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THE EFFECTS OF A TREATMENT PACKAGE OF VIDEO SELF-MODELING AND PHRASE DRILL INTERVENTION ON IMPROVING THE READING FLUENCY IN STUDENTS WITH ASD

A Dissertation

Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for

the degree of Doctor of Philosophy

By

Maha Ali Alghamdi

August 2021

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Maha Ali Alghamdi

2021

DUQUESNE UNIVERSITY

SCHOOL OF EDUCATION

Department of Counseling, Psychology and Special Education

Dissertation

Submitted in Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy (Ph.D.)

Special Education Doctoral Program

Presented by:

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B.A. Special education, King Saud University, 2009
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2021

THE EFFETS OF A TREATMENT PACKAGE OF VIDEO SELF-MODELING AND PHRASE DRILL INTERVENTION ON IMPROVING THE READING FLUENCY IN STUDENTS WITH ASD

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ABSTRACT

THE EFFECTS OF A TREATMENT PACKAGE OF VIDEO SELF-MODELING AND PHRASE DRILL INTERVENTION ON IMPROVING THE READING FLUENCY IN STUDENTS WITH ASD

By

Maha Ali Alghamdi

August 2021

Dissertation supervised by Dr. Temple Lovelace

As the incidence rate of students with autism spectrum disorder (ASD) in Saudi Arabia appears to increase, the need for evidence-based reading interventions that focus on the reading development of students with ASD increases. Reading fluency has been identified as a critical component of reading development and has been consistently linked with reading proficiency. Interventions to promote reading fluency in schools in Saudi Arabia have focused on promoting the literacy attainment of typically developed students, disregarding students with disabilities. In this study, a treatment package of video-self modeling and phrase drill has been used to improve the students reading fluency skills. This study used a single-subject multiple baseline design across participants to investigate the effectiveness of the treatment package on the reading fluency skills of students with ASD. Four students with ASD had been selected and

received the treatment package of video-self modeling and phrase drill. Results supported an improvement in the reading fluency skills of the four participants with ASD as evidenced by an increase in the correct words per minute (CWPM) read and a decrease in errors per minute (EPM). With the combination of the video-self modeling and phrase drill method, there was a significant increase in CWPM in all four participants with a moderate to large effect size and a significant decrease in EPM in all four participants with a large effect size. This study provides preliminary evidence of the usefulness of the treatment package in improving the reading fluency skills in students with ASD.

DEDICATION

This Dissertation is wholeheartedly dedicated to my father, Ali Alghamdi, who passed away four years ago and to my mother, Sadia Alghamdi, who has been my source of inspiration and gave me strength when I thought of giving up.

I also dedicate this work to my soulmate, my husband, and my little angel, Tala. You provided the inspiration necessary for me to complete this work and sacrificed immensely along the way. I love you!

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The completion of this dissertation would not have been possible without the encouragement and support of several special people. First. I would like to express my heartfelt thanks to my supervisor Dr. Temple Lovelace. A more supportive and considerate supervisor I could not have asked for. There were several times where I had reached “crossroads” and each time Dr. Lovelace was there to steer me towards the right path. She was prepared to sit and listen to my troubles and always made me feel as if my work mattered.

Besides my advisor, I would like to thank the rest of my dissertation committee: Dr. Ann Huang and Dr. Susan Rattan for their encouragement, insightful comments, and questions. My sincere thanks also go to Dr. Elizabeth McCallum for her motivation, enthusiasm, and immense knowledge.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF ABBREVIATIONS

ADHD	Attention-Deficit/Hyperactivity Disorder
ASD	Autism Spectrum Disorder
CVC	Consonant-Vowel-Consonant
DTPRD	Diagnostic Test for People with Reading Difficulties
EPM	Errors Per Minute
EVT-2	Expressive Vocabulary Test, Second Edition
IOA	Interobserver Agreement
MD	Middle Eastern
NAP	Nonoverlap of All Pairs
ORF	Oral Reading Fluency
PD	Phrase Drill
SLD	Specific Learning Disability
SSD	Single-Subject Design
VSM	Video-Self Modeling
WCPM	Words Correct Per Minute

Chapter 1

Introduction

Special Education in Saudi Arabia

Based on the last report from Saudi Arabia's General Authority for Statistics, the number of individuals with disabilities had reached 1,445,723 by 2017, and the percentage of individuals with disabilities accounts for 7.1% of the total Saudi population. Saudi males account for 52.2% of the total Saudi population with disabilities, whereas Saudi females account for 47.8% (General Authority for Statistics, 2017).

The prevalence of autism spectrum disorder (ASD) in Saudi Arabia has not been determined (Almandil et al., 2019), but it was estimated in 2012 that 42,500 autism cases were diagnosed and reported, with numerous cases remaining undiagnosed (Almandil et al., 2019). Historically, the total number of individuals with ASD in Saudi Arabia was considered to be over 167,000 in 2007, meaning that one out of 167 had been diagnosed with ASD (Alnemary, Aldhalaan, Simon-Cereijido, & Alnemary, 2017). Furthermore, a study conducted in the city of Taif in 2007 reported that 35 of every 1,000 elementary school students (i.e., aged 7 to 12) were diagnosed with ASD. ASD was found in 0.031% of male students compared to 0.004% of female students (Al-Zahrani, 2013).

In Saudi Arabia, the Ministry of Health provides diagnostic and related services to individuals with ASD; the Ministry of Labor and Social Development and the Ministry of Education are responsible for providing education (special education) and related services (Alnemary, 2017; Khodari, 2019). A new trend in special education has created the opportunity for more students to secure services: For example, the number of students with disabilities who used special education services has increased rapidly from 5,208

students in 1992 to 63,461 students in 2015 (Battal, 2016). In 2019, the number of students with disabilities who received special education services amounted to 89,923 students in the kingdom (Ministry of Education, 2019).

Out of those services provided for students with disabilities, 92% are provided in the regular school (private or public), and only 8% are provided in specialized institutions (Al-Mousa, 2010). Furthermore, students with disabilities have received special education services in resource rooms and self-contained classrooms, as well as through consultations and alternative scheduling (Battal, 2016).

Anecdotal and local reports suggested an increase in the prevalence of autism in Saudi Arabia (Zeina, Al-Ayadhi, & Bashir, 2014), although the number of students with ASD in Saudi Arabia who are eligible for or receive special education services in regular school or specialized institutions has not been reported. Multiple public schools (i.e., 746) across the country have special education classrooms for students with mild to moderate disabilities, including intellectual disabilities and multiple disabilities. Additionally, 47 programs are specifically designed for students with mild to moderate autism disorders (Aldabas, 2015). Moreover, specialized institutions and centers for autism are available in Saudi Arabia's major cities (i.e., Riyadh, Dammam, and Jeddah) to meet the special needs of students with ASD, such as the Academy of Special Education, Jeddah Center for Autism, and Prince Faisal bin Fahd Mother's Centre (Zeina et al., 2014).

