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The Effects of Decoding Instruction on Oral Reading Fluency for Older Students with Reading Delays

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THE EFFECTS OF DECODING INSTRUCTION ON ORAL READING FLUENCY FOR OLDER STUDENTS WITH READING DELAYS

by

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Struggling older readers often have difficulty with early decoding skills (Tolman, 2005; Toste, Williams, & Capin, 2017). If they are unable to master decoding, they may have difficulty with more complex skills, such as passage reading fluency. The current study extends research on reading fluency for older students by evaluating the combined effects of a phonics procedure and a fluency-building strategy on their reading fluency. Participants were older students with below grade level reading performance who had deficits in oral reading fluency and decoding. Dependent variables were the number of correctly sorted word patterns and the number of correct words per minute read in a passage and on a word list. During the intervention, a modified word sort procedure was used to train students to sort and read words containing the target word patterns. Following the initial word sort procedure, fluency building was employed by training word reading to a fluency criterion. Connected text passages were used to assess participants' fluency when reading passages that contained the word pattern. A multiple-probe design across responses was utilized to evaluate the effectiveness of the intervention on the decoding skills and oral reading fluency of participants.

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Decoding and Struggling Older Readers

Research suggests that readers must be able to use both phonemic awareness and phonics to decode unknown words and read fluently (National Institute of Child Health and Human Development, NICHD, 2000). Word decoding is the ability to recognize letter patterns, letter-sound correspondences, and word patterns to identify words in print (Bear, Invernizzi, Templeton, & Johnston, 2012). Phonics is the mapping of letters to sound and analyzing the structure of how a word is spelled (Tolman, 2005) and phonemic awareness is the ability to focus on and manipulate phonemes (i.e., individual speech sounds) in spoken words (NICHD, 2000). Although literacy development is made up of five critical areas - phonemic awareness, phonics, fluency, vocabulary, and comprehension - the ability to decode unknown words develops largely because of instruction in both phonemic awareness and phonics (NICHD, 2000). The National Reading Panel (NICHD, 2000) concluded that instruction in phonemic awareness and phonics might be effective for older students who lack prerequisite skills for fluent reading. Further, instruction in these areas contributes to the fluent reading of connected texts and passages (Gaskins et al., 1988) and rapid decoding (Martens, Werder, Hier, & Koenig, 2013). Finally, research suggests that when instruction in phonemic awareness and phonics is explicit, systematic, and includes instruction in reading fluency and automaticity, older students can benefit from it (NICHD, 2000).

However, many older students who are poor readers have difficulty using phonics to accurately and automatically decode words (Toste et al., 2017; Wexler, Vaughn, Edmonds, & Reutebuch, 2008). These two prerequisite skills are typically developed and mastered between kindergarten and third grade (Tolman, 2005). Therefore, if a learner is not competent in one or

the other by third grade, the subsequent areas of reading cannot develop. Further, although many interventions targeting word study/phonics to improve decoding have been identified (Bear et al., 2012; DiPierro, 2016; Ehri, 2005; Mixon, 2015; Silva, 2016), few have been developed for older readers (Abbott & Berninger, 1999; Bhattacharya & Ehri, 2004; Denton & Vaughn, 2010; Toste et al., 2017).

Developing decoding interventions for older students is important because research suggests that older students who struggle with early decoding concepts also struggle with more advanced phonics concepts such as morphemes, syllables types, and word origin (Archer, Gleason, & Vachon, 2003; Tolman, 2005; Toste et al., 2017). Additionally, while good readers rely primarily on the letters in a word, poor readers tend to rely on pictures, context, and simply guessing to identify familiar and unfamiliar words (Archer et al., 2003; Diliberto, Beattie, Flowers, & Algozzine, 2008; Torgesen, 2002). A reliance on pictures and context requires the reader to direct more attention to identifying a word than on understanding the meaning of the text. Also, it creates word errors and issues with fluency (Torgesen, 2002). Thus, it is necessary to explicitly teach struggling readers how to effectively decode and recognize unknown words.

Importance of Reading

Reading is a critical academic skill for students to master during the early years of school (Halldorsdottir, 2011). During the early elementary years, it is a major instructional objective and can be a predictor of overall school success (National Early Literacy Panel, 2008). This is largely because by the upper elementary levels and beyond, reading helps students understand and retain more complex material (Toste et al., 2017). Thus, if a student continues to have reading deficits beyond the early elementary grades, he or she will likely continue to struggle and make limited academic progress in secondary school (Hernandez, 2012). Further, reading problems are a

primary reason for referral to special education, where research suggests that some students are likely to have continued reading delays (Allington, 2011; Curtis, 2003; Denton, Vaughn, & Fletcher, 2003).

Based on standardized testing results, a significant number of elementary and secondary students are unable to read or may struggle with the skill. Specifically, the National Assessment of Educational Progress (NAEP) reports that about 64% of fourth-grade and 66% of eighth-grade students read below a proficient level in 2015 (Kena et al., 2015). Beyond formal schooling, reading challenges persist and have implications for post-secondary school success. According to a 2013 study by the Program for the International Assessment of Adult Competencies, 1 in 6 adults in the US have low literacy skills (Goodman, Finnegan, Mohadjer, Krenzke, & Hogan, 2013). Studies have found correlations between limited literacy skills and a decreased likelihood of graduating from high school, pursuing higher education, and obtaining and maintaining employment, etc. (Hernandez, 2012; Kern & Friedman, 2008).

Behavior Analysis

Behaviorism is a conceptual framework that has made contributions to society in multiple disciplines including its impact on education and learning through a behavioral approach to verbal development referred to as verbal behavior (Binder, 1996; Skinner, 1957; Slocum, 1995). Verbal behavior is behavior reinforced through the mediation of others and is concerned with the function of language (Greer & Ross, 2008; Skinner, 1957). That is, it is concerned with the effect that a speaker has on a listener. Research on verbal behavior has identified verbal repertoires necessary for effective communication and curricula/interventions to teach them when they are missing (Greer & Ross, 2008). Skinner identified six verbal functions of a speaker that are

referred to as verbal operants: echoics, mands, tacts, intraverbals, autoclitics, and textual behavior (Skinner, 1957).

In his analysis of verbal behavior, Skinner (1957) used the term *textual behavior* to refer to several reading behaviors occurring simultaneously. He defined the behavior of seeing printed text and saying the word as *textual responding* (Skinner, 1957). Textual responding is verbal behavior under the control of printed words and has point-to-point correspondence with the printed text. In other words, when a learner sees the printed text "c-a-t," he or she vocally responds "cat." Some researchers refer to this behavior as "decoding." However, from a verbal behavior approach, the "text serves as the stimuli that correspond to the sound the text represents" (Reilly-Lawson, 2008, p. 23). For the current study, the two terms - decoding and textual responding - are used interchangeably.

Subsequent verbal behavior research has identified stages of verbal development that allow students to learn new skills or repertoires including textual stages such as reader, writer, reader-as-own-writer (Greer & Ross, 2008). These stages may represent behavioral cusps that allow an individual to learn new behaviors (Rosales-Ruiz & Baer, 1997). Behavioral cusps are new behaviors that enable the development of multiple new behaviors, often at an accelerated pace. According to Novak and Pelaez (2004), fluency is a behavioral cusp in reading, as it opens doors to numerous other developments. For example, once an individual can read fluently, he or she can quickly read the ingredients of a recipe. In turn, the individual can quickly identify the necessary items in a grocery store, which then allows him or her to follow the directions in the recipe, and so on.

In behavior analysis, textual responding is stimulus discrimination and is facilitated by language acquisition during early childhood. Hart and Risley (1995) demonstrated that children

who did not have sufficient language experiences between birth and 36 months of age were more likely to have smaller vocabularies at age three than children whose parents had provided sufficient language interactions. Greenwood, Hart, Walker, and Risley (1994) suggested that children who did not have sufficient language experiences during early childhood also had quantifiable reading delays during elementary school. This relationship between language and reading is supported by additional research in the fields of speech-language pathology, developmental psychology, and special education (Catts, 2017; Hoff, 2013; O'Connor, Bocian, Beebe-Frankenberger, & Linklater, 2010).

A behavioral approach to reading suggests that appropriate responses to text are acquired through stimulus discrimination training and stimulus equivalence procedures. For instance, Sidman (1971) described the role of stimulus equivalence when teaching individuals with disabilities to read. His research involved teaching children with intellectual disabilities conditional discrimination through match-to-sample procedures. Participants were taught to select a picture of a word in the presence of the spoken word (i.e., when hearing the word) and to select a printed word in the presence of the spoken word. For example, in the presence of the instructor saying "cat," a participant was taught to select a picture of a cat. Next, the participant was taught to select the printed word "cat" in the presence of the instructor saying "cat." Participants were then able to select the printed word in the presence of the corresponding picture and vice versa without the direct instruction of that relation. Sidman (1971) referred to this novel behavior as an emergent relation (i.e., an equivalent relation between auditory, textual, and visual stimuli). Additional research on the use of the principles of learning and behavior to teach reading has demonstrated explicit or direct instruction to be effective strategies (Joseph, 2008; Stein, Carnine, & Dixon, 1998). Direct Instruction (DI) is a structured and systematic

approach to teach a skill (Alberto & Troutman, 2013). This teacher-directed instruction is characterized by "specific, constructed feedback, scripted lessons, and unison responding" (Stein et al., 1998). Other important behaviorally-based features of DI include teaching skills to mastery, fast-paced and carefully sequenced instruction, as well as the use of modeling, prompts, and shaping strategies (Joseph, 2008; Silva, 2016; Stein et al., 1998).

Basic Research on Fluency

According to Binder (1996), fluency is the "fluid combination of accuracy plus speed that characterizes competent performance" (p. 164). Initially referred to as simply "rate," fluency has its origins in free-operant conditioning research—especially that of B. F. Skinner (Lindsley, 1964, 1972, 1996; Lindsley & Skinner, 1954; Skinner, 1963). Skinner (1950) identifies rate or frequency of behavior as a "universal datum," concluding that "rate of responding appears to be the only datum which varies significantly and in the expected direction under conditions which are relevant to the learning process" (p. 198). Through his research on operant conditioning with animals, Skinner identified basic principles of behavior such as the effects of reinforcement schedules on various learning processes, extinction, shaping, cumulative responding, as well as other phenomena (Skinner, 1953, 1963). Later in his career, Skinner considered his use of response rate as the basic measure of behavior and the cumulative response recorder to be his most important contributions (Skinner, 1976). According to Binder (1996), despite his apparent emphasis on the rate or frequency of behavior, Skinner and his colleagues opted to use more conventional percentage correct or accuracy-only assessments when attempting to extend their experimental findings into education and training. It has been suggested that this may have been done as an attempt to appeal to educators at the time, who evaluated learners by using accuracy of a response (Binder, 1993). Binder (1996) also suggested that this departure from frequency

may be to blame for its exclusion in the initial design of behavioral instruction more than 50 years ago.

Ogden Lindsley, along with Skinner, conducted the first operant conditioning experiment with humans in an attempt to extend and confirm findings initially obtained in the animal laboratory (Lindsley & Skinner, 1954). Lindsley, known as the founder of Precision Teaching (PT; Lindsley, 1972, 1990), developed PT as a teaching system that retained many of Skinners' original ideas about operant conditioning (Lindsley, 1972). Principles like the behaver, or child, knows best as well as the importance of recording the rate, or frequency of behavior, are basic tenets of PT. Also, standard charting (cumulative responding) is a major component of Precision Teaching. Lindsley developed the Standard Behavior Chart, now known as the Standard Celeration Chart (Pennypacker, Koenig, & Lindsley, 1972), to "visually emphasize rate of response and to facilitate comparison of very different behaviors with very different rates within a single frame of reference" (Slocum, Street, & Gilberts, 1995, p. 381-382). The chart can be used with Precision Teaching, as well as other instructional programs. The Standard Celeration Chart separates itself from other graphs because it is a semi-logarithmic graph that charts behavior frequency (or rate) against calendar days (Binder & Watkins, 1990). The unique format of the graph allows students, teachers, and researchers to share behavior frequency data more efficiently than previously existing graphs. It also allows its users to continuously monitor and make decisions about the effectiveness of the materials and procedures being used to help learners achieve defined instructional goals (Binder & Watkins, 1990). Further, because early practitioners were heavily influenced by operant conditioning, it was believed that behavior frequency, or response rate, could be increased or decreased simply through the use of consequences (Binder & Watkins, 1990). However, PT practitioners quickly learned that no

matter which consequences (e.g., praise, tokens, etc.) were delivered for various academic skills, response rates were not increasing (i.e., students' performances hit "ceilings") due to non-fluent prerequisite skills (Binder & Watkins, 1990). This finding demonstrated that the rate of responding for prerequisite skills has on the development, and mastery, of subsequent skills (Haughton, 1972).

As previously suggested by its definition, in addition to response rate, fluency is also characterized by accurate responding (Binder, 1988). However, early research demonstrated that the accuracy of a response class is not sufficient to meet mastery (Binder, 1996; Haughton, 1972). Instead, the rate at which a learner correctly responds to prerequisite skills, such as letter sounds, has implications for how he/she masters subsequent skills (e.g., reading words, sentences, etc.). A learner who can read letters (i.e., letter sounds) both quickly and accurately is more likely to master the skill of reading words (Haughton, 1972). In contrast, a learner who can read letter sounds accurate, yet struggles to do so at an appropriate rate, is likely to have difficulty reading those letters when in a word (Haughton, 1972). Haughton (1972) demonstrated that aims, or goals, between 100 and 200 movements (i.e., words, numbers, etc.) per minute were indicators of proficient performance regardless of the curriculum area.

The use of the term fluency began shortly after the emergence of PT (Binder, 1988). In its original context, fluency was the "combination of accuracy (or quality) plus speed" and the true definition of mastery (Binder, 1988, p. 12). Moreover, Precision Teachers recognized the importance of fluency in the retention and maintenance of new skills, transfer of training, and endurance or resistance to distraction - characterizing fluency as "second-nature" and near-automatic performance (Binder, 1988, 1993). Research in other fields came to similar conclusions. For example, LaBerge and Samuels' (1974) theory of automaticity is built on two

similar ideas: 1) that learners have a certain amount of attention and that attention directed at one activity cannot be directed to another, and 2) with practice, the amount of attention needed for an activity decreases to the point that the activity becomes automatic, requiring no attention at all. LaBerge and Samuels' theory supported subsequent reading research that focused on improving the rate at which students recognize words (Ehri & Wilce, 1983) and repeated reading (Samuels, 1997).

Applied Research on Oral Reading Fluency

Since the publication of the National Reading Panel's report (NICHD, 2000), reading fluency has gained much attention in preschool through grade twelve (PK-12) education settings and is regarded as a critical component of proficient reading. Studies have shown that increased reading fluency increases an individual's ability to both read aloud (oral reading) (NICHD, 2000) and read silently (Kuhn et al., 2010; Rasinski et al., 2009). Research also shows that reading fluency is a reliable predictor of reading comprehension (Hudson et al., 2005; NICHD, 2000; Swain, Leader-Janssen, & Conley, 2013). The ability to read fluently can assist students in school and their daily lives (Scheriff, 2012).

Conversely, the failure to read fluently has been linked to reading deficits, including deficits in reading comprehension (Neumann et al., 2008; Therrien, Wickstrom, & Jones, 2006). Research has suggested that this is because there is a relationship between reading fluency and reading comprehension. Specifically, when teachers emphasize reading fluency and exclude reading comprehension, learners may not attend to the meaning of a text (Rasinski, 2006). Thus, while the number of words read correctly per minute may increase, a student may still fail to comprehend text. Research suggests that reading fluency may also have an impact on the motivation of students choosing to read because it affects reinforcement for reading (Alber-

Morgan, Mathson Ramp, Anderson, & Martin, 2007; Skinner, Pappas, & Davis, 2005; Winn, Skinner, Oliver, Hale, & Ziegler, 2006). That is, since non-fluent readers are less likely to choose to read, then their reading skills may not develop because they do not engage in reading activities that enhance reading skills such as choosing to read (Winn et al., 2006).

Use of the term *fluency* can sometimes be misleading because there is no unanimous consensus among reading practitioners on how to define the concept (Halldorsdottir, 2011; Kuhn, Schwanenflugel, & Meisinger, 2010). The current consensus appears to be that rate, accuracy, and prosody are three key components of reading fluency (Hudson, Lane, & Pullen, 2005; NICHD, 2000; Torgesen & Hudson, 2006; Valencia et al., 2010). However, the way in which each of these components is emphasized and conceptualized varies across the literature. These three components of fluency (rate, accuracy, and prosody) and their role in reading fluency instruction in schools are described below.

Rate. The use of rate as the primary measure of oral reading fluency is a common feature across definitions (Rasinski, Rikli, & Johnston, 2009). According to Torgesen and Hudson (2006), reading rate "comprises both fluent identification of individual words and the speed and fluidity with which a reader moves through connected text" (p. 4). The most common method to obtain reading rate is through timed readings. Timed readings allow the teacher to observe the number of words read correctly and the number of errors made in a given period. This method typically consists of selecting a short passage at the student's instructional level, setting a rate criterion, and having the student read and reread the passage over time until the rate criterion has been met (Hudson et al., 2005). Data are recorded on timing charts as a means to monitor student progress towards his or her goal.

Accuracy. Word reading accuracy "refers to the ability to recognize or decode words correctly" and can be measured by listening to oral reading and counting the number of errors per 100 words (Torgesen & Hudson, 2006, p. 4). As suggested by LaBerge and Samuels (1974), reading is made up of many smaller component behaviors (i.e., decoding and comprehension). As an individual gains proficiency in the smaller component behaviors (e.g., responding to letters, blending sounds into words, responding to whole words, etc.), he or she becomes more accurate.

If a reader is unable to read text accurately, he or she is unlikely to understand the author's intended message, and inaccurate word reading can lead to misinterpretations of the text (Hudson et al., 2005; Konza, 2014). Accuracy can be improved through the use of word-identification strategies (e.g., decoding) to teach readers to identify unknown words. According to Torgesen and Hudson (2006), "strong understanding of the alphabetic principle, the ability to blend sounds together [Ehri & McCormick, 1998], the ability to use other cues to the identity of words in text [Chapman & Tunmer, 1995] and knowledge of a large bank of high frequency words is required for word reading accuracy" (p. 4).

Many reading instructional and assessment methods measure both accuracy and reading rate; however, when determining reading proficiency, reading rate often overshadows accuracy (Neumann, Ross, & Slaboch, 2008; Rasinski et al., 2009). For example, while a learner may steadily increase the number of words read in a minute, the number of errors may also be increasing, instead of decreasing. Therefore, while measuring reading rate, the reader's accuracy must also be observed. This is often done through the use of a running record (Clay, 1985) and miscue analysis (Goodman & Burke, 1972), which provides more detailed information about the learner's reading accuracy (Hudson et al., 2005). Both running records and miscue analyses

allow the teacher to keep a more detailed record of the type of responses—both correct and incorrect—made while a student is reading. Further, the two methods can reveal which strategies the student is using and which strategies he or she is not using, which in turn can help guide instruction.

