

Spring 2012

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Wells, J., & Narkon, D. E. (2012). A Comparison of Traditional Versus Electronic Word Wall Instruction on Word Identification in Kindergarteners with Developmental Disabilities, *Electronic Journal for Inclusive Education*, 2 (9).

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**A Comparison of Traditional Versus Electronic Word Wall Instruction on
Word Identification in Kindergarteners with Developmental Disabilities**

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&

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Abstract

The purpose of this preliminary investigation was to examine the effectiveness of using a word wall strategy on the word identification skills of kindergarteners with developmental disabilities (DD). An alternating treatment design was used to examine the use of the word wall strategy and whether there were differences in children's word identification and on the teacher's sense of efficacy when using small-group traditional word wall instruction (Cunningham, 2000) versus an individualized electronic word wall (Narkon, Wells, & Segal, 2011) instructional format. Results indicated that both strategies were effective. However, children with motivational and attentional issues may differentially benefit from the EWW approach.

Keywords: word wall, developmental disabilities, word identification

A child's educational achievement, their development of syntactic and morphological skills, reading accuracy, and reading comprehension are dependent upon vocabulary acquisition (Nash & Snowling, 2006). For children to acquire vocabulary, the National Reading Panel (NRP) (2000) recommends that multiple exposures of words within text are necessary and vocabulary should be taught directly and indirectly. According to Neuman and Dwyer's (2009) pre-k early literacy study, "without frequent practice, multiple exposures to words, and systematic opportunities to use words, children are not likely to acquire vocabulary" (p. 391). Currently, there appears to be minimal agreement on strategies for teaching vocabulary and word identification. Additionally, research indicates that very little deliberate vocabulary instruction or intervention occurs during the pre-k grades (NRP, 2000; Neuman & Dwyer, 2009).

Computer assisted instruction (CAI) was reported by the NRP (2000) as one method of providing individualized intervention that results in larger vocabulary increases. CAI provides: (a) individualization and self-pacing, (b) repetition, (c) carefully sequenced instruction, (d) frequent child response, and (e) increased motivation. Advantages of CAI for children with disabilities include: (a) increased attention, (b) immediate feedback on the child's performance, (c) immediate reinforcement, and (d) increased motivation (Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011; Wild, 2009). In addition, CAI provides for extensive independent practice with a minimum of teacher supervisory time. In a study conducted by Coleman-Martin, Heller, Cihak, & Irving (2005) examining children's word identification performance in guided practice sessions under three conditions: (a) teacher-only, (b) teacher-plus-CAI, or (c) CAI-only

instruction, children demonstrated the greatest increases in word identification in the CAI-only condition.

Provided with direct and indirect large group vocabulary and word identification instruction most children will acquire the necessary skills needed to read. However, some children require individualized interventions to gain the needed vocabulary and word identification skills. These interventions may be delivered in small-group or one-to-one instructional formats (Loftus, Coyne, McCoach, Zipoli, & Pullen, 2010). In a search of the extant literature, numerous articles were located that discussed the benefits of a word wall as a means of supporting children's word-learning (Baumann, Ware, & Edwards, 2007; Berne & Blachowicz, 2008; Cunningham, 2000; Wagstaff, 2001). In a survey conducted by Berne and Blachowicz (2008), teachers cited the word wall as one of the practices they used that resulted in improvement in children's vocabulary knowledge. However, only two research studies were located that used a word wall intervention as an independent variable (Jasmine & Schiesl, 2009; Harmon, Wood, Hedrick, Vintinner, & Willeford, 2009).

Traditional Word Wall Instruction

Word wall is reported to offer "an interactive, ongoing display of words and/or parts of words, used to teach spelling, reading and writing strategies, letter-sound correspondence, and more" (Wagstaff, 2001, p. 1). A word wall (Cunningham, 2000) is created in the following manner. First, the letters of the alphabet are placed on the board, and then the printed words are cut out following the configuration of the word and placed on colored backing. The word cards are posted in a column under the letters of the

alphabet according to their first letter. During word wall group-instruction, the teacher points to the word and leads the children in saying and spelling the words.