Autism Spectrum Disorders and Reading Achievement

According to Reutebuch, El Zein, Kim, Weinberg, and Vaughn (2015), the incidence rates of children identified with ASD are on the rise, increasing the number of school-aged children who need specialized services in public schools. Most interventions

in the school setting focus on social and behavioral skills or communication skills and remediation services for students with ASD. Challenging behaviors and communication difficulties for students with ASD have guided previous studies to focus on these skills. However, research has overlooked academic skills, especially reading performance (Reutebuch, El Zein, Kim, Weinberg, & Vaughn, 2015). To date, only sparse information is available regarding evidence-based practices (i.e., must meet rigorous criteria and consistently give positive results for the subject of the study) that target reading fluency skills for students with ASD. The lacking research increases the need for evidence-based academic interventions (Accardo, Finnegan, Gulkus, & Papay, 2017). Furthermore, a wide variety of research has demonstrated that stimulus control interventions, such as the phrase drill (PD) evidenced-based practice, increase oral reading fluency in students with learning disabilities, behavioral disorders, and attention deficit hyperactivity disorder (Reutebuch et al., 2015; Whalon et al., 2009).

McIntyre et al. (2017) found that 68% of students with ASD exhibited moderate to severe reading difficulties, which were directly related to their cognitive and social skills. Additionally, students with ASD may struggle with content-area reading because of their limited vocabulary (Nation, Clarke, Wright, & Williams, 2006). These vocabulary deficits (Roux, Dion, Barrette, & Fuchs, 2015) can hinder their ability to read written text fluently. Students with ASD usually do not understand the full meaning of a text; however, the difficulty with unfamiliar words is subject-specific, as students' vocabulary is developed only in their areas of interest instead of all areas (Roux et al., 2015). Moreover, the lack of using the semantic and syntactical cueing systems, context

clues, and organizational skills (i.e., skills required to support memory while reading challenging texts) results in reading deficits (Senokossoff, 2016).

Some students with ASD might not apply relevant prior knowledge to the text while reading, so they fail to recognize its importance for reading the text or, in some cases, they lack activating relevant prior knowledge (O'Connor & Klein, 2004). Thus, building and accessing background knowledge is challenging for students with ASD (Nguyen et al., 2015). Furthermore, students with ASD struggle with understanding life's daily social cues, so the written texts (e.g., stories) that include social cues could affect their overall understanding (Digiulio, 2012). Ensuring those students interact with their classroom peers is crucial to address these issues and improve their understanding of the meaning of the texts (Digiulio, 2012).

McIntyre et al. (2017) explained the relationship between reading ability and students with ASD's characteristics by demonstrating that autism severity affects students' reading ability. When students' symptomatology is more severe, their reading ability is affected significantly compared to those with mild ASD symptoms. For example, the results of McIntyre et al.'s (2017) study indicated that reading fluency scores were high when ASD symptomatology on the Autism Diagnostic Observation Schedule, Second Edition was low and vice versa.

Reading Fluency

Fluency is a vital skill that bridges word recognition to comprehension. Fluency influences students' reading development and how students are taught and assessed (Kuhn, Schwanenflugel, & Meisinger, 2010) a major key that underlines reading proficiency (Barth et al., 2009). Reading fluency has several definitions. Kuhn et al.

(2010) defined fluency as a combination of automaticity, accuracy, and oral reading prosody. Students are fluent when they have the ability to recognize words and demonstrate appropriate pacing, phrasing, and intonation (Kuhn et al., 2010). Similarly, Klauda and Guthrie (2008) stated that reading fluency has three components: accuracy, speed, and appropriate expression or prosodic features of language (e.g., pitch changes, pause placement and duration, and emphasis). Therefore, students with ASD must retain reading fluency to improve their understanding of the written text. Spending less time and energy on fluency provides more time to enhance students' comprehension ability because if students read fluently, their energy and focus will be directed toward comprehension (Klauda and Guthrie, 2008).

Previous research has suggested that seven factors are primarily involved in establishing reading fluency: naming speed, language comprehension, accuracy, speed, working memory, prosody, and automaticity (Barth et al., 2009; Kuhn et al., 2010). Accuracy is the ability to decode or identify words correctly, whereas speed is the ability to read words faster. Speed is usually measured using Words Correct Per Minute, WCPM (Barth et al., 2009). Kuhn et al. (2010) indicated that automaticity is a critical factor for reading fluency because it contributes to overall reading comprehension capacity. Speed, effortlessness, autonomy, and lack of conscious awareness are required in determining whether a skill is automatized or not. Prosody is defined as appropriate expressions that are coupled with phrasing and allow for the maintenance of meaning (Kuhn et al., 2010). Barth et al. (2009) defined language comprehension as the ability to construct meaning while reading, and they contended that this ability could affect reading fluency in two different ways: reading rate (i.e., the number of words per time) and contextualization

(i.e., reading in a context). Naming speed is the ability to serially name presented stimuli, such as letters and objects, at an appropriate speed. The final factor that affects how the readers read words fluently is the readers' working memory capacity or the ability to simultaneously manipulate and store information during complex tasks (Barth et al., 2009).

Phrase Drill

The relationship between reading fluency and comprehension can be explained by the automaticity theory (Klauda & Guthrie, 2008), which is the foundation of PD. Kuhn et al. (2010) defined automaticity as automatic word recognition. When students can automatically decode words, their ability to effectively read fluently improves, enhancing their reading comprehension and, ultimately, their overall reading development (Perfetti & Roth, 1981). PD has been used in different studies as an additional intervention component or in a package of interventions (Barnes and Rehfeldt, 2013; Jones et al., 2009; Jones and Wickstrom, 2002). However, few studies have used PD as a stand-alone intervention (Begeny, Daly, & Valleley, 2006; Guthrie, 2017; Utley, 2017). PD intervention targets only the error words in a passage that can negatively impact the readers' speed, accuracy, and, ultimately, their fluency (Russell, 2012).

PD is an effective error-correction strategy designed to provide different opportunities to respond and promote the generalization of reading words in written texts (Begeny et al., 2006). Begeny et al. (2006) used PD as a stand-alone intervention for improving reading fluency. They compared two oral reading fluency interventions (PD and repeated reading), which differ in promoting student responses (i.e., the number of opportunities, stability, and accuracy). The researchers used WCPM and words incorrect

per minute or Errors Per Minute (EPM) to assess the child's reading fluency of a passage; the participant had one minute to read the passage. The baseline condition and three separate treatments were evaluated (i.e., PD, repeated reading, and reward). In repeated reading, the participant read a passage twice before the researchers assessed oral reading fluency. As for PD, the researchers allowed the participant to read a passage once and then practice each missed word by repeating the phrase (three to five words) that contained the error word correctly before moving to the next word (Begeny et al., 2006). The study outcomes revealed that PD and repeated reading improved the participants' reading fluency equally well relative to both reward conditions and the baseline (Begeny et al., 2006).

Video Self-Modeling

Video Self-Modeling (VSM) is a video modeling strategy similar to other basic video modeling types, such as video prompting modeling, video modeling, and point-of-view video modeling strategies (Buggey, 2009). Each of these types differs by the goals and procedures (Ulker, 2016). With other types of video modeling, the student watches a video of a peer performing the skill or behavior needed; however, with VSM, the student watches themselves performing a target skill or behavior successfully (Cihak & Shrader, 2009; Marcus & Wilder, 2009). Furthermore, studies have shown that VSM yields more positive outcomes for target skills and behaviors because individuals tend to be more engaged by videos of themselves and learn self-efficacy in the process of making their own VSM projects (Cihak & Shrader, 2009; Marcus & Wilder, 2009). Montgomerie, Little, and Akin-Little (2014) examined the effects of VSM on oral reading fluency of four 3rd graders who struggled with reading. Participants were recorded using a digital

video camera, and the videos were edited using video editing software. The final video durations were 1 to 3 minutes. The researchers used multiple baselines across participants design and used WCPM as the measurement of oral reading fluency. For 2 weeks, the participants viewed the final videos in a room without distractions and then were compared to their baselines. The results showed that three out of the four participants' oral reading fluency significantly improved.