Prosody. In addition to rate and accuracy, prosody is the third component of reading fluency to be discussed. Prosody refers to reading with expression and incorporates phrasing, stress, pitch, and rhythm (Konza, 2014; Rasinski et al., 2009). In other words, reading in a way that sounds like speaking. An inability to read with prosody can lead to confusion through inappropriate or meaningless groupings of words or inappropriate applications of expression (Hudson et al., 2005). Prosody is characterized as the ability to "speed up and slow down, raise and lower pitch, increase and decrease volume, and embed pauses and lengthened syllables that reflect punctuation and enhance textual meaning" (Paige, Rasinski, & Magpuri-Lavell, 2012, p. 68). On the other hand, a reader who is unable to read with prosody tends to "read in a word-to-word monotone" manner, making it difficult to understand the text (Paige et al., 2012, p. 68). For example, a student who reads at the expected reading rate for his or her grade and with minimal errors may also read aloud in a monotone manner. In such a case, unless they are listened to while reading aloud, the student may appear to be a proficient reader. While it is an important component of reading fluency, prosody can only be measured through observation of oral reading of connected text (Hudson et al., 2005). Further, the extent to which the prosodic component is associated with comprehension has yet to be reliably demonstrated (Deeney, 2010; Haskins & Aleccia, 2014; Kuhn et al., 2010), thus establishing the risk of solely relying on reading rate as an indicator of reading proficiency.

Overview of Common Reading Fluency Interventions

Past research has identified many strategies to improve oral reading fluency (NICHD, 2000). While the National Reading Panel (NICHD, 2000) identified evidence-based practices to build fluency, their meta-analysis categorized these strategies into only two areas: guided repeated oral reading and efforts to increase independent silent reading (NICHD, 2000; Scheriff, 2012). These approaches are typically used due to the general understanding that fluency is developed through reading practice (NICHD, 2000). However, research has not yet agreed upon the most effective form(s) practice should take.

An overwhelming amount of research has focused its attention on the use of guided repeated oral reading (GROR) to improve reading fluency (Lo, Cooke, & Starling, 2011; NICHD, 2000; Samuels, 1997; Swain et al., 2013; Therrien, 2004). In fact, this approach can take many forms (e.g., repeated reading, paired reading, shared reading, and assisted reading) (NICHD, 2000). In guided repeated oral reading approaches, learners typically read and reread passages aloud to a teacher (i.e., adult), tutor, or peer, for a certain number of times or until a predetermined criterion has been reached (NICHD, 2000). Some forms of GROR allow the learner access to the text in the form of previewing before formal instruction, either with a teacher or by him/herself (Massey, 2008). It is recommended that passages are at the learner's instructional or independent reading level (Meyer & Felton, 1999). While the learner reads a passage (timed for one minute), the teacher or tutor follows along on a separate copy of the passage and marks any errors made. Typically, once the passage is read, the teacher or tutor provides the learner with corrective feedback and records the number of words read correctly per minute. Many repeated reading procedures also incorporate a progress monitoring or self-

charting component, in which the learner graphs his/her fluency data to improve future performance (Lo et al., 2011).

While research has shown repeated readings (RR) to be effective when included in a treatment package (Alber-Morgan et al., 2007; Begeny & Martens, 2006; Begeny & Silber, 2006; Lo et al., 2011;), there are a few important criticisms to note. First, a major criticism of the RR procedure is that few studies have demonstrated convincing data of the generality or transfer of performance to novel passages (i.e., passages not practiced during the repeated reading intervention) (Ardoin, Eckert, & Cole, 2008; Klubnik & Ardoin, 2010; Lo et al., 2011; Yurick, Robinson, Cartledge, Lo, & Evans, 2006). Further, some studies fail to assess generality altogether (Alber-Morgan et al., 2007; Begeny, Krouse, Ross, & Mitchell, 2009; Berends & Reitsma, 2006; Swain et al., 2013). Finally, while research has shown RR to be effective in improving fluency with younger students, there is limited research showing its effectiveness with older students (Alber-Morgan et al., 2007; Scammacca et al., 2007; Winn et al., 2008).

Lo and colleagues (2011) assessed the use of a repeated readings (RR) program to improve the generalization of oral reading fluency of second-grade students at-risk for reading failure. The oral reading rate on transfer (generalization) passages at the student's instructional reading level (second-grade) served as the primary dependent variable. The oral reading rate on non-transfer passages at the student's independent reading level (first-grade) served as the secondary dependent variable. During the RR procedures, students practiced five difficult words from the intervention passage, read in unison with the teacher, and read the passage four or five times with error correction. Results showed that the RR procedures improved oral reading rates for all three students on the second-grade transfer passages.

Previewing, or modeling, is another form of repeated reading in which the learner has access to text material before formal instruction (Massey, 2008). Previewing can take on different forms including oral or silent previewing, which allows the learner to preview the text material aloud or silently and listening previewing. During listening previewing, the learner hears a fluent reader model the material, whether it be an entire passage or difficult words, before reading the material him/herself. Because of the model provided by the teacher or tutor, a form of automaticity begins to develop (Swain et al., 2013). Research has shown various types of previewing to be effective in increasing reading fluency when implemented individually and when used in combination with one or two other interventions (Begeny et al., 2009; Begeny & Silber, 2006; Swain et al., 2013). Swain and colleagues (2013) compared the effectiveness of three reading fluency interventions (repeated readings, audio listening passage preview, and teacher modeled listening passage preview) on increasing the fluency of a fifth-grade student. Results from the study showed all three interventions to improve the students' words correct per minute with the most growth for Audio LPP during the intervention. However, the growth demonstrated from Audio LPP during the intervention was not maintained on a five-month follow-up measure. On the other hand, both RR and LPP maintained the growth on the five-month follow-up measure. Results from this study demonstrate the importance of continued intervention for additional improvements in fluency.

Hawkins, Hale, Sheeley, and Ling (2011) compared the effects of two interventions (repeated readings RR, and repeated readings plus vocabulary previewing RR + VP) and a control condition, on the reading fluency, comprehension level (i.e., the number of comprehension questions answered correctly), and comprehension rate (calculated using the percentage of comprehension questions answered correctly and the total time required for

reading a passage) of six high-school students who read below grade level. Results showed the RR + VP condition to result in the greatest improvements in reading fluency for all students. Also, RR + VP lead to the highest reading comprehension levels for three of the students, and RR + VP and RR resulting in similar comprehension levels for the other three students. Finally, reading comprehension rates were highest under the RR + VP condition for five of the students. Although some research has suggested word previewing to be effective (Begeny & Martens, 2006; Begeny & Silber, 2006; Lo et al., 2011), a meta-analysis conducted by Lee and Yoon (2017) did not find isolated word preview to be an essential component to repeated readings for students with reading disabilities.

Decoding and Reading Fluency Research

Despite evidence indicating the effectiveness of fluency instruction in reading, some students do not respond well to fluency instruction relative to its stated benefits. While there is research suggesting that factors related to fluency instruction influence its outcomes (e.g., experimenter-delivered interventions and re-reading a passage three times), the reader's mastery of prerequisite decoding skills is another possible source of difficulty for learners who do not respond well to fluency. Since many common fluency interventions do not address each aspect of reading fluency (i.e., rate, accuracy, and prosody) (Kuhn et al., 2010; Rasinski, 2013; Valencia et al., 2010), it is possible that certain learners need more targeted fluency instruction or do not possess the prerequisite decoding skills necessary to read fluently.

Literature that targets decoding in order to build fluency is limited (Archer et al., 2003; Denton, Fletcher, Anthony, & Francis, 2006; Silva, 2016) and even more so for older students (Archer et al., 2003; Denton & Vaughn, 2010; Scammacca et al., 2007; Toste et al., 2017). The lack of research on decoding may be due in part to decoding skills seldom being taught beyond

the second- and third-grade (Denton et al., 2006; Palumbo, Kramer-Vida, & Hunt, 2015; Toste et al., 2017). When older students are unable to read fluently, they may struggle at the word-level (Archer et al., 2003; Roberts, Torgesen, Boardman, & Scammacca, 2008; Tolman, 2005). That is, they can decode single-syllable words correctly but have difficulty decoding multisyllabic words. Although research is limited, studies that have attempted to increase oral reading fluency suggest that effective fluency intervention efforts should first target sublexical and word-level skills as well as semantic, orthographic, and morphological processes, for struggling readers, both with and without disabilities (Staudt, 2009; Vadasy & Sanders, 2008).

As previously discussed, decoding is the ability to recognize the letter-sound correspondences as well as word and letter patterns to identify words in print (Bear et al., 2012). Interventions that focus on the more advanced components of decoding (word analysis and word recognition) are sometimes called advanced word study (Curtis, 2004). Advanced word study interventions target morphology (i.e., analysis of the meaningful parts of words, such as prefixes and suffixes) and orthography (i.e., the rules for writing a language). Word study interventions are typically used in elementary school settings with learners who have difficulty with spelling (Zutell, 1998) or decoding (DiPierro, 2016; Williams, Phillips-Birdsong, Hufnagel, Hungler, & Lundstrom, 2009), thus, research on its effectiveness with older students is limited (Atkinson, Zhang, Phillips, & Zeller, 2014; Denton & Vaughn, 2010).

Decoding and Fluency-Building Interventions

It has been suggested that teaching missing phonemic awareness (PA) and phonics skills can lead to generalized decoding skills as well as generalized oral reading fluency (Daly, Chafouleas, Persampieri, Bonfiglio, & LaFleur, 2004; Martens et al., 2013; Silber & Martens, 2010; Silva, 2016; Werder, 2012). Unlike oral reading fluency (words in isolation and connected

text), fluency or proficiency in prerequisite PA and phonics skills has received considerably less attention. Studies that have targeted fluency in PA or phonics typically assessed generalized performance to untrained real and/or nonsense words (Brosnan, 2015; Daly et al., 2004; Duhon, House, Poncy, Hastings, & McClurg, 2010; Martens et al., 2013; Thaler, Ebner, Wimmer, & Landerl, 2004) or connected text (i.e., in a sentence or passage) (Duhon et al., 2010; Martens et al., 2013; Silva, 2016; Werder, 2012). For example, Martens et al. (2013) conducted a preliminary study to assess the effects of fluency training in phoneme blending on students' generalized oral reading accuracy and fluency. The researchers trained three 2nd grade students to fluently blend phonemes of words containing target vowel combinations (aw, oi, and au) and then assessed generalization in three ways: to untrained words in lists, to trained and untrained words in passages, and to novel words in passages. Students were considered to be fluent in a target vowel combination when they were able to read the trained word list at 50% of their initial known high-frequency word list reading rate (obtained before intervention) with no more than one error. Results from their study support the idea that building fluency in prerequisite phonemic awareness skills can be an intervention for promoting generalized oral reading fluency.

Brosnan (2015) conducted 11 single-case experimental designs to investigate the effects of a PT intervention program targeting fluency in four foundational reading skills (i.e., letter sounds and names, phonemic awareness, decoding words, and high-frequency words) with typically developing children in kindergarten. The PT intervention was implemented one-on-one in discrete trials and included a criterion-based component. The intervention also incorporated progress monitoring and the use of decision rules to make data-based instructional changes. Because participants received the PT intervention on an identified need-basis (i.e., participants

received only the relevant interventions), it is difficult to evaluate the effect of skills targeted on overall reading development. However, this approach allowed the researcher to determine gains in specific areas of decoding as a direct result of building fluency in the foundational reading skills. Overall outcomes demonstrated that the PT intervention produced large gains in word-reading and nonsense word decoding both within and across experiments, and in a pre-posttest context.

Word Sort (WS) is a reading intervention that focuses on building fluency in decoding skills (Bear, Invernizzi, Templeton, & Johnston, 1996; Burns, Riley-Tillman, and VanDerHeyden, 2012). WS involves the learner sorting words with a similar sound, spelling, or meaning patterns into categories (Bear et al., 2012). The activity is part of the comprehensive *Words Their Way* reading program, which targets phonics, spelling, and word knowledge. According to Burns and colleagues (2012), WS is appropriate for learners who can identify sounds being practiced and the other sounds that make up a word, but needs additional practice using the sounds to read words (Silva, 2016). Research suggests that WS is an effective intervention for students having difficulty with decoding (Chan, 2009; Staudt, 2009; Whaley, 2009). Whaley (2009) evaluated the effects of Word Sorts on students' ability to decode and spell target word patterns (e.g., words containing long vowels). Participants in the study were three 2nd grade students, one of which was an English Language Learner. During each WS, the researcher focused on a long vowel pattern and a short vowel pattern. Student performance was assessed through pre- posttests, as well as ongoing assessments during the intervention period. Results from the study showed improved scores for all three students from pre- to posttests on both decoding and spelling. Although scores from the decoding pre- to posttests were not

significant (the biggest score increase was from 11 to 16) , the results have implications for the use of WS when combined with more than one decoding strategy.

Although research has demonstrated that Word Sort (WS) improves decoding skills, few studies have reliably demonstrated its ability to improve reading fluency (DiPierro, 2016; Miles, 2014; Silva, 2016; Staudt, 2009; Tyk, 2014). DiPierro (2016) evaluated the effects of the *Words Their Way* program on teaching decoding skills, oral reading fluency (ORF), and reading comprehension for five 3rd and 4th grade students with learning disabilities. During the intervention, the students received teacher-led lessons based on word patterns with a discussion of words and completed word study activities including WS, word hunts, and passage readings within a group. Results showed increased scores on the spelling and comprehension measures for all of the students. However, only three out of the five students showed increased ORF scores from baseline to post-intervention.

Due to the uncertain nature of its effectiveness, some studies suggest larger gains when decoding instruction is combined with other evidence-based strategies (Archer et al., 2003; Gorp, 2016; Silva, 2016; Vadasy & Sanders, 2008). For example, Silva (2016) examined the effectiveness of WS on the oral reading fluency of three 2nd grade bilingual students receiving Dual Immersion education. During the intervention, WS target sounds were generated based on errors the students made on R-CBM passages during baseline. The WS procedure was practiced until the student was able to sort with 100% accuracy and read the words with 100% accuracy. Once the student met this criterion, the researcher administered three R-CBM passages to assess the effects of WS on ORF. Results from the study showed WS to be effective at increasing the ORF of two out of the three (one student withdrew prematurely). However, the researcher suggested that WS alone may not be enough or as impactful intervention for students receiving

Dual Immersion education. The researcher recommended combining WS with other evidence-based strategies for future practice, to yield greater outcomes.

Staudt (2009) and Mixon (2015) also embedded or used variations of Word Sorts with other reading interventions. Staudt (2009) examined the combined effects of intensive word study (e.g., Word Sort) and repeated readings on the reading skills of two fourth-grade students with learning disabilities. The researcher employed timed repeated readings daily, using poems at the students' instructional reading level. Also, the students received supplemental intensive word study instruction which included Word Study. By the end of the school year, the researcher reported that, although both students were still slow readers, the gains they made in their reading fluency were large enough to impact their word recognition and comprehension skills. Mixon (2015) examined the effects of *Words Their Way* (Bear et al., 2012) on the reading and spelling skills, as well as oral reading fluency, of four 3rd grade students diagnosed with Emotional and Behavioral Disorders. Word study procedures were broken up into daily lessons. Daily lessons were conducted within small groups as well as in partners. During these lessons, students were required to complete WS's (both as a group and with a partner), practice writing the words from the WS's, engage in a word study game, and finally, take a spelling test at the end of the week. Student performance was periodically assessed through the use of daily word probes and oral reading fluency probes twice a week. The researcher reported that the data indicated a functional relationship between a word study program and students' reading skills for three out of the four students. Also, the data showed all four students made gains in the spelling of the target word patterns. Further, all of the students showed some improvement in their ability to read words containing the target word patterns. Finally, two out of the four students showed an increase in their oral reading fluency scores. The researcher noted that while the students did not make

significant gains compared to their on-grade-level counterparts, they all made progress from their pre-intervention performance.

While Word Sort has been described as a fluency-building intervention, during the completion of this literature review, aside from Silva (2016), no other studies were identified that implemented it in this fashion. That is, repeatedly practicing WS's for unknown word/spelling patterns until a predetermined criterion has been met, a procedure more consistent with typical fluency-building strategies (e.g., repeated reading). The present study will address this limitation by incorporating a fluency criterion.

Assessment

To plan for instruction in reading, as well as continuously screen and monitor student progress, some schools administer brief reading assessments called curriculum-based measures (CBM). CBMs were first developed in the 1980s by Stanley Deno as an alternative to traditional assessment methods (e.g., teacher observation, daily assessment scores, etc.) (Deno, 1985). The purpose of CBMs is to assess student performance to guide or adapt, instruction. Although CBMs may measure the components of reading differently, they often share some commonalities. There are four specific features that distinguish CBM: 1) students are tested on an ongoing basis from multiple reading tests, 2) tests are standardized, short tasks, 3) tests measure an important key skill, (oral reading), and 4) tests use reading passages of about equal difficulty (Howe & Shinn, 2002). Research on CBM as an approach to measure reading fluency has been extensive (Deno, 1985; Deno & Marston, 2006; Shinn, 1989). All of the assessments discussed in this section expand upon the early research on CBMs (Anderson et al., 2014; Good & Kaminski, 2002; Pearson Education, 2012).

One specific CBM that is commonly used is the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002). DIBELS is used to assess the early literacy skills of students ranging from kindergarten through sixth grade. It has procedures and measures to assess the development and growth in the areas of phonological awareness, alphabetic principle and phonics, accuracy and fluency, comprehension, and vocabulary and oral language. Lower level reading skills such as phonological awareness (i.e., initial sound and phoneme segmentation fluency), alphabetic principle and phonics (i.e., nonsense word fluency), and vocabulary and language (i.e., word use fluency), are only assessed up to the second grade (third grade for vocabulary and language). Higher level reading skills such as accuracy and fluency (i.e., oral reading fluency) and comprehension (i.e., retell fluency and DAZE) are assessed through sixth grade. There are over 20 alternate forms of each measure, and each measure is designed to take approximately one-minute to administer (Good et al., 2003). Typically, DIBELS is administered at three different levels: tri-yearly for universal screening, monthly for progress monitoring, and weekly for intensive instruction (Good, Gruba, & Kaminski, 2002).

Research and development of DIBELS is conducted by the University of Oregon's Center on Teaching and Learning. Many studies have investigated the reliability and validity of DIBELS (Good & Kaminski, 2002; Kaminski & Good, 1996; Smolkowski & Cummings, 2016). In 2016, Smolkowski and Cummings evaluated the 6th Edition of DIBELS as a screening and diagnostic tool. Drawing from a sample of 13,507 English-proficient students in kindergarten through third grade, the authors' analysis indicated most DIBELS measures (i.e., letter name, nonsense word, and oral reading fluency) to be accurate and previously published decision thresholds (i.e., the score at which students are no longer identified as a member of the reading-difficulty population for a given level of risk) to be generally appropriate.

The AIMSweb reading assessment (Pearson Education, 2012) is another common standardized curriculum-based measurement. Similar to DIBELS, AIMSweb is used for universal screening, progress monitoring, and program evaluation of students from first through eighth grade. AIMSweb offers a reading-CBM (R-CBM), which measures oral reading fluency through the use of graded passages, a comprehension curriculum-based measurement (MAZE-CBM), as well as a Test of Early Literacy, which assesses letter naming, letter sounds, phoneme segmentation, and nonsense words. Unlike DIBELS, AIMSweb offers assessment in not only reading, but language arts, math, and behavior as well.