E-Word Wall (EWW)

As CAI has been demonstrated to be an effective tool in increasing reading skills (Coleman-Martin, Heller, Cihak, & Irving, 2005; Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011, Wild, 2009), a computerized version of a word wall (EWW) was developed by the authors. EWW (Narkon, Wells, & Segal, 2011) is an interactive, digital instructional tool that can be created in any computer presentation software (e.g., PowerPoint, Impress) making it a cost effective alternative to commercial computer programs. As learning is thought to be enhanced when visual and spoken materials are presented simultaneously (Wild, 2009), target words and contextual sentences with corresponding spoken output were incorporated into the EWW.

To create the EWW, make an alphabet chart as the first slide in the presentation file. Hyperlinks connect each letter on the alphabet chart with its individual alphabet slide that displays the target vocabulary words beginning with that letter. Vocabulary words are listed in rows with the word in isolation with an associated picture cue and a contextual sentence. Children click on a word to hear that word pronounced in isolation and then on the sentence to hear the word used in a contextual sentence. EWW provides picture and auditory cues that assist with the activation of children's prior knowledge and language development. These components also provide modeling of correct pronunciation and word usage (Narkon, Wells, & Segal, 2011).

Purpose of Study

There has been limited research that makes explicit comparisons of CAI with other more traditional instructional media (Wild, 2009). We were interested in examining the use of a word wall strategy and whether there were differences in effectiveness on children's word identification and on the teacher's sense of efficacy when using small-group traditional word wall instruction (Cunningham, 2000) versus an individualized electronic word wall (Narkon, Wells, & Segal, 2011) instructional format. We conducted a preliminary investigation to examine the effectiveness of using a word wall strategy on the word identification skills of kindergarteners with developmental disabilities (DD).

Method

Participants

The participants were three, kindergarten-aged children with developmental delays attending a special education resource setting for math and language arts (see Table 1 for demographic data). The three students received speech-language therapy. They also participated with their general education peers in computer class, music, library, and physical education. The procedures for this study were reviewed and approved by a university Human Subjects Internal Review Board. Parental informed consent and student assent were secured prior to the initiation of the study. The names used in this study are pseudonyms.

Sky. Upon eligibility testing for special education, Sky ranked 14th percentile in total receptive language and 1st percentile in total expressive language on the *Brigance Diagnostic Inventory of Early Development – II*. He was 4 years and 2 months old at the time of this testing. Sky does not have any significant birth/medical history and comes from an intact family that includes one older sister and one older brother.

Tess. Tess ranked more than 0.1 percentile in total receptive language and more than 0.2 percentile in total expressive language on the *Brigance Diagnostic Inventory of Early Development –II*. She was 4 years and 11 months old at the time of this testing. Tess is bilingual. Vietnamese is her native language and English is her second language. She does not have any significant birth/medical history and comes from an intact family that includes one older brother and two younger sisters.

Kristy. On *The Peabody Picture Vocabulary Test-Fourth Edition (PPVT-4) (Form A)*, Kristy scored in the 13th percentile in receptive language, the 16th percentile in expressive language, and 16th percentile in language content. Additionally, she scored in the 20th percentile in letter word identification on the *Woodcock-Johnson III Tests of Achievement (WJ3)* and in the 16th percentile in broad reading. Kristy has no significant birth/medical history and comes from an intact family that includes one younger brother. She is left-handed and was repeating kindergarten this year.

Setting

A special education teacher in a resource room setting implemented the intervention during the language arts block. This study took place on the campus of a suburban, K-5 elementary school with enrollment of approximately 550 students. The student population was ethnically diverse with over two-thirds Asians, one-fourth Caucasians, and a little less than one-tenth Hawaiian, Part-Hawaiian, and other Pacific Islanders. Of the total school population, 7.1% are attending special education, 10.4% receive free and reduced lunch, and 7.8% are English Language Learners (ELL). Finally, 2.1% receive public assistance and 3.1% live in poverty.