Problem Statement

Regardless of the increasing number of students with ASD worldwide, Asberg, Dahlgren, and Dahlgren-Sandberg (2008) argued that research that focuses on reading interventions for these students is lacking, especially regarding oral reading fluency. According to the U.S. Department of Education (2013), the past 20 years of reading research has mostly focused on general reading difficulties instead of orienting those difficulties toward specific groups of students, such as those with ASD. Whalon, Al Otaiba, and Delano (2009) suggested that because reading intervention research focusing on students with ASD is still in the preliminary stages, more research is needed. For instance, in the area of literacy, reading interventions for students with ASD are sparse (Reutebuch et al., 2015). Furthermore, evidence-based reading practices for students with ASD are needed to enhance their academic performance (Accardo et al., 2017).

In inclusive settings, students with ASD's reading assessment scores are lower by an average of one grade level (McIntyre et al., 2017). Furthermore, reading comprehension assessments of students with ASD indicate their comprehension performance is compatible with or below their cognitive level, verbal ability, or age level (O'Connor & Klein, 2004). Additionally, atypical reading abilities are frequently

identified in students with ASD due to the cognitive differences in language (Howard et al., 2017). Roux et al. (2015) asserted that students with ASD could not understand the meaning of a text or complex stimuli.

Purpose and Research Questions

Researchers have adequately documented that individuals with ASD benefit from visual support and error-correction strategies (Leach & Rodecki, 2013; Utley, 2017). VSM, a relatively new intervention, is well suited to address the educational needs of students with ASD because it capitalizes on the observational learning concept (Delano, 2007; Wu & Gadke, 2017). Additionally, VSM, as a visual learning method, is effective with individuals with ASD because it focuses on individuals' strengths rather than weaknesses, and it promotes self-efficacy (Lee, Lo, & Lo, 2017).

PD, an effective error-correction procedure, is designed to provide different opportunities for responding and promote generalizing reading words in a text (Guthrie, 2017). PD's overall goal is to increase students' reading and the accuracy pace to help them become fluent readers (Begeny et al., 2006). PD has been found to improve the reading performance of students who struggle with reading (Guthrie, 2017).

Given the emerging use of VSM as a reading intervention, researchers can investigate and develop numerous areas, specifically using VSM in oral reading fluency interventions. The literature reviewed previously has yet to investigate VSM's impact compared to other evidence-based reading interventions (e.g., PD). Thus, utilizing a single-subject design, the present study aimed to add to the literature by (a) investigating whether the treatment package incorporating VSM and PD is effective in improving Oral

Reading Fluency (ORF) in students with ASD and (b) evaluating the social validity of the treatment package.

Accordingly, three research questions are explored:

1. Is the treatment package significantly effective in improving ORF in students with ASD?
2. To what extent will the effects of the treatment package on reading fluency skills for students with ASD be maintained over time?
3. To what extent is the treatment package consisting of VSM and PD socially valid?

Chapter 2

Literature Review

Autism Spectrum Disorder Characteristics

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that includes functional impairments, such as social interaction, communication, and repetitive behavior patterns (Ignatova, 2013). According to the Central of Disease Control and Prevention's Autism and Developmental Disabilities Monitoring Network, one in every 59 children from all racial, ethnic, and socioeconomic groups was diagnosed with ASD in 2014, and diagnosis is four times more common among males than females (Baio et al., 2018). The increasing prevalence of ASD has been attributed to changes in diagnostic capability (improved detection), changes in diagnostic criteria (expanding the definition of autism), and changes in therapeutic practice (Ignatova, 2013).

ASD is characterized by deficits in communication and socialization (Ludlow, Wilkins, & Heaton, 2006; Utley, 2017). Children with ASD might exhibit repetitive and restrictive behaviors, obsessions, and intense interests (Reisener, Lancaster, McMullin, & Ho, 2014). These children are also sensitive to visual and other sensory stimuli (Ludlow et al., 2006). ASD's characteristics often impact their ability to access general education, which might have a direct influence on their ability to understand class instructions or materials (Guthrie, 2017; Reisener et al., 2014; Utley, 2017). The social and communication deficits can affect various skills of students with ASD, including reading skills, and ultimately impact their overall academic achievement (Utley, 2017).

Although individuals with ASD vary in their intellectual abilities, they can learn to read (Ludlow et al., 2006). Students with ASD can usually master the following

academic areas: phonetic analysis, simple encoding, synthesis procedures, and rote memory (Guthrie, 2017). However, some students with ASD demonstrate difficulties when learning to read (Asberg et al., 2008). Although children with ASD have skills similar to their typically developed peers (e.g., memory, attention, simple language, and visual-spatial skills), they often exhibit deficits in memory, language, and reasoning skills (Guthrie, 2017).

Literacy

Literacy is defined as the ability to read and write effectively in one's language (Guthrie, 2017). The scope of literacy has recently expanded to include the ability to adequately read, write, speak, and complete other language tasks related to everyday life (Kenna, Russell, & Bittman, 2018). Thus, literacy comprises reading fluency and reading comprehension (Barnes & Rehfeldt, 2013). Ignatova (2013) found a solid connection between communication, employment, culture, access to education, and literacy. Acquiring literacy skills early can establish a robust foundation for lifelong learning because skilled young readers usually encounter positive academic outcomes and experience fewer emotional and behavioral difficulties compared to their peers with reading difficulties (Bailey, Arciuli, & Stancliffe, 2017).

In the United States, poor literacy skills among K–12 students have been well documented (Kenna et al., 2018) and have caused significant concern for several years. For example, students aged 15 in the United States were ranked 15th in the administration of international assessments of reading literacy among students across all developed countries in 2011; no sign of any measurable gain from previous years' results was indicated (Swanson et al., 2016). In 2013, approximately 64% of eighth-grade

students tested were at or below the basic performance level in reading (Kenna et al., 2018). The national assessment in 2009 showed that only 32% of eighth-grade students and 38% of 12th-grade students scored in the proficient range in reading ability (Swanson et al., 2016). The current knowledge regarding literacy development has emphasized that a student developing literacy and language skills early in life is associated with later reading achievement (Fleury & Schwartz, 2017).

Asberg et al. (2008) argued that limited literature on the literacy of students with ASD had been conducted. The literacy goal for students with ASD is to read and write adequately, and these students cannot comprehend or be actively engaged with the curriculum or knowledge provided to them without literacy (Guthrie, 2017). The current research on conventional literacy skills of students with ASD has increased, but knowledge is still lacking regarding what skill development looks like and what constitutes early literacy instruction (e.g., information is lacking regarding the predictive value of early literacy skills) for students with ASD and other severe disabilities (Fleury & Schwartz, 2017). However, further research on literacy for students with ASD has been recommended (Barnes & Rehfeldt, 2013). Strengthening reading skills and overall literacy development is key for overall development for children with ASD (Guthrie, 2017).