AIMSweb was developed out of a need for a sufficient number of graded reading passages within each grade level that were also reliable valid for teachers to use to assess students' reading skills (Howe & Shinn, 2002). Reading passages at each grade level (first through eighth) for the AIMSweb R-CBM and MAZE-CBM were written, reviewed, and revised by teachers and paraprofessionals (Pearson Education, 2012). A sample of 24 students at each grade level read all passages created for their grade level. After collecting student data, the researchers eliminated passages that: had low alternate-form reliability, and that showed the most variability in means, standard deviations, and standard errors of measurement by grade (Howe & Shinn, 2002). The final review process yielded a total of 23 passages for first grade and 33 passages each for second through eighth grade. A study by Christ and Silberglitt (2007) supports the test-retest reliability of the AIMSweb R-CBM across four months. The authors evaluated benchmark data for 8,200 students in first through fifth grade and obtained consistent scores across a four-month interval.

Additional research through the University of Oregon developed EasyCBM, an assessment of early literacy skills from kindergarten through eighth grade (Alonzo & Tindal,

2010). Like the previous assessments, EasyCBM is used for universal screening and progress monitoring. It consists of measures of: alphabetic principle (letter names and letter sounds), phonological awareness (phoneme segmentation), fluency (word reading fluency and passage reading fluency), and comprehension (Common Core State Standards Reading [CCSS] and multiple-choice reading comprehension [MCRC]) (Alonzo & Tindal, 2007a). All EasyCBM measures were developed for use within a Response to Intervention (RTI) framework. Benchmark tests for alphabetic principle, phonological awareness, and fluency are individually-administered for all grades while reading comprehension and vocabulary and oral language tests are group-administered. Seventeen alternate forms are available at each grade level for all alphabetic principle, phonological awareness, fluency, and MCRC progress monitoring measures. Ten alternate forms are available at each grade level for all vocabulary and CCSS Reading progress monitoring measures, allowing EasyCBM to be flexible.

Although EasyCBM is relatively new (it began with a grant from the federal Office of Special Education Programs in 2006) (Alonzo & Tindal, 2010), its development builds on to the early work on CBMs. Since its inception, it has continued to expand. When it was initially developed, EasyCBM only targeted students in kindergarten through fifth grade (Alonzo, Park, & Tindal, 2008). Through continued research, EasyCBM eventually extended through the eighth grade (Alonzo et al., 2008). As of 2014, over 4 million students had taken over 26 million EasyCBM assessments (Anderson et al., 2014).

Extensive research has been conducted to support the validity and reliability of the different EasyCBM Reading measures (Alonzo, Liu, & Tindal, 2007; Alonzo et al., 2008; Alonzo & Tindal, 2007a, 2007b). For example, the technical adequacy of the letter names measure began in 2006 (Alonzo & Tindal, 2007a). After collecting data on student responses on

each letter of the alphabet, letter names were analyzed with a Rasch model (a statistical model for test development) to ensure that the test forms were adequately ranged from easy to difficult. Alternate form and test-retest reliability of the letter name measure was investigated by Alonzo and Tindal (2009) and Wray, Lai, Saez, Alonzo, and Tindal (2014). The validity of the letter names measure was also explored by Lai, Nese, Jamgochian, Alonzo, and Tindal (2010), Lai, Alonzo, and Tindal (2013), and Wray and colleagues (2014). Technical adequacy of the EasyCBM passage reading fluency measure, which includes tests of reliability and validity, has also been explored extensively (Alonzo, Lai, Anderson, Park, & Tindal, 2012; Alonzo & Tindal, 2007b, 2008, 2009; Anderson, Lai, Park, Alonzo, & Tindal, 2012). Passage reading fluency measures were initially developed and piloted between 2006-2008. Passages for each grade level (first through eighth) were created, reviewed, and revised by graduate students and former educators. Alonzo and Tindal (2009) tested the reliability of three alternate passage reading fluency test forms to first-grade students. The authors found student scores to be stable regardless of the test form administered. Similarly, Anderson et al. (2012) investigated the reliability of six, 2nd-grade alternate test forms and found stable student scores across test forms.

Additional research continues to support its reliability, validity, as well as refine the assessments (Anderson et al., 2014). For example, new norms were developed during the 2013-2014 school year to provide a better representation of the students who take the assessments (Anderson et al., 2014). The researchers at the University of Oregon's Behavioral Research and Teaching used the most recent Common Core Data (at the time) to determine the counts and percentages and then used a stratified random sample to develop new norms for all EasyCBM measures.

The current section provides a brief overview of the various reading assessments that exist, many of which share common features. To begin, all three CBMs have measures to assess early literacy skills (i.e., alphabetic principle and phonological awareness). However, when looking at the administration timeline of the assessments, there is a clear shift in focus from decoding fluency to passage fluency (e.g., nonsense word fluency to passage fluency) beyond the primary grades. Decoding skills are no longer assessed beyond second grade. Thus, if a student fails to master these skills before second grade, subsequent assessments may not reflect the appropriate deficit. On the contrary, Alonzo et al. (2008) suggest that it is necessary to use different reading measures (i.e., reading comprehension measures) to track a student's progress. Unfortunately, this approach does not take into account the students who continue to struggle to make progress beyond the primary grades. There is a clear need for measures to assess the decoding skills of older students. The focus in reading skills shifts again by the sixth grade. Instead of focusing on fluency, the assessments begin to target reading comprehension. This is due to the notion that the information that oral reading fluency measures provide is limited (Alonzo et al., 2008). Research has shown a link between reading fluency and reading comprehension (Hudson, Pullen, Lane, & Torgesen, 2009; Kuhn et al., 2010; NICHD, 2000; Swain et al., 2013). Research also suggests that once an individual can read at least 100 words per minute (and less than six errors) by sixth grade, fluency is no longer sensitive to increases in comprehension (Alonzo et al., 2008; Hasbrouck & Tindal, 2006). Another limitation of many of current reading assessments is that they do not provide a complete view of reading fluency. That is, fluency measures do not identify specific deficits in fluency such as poor accuracy or low rate. Problems may arise when a student is identified as having poor fluency because the specific deficit has not been identified. This issue could be addressed by the inclusion of a miscue

analysis (Goodman & Burke, 1972), which provides more detailed information about a student's reading strategies as well as strengths and weaknesses (Bader & Pearce, 2012).

Study Rationale and Research Questions

There is limited knowledge of the effects of decoding fluency on overall oral reading fluency (i.e., with older readers). The following study expands upon the sparse research on decoding fluency with older readers by evaluating the effects of phonics instruction and fluency-building on the overall oral reading fluency (i.e., words in isolation and connected text) of struggling readers. To the knowledge of the researcher, there have been no other empirical studies that used the strategies employed in the present study. This study combined and extended upon work carried out by several studies, namely Vogel (2010), Werder (2012), Martens et al. (2013), and Silva (2016). It also attempted to address limitations identified by these studies by utilizing different strategies to enhance decoding, promote accuracy and fluency, as well as promote generalization of words trained in isolation to connected text. For example, Word Sort (WS), which serves as the phonics instruction, employed behavioral principles of teaching and learning such as modeling, opportunities to respond, repeated exposures, corrective feedback, and reinforcement (Ardoin & Daly, 2007; Joseph, 2002).

Also, current curriculum-based measures (CBM) do not assess decoding skills beyond second grade. By including decoding measures in CBMs, older students struggling with these skills are more likely to be identified (earlier) and provided the appropriate intervention. The current study addressed this issue by identifying measures that more accurately assess these skills for older students. The study sought to determine if phonics instruction would improve reading accuracy and fluency for secondary students with reading delays.

METHOD

Participants

Participants included three students enrolled in fourth through seventh grade. Students were initally identified by their teacher(s) or parent as having difficulty in reading and then selected from a pool of students if they: a) had below grade level performance (read at or below the 10th percentile) on the AIMSweb Reading-Curriculum Based Measure (Pearson Education, 2012); and b) low accuracy levels on any section of the *McGraw-Hill Phonics Survey* from the *Wonders Placement and Diagnostic Assessment* (McGraw-Hill Education, 2017). Informed consent was obtained for all students participating in the study, and included written informed consent from their parents and verbal assent from students. Participants received a $20 gift card as compensation for participation. Table 1 summarizes the results of the Phonics Survey and target word patterns for each participant.

Student 1. James was a 13 year old seventh-grade boy with no reported disabilities. He attended a middle school located in a rural community and received support for reading. James began the study reading 94 Words Correct Per Minute (WCPM) on the Winter AIMSweb R-CBM benchmark administered by his school, and had a median of 104 WCPM on third-grade AIMSweb reading material administered by the experimenter.

Student 2. Jason was a 12 year old fifth-grade boy with an Individualized Education Plan (IEP) for Autism. He received his education at a local middle school in an inclusion classroom. Jason began the study with a median score of 67 WCPM on first-grade AIMSweb reading measures administered by the experimenter. Based on the San Diego Quick Assessment (SDQA), Jason read at a second-grade instructional reading level. The San Diego Quick

Assessment measures the recognition of words out of context and targets a student's ability to read grade-level sight words (La Pray & Ross, 1969).

Student 3. Gary was a 10 year old fourth-grade boy with an IEP for cognitive impairment. He attended a local middle school and received daily guided reading instruction from his classroom teacher as well as a special education teacher. Gary began the study with a median score of 66 WCPM on first-grade AIMSweb reading measure administered by the experimenter. Based on the SDQA, Gary read at a first-grade reading level.

Table 1

Summary of Phonics Survey and Target Word Patterns for Each Participant

Participant	Target Word Patterns
James	CVCe across vowels: 1) a, 2) i, 3) o
Jason	1) "igh", 2) "sh", 3) three-syllable words
Gary	CVCe across vowels: 1) a, 2) i, 3) o

Setting

This study took place in the library of each participant's school, after-school program, or local library. All sessions were conducted individually in a quiet location. Sessions only consisted of the experimenter and student unless an independent observer was present to collect treatment fidelity data. Sessions for James were conducted three to four times a week, lasted approximately 15 minutes, and took place in the participant's public school library. The library was quiet with little interference or interruptions from other individuals. Except for the librarian, there were no other individuals present in the library unless they were passing through to make copies, turn in a book, or completing other library-related activities. During intervention

sessions, the experimenter and student sat at one of the tables located at the back of the library to avoid distractions. Sessions for Jason were conducted four to five days a week and lasted approximately 45 minutes each. Sessions took place either in a reserved study room in a university library or the reading room in a local recreational center. The study rooms in the university library consisted of a rectangular conference table with six chairs, clear glass windows on three of the four walls, a dry erase board, and a screen mounted on the wall. The reading room consisted of a rectangular conference table with six chairs, a clear glass window on one of the four walls, a shelf with various supplies, book case, and a dry erase board affixed to one of the walls. Sessions for Gary were conducted four to five days a week, lasted approximately 45 minutes, and took place either in a reserved study room in a university library or in a quiet area in a local library. Sessions taking place in the local public library were conducted at a square conference table with four chairs in an area with limited distractions.

Materials and Assessment Procedures

This study utilized three different types of materials for assessment and intervention: a) reading screeners, b) reading fluency assessments, and c) word sort flashcards. Reading screeners were used prior to the study to measure the accuracy of students' reading at both the phonics and word levels. Reading fluency assessments were used throughout the study to give students an opportunity to practice fluency in reading target phonetic sounds and to assess their growth in fluency. The three types of reading fluency assessments that were used measured participants' rates of reading: a) standard reading curriculum-based measures (R-CBM) to assess passage reading fluency; b) word lists to measure target word pattern fluency in isolated nonsense and real words; and c) connected text to measure target word pattern fluency in a reading passage. Each fluency measure is also described below. Finally, the Word Sort

flashcards were used to teach students target phonetic sounds. Examples of the Word Sort flashcards are included in Appendix B.

Phonics survey. The Phonics Survey (PS) in the *McGraw-Hill Placement and Diagnostic Assessment K-6* (McGraw-Hill Education, 2017) was used as a phonics screener to identify each students' strengths and needs in decoding skills. The PS was developed by McGraw-Hill and is based on the Quick Phonics Screener, Standard Version (Hasbrouck, 2008). The PS is organized into 10 skill sets, or tasks, arranged in order from least to most difficult. The PS contains real words and nonsense words divided into two groups: 1) words that contain common short vowels, consonant digraphs, consonant blends, long vowel/silent e patterns, r-controlled vowels, advanced consonants; and 2) words that contain vowel teams, multi-syllable words, and prefixes and suffixes. Items assessed in group 1 (short vowels to advanced consonants) are assessed within nonsense words in a list as well as within connected text. These word patterns (e.g., consonant blend or vowel team) are presented two times on a word list and/or in connected text. Items assessed for the remaining tasks (vowel teams, multi-syllable words, and prefixes and suffixes) are only assessed on a word list. For the short vowel (i.e., VC and CVC) task, there are 10 opportunities to respond to words in a list and 20 opportunities to respond to words within connected text. Next, for items assessed through advanced consonants, there are 10 opportunities to respond to nonsense words in a list and 10 opportunities to respond to words within connected text. The vowel team task assesses 15 common vowel teams and has 30 response opportunities. Words containing two, three, and four-syllables are assessed in the multi-syllable task, with each having 10 response opportunities (there are a total of 30 for the entire task). Finally, the prefix and suffix task assess seven prefixes and eight suffixes. Each prefix or suffix appears twice for a total of 30 response opportunities.

To obtain a more comprehensive view of a student's skill set, the experimenter conducted the PS using modified directions. For example, the directions for administration and scoring suggest starting where the student's skills are believed to be fairly strong; however, the experimenter began the PS at the first task, which assesses letter names and sounds, and continued until all of the remaining tasks were presented or until the student made consecutive errors within a task. From each participant's results on the PS, the experimenter selected target word patterns with the most errors.

Word screening. A list of words from common word banks was used to identify words for both assessment and intervention phases. Specifically, the experimenter screened for known/unknown words using words from three different sources: *Words Their Way with Struggling Readers: Word Study for Reading, Vocabulary, and Spelling Instruction, Grades 4-12* word lists (Flanigan et al., 2011), High-Utility Academic Words Lists from *The Reading Teacher's Book of Lists* (Kress & Fry, 2016), and *The Academic Word List* (Coxhead, 2000). After approximately 20 words were unknown, they were divided into two different categories of words that were similar in length, difficulty, and structure: a) 12 words used as untrained words and novel words in pre-posttests, and b) eight words trained during the word sort intervention.

Experimenter-created nonsense words for probes and pre-posttests were also included. Specifically, the experimenter created nonsense words for each target word pattern. Nonsense words were matched across and within target word patterns in terms of onsets and rimes. That is, if the word "bame" appeared in the Word List Fluency (WLF) Pretest, the word "wame" appeared on a word list during training. Similarly, the words "bime" and "bume" may have appeared during training of the other vowels. These words were used after the Word Sort (WS) as part of the Word List Fluency procedure.

Automatic word list fluency screening. Before the study began, students' responses on the *Automatic Word Lists* (Adams & Brown, 2007) were assessed to create the fluency criterion to move students from intervention to post-intervention probes (Martens et al., 2013; Werder, 2012). Based on the recommendations of Werder (2012), the current experimenter set a fluency criterion of 30% of the student's median score on the three *Automatic Word Lists* as his Word List Fluency criterion. For example, if a student's fluency scores on the word lists were 86, 72, and 68 WCPM, his/her WLF criterion would be 30% of 72, or 22 WCPM. Automatic *Word Lists* (Adams & Brown, 2007) contain frequently encountered sight words in reading texts. In this study, students read the first three *Automatic Word Lists* found in *The Six-Minute Solution: A Reading Program (Intermediate Level)* book.

Reading curriculum-based measures (R-CBM). R-CBM passages from AIMSweb (Pearson, 2012) progress-monitoring materials were used in two ways. First, before the study, AIMSweb progress-monitoring passages were used to conduct a survey level assessment (SLA), which is used to identify a learner's instructional reading level. The SLA process involves administering increasingly less difficult reading probes until a learner reads at a predetermined rate. Second, after the last intervention session, three AIMSweb progress-monitoring R-CBM were used to determine participants' reading fluency based on a standard measure. See Appendix A for the SLA protocol.

Word list fluency. Word list fluency stimulus sheets were used to give students opportunities to practice fluent reading of words that contain trained word patterns. Word list fluency stimulus sheets used during training, had four nonsense, four known, and four WS words, with each word appearing 20 times on one sheet (a total of 160 words on a list of words for word list fluency). Similarly, word list fluency stimulus sheets used for pre-posttests and

probes consisted of nonsense, known, and unknown words. As in Werder's (2012) study, known and unknown words were combined because previous research has shown this practice to decrease task difficulty, promote retention, and increase student attention and engagement. Appendix B has a sample word list fluency probe.

Connected text. Connected text pre-posttests consisted of randomly generated sentences that contained both target and novel words. The purpose of the connected text pre-posttest was to assess a student's fluency with trained target word patterns within connected text instead of word lists and flashcards. Each target word appeared two times, in two different sentences in pre-posttests. See Appendix B for a sample connected text probe.

Word sort. Word sort flashcards had two parts: a) two model words (e.g., the word "cop" on one card and the word "cope" on another card when the target was the silent e rule) or a description of a spelling rule such as the silent e rule (e.g., one card with "not a silent e" and one card with "silent e" written on them); and b) eight flashcards containing real words that had the target word pattern in them. Flashcards used in Word Sorts were printed electronically on small pieces of white cardstock in size 26 font in black ink. No other text or pictures appeared on the flashcards.

Discrimination training. Flashcards used during discrimination training were created in the same fashion as WS flashcards. It is important to note that these flashcards were only used with Gary and this procedure is described below in detail.

Research Design

A multiple-probe design across behaviors (Horner & Baer, 1978; Martens et al., 2013) was used to assess whether phonics instruction using a word sort and fluency-building strategy improves participants' accuracy and fluency of trained and untrained words in word lists and

connected text. This design combines multiple-baseline and probe procedures "to provide a thorough analysis of the relationship between an independent variable and the acquisition of a successive-approximation or chain sequence" (Horner & Baer, 1978, p. 189). A multiple-probe design features: "(1) one initial probe of each step in the training sequence, (2) an additional probe of every step after criterion is reached on any training step, and (3) a series of "true" baseline sessions conducted just before the introduction of the independent variable to each training step" (Horner & Baer, 1978, p. 189).

Dependent Variables

This study had two primary dependent variables: a) accuracy and fluency (i.e., rate) on word lists and connected texts that contained the target word pattern or sound, and b) the accuracy of responses during Word Sort. The two secondary dependent variables were: a) Words Correct Per Minute (WCPM) on R-CBM passages administered pre- and post-intervention, and b) accuracy of responses on reading screeners administered during probes and pre-posttest conditions. Table 2 lists the dependent variables and corresponding measures.

For each intervention condition, the student had to meet certain mastery criteria in order to progress to subsequent conditions. Word Sort conditions continued until the student was able to read and sort all of the words with 88% accuracy or higher on three consecutive sessions. Word List Fluency conditions were initially planned to continue until the student met his WLF criterion, which was calculated as 30% of the student's median fluency score on lists of high-frequency words, however, during the course of intervention conditions, this criterion was determined to be too stringent for Jason and Gary, and a general fluency criterion of 92% accuracy or above on two consecutive sessions was considered to be more appropriate. Similar to the Martens et al. (2013) and Werder (2012) studies, a fluency criterion was employed in order to

allow a student opportunities to practice the newly trained skill before having him/her use the skill in a novel circumstance.