During the language arts block there are five to six kindergarten children in the classroom. Classroom staff included the special education teacher, one education assistant, and two one-to-one paraprofessionals. The classroom was divided into several instructional areas on opposite sides of the room with several student carrels clustered in the center of the classroom.

The EWW was presented on a Macintosh computer, which was set-up in a carrel in the middle of the classroom. The children were sent to the computer station individually where the teacher instructed them to study their vocabulary words. The traditional word wall group-instruction was delivered in the front of the room at a kidney-shaped table with the special education teacher standing by a large, lightweight, portable word wall that was placed on the whiteboard tray. Six children participated in the traditional word wall group-instruction although only three children were participants in this study.

Instructional Targets

The children's special education teacher selected the instructional vocabulary prior to the implementation of the study. Six words were selected as instructional targets from the kindergarten level of the commercial program, *Wordly Wise 3000* (2007). The same words were used with all participants. Three of the words were used in the EWW condition (i.e., muddy, join, soil) and the other three were used in the traditional word wall condition (i.e., ring, fluffy, slip). The words were randomly assigned to one of the experimental conditions. The introduction of the vocabulary in the instructional conditions was counterbalanced across conditions and the number of trials in each of the conditions was equivalent for all participants.

Dependent measures

The dependent measure, percentage of words read correctly during testing probes prior to each intervention, was used to compare the relative effectiveness of the two vocabulary instructional methods on participants' word identification. The special education teacher's perceptions of the usefulness and acceptability of the two instructional formats was also analyzed.

Test probes. The special education teacher conducted the test probes in the resource room setting. Children were shown a flashcard of each target word for the day's intervention condition prior to each intervention session. The first and second authors conducted four observations of the instructional sessions across both treatment conditions. The children were asked to respond once to each of the words in the instructional set for that day's condition. The words were presented in random order during each test probe where the teacher showed the participant each card and said, "Say this word." Praise was provided for children's on-task behavior and for all attempts to read the word. Corrective feedback was not provided to words read incorrectly during the test probes.

Social validity. A follow-up questionnaire was used to assess the special educator's perceptions of the effectiveness and ease of use of each intervention. The questionnaire contained twelve statements on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). In addition, the teacher provided feedback to the authors during observed intervention sessions on her perceptions of the interventions and the children's behavior during the instruction.

Instructional Design and Procedures

A single subject alternating treatment design was used (Holcombe, Wolery, & Gast, 1994) to compare the relative effectiveness of traditional group word wall instruction and EWW instruction. Treatments were implemented alternately in the following pattern: A B A B A A B A B B A B. The two instructional interventions (i.e., traditional group word wall, EWW) were alternated by day and only one instructional session was held per day. Children were presented with a distinctive cue before starting instruction that made it clear to the child which intervention was in effect for that day's instruction (e.g., "It's time for the E-Word Wall", "We are going to do the traditional word wall, now").

Baseline. The special education teacher, using the test probe procedures described previously, collected baseline data on the target words. Three baseline probes were conducted for all the instructional target words ensuring baseline stability. All probes were administered to each child individually.

Traditional word wall instruction. First, the special education teacher created a portable word wall following written instructions provided by the second author. The special education teacher created the word cards and placed the instructional targets selected for this condition on the wall. During group-instruction, she followed a procedural checklist for the presentation of each target word. First, she pointed to the word and modeled the pronunciation followed by pointing to each letter as she spelled the word. Next, the children chorally read and spelled each word on the wall as the teacher pointed to the word and then to each letter of the word.

EWW instruction. In the EWW (Narkon, Wells, & Siegel, 2011) instructional condition, the special education teacher was provided with written instructional

procedures for creating the EWW by the first author. The teacher was provided a procedural checklist to follow when implementing the EWW intervention. The teacher developed the EWW digital instruction for the target vocabulary to be used with the children in this condition using her classroom MacIntosh laptop and PowerPoint presentation software. Test probes were conducted with commercial flashcards containing the vocabulary instructional targets prior to each intervention session. For each target word, the EWW digital instruction included the word in isolation with audio feedback, an associated picture, and a sentence that used the word in context with audio feedback. The first day of intervention included initial instruction with each child individually on navigation of the EWW. During this session, the special education teacher provided corrective feedback on using the EWW navigation and audio feedback buttons, as well as feedback on repeating the target words and reading along with the sentences. In subsequent sessions, the teacher remained in close proximity to provide further instruction or feedback as needed. The procedures were the same for all three children.