Reading Skills and Autism Spectrum Disorder

Students with ASD exhibit behavioral, social, and academic difficulties that affect their educational experience. Thus, individuals with ASD can benefit from explicit instruction and additional support in academics, social skills, behavior, and communication (Leach & Rodecki, 2013). Reisener et al. (2014) stated that ASD

characteristics, such as repetitive behaviors, communication deficits, and lack of motivation in addition to mood disorders and anxiety, could disturb the learning process and decrease the academic success of students with ASD. This challenge especially holds true for students with ASD placed in inclusive settings (Reisener et al., 2014).

Reading fluently is a fundamental skill for all students, and fluent readers demonstrate better reading comprehension skills than dysfluent readers (Morgan, Sideridis, & Hua, 2012). However, many children with ASD have difficulty with reading fluency (Reisener et al., 2014). In 1997, the U.S. Individuals with Disabilities Education Act (IDEA) increased the number of educators who were involved with students with ASD, which increased the need to support the academic needs of students with ASD (Ignatova, 2013). Students with autism (particularly with an average to high IQ) are progressively being placed in general education classrooms and engaging in academic curricula, leading educators to become familiar with the ASD population and how to interact with students with autism (Ignatova, 2013).

Students with autism commonly struggle with learning two essential reading skills: reading fluency and reading comprehension (Roux et al., 2015). Various studies have recently examined the reading development of students with ASD and suggested that these difficulties are due to trouble with oral reading fluency (Ignatova, 2013; Solari et al., 2017). A deficit in a student's cognitive domain, particularly processing speed, may affect their fluency. These processing-speed deficits have been associated with impairments in social communication, which is a predominant characteristic of autism (Solari et al., 2017). In order to become fluent readers, students must quickly and accurately read and decode words in a passage (Guthrie, 2017).

Prevalence and placement of students with an autism spectrum disorder. The number of children with disabilities (including ASD) receiving special education services in Saudi Arabia has been significantly increased between 2015 and 2019, with over a 70% increase for individuals between the ages of 6 and 19. The majority of students with disabilities (92%, including ASD) attend public or private general education schools (Al-Mousa, 2010). This statistic indicates that students with ASD spend some of their time in school attending general education classes. However, the data regarding the amount of time spent in general education classrooms for students with ASD in Saudi Arabia has not been documented.

Students with ASD in special education settings (e.g., self-contained classrooms) have limited access to instructional services and other activities that can promote literacy acquisition (McIntyre et al., 2017). Moreover, excluding students with ASD can hinder their ability to acquire and develop reading skills that contribute to their successful educational experience (Reisener et al., 2014). In the United States, a considerable percentage (51.3%) of students with ASD spend less than 80% of their school day in a general education classroom (Guthrie, 2017). Students with ASD placed in inclusive settings achieve lower scores in reading assessments, and they are one grade level behind their peers without disabilities in reading (McIntyre et al., 2017).

Evidence-based reading practices. Although the number of children diagnosed with ASD has drastically increased worldwide, limited research has focused on reading interventions and reading skills, including reading fluency or reading comprehension for these students (Asberg et al., 2008). Over the past 20 years, studies focal points have been on reading deficits in general; however, little attention has been oriented to reading

difficulties specific to students with ASD (O'Connor & Klein, 2004; Senokossoff, 2016). Recent studies have focused on the academic skills of students with ASD, such as on-task behaviors, attention, motivation, computer-assisted technology, and instructional modifications, whereas fewer studies have focused on interventions and strategies that improve the reading level (specifically the ORF) of students with ASD (Guthrie, 2017; Reisener et al., 2014; Utley, 2017). Previous studies that aimed to improve the reading performance of students with autism have not focused on the ORF, although ORF is a fundamental skill that facilitates comprehension (Reisener et al., 2014). In addition to the aforementioned gap in the literature, the challenging behaviors and lacking communication skills of students with ASD have led researchers to focus on these skills and overlook academic underachievement, for example, reading comprehension and reading fluency (Reutebuch et al., 2015).

The IDEA (2004) requires that all children receive instruction that improves their literacy skills. The IDEA mandates that school personnel provide reading instruction that includes five fundamental reading components: phonemic awareness, vocabulary, phonics, ORF, and comprehension strategies (Reisener et al., 2014). The five pillars of reading (phonics, phonemic awareness, vocabulary, fluency, and comprehension) are crucial for the students' reading development (Harris, 2010). Regardless of these critical pillars of reading, reading-related literature and evidence-based reading practices geared toward students with ASD are limited (Reisener et al., 2014). Individuals with ASD who have lower reading performance than their peers have demonstrated impairments in cognitive-linguistic tasks that require phonological processing, rapid automatic naming,

oral language, and reading comprehension: These impairments ultimately affect their ability to read effectively (Turner, 2010).

Reading Skill Components

Current reading research is oriented toward comprehension difficulties and how to address them; however, limited research has focused on reading fluency for children with ASD (Utley, 2017). Because students with autism demonstrate deficits in inferencing, increasing ORF might help tackle the issue, in turn increasing comprehension (Solari et al., 2017). In theory, if students with ASD have sufficient skills to read connected text fluently (high performance in ORF), their cognitive capacity will handle a high-level reading comprehension, especially the ability to adequately formulate inferences while reading a text (Solari et al., 2017). Thus, reading fluency is a prerequisite skill for reading comprehension (Barnes & Rehfeldt, 2013)—to improve the comprehension performance of students with autism, research needs to target ORF difficulties (Utley, 2017).

Students' difficulties with fluent reading negatively affect their comprehension performance because they solely focus on reading the words of the text. Therefore, students focus on fluency rather than comprehension (Hua et al., 2012). Students with autism are effective word decoders, and they have adequate skills that make them read a word without struggling or mispronouncing (Solari et al., 2017). Word decoding is an important aspect of reading comprehension and reading fluency, measuring the accuracy of reading the sounds in a word but not the "automaticity" of reading an entire word. In addition, decoding does not indicate the readers' ability to read connected text: for example, from one word to the next. Thus, ORF, in both ability and skills, is more complex than basic word reading (Solari et al., 2017). Whalon et al. (2009) stated that

more research is needed related to reading instruction of students with ASD beyond word decoding. Because reading interventions for students with ASD are scarce (Reutebuch et al., 2015), evidence-based practices in reading, which meet rigorous criteria and consistently improve the students' development, are needed (Accardo, Finnegan, Gulkus, & Papay, 2017).

Oral reading fluency. ORF is the ability to read a passage of text with appropriate speed and accuracy; it may also include the quality of reading expression (Guthrie, 2017; Whalon et al., 2009). Likewise, reading fluency is the ability to read accurately at an acceptable rate to comprehend written material, which is measured in word correct per minute, WCPM (Guthrie, 2017). ORF is strongly associated as a positive indicator of overall reading ability (Reisener et al., 2014) and can be divided into two components: the accuracy of word identification and the speed of reading (Guthrie, 2017). At the end of first grade and the beginning of second grade, students start to develop reading and writing fluency for words following a Consonant-Vowel-Consonant (CVC) construct, for example, cat, hat, run, and dog (Guthrie, 2017). CVC words consist of three letters: the first is a consonant, the second is a vowel, and the third letter is a consonant. First-grade students should master the skills for decoding CVC words, and second-grade students must be fluent in reading CVC words and simple text made up of CVC words (Guthrie, 2017). Mastering ORF skills means that readers spend less time decoding written words and paying more attention to understanding and comprehending the written text (Hua et al., 2012).