Table 2

Intervention Sequence and Corresponding Dependent Variable(s)

Sequence	Dependent Variable	Mastery Criteria
1. Word List Fluency Pretest	Accuracy and Rate	N/A
2. Connected Text Pretest	Accuracy	N/A
3. Word Sort Intervention	Accuracy	Read and sort words with 88% or above accuracy
4. Word List Fluency Training	Accuracy and Rate	Initially participant dependent; 92% or higher accuracy
5. Word List Fluency Posttest	Accuracy and Rate	N/A
6. Word List Fluency Probes	Accuracy and Rate	N/A
7. Connected Text Posttest	Accuracy	N/A

Procedures

Overview. This study had six conditions that included: a) pre-baseline screening, b) baseline probes, c) the word sort phonics intervention, d) the word list fluency training intervention, e) post-intervention maintenance, baseline, and retention probes, and f) selection response/discrimination training. Each condition is described below.

Pre-baseline screenings. The purpose of pre-baseline screening was to assess students' fluency performance before an intervention. Pre-baseline data were obtained from the students' oral reading fluency (ORF) on three passage probes at the student's instructional level during the survey level assessment (SLA) (Shapiro, 2011). A students' instructional reading level is identified in the SLA once he reads three passages at a given grade level and the median ORF

fluency score falls between the 25th and 75th percentile as indicated by national norms. The ORF scores obtained on these three passages served as the students' pre-baseline for ORF.

Baseline probes. The purpose of baseline probes was to assess students' accuracy on the target word patterns prior to the intervention. Measures used during this condition were the Word List Fluency and Connected Text Pretests. First, the experimenter administered a word list stimulus sheet that contained nonsense, known, and unknown words, and had the student read for one minute. The percentage of words read correctly served as the baseline data point for WLF for that target word pattern. Next, the experimenter administered a Connected Text Pretest that contained the words used during WS. Each word appeared twice in two different sentences. The percentage of words read correctly on this pretest served as the baseline data point for Connected Text.

Word sort phonics intervention. The Word Sort (WS) phonics intervention began after baseline probes. It is important to note that if a student made highly specific errors during the Phonics Survey, a similar known target word pattern was used as a comparison to teach discrimination between the two patterns. For example, if the Phonics Survey showed that a student had difficulty with words that contained the long *a* sound (i.e., words that have a silent e at the end), words that contain the short *a* sound were used as an exemplar during WS. The procedures that follow use these word patterns as examples.

In the first intervention session, the student was introduced to two flashcards containing the target word patterns (e.g., "silent e" and "no silent e") as the header (herein referred to as header flashcards). The experimenter began by stating the rule for the word pattern (e.g., "When a word ends with an *e*, the middle vowel says its name. It makes the long vowel sound. What's the rule?") and modeling the sorting task with two sample words. That is, read a sample word

(e.g., cake) out loud and placed it underneath the appropriate heading ("silent e"). Next, the experimenter previewed the remaining words by presenting each card to the student, reading the word on the card, and then having the student vocally repeat the word. After previewing the words, the experimenter presented the student with a word for each word pattern to sort on his own and provided feedback on each one. If the student placed the word under the appropriate heading and/or read the word correctly, the experimenter provided praise. If the student placed the word under the inappropriate heading and/or read the word incorrectly, corrective feedback such as "This word has a silent e at the end, so it is placed under the "silent e" heading" or "This word is cake. What word?" Then, the experimenter provided the student with the remaining cards to be sorted and delivered praise and corrective feedback, if necessary. This part of the procedure was only done when a new target word pattern was introduced. The student subsequently repeated this same procedure until he could sort all of the words with 100% accuracy on three consecutive sessions and read all of the words with 88% accuracy on three consecutive sessions. Appendix A contains the WS intervention protocol.

Word list fluency training. Once the student achieved the WS criterion, he proceeded to Word List Fluency (WLF) Training. During WLF Training, students practiced building fluency in the most recently trained word pattern. A student was instructed to read as many words on the word list stimulus sheet as he could in one minute. This procedure was repeated until the student achieved his/her fluency criterion, which was 30% of his WCPM score on the Automatic Word List, with no more than two errors, two consecutive times (Werder, 2013). It is important to note that this fluency criterion was adjusted for two of the participants during the intervention. An explanation is provided in the discussion section. After each timing, the experimenter delivered praise, read any missed words aloud, and then encouraged the student to beat the previous score.

During each WLF Training session, the experimenter used a different WLF stimulus sheet. A copy of the WLF Training intervention protocol can be found in Appendix A.

Maintenance, baseline, and retention probes. After the student met the WLF criterion on a target word pattern, the experimenter administered the WLF Posttest to compare performance to the pretest and to assess maintenance of performance from the intervention conditions. If the student did not achieve the WLF criterion on the posttest, he returned to the WLF Training condition during the next session. If the student did achieve the WLF criterion on the posttest, the experimenter administered additional fluency probes to measure performance of the target word patterns that were still in baseline as well as retention of performance on previous target word patterns. Once fluency probes were administered, the experimenter presented the student with the Connected Text Posttest on the current target word pattern. When all probes were administered, the previous procedures were repeated with the remaining target word patterns.

Selection response/discrimination training. A selection response or discrimination training condition was implemented for a student when he was unable to reach the mastery criterion for either WS or WLF training within nine sessions. The selection response and discrimination training conditions were conducted until the student read with 100% accuracy on two consecutive sessions or after a total of three sessions. During training on Gary's second target word pattern, the criterion of three sessions was determined to be insufficient, so his criterion was increased to 100% accuracy on two consecutive sessions. The participant then returned to the WS or WLF condition. Procedures for these conditions were modified based on each student's needs. Copies of these modified procedures can be found in Appendix A.

The selection response condition was implemented for James for the CVCe word pattern. During this condition, the experimenter administered a WLF stimulus sheet and instructed James to underline the target word pattern as he read for one minute. This procedure was done in an attempt to help James attend to the target word pattern within words.

A modified discrimination training condition was implemented for Gary on the long vowel sounds. The purpose of discrimination training for Gary was to provide instruction on the long vowel sounds. During training, the experimenter presented the student with flashcards containing words with the target long and non-target short vowel sound (e.g., plane and plan). The student was required to select and read the word that had the target long vowel sound and was done with a total of eight words.

Procedural Integrity and Interobserver Agreement

An independent observer collected procedural integrity data for 22% of all sessions. The average procedural integrity was 100%. Using procedural integrity checklists detailing the steps of each condition, the observer checked off each intervention step after the experimenter completed it. Procedural integrity was calculated by dividing the number of steps completed by the number of steps possible. An independent observer collected interobserver agreement (IOA) for 25% of all sessions. The average IOA was 95% across sessions. IOA was calculated by dividing the number of agreements on errors by the total number of possible agreements on errors.

RESULTS

James

Figures 1-5 display James' responses during probes, training, and pre- and posttests. Figure 1 displays combined data from WLF and Connected Text Pre-Posttests, Word Sort,

Probes, WLF Training, and Selection Response conditions. Generally, James acquired the targeted word patterns after the intervention and met his WLF criterion for the remaining two word patterns in fewer sessions following the acquisition of the first word pattern. Further, his mean ORF at his instructional level (third-grade) increased from 105 WCPM pre-intervention to 116 WCPM post-intervention. Finally, because James' performance on WLF and Connected Text Pre-Posttests represent his responses to trained, untrained, and nonsense words in lists and passages that contained the target word pattern, they suggest that he generalized trained word patterns to novel words in a list and in reading passages. Table 2 summarizes his responses to untrained words (words that were previously identified as unknown) within the Connected Text Posttest.

Figure 2 displays James' percentage of correct responses on pretests and posttests for each of the three target CVCe word patterns. During the Connected Text Pretests across all word patterns, James had a mean of 79% correct responses per minute (range, 69% to 88%). During the Connected Text Posttests across all word patterns, James had a mean of 100% correct responses (range, 100% to 100%). During the WLF Pretests, James had a mean of 76% correct responses per minute (range, 42% to 86%). During the WLF Posttests, James had a mean of 98% correct responses per minute (range, 95% to 100%).

Figure 3 displays James' percentage of correct responses during the Word Sort (WS) intervention, which occurred after pretests and before WLF Training. During WS across all target word patterns, James had a mean of 98% correct sorting responses (range, 75% to 100%) and a mean of 98% correct reading responses (range, 75% to 100%). James had a mean of 6 sessions to criterion (range, 4 to 7) across all word patterns for WS Training.

Figure 4 displays James' accuracy during Word List Fluency (WLF) Training and probes, which occurred after WS Training and before posttests. During WLF Training, across all target word patterns, James had a mean accuracy of 96% (range, 79% to 100%). James had a mean of 4 sessions to criterion (range, 2 to 7) across all word patterns for WLF training.

Figure 5 displays James' fluency during WLF Training and probes. During WLF Training across all target word patterns, he had a mean of 43 words correct per minute (WCPM) (range, 27 to 57). James had a mean of 27 WCPM (range, 22 to 31) on probes administered throughout the intervention. It is important to note that fluency scores on probes for each target word pattern are the same because probes contained nonsense words containing each vowel interspersed on a single fluency stimulus sheet (e.g., there were multiple response opportunities for each vowel).

Baseline data were based on the students' performance on the three AIMSweb R-CBM reading probes at his instructional reading level during the survey level assessment. Based on his performance, James was determined to be at a third-grade instructional reading level. Table 6 displays his ORF scores on the third-grade passages before and after the intervention. His mean ORF on third-grade passages prior to the intervention was 105 WCPM (range, 100 to 111) and a mean of 116 WCPM (range, 104 to 129) post-intervention.

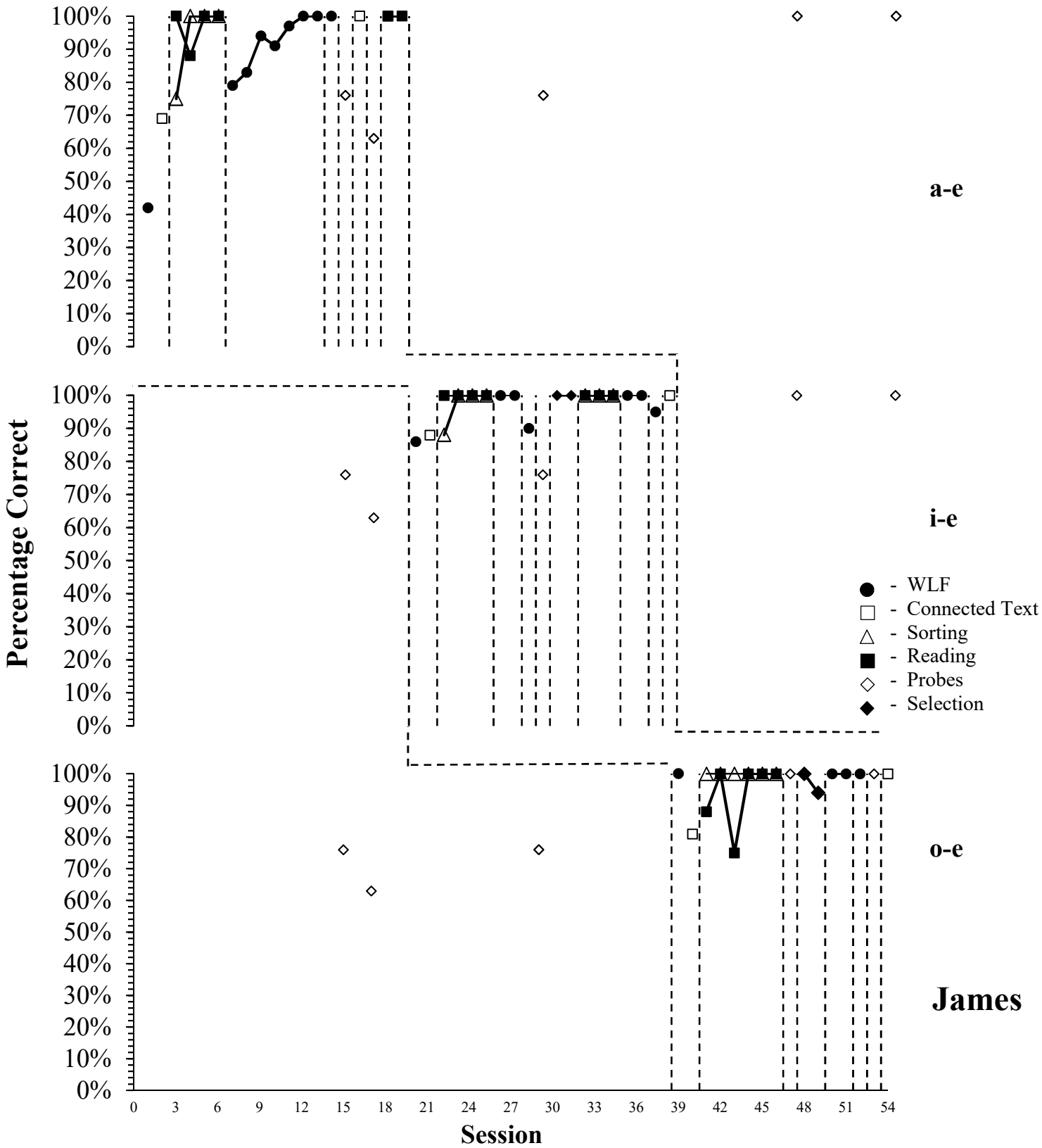

Figure 1 Probes, WLF and Connected Text Pretests, Word Sort, WLF Training, WLF and Connected Text Posttests, and Selection Response.

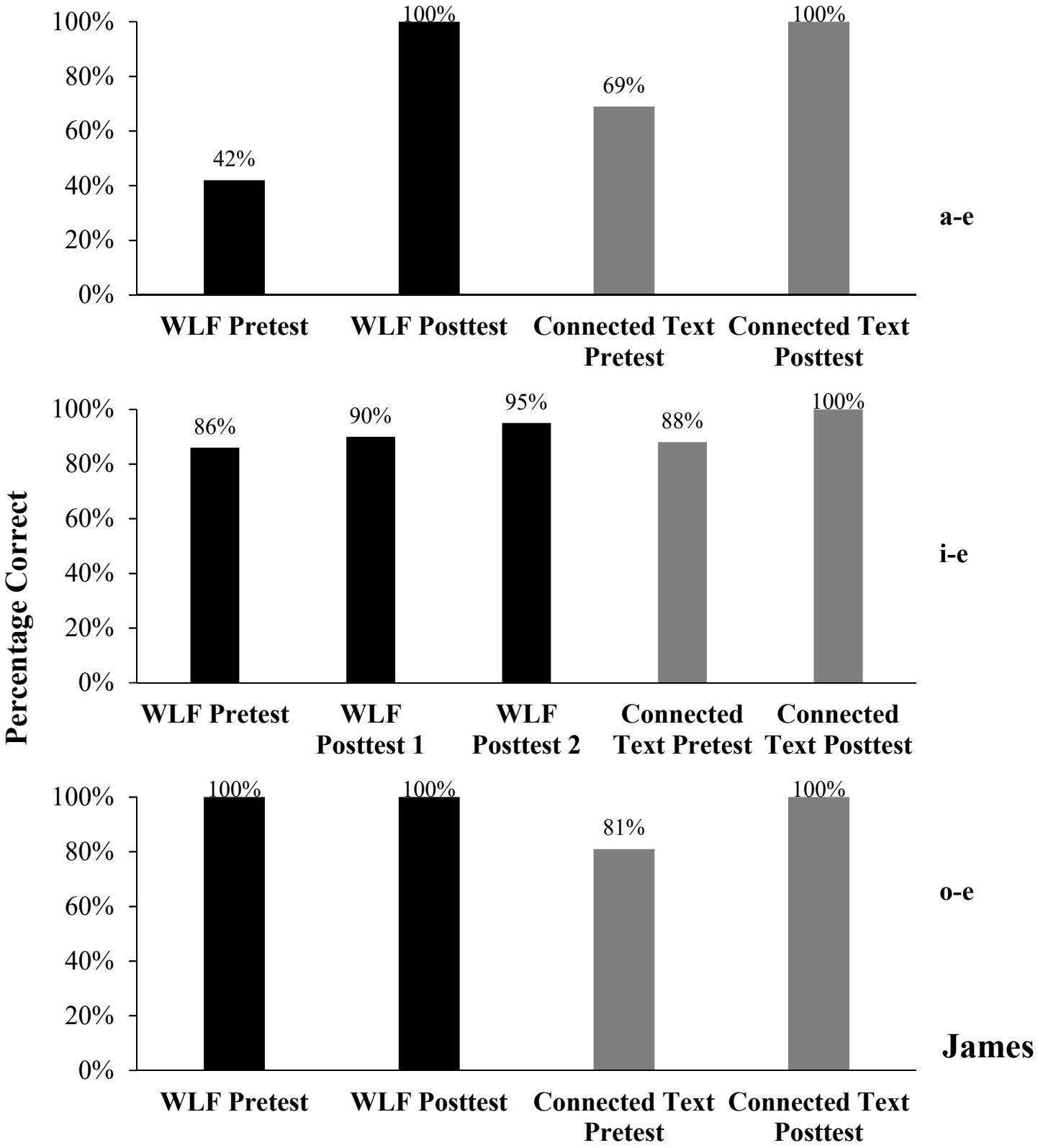

Figure 2 Word List Fluency and Connected Text Pre-Posttests.