Reliability

Inter-observer reliability data was gathered during four of the 12 intervention sessions. During the test probes, the special education teacher would implement the probes while one of the authors independently recorded whether the children's responses were correct or incorrect. Reliability was calculated by dividing the number of agreements between the number of trials and multiplying by 100. Inter-observer agreement was 100%. The procedural checklists for both conditions were used by the

observers during each reliability check to monitor integrity of the instructional procedures. The procedures were followed accurately in 100% of the observations.

Results

Test Probes

The data indicate that both a traditional group word wall instructional approach and an individualized electronic word wall (EWW) approach were effective strategies for teaching new words to kindergarteners. Tess and Kristy mastered the word sets in both conditions and reached criterion only slightly faster (one test probe session) in the EWW condition. Luke mastered the word set in EWW but failed to master all words in the traditional word wall group-instruction. Additionally, he reached criterion more rapidly in the EWW condition (two test probe sessions) than in the traditional word wall condition. When the word that was not mastered in the traditional word wall approach was introduced in EWW, Luke was able to read the word in a test probe after one instructional session. The following figures show the children's performance in each condition (See Figure 1).

<Fig. 1 here>

The three children demonstrated the ability to independently navigate the EWW program without teacher assistance after one training session of 6 to 9 minutes depending on the child. Subsequent EWW instructional sessions were completed by the children independently with the teacher within 5 feet of the students. The children were on task 100% of the time in the EWW condition. On task was defined as operating the computer program as designed, maintaining gaze on the computer keyboard, screen, or word cards, and verbalizing appropriately following along with the voice output of the EWW.

The teacher reported that frequent redirects were required to maintain engagement during the traditional word wall instruction and the students' attention to instruction was highly variable in this condition. The students failed to maintain their visual attention on the word wall or the teacher, focusing instead on other areas of the room and on miscellaneous materials that were within reach. At times, they also failed to respond orally to the teacher's verbal cues to say or spell the target words.

Social Validity

A follow-up questionnaire was used to examine the special education teacher's perceptions of the effectiveness and ease of use of each intervention. Previously, the teacher had not used the traditional word wall as a strategy in her vocabulary instruction. She rated the word wall instruction's ease of use and the possibility of using this group strategy again in her classroom as a 3, indicating a lack of commitment either for or against the use of the strategy. During one of the author's observations of the teacher implementing the traditional word wall instruction, the teacher commented, "the word wall instruction was more difficult than EWW because it was harder to maintain the children's attention." However, results of the questionnaire indicated the teacher felt the children were motivated while participating in the word wall group-instruction, rating this item as a 5 (strongly agree) and rating the effectiveness of the strategy as a 4 (agree).

In contrast, the teacher was familiar with the EWW and strongly agreed that it was an effective strategy to teach word identification. She also indicated strong agreement with the ease of implementation and felt confident that she could use the EWW to program new vocabulary. She reported that the development of the EWW tool in PowerPoint took approximately one hour. When asked whether she would use EWW

individualized instruction again in her classroom, the teacher strongly agreed. She also indicated strong agreement that the children were motivated to use EWW and were capable of navigating this interactive computer-based instructional tool independently.

Discussion

Although numerous publications extoll the benefits of a word wall as a means of supporting children's word identification, only two studies were located using a word wall strategy as an independent variable (Harmon, Wood, Hedrick, Vintinner, & Willeford, 2009; Jasmine & Schiesl, 2009). The purpose of this preliminary investigation was to examine the effectiveness of a traditional word wall group-instruction strategy compared to an individualized, computer-based word wall strategy (EWW) on the word identification skills of children with DD in kindergarten. The data show that either word wall strategy can be an effective instructional strategy for children with DD in kindergarten in a special education resource setting. These findings extend the findings of Jasmine and Schiesl (2009) who employed a traditional word wall group-instruction strategy with typically developing first-graders in general education.