Students with ASD who demonstrate ORF-related problems exhibit more reading deficits than their typical peers (Solari et al., 2017). The inability to achieve ORF affects

the ability to read sight words or passages with adequate speed and accuracy (Guthrie, 2017). Successful interventions for individuals who exhibit lower reading rate and accuracy on assessments include modeling, error-correction strategies (e.g., phrase drill), interventions focused on repetition (e.g., repeated reading), and reward components (Szadokierski, Burns, & McComas, 2017). What differs in these individuals' responses is the level of accuracy (i.e., high or low) that they displayed prior to intervention (Solari et al., 2017). Turner (2010) explored the reading achievement of children with ASD compared to their typically developed peers and other children with disabilities. The results indicated that children with ASD's performance was lower on all five reading measures than their typically developed peers.

The promise of oral reading fluency interventions for students with ASD. Arabic is a Semitic language that is read and written from right to left. It consists of 28 letters including 15 letters associated with dots (i.e., one, two, or three) that are placed above or below the letter to distinguish it from other letters. Those letters have been used to represent consonants while the vowels are marked with diacritics markings that are located above or below the consonants (Emam et al., 2014). Students with disabilities who have reading difficulties in Arabic are increasing, and the literature targeting those individuals are limited (ElKah, & Lakhouaja, 2015). In the last decades, the research interest regarding ORF is increasing internationally; however, less attention has been oriented toward ORF for Arabic-speaking students (Hussien, 2014). Even though few previous studies addressed reading difficulties, these studies focus were on accuracy (e.g., predicting word reading and phonological awareness) and not ORF (Emam et al., 2014).

In Riyadh city, the capital of Saudi Arabia, Ewain et al., (2017) stated that students with disabilities in Riyadh represented approximately 23.89% of the total students, and reading difficulties affect the reading performance of 31.4% of students with disabilities. Moreover, the academic performance was affected in most of the students with disabilities. Roughly 68% of students with disabilities have a weak academic performance in comparison to their peers without disabilities, and reading difficulties has been the leading cause that has the most influence on academic achievements (Ewain et al., 2017). Most attention for reading difficulties in the literature has been directed toward students with disabilities in general and no studies have discussed or targeted ORF for Arabic-speaker students with ASD.

The reading of connected text has not been adequately investigated for students with ASD (Solari et al., 2017). The majority of interventions targeting students with ASD focus on behavior, communication, and social skills (Reisener et al., 2014)—but not on reading fluency. Literature is limited on evidence-based academic interventions that address ORF skills of students with ASD (Reisener et al., 2014); most previous studies that addressed the reading problems for students with ASD did not discuss, target, or measure the students' ORF (Solari et al., 2017). Hua et al. (2012) indicated that their study and few studies (Guthrie, 2017; Reisener et al., 2014; Utley, 2017) had examined the effects of using reading fluency interventions on students with ASD. Thus, a literature gap has emerged in terms of finding effective strategies that improve the ORF of students with ASD and how to tackle students with ASD's reading difficulties (Utley, 2017). To enhance students with ASD's academic success, academic interventions that strengthen

the weaknesses and magnify the strengths of those students' academic skills (including oral language abilities and reading) should be identified.

Successful reading comprises two factors: identifying words and turning them into meaningful messages (Guthrie, 2017). Solari et al. (2017) examined the relationship between oral reading fluency and reading comprehension to learn whether ORF is a reading-comprehension predictor while controlling the components of word recognition, traditional simple-view construct, linguistic comprehension, and decoding. The study participants included 68 students with higher functioning ASD and 38 age-matched typically developing students. The researchers used confirmatory factor analysis and structural equation models in the reading-comprehension prediction process. The researchers found that typically developing students performed better than students with higher functioning ASD in every reading measure. The researchers also found that ORF is a significant predictor of reading comprehension above and beyond the contribution of other reading variables. Such variables have been shown to be significant predictors in previous studies when added to the predictive model that bases single word decoding on the variance in the prediction for reading comprehension (Solari et al., 2017). Over 30 years of research has indicated that fluency is one of the critical building blocks of reading and directly relates to comprehension (Solari et al., 2017).

Students with ASD have a limited amount of executive functioning. If they want to multitask or become proficient at a complex task, such as reading, they first need to master the component's tasks separately so they can perform them automatically (Guthrie, 2017). For instance, a reader directing all his attention to decoding words may disturb the flow of thoughts and may not have enough time left to think about the text's

meaning. However, a fluent reader who can automatically decode words can, instead, give full attention to comprehending the text; consequently, to become proficient readers, students with ASD must develop the ability to read text automatically so they can focus on the meaning (Guthrie, 2017).

Evidence-Based Practices

Evidence-based practices are essential for students with and without disabilities and a critical area of need for students with ASD (Utley, 2017). Implementing evidence-based practices could enhance students with ASD's reading skills, so focusing on such an area is worthwhile (Guthrie, 2017; Whalon et al., 2006). Reading strategies can be divided into three main categories: cognitive, facilitating, and instructional strategies. Cognitive strategies include but are not limited to repeated reading, reading aloud, question–answer relationships, story mapping, and inferential questions. Facilitating strategies include anaphoric cueing, prereading questions, guided reciprocal questioning, cloze activities, visual colored-stick figures, textual key terms, and phrase cues. Instructional methods comprise direct instruction and peer-mediated class-wide instruction. Most of these strategies have been used with students with ASD to improve their reading fluency or reading comprehension (Reisener et al., 2014).

Kamps et al. (1994) investigated the effect of class-wide peer tutoring on reading fluency and reading comprehension of students with ASD. The results revealed that class-wide peer tutoring significantly enhanced students with ASD's academic achievement and social interaction. Using a single-subject withdrawal design, Reisener et al. (2014) examined the impact of repeated reading and listening passage preview interventions on the ORF of children with ASD. The researchers used WCPM to assess

the students' reading performance. The study outcomes indicated that a repeated reading intervention improved the ORF for all four participants, and the percentages of nonoverlapping data points' results showed that the listening passage preview approach greatly increased the fluency scores in two out of four participants. Using an alternating treatment design, Noltemeyer, Joseph, and Watson (2014) investigated the effect of repeated reading, phrase drill (PD), and listening passage preview on prosody and oral retelling fluency of four children with reading difficulties. The study's findings revealed no significant differences between the three interventions for the prosody outcomes in all participants; however, all the participants' prosody levels improved significantly. Furthermore, the study revealed that error correction and repeated reading had a significant effect on retelling fluency.

