A review of the research literature and pilot study. *Seminars in Speech and Language, 38,* 263-275.

Mandak, K., Light, J., & Boyle, S. (2018). The effects of literacy interventions on single-word reading for individuals who use aided AAC: A systematic review. *Augmentative and Alternative Communication*. Advance online publication.