The two word wall strategies investigated in this study were equally effective for two of the students with both reaching criterion (identifying 3 words) within five sessions in each condition. Results were almost identical for Tess in both conditions. Kristy could identify one word after only one session in both conditions. Subsequently, her results indicated a more rapid acquisition in the EWW condition, identifying all three words after only three sessions where five sessions were required for her to identify three words in the traditional word wall instruction. Sky's results were more variable between the two conditions. He failed to master one of the words in the traditional word wall after

six sessions while identifying two of the words from the EWW condition in only one session. In addition, he reached criterion (identifying all three words) in the EWW condition in only three sessions. The one word that Sky failed to identify from the traditional word wall condition was incorporated into the EWW instruction. After one instructional session in EWW, he successfully identified the word in the test probe the following day.

There are several possible explanations for the differences in children's performance in word identification between the two word wall instructional approaches. Research in CAI has previously indicated increases in children's (a) attention and (b) motivation (Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011; Wild, 2009). The more rapid acquisition in word identification in the computer-based instruction (EWW) may be linked to these two factors. The data from this study also corroborates the findings of Coleman-Martin, Heller, Cihak, and Irving (2005) and Moore and Calvert (2000) indicating greater increases in word identification in a CAI-only condition as compared to a teacher-directed group-instruction.

In addition, the special education teacher in this study found it more difficult to maintain the children's attention during traditional word wall group-instruction. Conversely, this was not the case in the computer-aided, individualized EWW where the children were on-task without teacher redirection. Finally, another possibility may be that the visual and auditory components in EWW provided a more salient learning experience. Research has demonstrated that a picture cue enhances memory (Baker, Simmons, & Kame'enui, 1995) and that the auditory component serves as immediate feedback for the child. These components provide a multi-modal experience and may

have contributed to the enhanced learning (Wild, 2009) evidenced by the children during EWW instruction.

Although both word wall strategies were effective, students with greater attention or motivation issues may differentially benefit from EWW instruction. Preparing the EWW did not prove to be overly time-consuming for the teacher and the children required minimal training to implement the procedures with fidelity making this a viable instructional option

Recommendations

Continued investigation of the impact of EWW on a larger pool of students' word identification and vocabulary development would provide further evidence of the efficacy of this instructional tool. In addition, research to determine the effectiveness of the EWW approach in building vocabulary across the content areas with older students would expand the research on the utility of CAI in adolescent vocabulary development.