Video Self-Modeling

In the early 1970s, video self-modeling (VSM) was used as an intervention to improve ORF (Hitchcock, Dowrick, & Prater, 2003). VSM is defined as a strategy that involves watching an edited video of oneself repeatedly. The edited version is designed to model the target behavior (Wu & Gadke, 2017). The target behavior represents a behavior that is beyond the viewer's present functioning level (Buggey, 2007). For example, the video may show the students reading a passage fluently even though they currently cannot read the entire passage fluently. VSM has been used to improve functional, verbal, and social skills in children with autism (Wu & Gadke, 2017). This technique of combining a model of behavior and providing targeted support to the behavior in need of change have indicated positive results over a large body of research (Buggey, 2007). Additionally, VSM has been categorized as an evidence-based practice

in conjunction with RR (Wu & Gadke, 2017). Prater, Carter, Hitchcock, and Dowrick (2012) stated that eight studies had explored the effectiveness of VSM on typical school-based academic skills. VSM can reduce problem behaviors, promote the acquisition of skills, or increase skill performance (Schaeffer, Hamilton, & Johnson, 2016).

VSM was developed as an academic intervention in educational settings by inserting the method into a package of interventions or adding it to an intervention as a component (Wu, Gadke, & Stratton, 2018). The development of using VSM in educational settings has advanced to the point where the approach can be used as a stand-alone intervention. VSM is now implemented by filming a video and editing the video to create a new video that shows the student's best and ideal performance of target behaviors. The student can then view themselves performing the behavior at the desired level (Buggey, 2009). Watching VSM results has three advantages for the student. The student sees (a) the existence of the possibility of performing the targeted behavior, (b) the ability to learn from the video and imitate the behavior, and (c) an increase in self-esteem, motivation, and self-efficacy (Robson, 2013). Watching oneself in a VSM can provide clear information on how to perform the skill at an effective level (Schmidt & Bonds-Raacke, 2013).

VSM has been used as an intervention to improve both behavior and academic skills (Hitchcock, Prater, & Dowrick, 2004). VSM is an evidence-based practice for individuals with ASD (Bellini, Gardner, Hudock, & Kashima-Ellingson, 2016). Skills obtained via VSM are maintained over time, and they are transferable across contexts and settings (Bellini & Akullian, 2007). VSM is usually divided into two components: (a) positive self-review, which focuses on behaviors the individual has the ability to display

but not at the desired frequency; and (b) feedforward VSM, which focuses on behaviors the individual has not yet achieved (Hitchcock, Prater, & Dowrick, 2004).

VSM has been used as a stand-alone intervention in several studies focusing on behavioral issues; however, only three studies have examined the effects of VSM as a stand-alone intervention on the reading performance of students with disabilities (Decker & Buggey, 2014; Montgomerie et al., 2014; Robson, 2015). VSM is effective for individuals with ASD due to solely focusing on individuals' strengths rather than weaknesses. It is a visual learning method that avoids social interaction with peers or adults and promotes self-efficacy (Lee, Lo, & Lo, 2017). VSM is a relatively new strategy that can improve ORF (Wu & Gadke, 2017) because it focuses heavily on modifying behavior and social skills. As of 2012, only two studies have examined the effect of VSM on ORF (Prater, Carter, Hitchcock, & Dowrick, 2012), and only a handful of studies (Decker & Buggey, 2014; Montgomerie et al., 2014; Robson, 2015) continued using VSM as an independent strategy for improving ORF.

Moreover, VSM is inexpensive and easy to implement: Researchers only need a small digital camera (Ayala & O'Connor, 2013). Modern mobile phones and tablets can also be used to display and even edit high-definition videos. Media websites, such as YouTube, can easily display videos for private intervention use (Ayala & O'Connor, 2013). A need for more empirical research on using VSM with children with ASD still exists because previous studies have shown that VSM positively influences academic, behavioral, and social areas of children with ASD (Ayala & O'Connor, 2013; Bellini & Akullian, 2007; Buggey, 2005; Hitchcock et al., 2003; Montgomerie et al., 2014; Leach & Rodecki, 2013; Wu & Gadke, 2017).

Phrase Drill

Error correction is a teaching method that increases children's reading pace, which improves struggling readers' reading performance (Guthrie, 2017). Guthrie (2017) indicated that error correction is composed of a variety of components, namely, PD (or drill), word supply and meaning, phonic analysis, sentence review, discrimination, as well as systematic and multi-learning channel-error correction. The PD's error correction is similar to the repetition method where the student repeats the misread word multiple times to increase the student's retention of the word. Word-supply and meaning-error correction consist of providing missing words to the student while reading, having the student repeat the word, and then discussing the word's meaning. In the phonic analysis error-correction method, the teacher teaches the student how to sound out the misread words by their phonetic portions and then how to read the word naturally. As for sentence review error correction, this method builds on the word-supply error-correction method where word supply is implemented first, and then the student rereads the sentences where the errors exist (Guthrie, 2017).

Guthrie (2017) indicated that the discrimination error-correction method is different from other error-correction methods. The discrimination error-correction method provides the student with a visual or auditory version of their response compared to the correct response that should have been stated. The student is able to discriminate or see the differences between the corrected model and the incorrect response they provided. This discrimination error-correction method is part of a multi-step systematic error-correction procedure (Guthrie, 2017).

For example, during an oral reading session, the multi-step error-correction procedure allows a teacher to listen to a student's oral reading and provides formative and summative feedback on errors to improve fluency. During a 5-minute probe, the student is stopped by a teacher each time they mispronounce a word (formative feedback). Once the teacher has gained the student's attention, the teacher reads the word correctly (modeling) and asks the student to read it correctly and continue reading. At the end of the reading probe, the teacher has the student repeat the misread words and read the passage again for 1 minute (summative feedback). This step in the process can be a multi-learning and multisensory error-correction method, which is similar to the word-supply error-correction method. However, after repeating the word, the student also spells the word orally with and without covering the word. The student then writes the word on paper without seeing the word; if any mistake was made during the process, the student repeats the same steps until successfully completing the task (Guthrie, 2017).

In PD, the student reads the passage, and the administrator marks the errors, introduces the missed words to the student, and asks the student to read them aloud (Utley, 2017). When the student rereads a missed word, the student is then required to read a two- to five-word phrase that contains the missed word (Barnes & Rehfeldt, 2013). The student must read the phrases containing the missed words three times in a row correctly before advancing to the next phrase (Russell, 2012: Utley, 2017). Afterward, the student reads the passage again for 1 minute, and WCPM is calculated (Utley, 2017).

Five hypotheses might explain low reading fluency: insufficient (a) motivation, (b) regular practice, (c) feedback, (d) modeling, as well as (e) extremely difficult materials (Burns & Wagner, 2008). Interventions are generally developed by targeting at

least one of these hypotheses (Burns & Wagner, 2008). Error-correction strategies, such as PD, can be used to improve reading skills (Guthrie, 2017) and word-identification accuracy in the context of a passage (Edwards, 2016). PD was significantly effective in addition to repeated reading in enhancing the WCPM (Guthrie, 2017). PD is applied to insufficient feedback and practice where repeated reading addresses insufficient practice. Using PD maximizes corrective feedback, modeling, and rehearsal, which are important academic intervention components (Jones et al., 2009).

The repeated reading strategy allows the students to reread the whole passage multiple times but does not provide opportunities for students to focus exclusively on repeating and fixing the mistakes as PD does (Utley, 2017). PD might be a sufficient method for introducing repeated practice because it targets the weakest responses in the student's response repertoire (Begeny et al., 2006). In addition, PD can help in providing correct response modeling, address weaker responses directly, and create a negative reinforcement contingency (i.e., escaping the effort and potential aversiveness of repeating words or phrases in future reading). These factors increase the chances that the student will read words correctly in the future to escape the consequence of repeating phrases (Begeny et al., 2006).