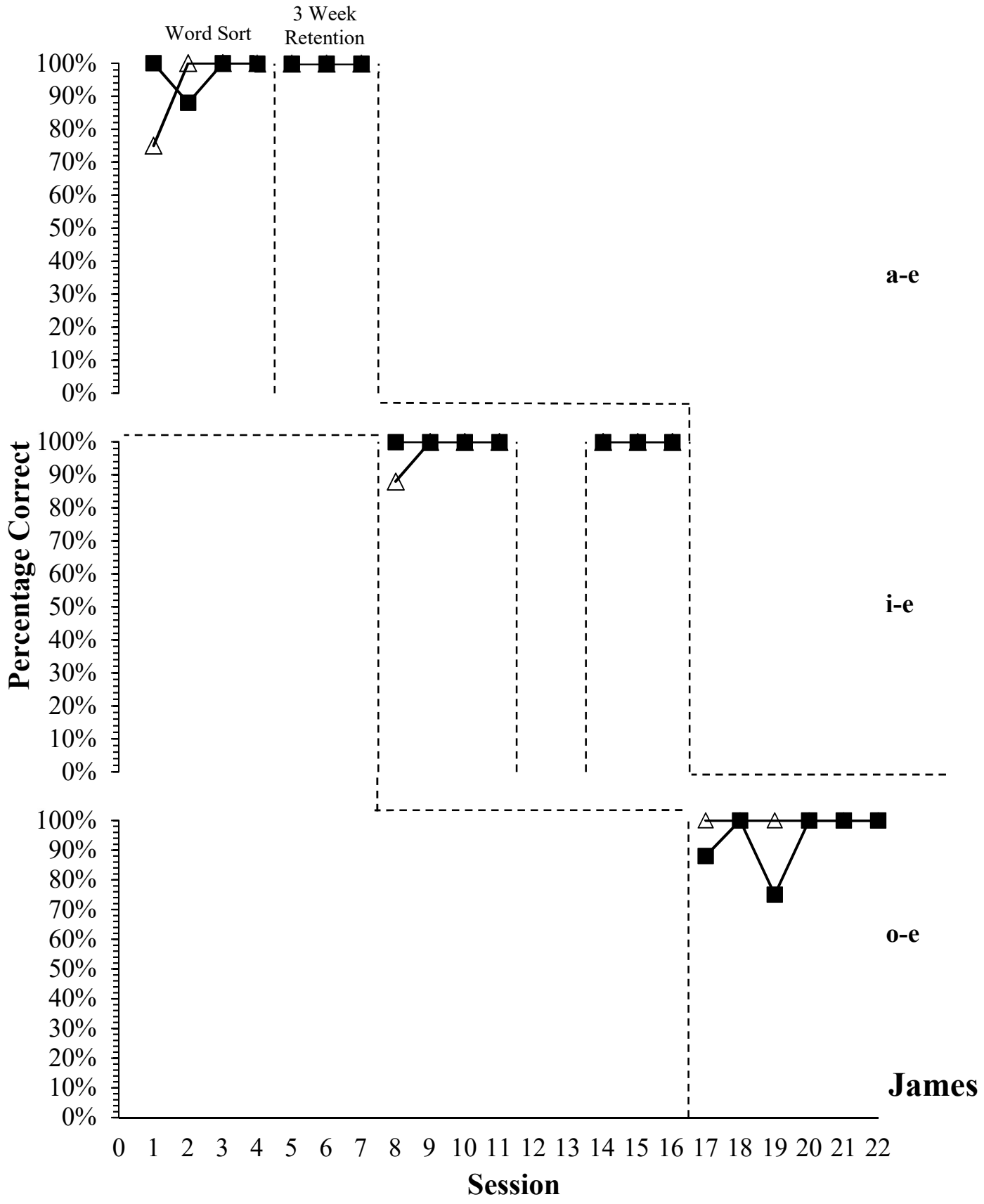

Figure 3 Word Sort Intervention. Closed squares represent reading responses and open triangles represent sorting responses.

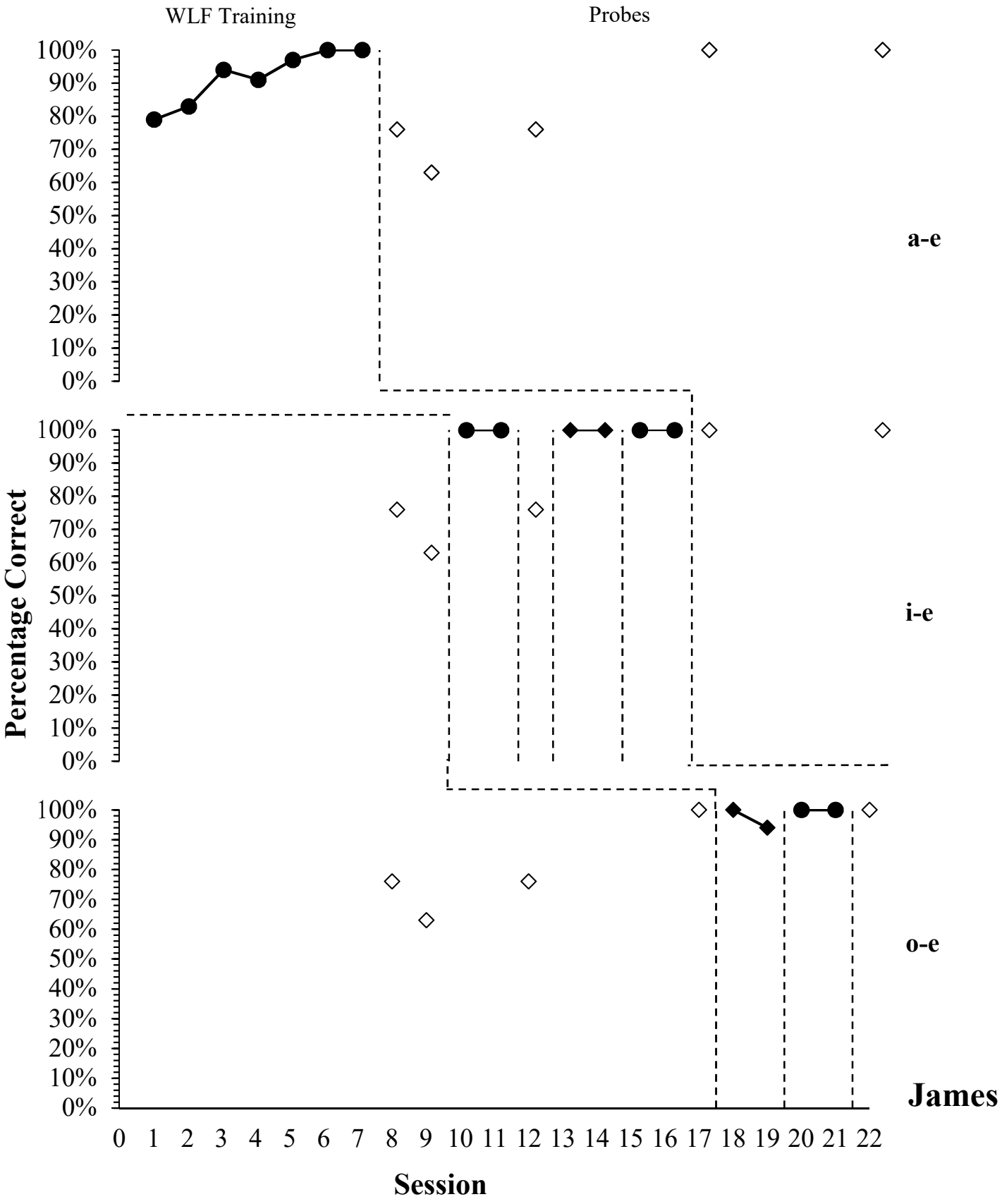

Figure 4 Word List Fluency Training accuracy data. Closed circles represent WLF Training, open diamonds represent baseline and maintenance probes, and closed diamonds represent selection responses.

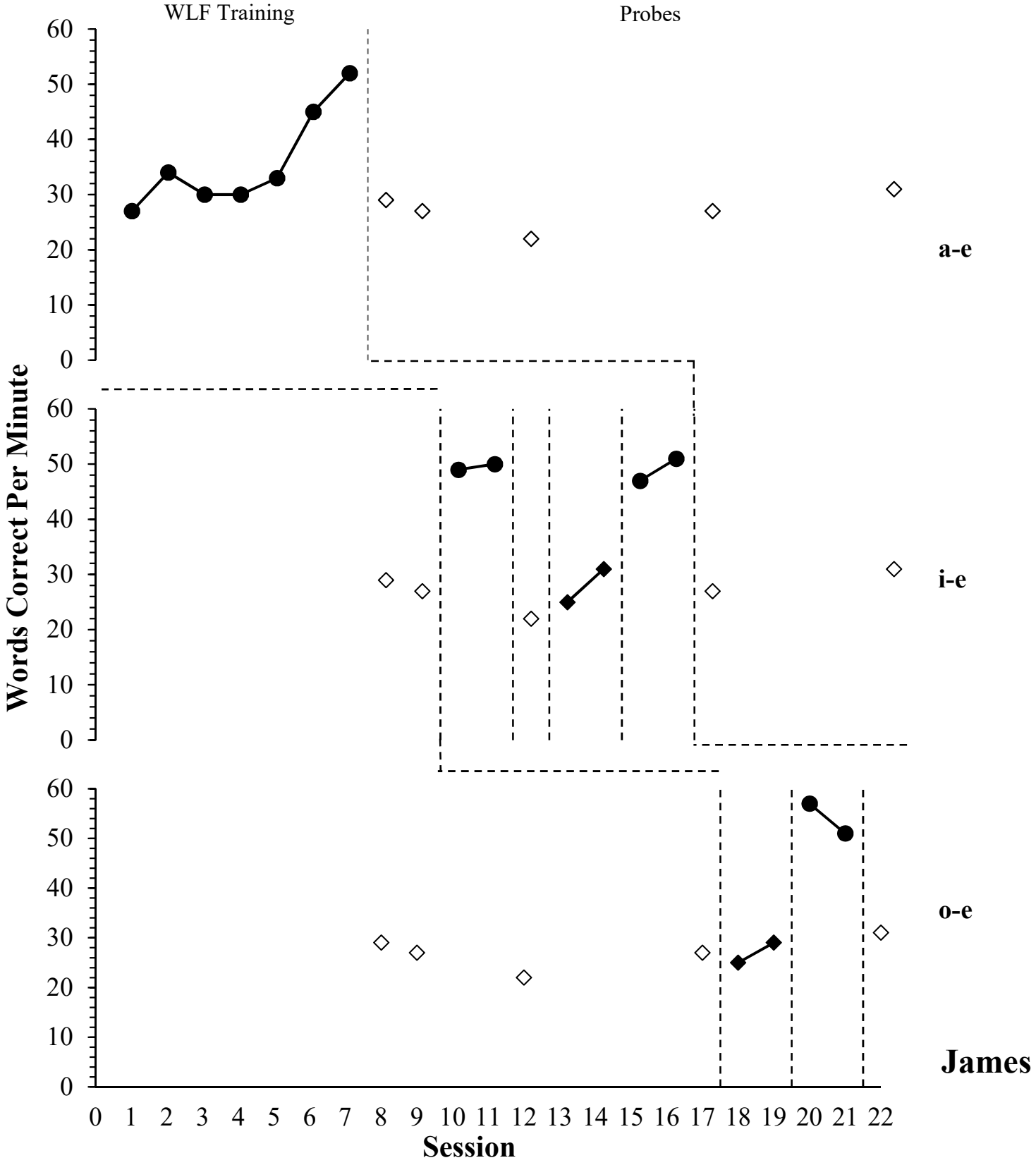

Figure 5 Word List Fluency Training fluency data. Closed circles represent WLF Training, open diamonds represent baseline and maintenance probes, and closed diamonds represent selection responses.

Table 3

Accuracy of Novel/Untrained Words in Connected Text Posttests for James

Target	Pre-Intervention	Post-Intervention
a-e	0/10	8/10
i-e	0/3	3/3
o-e	0/8	6/8

Jason

Figures 6-10 display Jason's responses during probes, training, and pre- and posttests. Figure 6 displays combined data from WLF and Connected Text Pre-Posttests, Word Sort, Probes and WLF Training conditions. Generally, his data show that after meeting the Word Sort mastery criteria for his first word pattern, he met the WS mastery criteria for his second target in fewer sessions. Further, since pre- and posttest data represent Jason's responses to trained, untrained, and nonsense words in lists and passages that contained the target word pattern, they suggest that Jason generalized trained word patterns to novel words in a list and in reading passages. Table 4 summarizes his responses to untrained words (words that were previously identified as unknown) within the Connected Text Posttest. Finally, Jason's mean ORF at his instructional level (first-grade) increased from 66 WCPM pre-intervention to 77 WCPM post-intervention.

Figure 7 displays Jason's percentage of correct responses on pretests and posttests for each of the three target word patterns. During the Connected Text Pretests across all word patterns, Jason had a mean of 36% correct responses per minute (range, 19% to 50%). During the Connected Text Posttests across the two mastered word patterns, Jason had a mean of 94% correct responses (range, 88% to 100%). During the WLF Pretests, Jason had a mean of 44% correct responses per minute (range, 29% to 52%). During the WLF Posttest, Jason had a mean of 71% correct responses per minute (range, 24% to 98%).

Figure 8 displays Jason's percentage of correct responses during the Word Sort (WS) intervention, which occurred after pretests and before WLF Training. During WS training across all target word patterns, Jason had a mean of 84% correct sorting responses (range, 0% to 100%)

and a mean of 74% correct reading responses (range, 25% to 100%). Jason had a mean of 7 sessions to criterion (range, 4 to 11) across all word patterns for WS training.

Figure 9 displays Jason's accuracy during Word List Fluency (WLF) Training and probes, which occurred after WS training and before posttests. During WLF training, Jason had a mean accuracy of 84% across all target word patterns (range, 62% to 100%). Jason had a mean of 7 sessions to criterion (range, 6 to 9) across all word patterns for WLF Training.

Figure 10 displays Jason's fluency during WLF Training and probes. During WLF Training across all target word patterns, he had a mean of 30 words correct per minute (WCPM) (range, 11 to 52). Jason had a mean of 23 WCPM (range, 0 to 42) on probes administered throughout the intervention.

The Survey Level Assessment determined Jason to be at a first-grade instructional reading level. Table 6 displays his ORF scores on the first-grade passages before and after the intervention. Jason had a mean of 66 WCPM (range, 58 to 72) on first-grade passages prior to the intervention and a mean of 77 WCPM (range, 69 to 81) post-intervention.

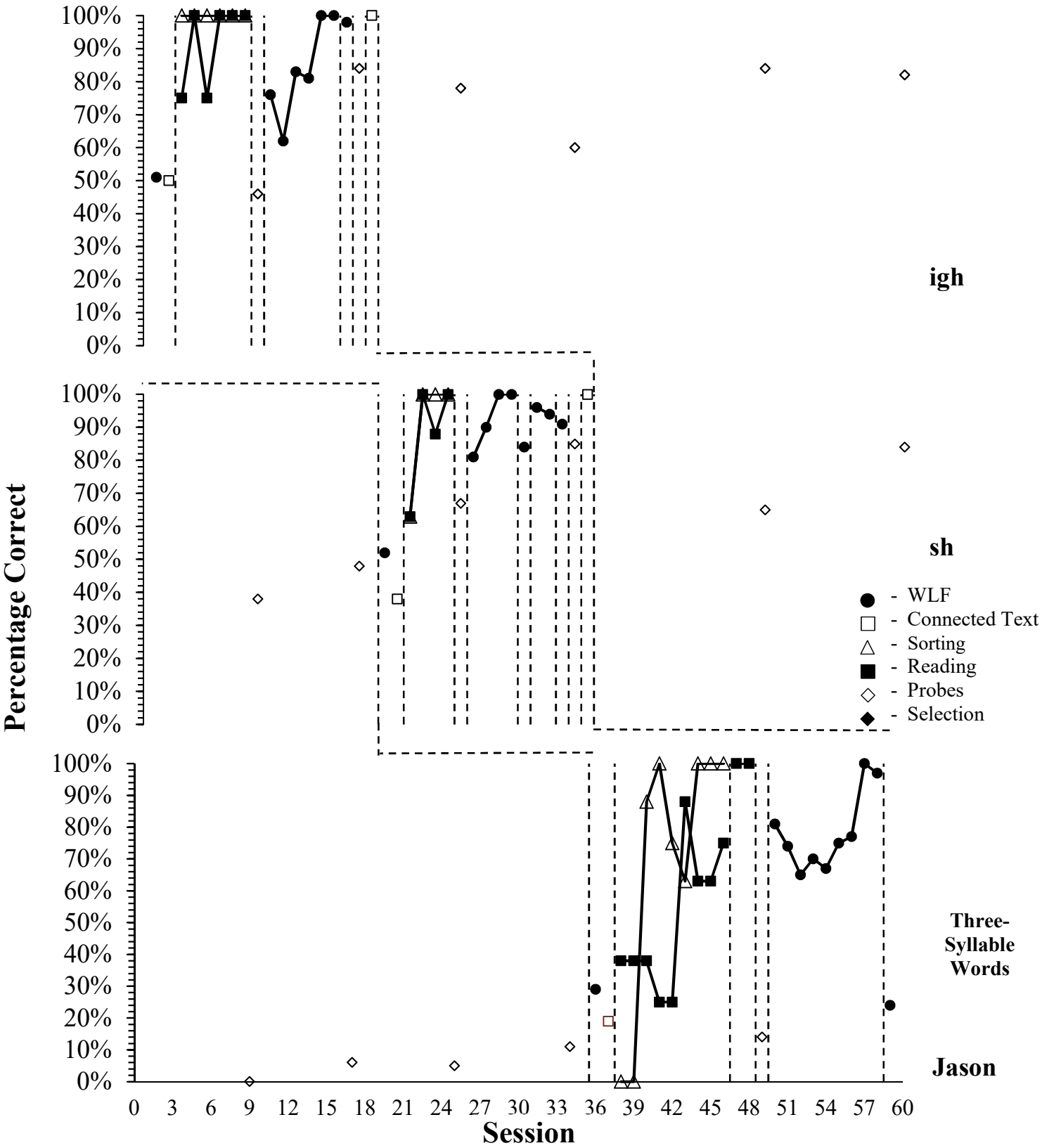

Figure 6 Probes, WLF and Connected Text Pretests, Word Sort, WLF Training, and WLF and Connected Text Posttests.

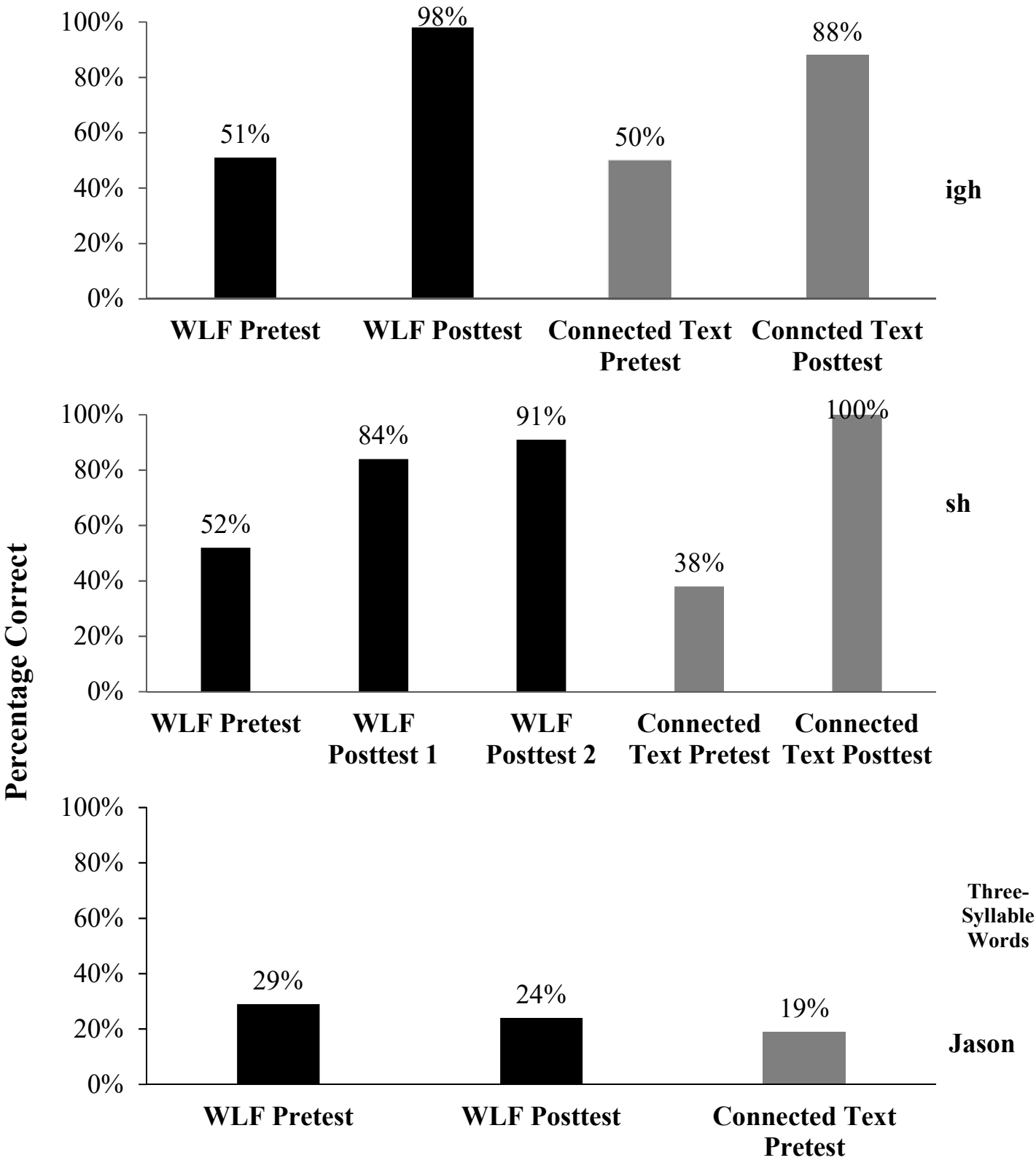

Figure 7 Word List Fluency and Connected Text Pre-Posttests.