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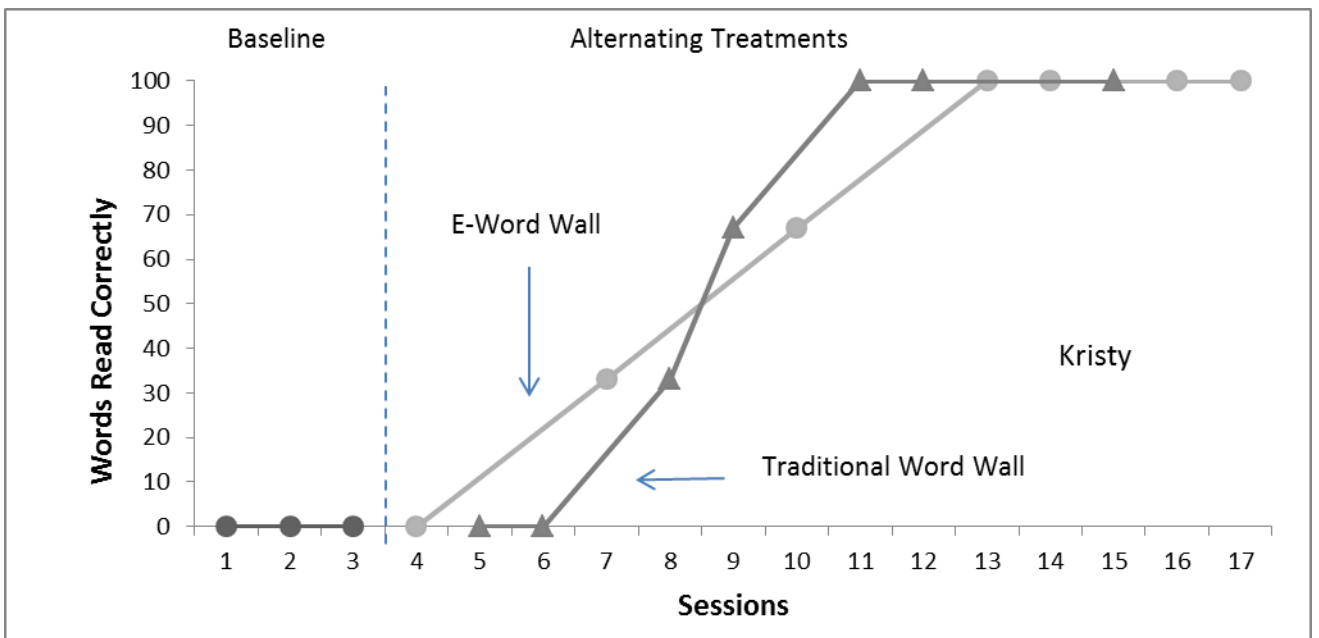
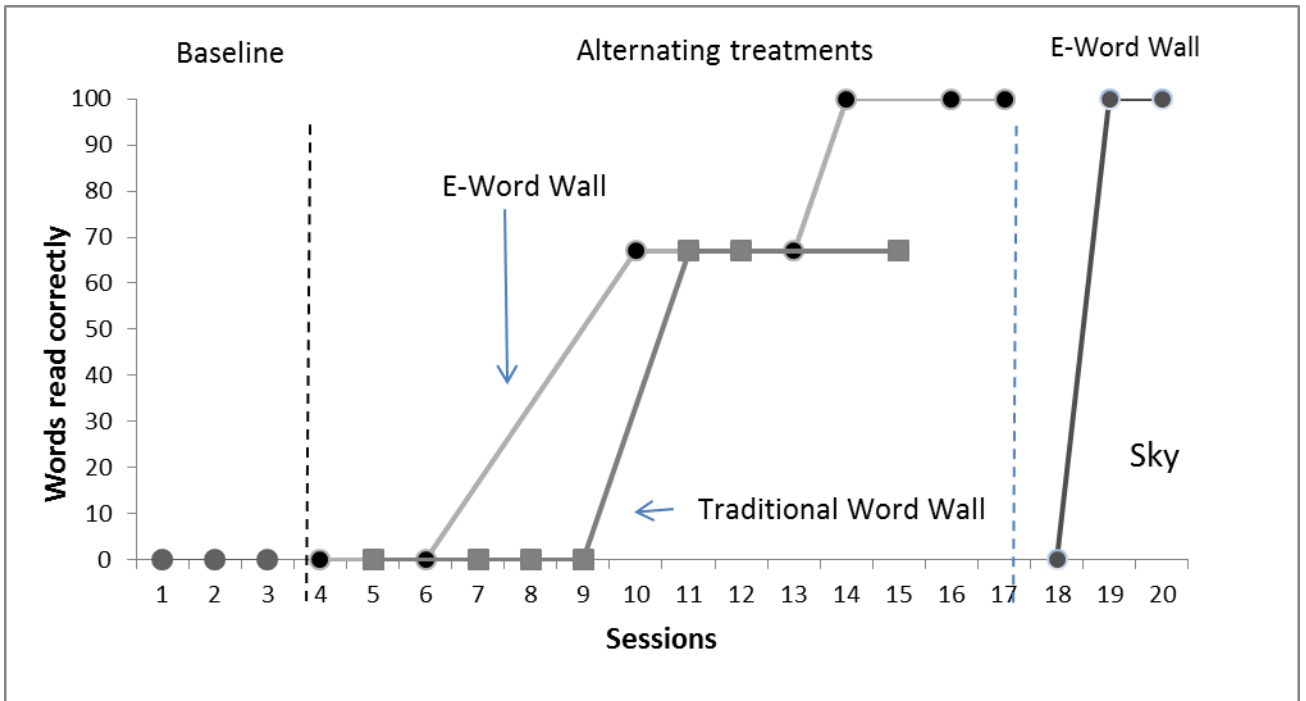
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Figure 1