Jones and Wickstrom (2002) used PD within a multiple intervention package that consisted of four instructional strategies: repeated reading, PD, easier materials, and incentives. The researchers divided the PD procedures into two. First, they limited the administrators' feedback to the first 15 student-made errors due to time restraints. Additionally, the administrators read at the rate of 90 WCPM. The researchers implemented an alternating treatment design in the study to investigate and measure the

differential effects of the selected strategy across time. The study's results revealed that two students with reading difficulties responded to PD intervention, whereas the remaining participants responded to the RR intervention. The effects of the selected strategy were stable for four out of five participants across time.

Jones et al. (2009) used PD (i.e., an intervention package containing PD and listening passage preview) in addition to repeated reading, incentives, and easier material strategies on six elementary-age students with reading difficulties to improve ORF. The researchers utilized a multi-element design by implementing brief and extended assessments in the study to analyze the problem and implement the treatment. PD was significantly effective for at least two out of six students; for two out of the four remaining students, PD was the only effective intervention—meaning that PD was effective for four out of six students. During the intervention, the students read a passage once while the administrator marked the errors, which occurred in the first minute of reading that was scored according to WCPM. Then the administrators pointed out the students' errors and read each of them aloud. The students then read the phrase or sentences containing the errors three times correctly while the administrators provided corrective feedback when needed. When each error was drilled three times, the students read the same passage again for 1 minute, and the administrators recorded the errors and counted the first minute in the assessment result as the ORF results.

Barnes and Rehfeldt (2013) investigated the effects of an intervention package (including PD error correction, performance feedback, and listening passage preview) on reading fluency and section-based and topography-based comprehension tasks of three students with high functioning pervasive developmental disorders. The researchers found

that reading fluency and topography-based reading comprehension improved for all participants. Using an alternating treatment design with baseline and reward phases, Begeny et al. (2006) examined the effect of PD and repeated reading on a child with reading difficulties. The results indicated that both PD and repeated reading were equally effective and improved the subject's reading fluency. Notably, PD was more effective than repeated reading in reducing errors, and it also exhibited greater stability than repeated reading.

Theoretical Basis

Verbal efficiency theory. The verbal efficiency theory (Lesgold & Perfetti, 1978; Perfetti & Lesgold, 1977) is based on the information-processing theory and assumes that low-level processes (e.g., word identification) must reach a certain level of mastery before high-level processes (e.g., reading comprehension) can occur concurrently during reading. Therefore, individuals should reach a higher level of reading fluency to effectively comprehend meaning from the text (Edwards, 2016). Alternatively, less-skilled readers demonstrate incorrect word identification, especially to long and less frequently used words (Perfetti & Roth, 1981). The theory suggests that the need for resources can be diminished through learning and practice because the automaticity of lower-level processes is built (Edwards, 2016). Using the verbal efficiency theory as a basis, PD is an effective intervention because it directly supports the modeling of accurate reading and fluent word identification (i.e., fluency processing skills and decoding; Edwards, 2016; Perfetti & Roth, 1981). In addition, it gives the reader the ability to pay more attention to higher-level processing, such as comprehension. Although lower-level processing skills include fluent decoding, accurate and automatic

decoding are key factors in improving reading comprehension, which implies that fluent decoding skills are required for reading comprehension (Edwards, 2016).

Social learning theory. Bandura's (1971) social learning theory states that individuals learn from each other by observing, imitating, and modeling. The social learning theory consists of four parts: (a) participation of the observer within a modeled event, (b) ability of the observer to demonstrate a behavior, (c) the existence of the observer's adequate motivation to demonstrate the behavior, and (d) maintaining the materials in their original state (Ulker, 2016). Bandura (1971) stated that individuals learn the majority of their skills by observing the behaviors of people around them.

Based on the social learning theory, four primary conditions construct an effective model: attention, retention, reproduction, and motivation. Attention might increase or decrease in a model based on multiple factors, such as functional value, distinctiveness, complexity, and characteristics. Retention is related to the observer's primary focus and includes mental images, motor rehearsal, cognitive organization, symbolic rehearsal, and coding. Reproduction is the physical capabilities and self-observation of reproducing the image. The last condition is motivation, which is the initiative to perform the modeled task (Bandura, 1971).

Within the social learning theory, the individual learning process is composed of the integration and unification of cognitive processes (e.g., thinking, imitation, memory, language, observation, and the estimation and evaluation of the behaviors) that lie within the personality but do not provide a guarantee from society or personal history (Ulker, 2016). The ability to learn is manifested through observing a model or receiving instructions without having prior experience of the behavior (Hitchcock, Dowrick, &

Prater, 2003). Acquiring skills for individuals with ASD via systematic observation of typically developed peers is a method with high skill-acquisition rates (Rehfeldta, Latimoreb, & Stromerc, 2003). For instance, children with ASD learn colors, shapes, and preposition discriminations from watching typically developed peers model the discriminations (Rehfeldta et al., 2003).

A student watching a video of themselves performing a skill successfully provides a clear understanding of how to best perform that skill and positively reinforces the belief of their capability to perform the same task again (Hitchcock, Dowrick, & Prater, 2003). Furthermore, the motivation to display the behavior and self-efficacy increases in individuals who self-model (Ulker, 2016). Therefore, the social learning theory is one of the predominant theoretical bases for video self-modeling (Hitchcock et al., 2003).

Chapter 3

Method

The purpose of this study is to examine the effectiveness of an intervention package that combines video self-modeling (VSM) and phrase drill (PD) to improve the oral reading fluency (ORF) and reading skills of students with autism spectrum disorder (ASD) in the Kingdom of Saudi Arabia. This study addresses the following research questions:

1. What are the effects of a treatment package consisting of VSM and PD on the ORF of students with ASD?
2. To what extent will the increased ORF of students with ASD be maintained over time?
3. What is the social validity of the VSM and PD intervention package?

In this study, data was collected by employing a single-subject design: specifically, the multiple baseline design across participants. Single-subject research is used widely in the field of special education and is useful when the researcher is attempting to change the individualized behavior of an individual or a small group of individuals. (Richards, Taylor, & Ramasamy, 2014).

This chapter presents the method for examining the effects of a treatment package that contains the PD and VSM interventions as one treatment package on the ORF of students with ASD. Furthermore, the study participants, settings, materials, measures, procedures, the fidelity of implementation, inter-rater reliability, social validity, research design, and data analysis are discussed.

Participants

Eligibility criteria. The following selection criteria were applied to recruit participants: Each participant must be (1) in grade 4–8, (2) diagnosed as having an ASD, (3) eligible to receive itinerant or supplementary special education services by their school district, (4) at risk for reading failure or identified as having reading difficulties based on the school's reading measurements, (5) without a visual or hearing impairment diagnoses, and (6) from any race, socioeconomic status, gender, and religion (See Table 1).