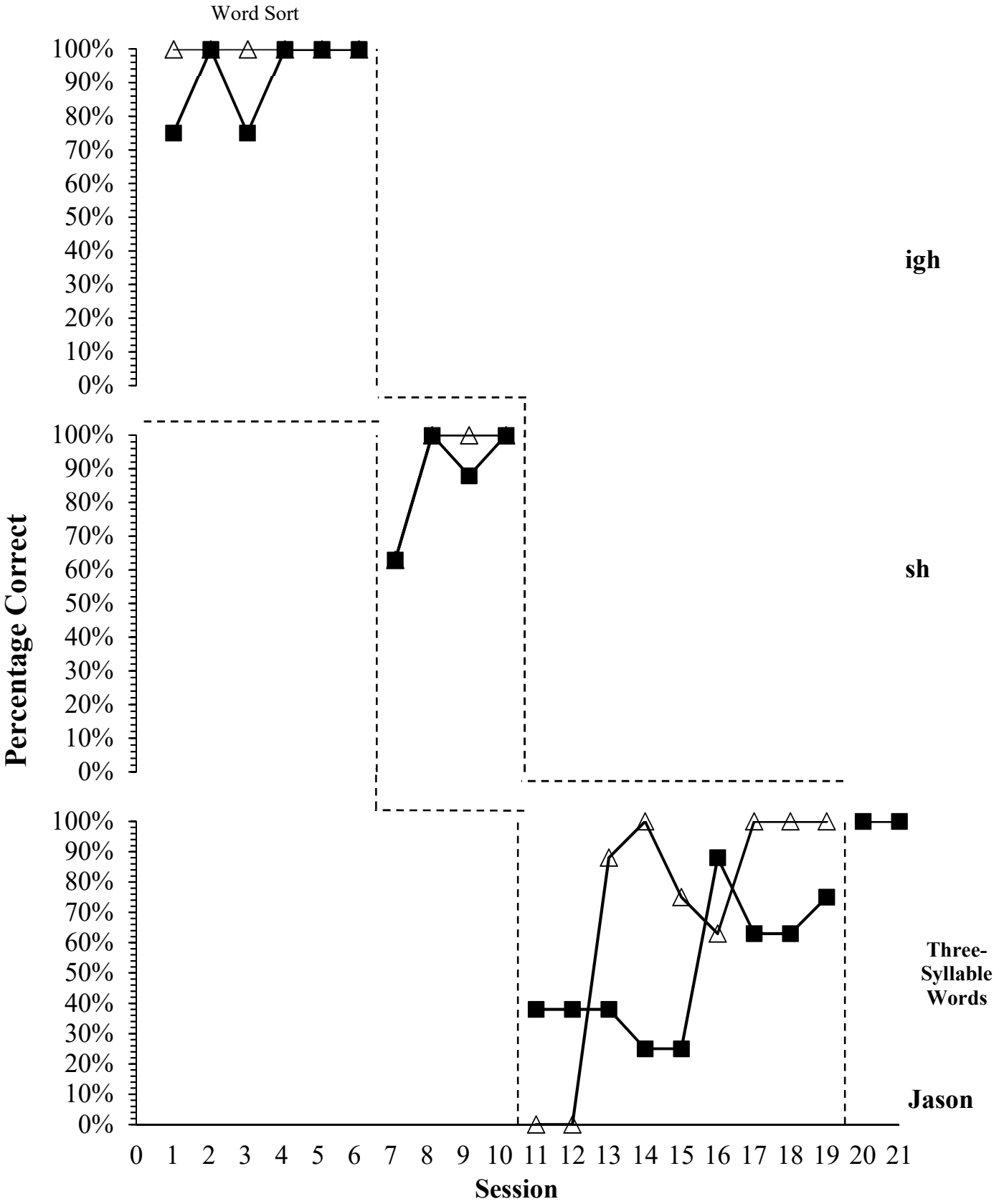

Figure 8 Word Sort Intervention. Closed squares represent reading responses and open triangles represent sorting responses.

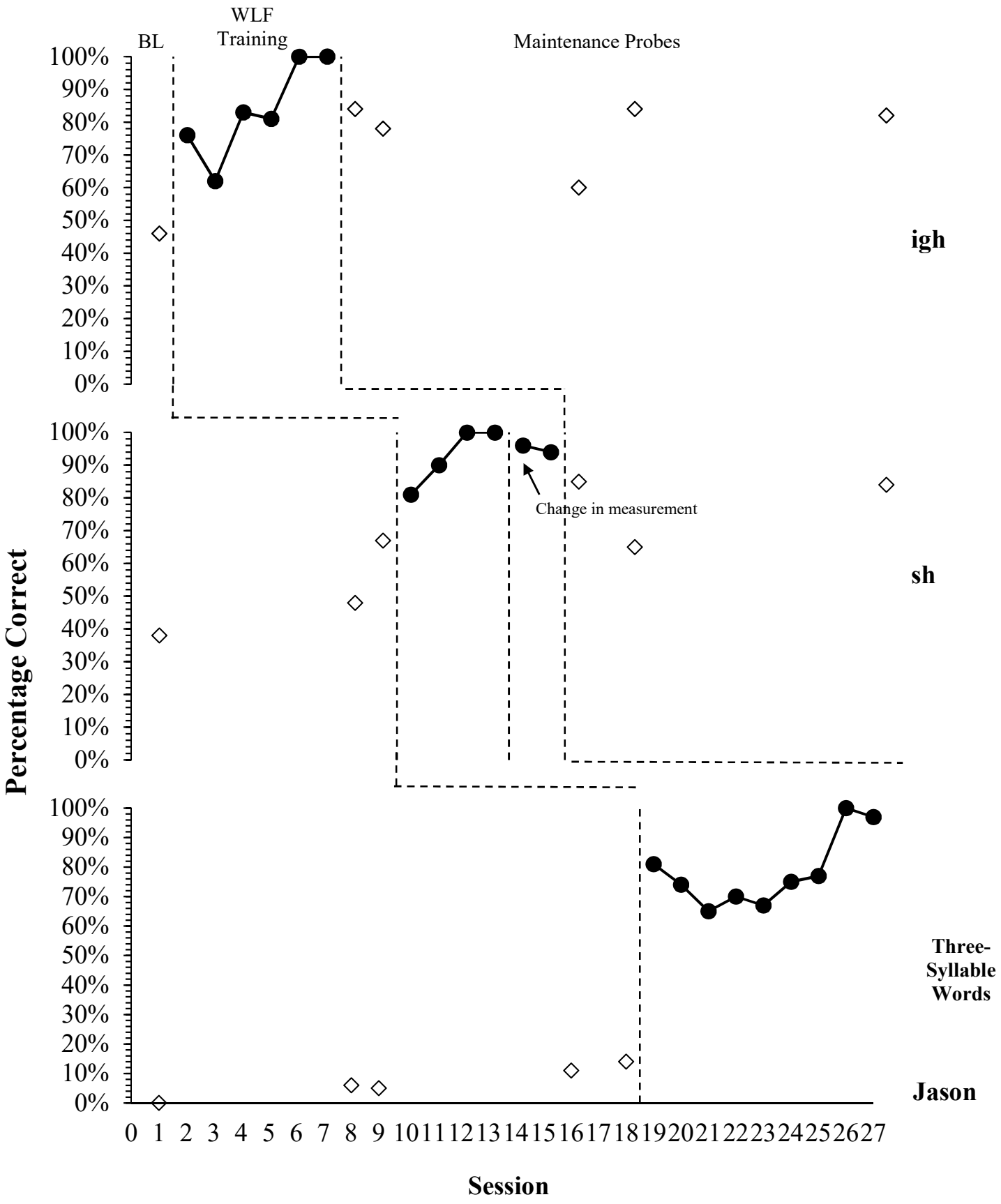

Figure 9 Word List Fluency Training accuracy data. Closed circles represent WLF Training and open diamonds represent baseline and maintenance probes.

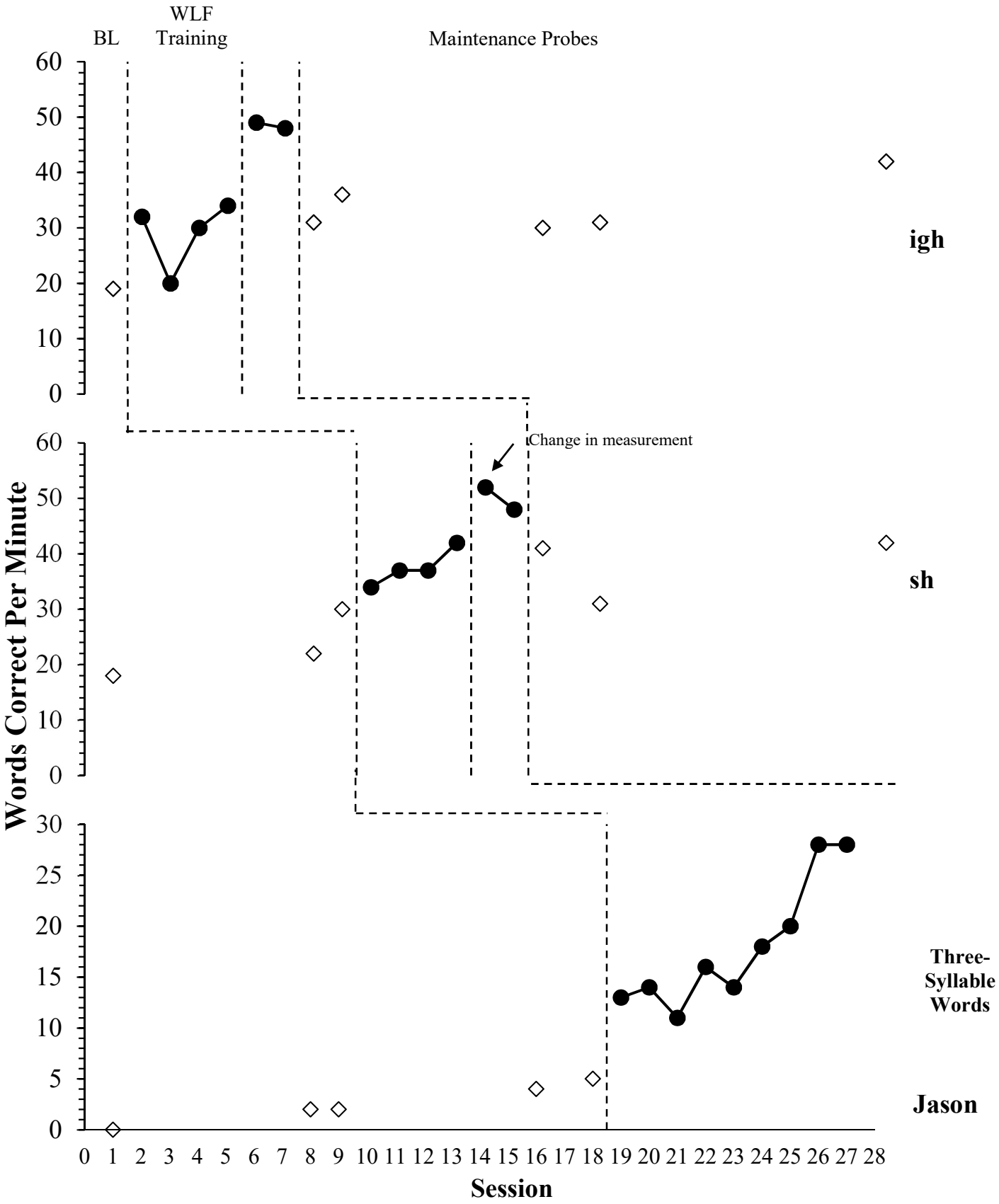

Figure 10 Word List Fluency Training fluency data. Closed circles represent WLF Training and open diamonds represent baseline and maintenance probes.

Table 4

Accuracy of Novel/Untrained Words in Connected Text Posttests for Jason

Target	Pre-Intervention	Post-Intervention
igh	0/3	3/3
sh	0/6	4/6
Three-syllable words	-	-

Gary

Figures 11-15 display Gary's responses during probes, training, and pre- and posttests. Figure 11 displays combined data from WLF and Connected Text Pre-Posttests, Discrimination Training, Word Sort, Probes and WLF Training conditions. Since Pre- and Posttest data represent Gary's responses to both trained, untrained, and nonsense words in lists and passages that contained the target word pattern, they suggest that Gary generalized trained word patterns to novel words in a list and to words in reading passages. Table 5 summarizes his responses to untrained words (words that were previously identified as unknown) within the Connected Text Posttests.

Figure 12 displays Gary's percentage of correct responses on pretests and posttests for each of the three target CVCe word patterns. During the Connected Text Pretests across all word patterns, Gary had a mean of 42% correct responses per minute (range, 25% to 63%). During the Connected Text Posttests across all word patterns, Gary had a mean of 96% correct responses (range, 94% to 100%). During the WLF Pretest, Gary had a mean of 54% correct responses per minute (range, 33% to 87%). During the WLF Posttest, Gary had a mean of 95% correct responses per minute (range, 92% to 98%).

Figure 13 depicts Gary's percentage of correct responses during Discrimination Training across all three target word patterns. During Discrimination Training, Gary had a mean of 98% correct selection responses (range, 88% to 100%) and a mean of 70% correct reading responses (range, 38 to 100%). Gary had a mean of 4 sessions to criterion (range, 3 to 6) across all word patterns for Discrimination Training.

Figure 14 displays Gary's percentage of correct responses during the Word Sort (WS) intervention, which occurred after pretests and before WLF Training. During WS Training across

all target word patterns, Gary had a mean of 98% correct sorting responses (range, 88% to 100%) and a mean of 70% correct reading responses (range, 63% to 100%). Gary had a mean of 4 sessions to criterion (range, 3 to 6) across all word patterns for WS training.

Figure 15 displays Gary's accuracy during Word List Fluency (WLF) Training, which occurred after WS training and before posttests. During WLF Training, across all target word patterns, Gary had a mean accuracy of 86% (range, 57% to 100%).

Figure 16 displays Gary's fluency during WLF Training and probes. During WLF Training across all target word patterns, he had a mean of 42 words correct per minute (WCPM) (range, 19 to 63). Gary had a mean of 18 WCPM (range, 9 to 28) on probes administered throughout the intervention. He had a mean of 15 sessions to criterion (range, 7 to 22) across all word patterns for WLF Training.

Pre- and post-intervention data for Oral Reading Fluency (ORF) are depicted in Table 6. Baseline data were based on the students' performance on the three AIMSweb R-CBM reading probes at his instructional reading level during the survey level assessment. The Survey Level Assessment determined that Gary's instructional reading level to be at the first-grade. Gary had a mean ORF score of 63 WCPM (range, 55 to 67) on first-grade passages prior to the intervention and a mean of 69 WCPM (range, 60 to 77) post-intervention on first-grade passages.

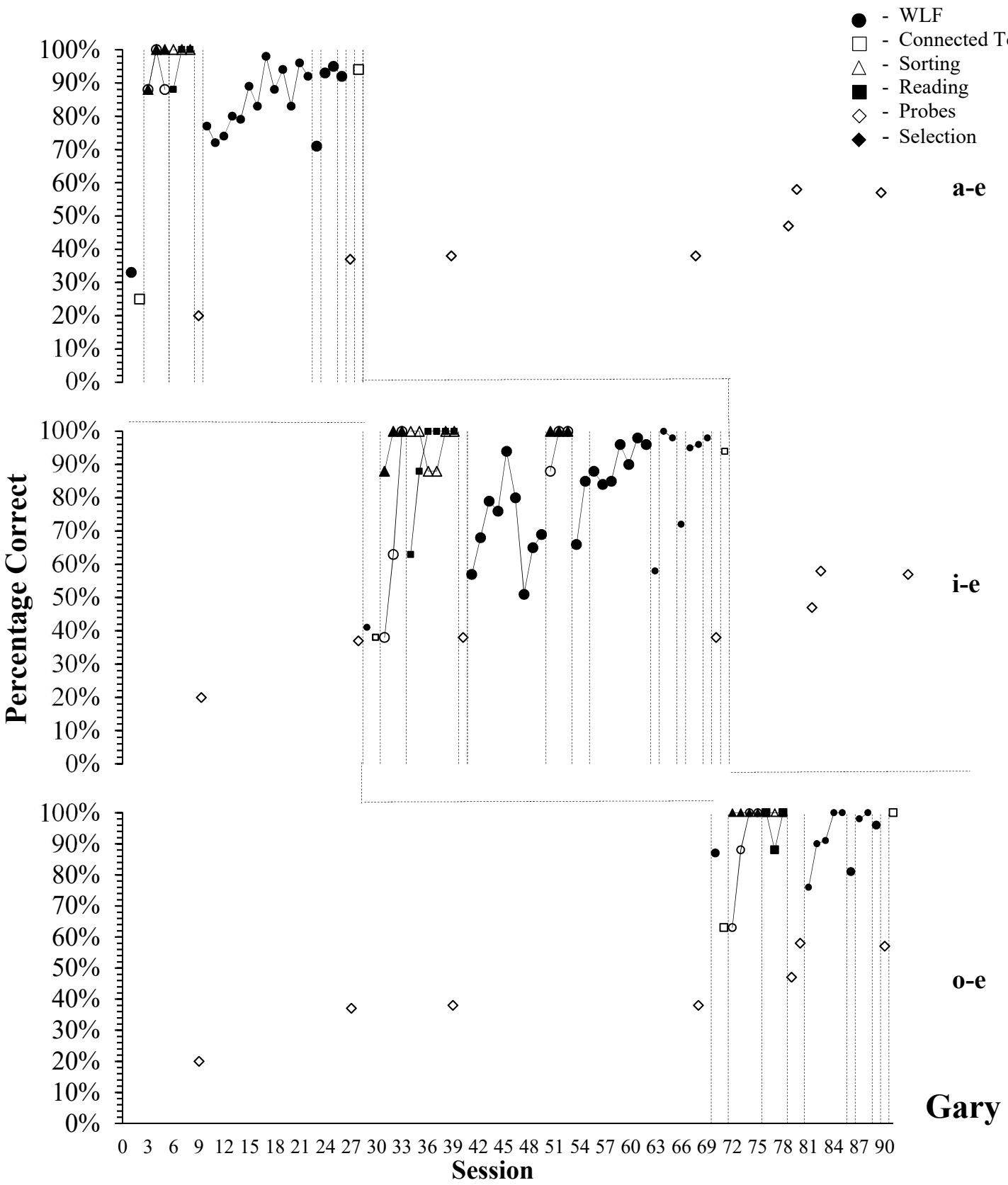

Figure 11 Probes, WLF and Connected Text Pretests, Discrimination Training, Word Sort, WLF Training, and WLF and Connected Text Posttests.