Percent of words read correctly for Sky, Kristy, and Tess during test probes



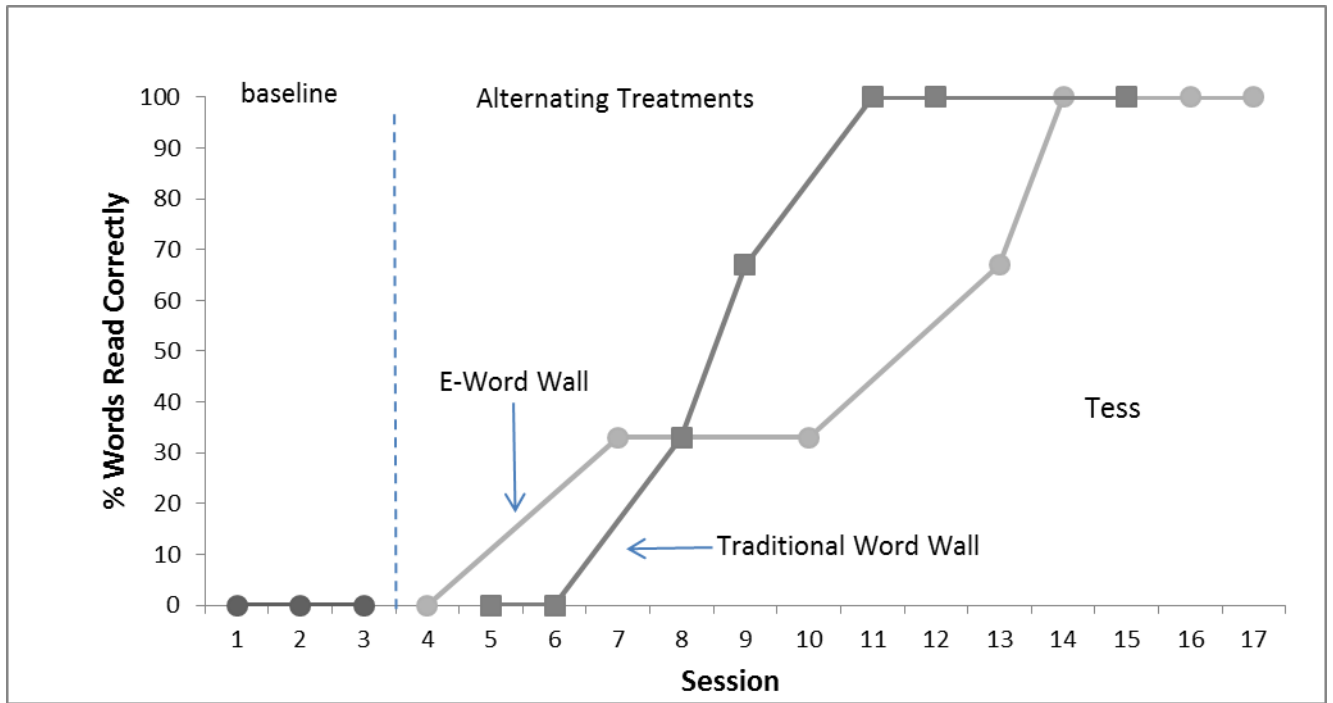


Table 1
Participant characteristics

Characteristic	Student Data		
	Sky	Tess	Kristy
Gender	Boy	girl	girl
Age	5.4	5.8	6.6
Ethnicity	Hispanic	Vietnamese	Native American
IQ standard score	80	75	84