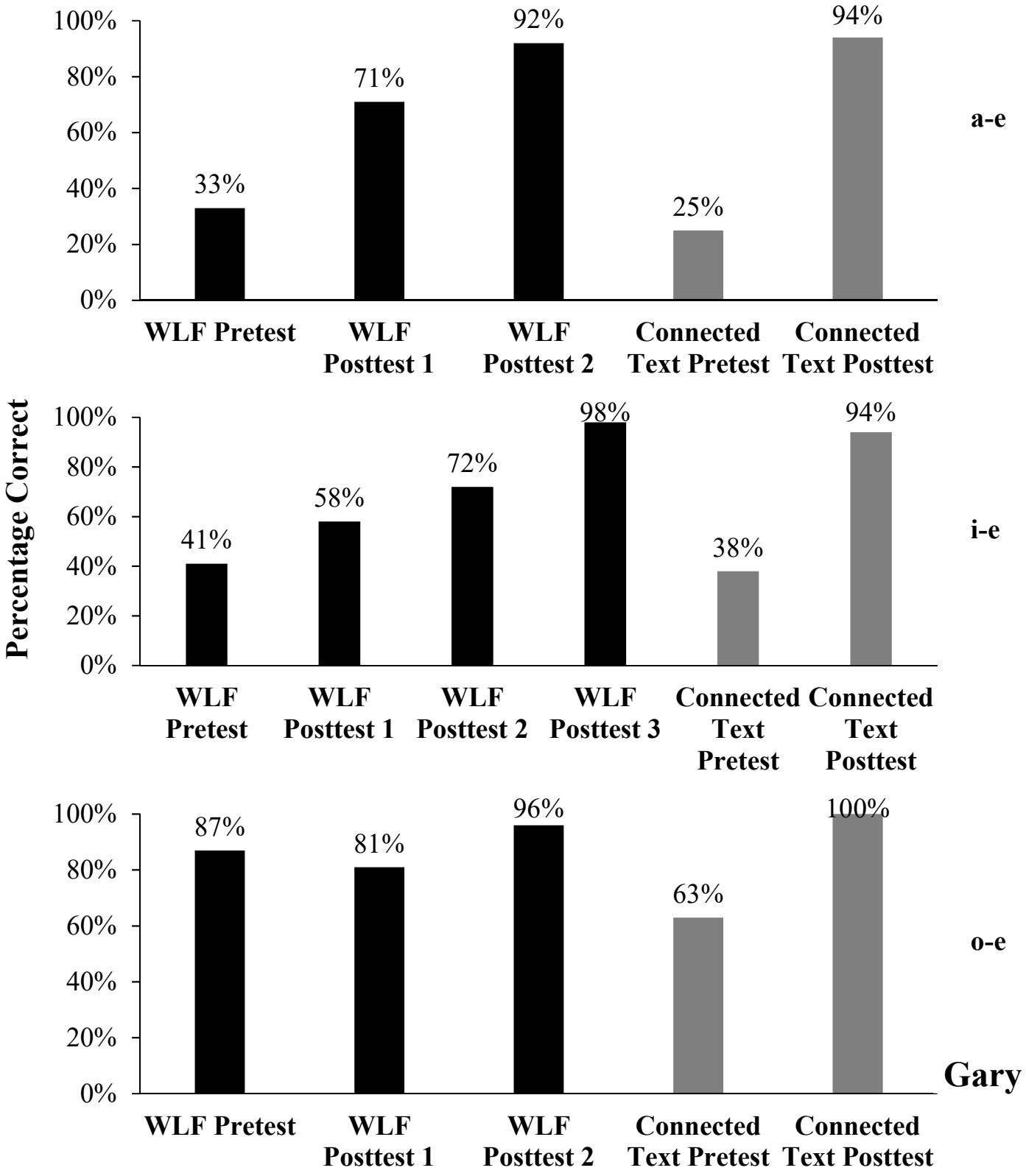

Figure 12 Word List Fluency and Connected Text Pre-Posttests.

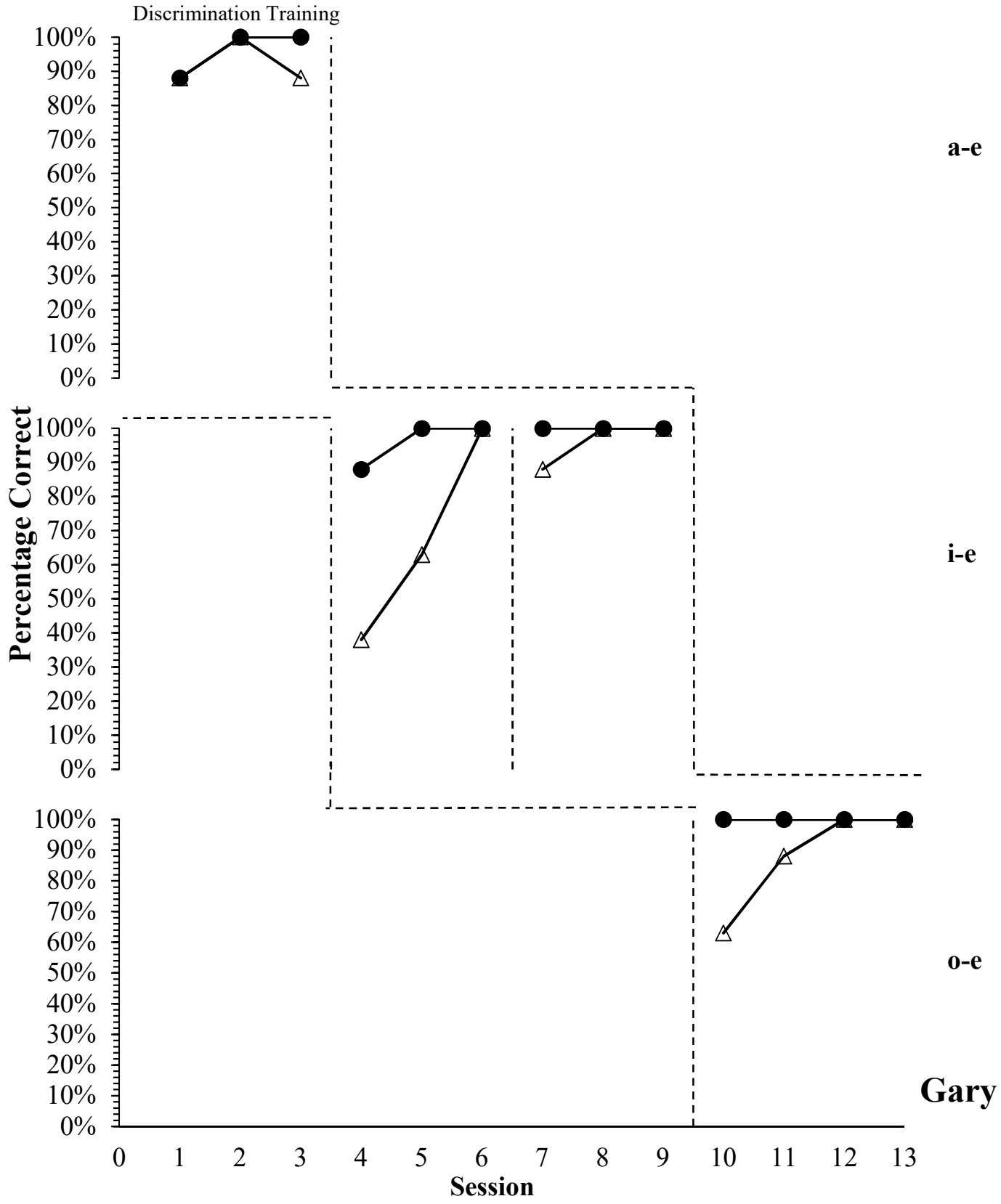

Figure 13 Discrimination Training. Closed circles represent selection responses and open triangles represent reading responses.

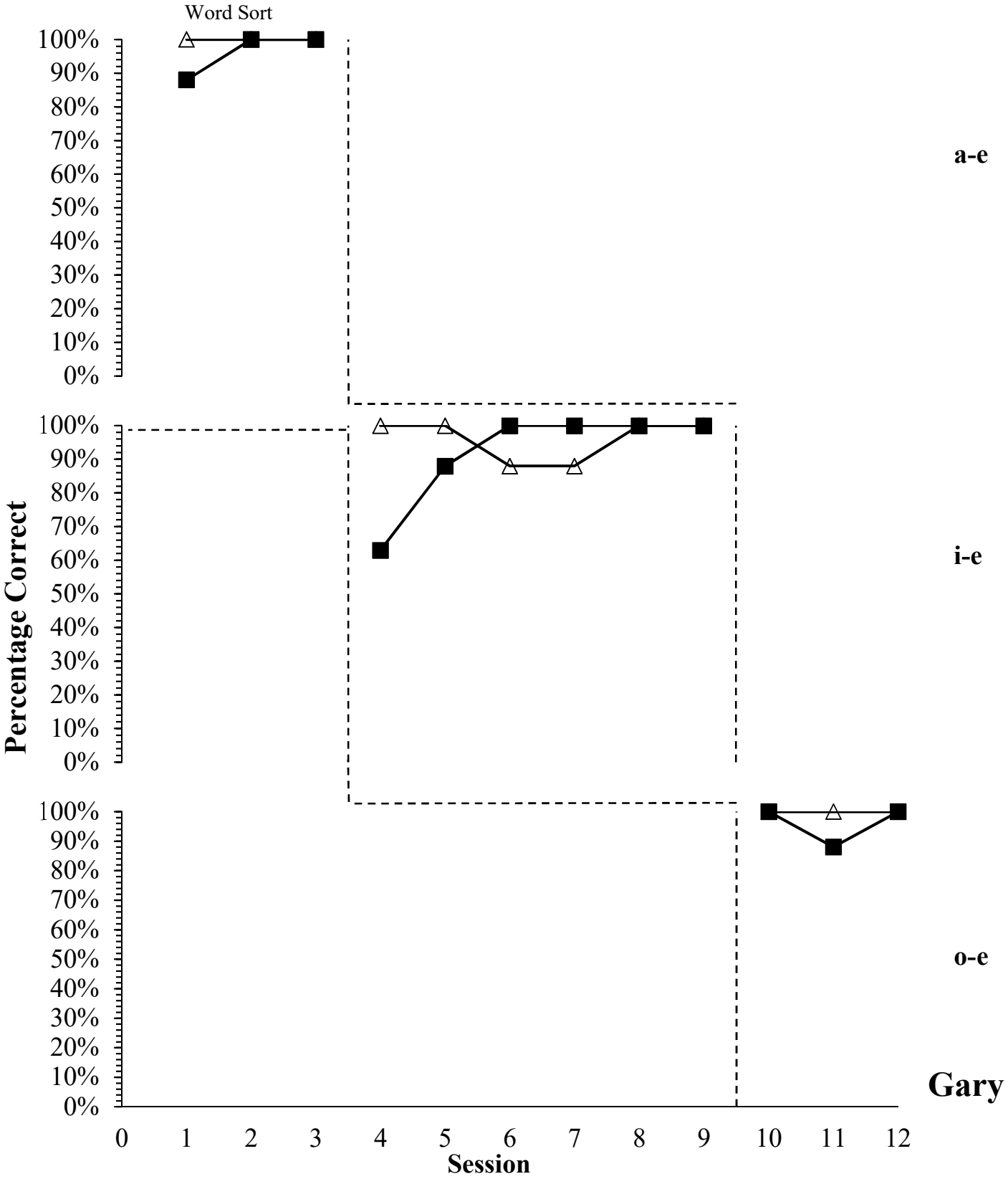

Figure 14 Word Sort Intervention. Closed squares represent reading responses and open triangles represent sorting responses.

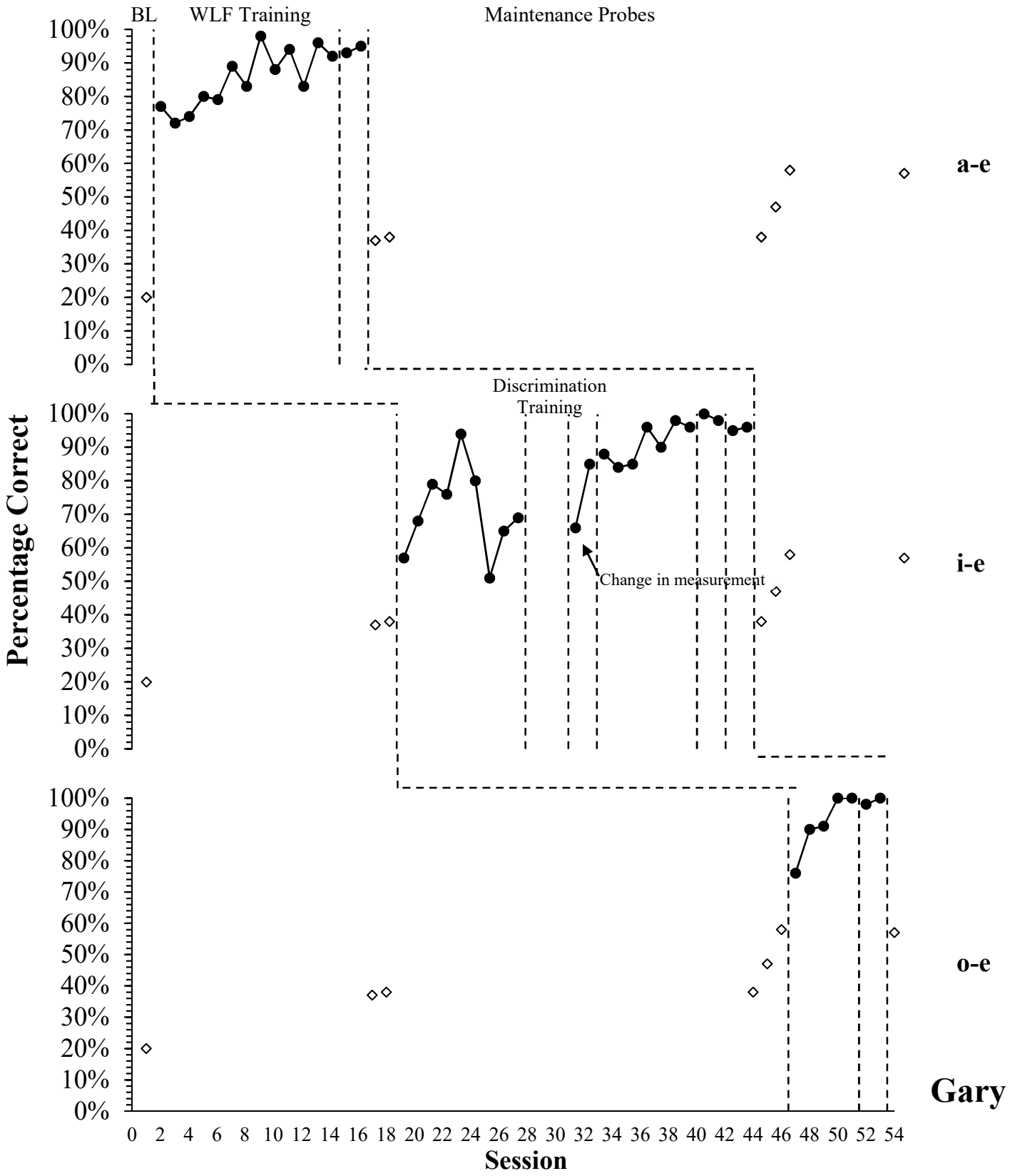

Figure 15 Word List Fluency Training accuracy data. Closed circles represent WLF Training and open diamonds represent baseline and maintenance probes.

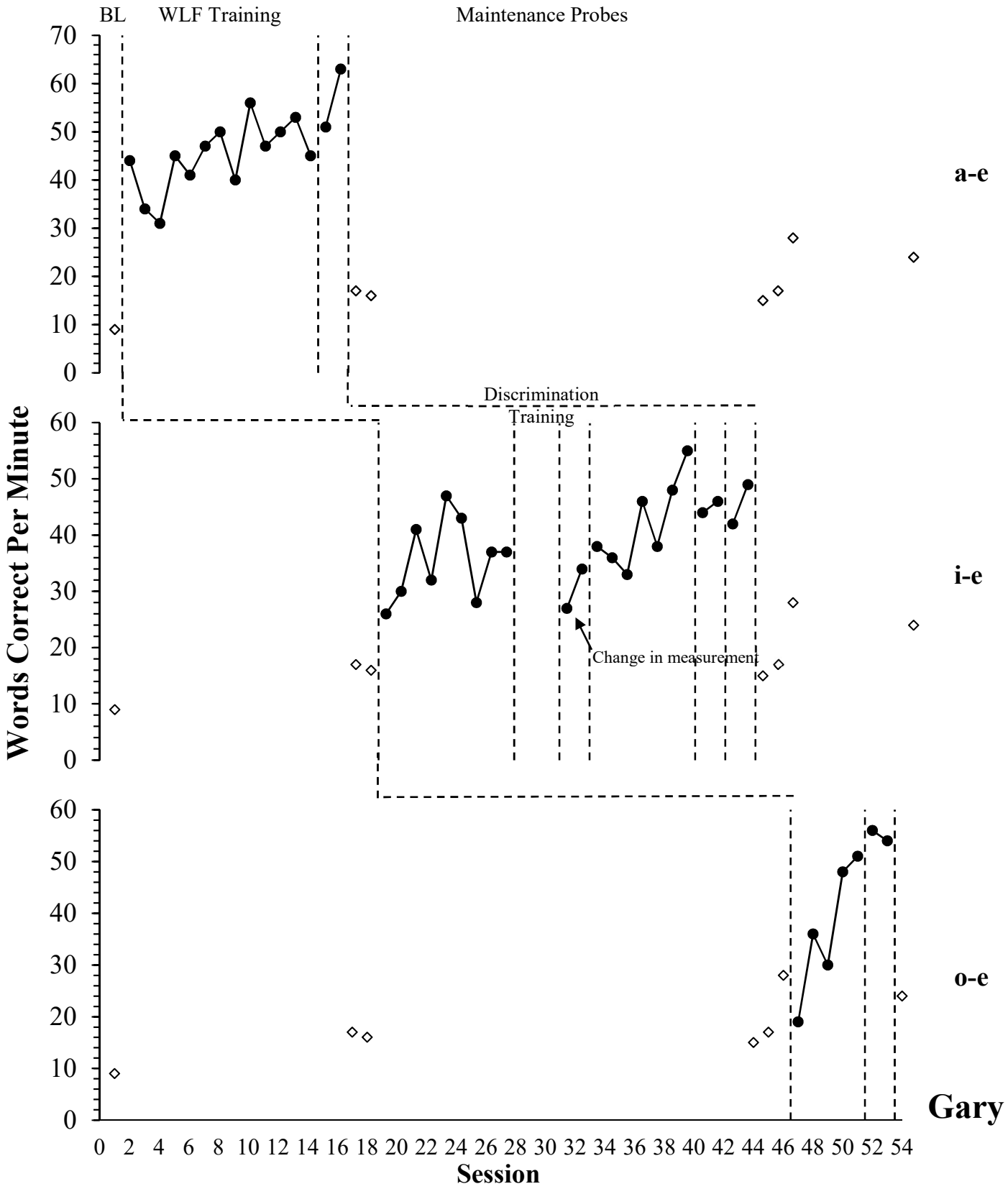

Figure 16 Word List Fluency Training fluency data. Closed circles represent WLF Training and open diamonds represent baseline and maintenance probes.

Table 5

Accuracy of Novel/Untrained Words in Connected Text Posttests for Gary

Target	Pre-Intervention	Post-Intervention
a-e	0/2	2/2
i-e	0/4	3/4
o-e	0/8	7/8

Table 6

Summary of Pre- and Post-Intervention ORF Measures for Each Participant

Participant	Pre-Intervention Mean WCPM	Post-Intervention Mean WCPM
James	105	116
Jason	66	77
Gary	63	69

DISCUSSION

Struggling older readers often have difficulty with early decoding skills. (Tolman, 2005; Toste, Williams, & Capin, 2017). If they are unable to master decoding, they may have difficulty with more complex skills such as passage reading fluency. As previously mentioned, the current study sought to extend research on reading fluency for older students is by evaluating the combined effects of a phonics procedure and a fluency-building strategy on their reading fluency. Participants were three upper elementary and middle school students with below grade level reading performance and deficits in oral reading fluency and decoding. Dependent variables were the percentage of correctly sorted and read words, as well as the accuracy and rate of words read correctly per minute in a passage and on a word list. During the intervention, a modified Word Sort procedure was used to train students to sort and read words containing the target word patterns. Following the initial Word Sort procedure, fluency building was employed by training word reading to a fluency criterion. Connected text passages were then used to assess participants' reading fluency with passages that contained the word pattern. A multiple-probe design across responses was utilized to evaluate the effectiveness of the intervention on the decoding skills and oral reading fluency of participants. Results showed that participants gained target word patterns after Word Sort and Word List Fluency Training.

Major Findings

Overall, this study sought to determine if phonics instruction would improve reading accuracy and fluency for older students with reading delays. It was the intent of this study to answer the following questions: (1) Does Word Sort and WLF Training increase accuracy on target word patterns? (2) Do Word Sort and WLF Training increase fluency on target word patterns? (3) What are the effects of Word Sort on accuracy and fluency on probes containing

nonsense words? (4) What are the effects of WLF Training on fluency on probes containing nonsense words? (5) What are the effects of Word Sort and WLF Training on Oral Reading Fluency on R-CBM passages?

Combined, Word Sort (WS), and WLF Training resulted in increased accuracy and fluency on words containing a mastered target word pattern for all three participants (three for James and Gary, two for Jason). Next, there were no substantial differences between accuracy on probes immediately following WLF Training, or after WS for any of the participants, however, the data show increasing trends in accuracy immediately after the removal of WLF Training for two of James and Gary's mastered targets. While the data do not show an increasing trend in accuracy for all of the mastered targets, accuracy levels remained higher than baseline for all of James' targets, one of Jason's targets, and two of Gary's targets. Also, fluency levels remained higher than baseline for all of James' targets, both of Jason's targets, and for one of Gary's targets. WLF Training resulted in higher fluency gains on probes for both of Jason's mastered targets and one of Gary's mastered targets. It is important to note that probes were only administered immediately after WS and again after WLF Training for James' third target, thus, comparisons cannot be made between accuracy and fluency immediately following WS and after WLF Training. Finally, WS and WLF Training resulted in increased ORF on R-CBM passages for all three participants.

Further, this study attempted to formally evaluate Word Sort (WS) as an intervention for decoding instruction for struggling secondary readers. To date, few studies have evaluated Word Sort as an intervention for decoding. Results suggest that during the WS intervention, which occurred after pretests and before WLF Training, all participants achieved mastery criterion for discriminating between target and non-target word patterns. A stimulus discrimination

intervention to teach prerequisite vowel sounds was only employed with one participant – Gary. For the other participants, repeated practice with the WS procedure resulted in mastered word sounds and patterns.

Practice effects often accompany the use of a repeated reading procedure, however, the experimenter attempted to minimize this by using different stimulus sheets during each WLF Training session. Each session, a stimulus sheet contained four different nonsense words, four different known words, and the same four trained WS words.

Modifications

Although changes in measurement and materials during a study are not ideal from a research design standpoint, clinical modifications are often necessary to best suit the needs of each learner. During the study, modifications were made for Jason and Gary. During WLF Training, although students were appropriately reading the target word pattern (e.g., applying the long vowel sound following instruction), they continued to make errors on other aspects of a word (e.g., given the word "slide" the student read "side"). To avoid punishing correct responding, the definition of correct responding was modified to include the correct application of a target word pattern, even if the entire word was not read as written. For example, given the "shred" and the student read "shed," the response was marked as correct, however, if the student read "sed," the response was marked as incorrect. This change in measurement was done during WLF Training for Jason's first target and Gary's second target and was implemented during remaining WLF Training, WLF, and Connected Text Pre-Posttests. This modification resulted in fewer sessions to criterion for Gary's two remaining targets.

Next, due to consistent errors on nonsense words, there was a change in format for Gary's probes. Initially, probes only contained nonsense words, however, after meeting the Word

Sort mastery criterion for his second target, modified probes containing real words that were previously unknown were included on Gary's probes. This modification resulted in an increasing trend for the remaining probes for all three targets.

Relationship Between Current Findings and Previous Research

This research extends existing research on older readers, decoding, fluency and the Word Sort procedure. Specifically, literature that targets decoding in order to build fluency is limited (Archer et al., 2003; Denton, Fletcher, Anthony, & Francis, 2006; Silva, 2016) and even more so for older students (Archer et al., 2003; Denton & Vaughn, 2010; Scammacca et al., 2007; Toste et al., 2017). When older students are unable to read fluently, they may struggle at the word-level (Archer et al., 2003; Roberts, Torgesen, Boardman, & Scammacca, 2008; Tolman, 2005). That is, they can decode single-syllable words correctly but have difficulty decoding multisyllabic words. Although research is limited, studies that have attempted to increase oral reading fluency suggest that effective fluency intervention efforts should first target sublexical and word-level skills as well as semantic, orthographic, and morphological processes, for struggling readers, both with and without disabilities (Staudt, 2009; Vadasy & Sanders, 2008). The current study identified a procedure – Word Sort plus Word Fluency Training – that may be useful for struggling older readers.

Limitations

This study had some limitations. The first limitation was that the original word list fluency criterion was stringent and prevented students from meeting mastery criterion. For instance, Gary required a mean of 15 sessions to meet mastery criterion. Further, his initial WLF criterion was set at 24 WCPM with no more than two errors. However, he read 44 WCPM and made 13 errors during the first WLF Training session. This limitation was reduced by changing

the mastery criterion to 92%. Second, this procedure may not be useful for more complex skills such as three syllable words. For instance, initially, the experimenter targeted multi-syllabic words for Jason. However, he had difficulty meeting the mastery criteria for Word Sort and required several more practice opportunities than with less complicated sounds. Finally, the assessment that was used to identify target skills before the procedure began did not detect very early reading deficits. For instance, Gary needed to learn long vowel sounds. Thus, a better assessment was required to identify missing prerequisites.

Future Research

Future research should include a fluency criterion or threshold to determine mastery criterion. That is, how many times does a student have to practice a new word pattern to master it? A criterion of stable responding during WLF Training could serve as a more appropriate fluency criterion. Future research should explore additional fluency criterion options. Further, future studies may also compare the effectiveness and efficiency of this procedure to fluency instruction alone because fluency instruction with error correction may be more efficient. Finally, future research might also incorporate multiple exemplars of word patterns (e.g., teach all vowel sounds at once) and response types (e.g., matching, selection, and production of word patterns).

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Appendix A

Assessment and Intervention Protocols

Survey Level Assessment Treatment Integrity Checklist

Student Initials: _____ **Date**: _____ **Experimenter**: _____

Observer/Rater: _____

Description of Behavior	Components Observed		
	Yes	**No**	**N/A**
1. Places the Student Copy of the WLF sheet in front of the student and has Teacher Copy in front of him/her and gives instructions.			
2. Sets the timer for one minute. When the student is ready, says "**Begin**" and starts the timer.			
3. Follows along while the student is reading and marks any errors that the student makes on the Teacher Copy.			
4. If the student hesitates for more than 3 seconds, instructs the student to go to the next word.			
5. At the end of 1 minute says, "Stop" and marks a bracket (]) around the last word read and delivers praise for effort.			
6. Counts the number of errors and subtracts it from the total number of words read.			
7. If the score falls **above the 75th percentile for that grade level** on the first passage (refer to the National Norms below), discontinues the Survey Level Assessment.			
8. If the score falls **within the 25th and 75th percentile for that grade level** on the first passage, administers the remaining 2 passages.			
9. If the score falls **below the 25th percentile for that grade level on the first passage**, administers three passages at the next lowest grade level.			

10. If the median score of those three passages falls **more than 2 words below the 25th percentile for that grade level**, administers the 3 passages for the next lowest grade level.			
11. Repeats Step 10, as appropriate, until the median score falls **within the 25th and 75th percentile for that grade level**.			

Treatment Integrity Summary:
_____ Number of applicable components observed
_____ Percentage of Integrity
Observer Comments:
_____
_____

AIMSweb National Norms

Grade	%tile	Winter WCPM
3	90	162
	75	139
	50	111
	25	84
	10	56
4	90	178
	75	152
	50	125
	25	101
	10	78
5	90	192
	75	168
	50	139
	25	111
	10	87
6	90	204
	75	179
	50	155

	25	131
	10	106
7	90	199
	75	180

	50	155
	25	130
	10	107

Instructional Placement/Levels of Instruction:

Mastery: Mastery level is when student can complete task with 97% accuracy and falls **above the 75th percentile** on national ORF norms.

Instructional: Instructional level is when student falls **within the 25th and 75th percentile** range on national ORF norms.

Frustrational: Frustrational level is when student falls **below the 25th percentile** on national ORF norms.

Word Sort Treatment Integrity Checklist

Student Initials: _____ **Date**: _____ **Experimenter**: _____

Observer/Rater: _____

Description of Behavior	Components Observed		
	Yes	**No**	**N/A**
1. (*When introducing a new WS*) Selects one target word flashcard and one non-target word flashcard.			
2. Places header flashcards at top of table in a row and gives WS instructions and states the rule for the target word pattern.			
3. (*When introducing a new WS*) Models the sorting task and each word flashcard for the target word pattern and has the student repeat each word.			
4. (*When introducing a new WS*) Gives the student one flashcard for each word pattern to independently sort and gives feedback after each one.			
5. (*When introducing a new WS*) Gives the student the remaining flashcards and asks him/her to sort them into the columns.			
6. (*For* WS's *after the introduction of a new WS)* Gives student all flashcards and has him/her sort and read them.			
7. Records errors on data recording sheet.			
8. If student incorrectly reads word or takes over 3 seconds to respond, says the correct word.			
9. Once the student is finished sorting, provides praise.			
10. Reviews any errors the student made and has him/her sort into the correct category.			
11. Repeats WS procedure two more times. Does not preview/read the words on the remaining WS's.			

12. Continues WS condition until student sorts flashcards with 100% accuracy three consecutive times **and** reads target words with 88% accuracy or higher three consecutive times.			
13. Once student meets these criteria, moves to the WLF Probes.			
14. If student does not meet these criteria within **nine sorts**, moves to the Selection Response Condition.			

Treatment Integrity Summary:
_____ Number of applicable components observed
_____ Percentage of Integrity
Observer Comments:
_____
_____
__

WLF Training Treatment Integrity Checklist

Student Initials: _____ **Date**: _____ **Experimenter**: _____

Observer/Rater: _____

Description of Behavior	Components Observed		
	Yes	**No**	**N/A**
1. Places the Student Copy of the WLF sheet in front of the student and has Teacher Copy in front of him/her and gives instructions.			
2. Sets the timer for one minute. When the student is ready, says "**Begin**" and starts the timer.			
3. Follows along while the student is reading and marks any errors that the student makes on the Teacher Copy.			
4. If the student makes an error or hesitates for more than 3 seconds, **immediately** says, "**Go on to the next word.**"			
5. At the end of 1 minute says, "**Stop**" and marks a bracket (**]**) around the last word read. Counts the number of errors and subtracts it from the total number of words read.			
6. Delivers praise, provides feedback on the number of words read correctly, and reviews any missed words.			
7. (*Second and Third Read*) Places the Student Copy of the second WLF sheet in front of the student and has Teacher Copy in front of him/her and encourages student to beat previous score.			
8. Repeats Steps 2-6.			
9. If student beats previous score **and meets fluency criterion, proceeds to WLF Posttest.**			
10. If student beats previous score **but doesn't meet fluency criterion <u>or</u>** doesn't beat previous score, repeats Steps 1-6 with third WLF sheet.			
11. Continues procedure until student achieves the fluency			

criterion two consecutive times, using a different set of WLF training sheets each session.			
12. Once student meets fluency criterion, proceeds to **WLF** Posttest.			
13. If student does not meet the fluency criterion within **nine sessions**, proceeds to the Selection Response Condition.			

Treatment Integrity Summary:
_____ Number of applicable components observed
_____ Percentage of Integrity
Observer Comments:
_____
_____

Selection Response Treatment Integrity Checklist

Student Initials: _____ **Date**: _____ **Experimenter**: _____

Observer/Rater: _____

Description of Behavior	Components Observed		
	Yes	**No**	**N/A**
1. Places the Student Copy of the WLF sheet and a pen in front of the student and has Teacher Copy in front of him/her, and gives instructions.			
2. Sets the timer for one minute. When the student is ready, says "**Begin**" and starts the timer.			
3. Follows along while the student is reading and marks any errors that the student makes on the Teacher Copy.			
4. If the student makes an error or hesitates for more than 3 seconds, **immediately** says correct word and encourages student to continue reading.			
5. At the end of 1 minute, says, "**Stop**" and marks a bracket (**]**) around the last word read. Counts the number of errors and subtracts it from the total number of words read.			
6. Delivers praise and reviews any missed words.			
7. Repeats Steps 2-6 with remaining WLF sheets.			
8. Proceeds to WLF Training Phase.			

Treatment Integrity Summary:
_____ Number of applicable components observed
_____ Percentage of Integrity
Observer Comments:
_____
_____

Discrimination Training Treatment Integrity Checklist

Student Initials: _____ **Date**: _____ **Experimenter**: _____
Observer/Rater: _____

Description of Behavior	Components Observed		
	Yes	**No**	**N/A**
1. **On initial Discrimination Training session**: provides instruction for target long vowel sound.			
2. Delivers specific praise for correct responding.			
3. Provides corrective feedback for incorrect responding.			
4. Places a CVC and CVCe word flashcard in front of student, previews both words, and gives instructions for student to select the appropriate word.			
5. Delivers praise for a correct selection response.			
6. Once student makes a correct selection response, asks student to read the word.			
7. Delivers praise for a correct response.			
8. Provides corrective feedback if student reads word incorrectly.			
9. Repeats with remaining words.			
10. **During sessions following initial Discrimination Training session**: does not preview the words.			
11. Continues until student meets mastery criterion of 88% or above for three consecutive sessions.			

Treatment Integrity Summary:
_____ Number of applicable components observed
_____ Percentage of Integrity
Observer Comments:
_____
_____

Appendix B

Sample Materials

Sample Word Sort Flashcards

sh	other
shrug	self

Sample Word List Fluency Probe – Student Copy

Word List Fluency - Posttest
Student

lope	cofe	dode	goes	dome	those
pone	hone	note	sope	vote	chose
those	dome	goes	dode	cofe	lope
chose	vote	sope	note	hone	pone
those	dome	goes	dode	cofe	lope
chose	vote	sope	note	hone	pone
lope	cofe	dode	goes	dome	those
pone	hone	note	sope	vote	chose
those	goes	cofe	pone	note	vote
lope	dode	dome	hone	sope	chose
pone	hone	note	sope	vote	chose
those	dome	goes	dode	cofe	lope
cofe	dode	dome	those	lope	goes
hone	note	vote	chose	pone	sope
dome	goes	cofe	lope	those	dode
vote	sope	hone	pone	chose	note

Sample Word List Fluency Probe – Teacher Copy

Word List Fluency - Posttest
Teacher

Student Name: Date:

lope	cofe	dode	goes	dome	those	6
pone	hone	note	sope	vote	chose	12
those	dome	goes	dode	cofe	lope	18
chose	vote	sope	note	hone	pone	24
those	dome	goes	dode	cofe	lope	30
chose	vote	sope	note	hone	pone	36
lope	cofe	dode	goes	dome	those	42
pone	hone	note	sope	vote	chose	48
those	goes	cofe	pone	note	vote	54
lope	dode	dome	hone	sope	chose	60
pone	hone	note	sope	vote	chose	66
those	dome	goes	dode	cofe	lope	72
cofe	dode	dome	those	lope	goes	78
hone	note	vote	chose	pone	sope	84
dome	goes	cofe	lope	those	dode	90
vote	sope	hone	pone	chose	note	96

Total Words Read: _____ - # of Errors: _____= CWPM: _____

Sample Connected Text Pretest - Teacher Copy

Student Name:

Date:

Can I stay here for a **while**? The **chime** of the clock woke me up. The grapes are **ripe.** Check out our web **site**. Watch the plane **glide**. There is a big **pile** of trash. My bug **bite** hurts. You should be on my **side**.

The fruit isn't **ripe** yet. Make hay **while** the sun shines. Look at that **pile** of junk. Put the book on the left **side**. I only heard three **chimes**. He took a **bite** of his food. A bird can **glide** in the air. Keep this **site** as a bookmark.

Target words read: /16

Total Time:

Appendix C

HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Institutional Review Board
FWA00007042
IRB00000254

Date: January 17, 2018

To: Denise Ross, Principal Investigator
Gaige Johnson, Student Investigator for Thesis
Student Investigators: Ariana McClellan, Brandi Fontenot, Mya Hernandez, Michael Jones, Katherine Mahaffy, Margaret Uwayo, Garrett Warrilow,

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 15-05-04

This letter will serve as confirmation that the changes to your research project titled "Establishing the Literacy Skills of Students with Reading Delays" requested in your memo received January 17, 2018 (to add $20 compensation to all high school participants who complete the intervention; to remove student investigators Dawnielle Goodwin, Jasmine Jefferson, Mara McAree, Danielle Prentice, and Crescent Townes: to add student investigator Katherine Mahaffy; consent document revised to reflect compensation change) have been approved by the Human Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **June 14, 2018**

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