Table 1

Inclusion Criteria for Participants

Number	Inclusion Criteria
1	4th to 8th-grade students
2	Diagnosed as having ASD and eligible to receive special education services
3	At risk for reading failure or identified as having reading difficulties based on the school's reading measurements
4	Without a visual or hearing impairment diagnoses
5	From any race, socioeconomic status, gender, and religion

Recruitment. The participants were recruited for this study after obtaining approval from the Institutional Review Board (IRB) at Duquesne University. To recruit participants, the researcher contacted public school principals serving students with ASD located in Riyadh and surrounding areas and requested permission to conduct the study. Additionally, the researcher contacted special schools located in Riyadh and surrounding areas with students who matched the eligibility criteria and requested permission to conduct the study. Upon the school principal approving the study, the researcher asked the principal to forward the recruitment flier to eligible teachers, school psychologists,

and special educators willing to participate. Once the classroom teacher (i.e., fourth-grade teacher) agreed to participate, the researcher met with the school staff to discuss the study. The classroom teacher identified eligible participants and dispensed the consent forms to parents. After collecting the consent forms, the researcher obtained agreement, confirmed eligibility, and began the study.

Students in fourth grade were eligible to participate in this study: Four students previously identified with ASD and educated in inclusive settings were invited to participate. These students were receiving supplementary special education support in their school. Pseudonyms were assigned to replace the participants' real names and protect their privacy in this study.

Ali was a Middle Eastern male, aged 9 years and 6 months, and in fourth grade. A developmental pediatrician diagnosed him with ASD. He was receiving special education services under the disability category of autism. Prior to the study, Ali's reading level was measured on the Diagnostic Test for People with Reading Difficulties (DTPRD) provided by the school, and he scored below his grade's cut-off score. Ali received all his core academic instruction in the regular education classroom and reading instruction in the special education classroom at the school. According to his report, Ali's academic weaknesses included reading. Ali was friendly and cooperative during sessions and was eager to participate in the reading sessions, as well.

Ahmed was a Middle Eastern male, aged 9 years and 1 month, and in fourth grade. A licensed psychologist diagnosed Ahmed with ASD. He received special education services by meeting the educational criteria for autism. Ahmed received speech and language services at school to address his receptive and expressive language deficits

and occupational therapy to address fine motor deficits. According to the DTPRD, Ahmed scored below his grade-level cut-off score in the reading. He received his reading instruction in the special education classroom at school. Ahmed was easily distracted during sessions, and he sometimes grew fixated on the timing of the passages and how many more times he had to read. Prior to the study, Ahmed's doctor started a trial of a low-dose medication with him to address symptoms of attention-deficit/ hyperactivity disorder.

Khalid was a Middle Eastern male, aged 10 years and 2 months, and in fourth grade. A developmental pediatrician diagnosed him with ASD. The school psychologist also identified him as meeting the eligibility criteria for autism. Khalid currently received his core academic instruction in a regular education classroom and received special education services for autism in addition to speech-language services for receptive and expressive language deficits in the special education classroom. On the DTPRD, Khalid scored below his grade-level cut-off score in reading. Khalid's classroom teacher was concerned about his overall health and sleep habits. According to the classroom teacher, Khalid would sometimes fall asleep in class—and would do so quickly. Khalid's mother indicated starting the evaluation process for a possible sleep disorder. Prior to several sessions, Khalid sometimes engaged in repetitive types of behaviors; however, he did not display repetitive behaviors during the actual readings. Khalid was friendly and cooperative during sessions.

Sarah was a Middle Eastern female, aged 11years and 2 months, and in fourth grade. Sarah received an ASD diagnosis from a licensed psychologist and qualified for special education services under the disability category of autism. She received reading

instruction in the special education classroom. According to the DTPRD used by the school, Sarah scored below her grade-level cut-off score in reading. The classroom and special education teachers reported that Sarah had little social interaction with other students her age and displayed poor social skills. Although Sarah was friendly and cooperative during sessions, she sometimes expressed concern or a dislike of reading passages that appeared long to her. She also experienced distress with unexpected changes in her routine.

Settings

Once the researcher acquired the desired number of participants (i.e., four participants), the school principal and school staff were informed, and the researcher stopped the recruitment process. This study was conducted in Riyadh, Saudi Arabia, and was completed through the private school's platform, Zoom. The pretests, baseline phase, intervention phase, and maintenance phase were administered in a quiet virtual classroom free from distractions. Testing was conducted during school hours, and participants joined the Zoom sessions during reading and art class times. The researcher asked the participants' parents to ensure the learning area was suitable and free of outside distractions.

Measures

Expressive Vocabulary Test, Second Edition. The Expressive Vocabulary Test, Second Edition (EVT-2) is an individually administered norm-referenced instrument that assesses vocabulary acquisition, word retrieval, and comprehension for children and adults ages 2.6 to 90+ years old (Williams, 2006). The EVT-2 is available in two forms (Forms A and B) that are administered individually. Each form of the EVT-2 contains

example items and 190 test items that are arranged by increasing difficulty. For each item, the investigator presented a picture and read a stimulus question to the participants. The participants had to either respond with one word that provide an acceptable label (word retrieval subtest), a synonym for a word that fit the picture (vocabulary subtest), or an answer to a specific question (comprehension subtest). The administration was untimed but expected to take approximately 10 to 20 minutes, depending on the participants' age and vocabulary knowledge (Williams, 2006). The EVT-2 in this study took 15 minutes to administer and complete for each participant.

In this study, the EVT-2 was used to help detect language impairments across the age range, monitor growth across a specific period, measure word retrieval, and help understand reading difficulties and assess literacy skills. A broad range of expressive vocabulary levels was covered through the test content, and 20 content areas were represented through the test items (e.g., tools, actions, vegetables, home and school, and parts of speech including nouns, verbs, and attributes; Williams, 2006). The EVT-2 prompts, questions, and answers were translated into the Arabic language before administering the test due to the participants' limited English language proficiency.

Regarding sensitivity to other cultures, all EVT-2 items underwent empirical analyses and qualitative reviews to ensure that all items were valid and free from bias with respect to race, sex, ethnicity, geographic region, and socioeconomic status (Williams, 2006). The investigator implemented the EVT-2 before collecting data to provide information about the participants' vocabulary knowledge. The assessment was administered and scored by hand, according to the EVT-2 scoring manual. Scoring was completed as follows: The researcher calculated the raw score (i.e., the total number of

words the participant answered correctly), converted the raw score to a standard score, and then found the percentile for each participant (Williams, 2006). The EVT-2's test–retest reliability was based on a subsample of 348 examinees who were retested with the same EVT-2 test from 2- to 6-week intervals after the first administration: The results yielded high-reliability coefficients between .94 and .97 (Williams, 2006).

Oral reading fluency probes. In the current study, ORF probes from the classroom teacher's textbook were used to determine each participant's instructional reading level prior to the beginning of the study. The ORF probes were also used to collect data during the baseline, intervention, and maintenance phases. The teacher's reading textbook contained a set of 40 passages for grades 2–6 that were calibrated per grade level (200 passages total). The reading passages were numbered based on their level of difficulty and number of words. Administrating the probes in the baseline and maintenance phases took 5 minutes, whereas it took 30 minutes to administer the intervention phase.

Materials

IPad. The participants had access to the video clips using their iPad during the intervention phase. If the participants were uncomfortable using an iPad, the researcher was prepared to conduct a training session with the participants until they felt comfortable using the iPad; however, when asked by the researcher, all the participants stated that they were already acquainted with using an iPad and could follow instructions to (a) switch on the iPad or open the iPad if it was not already on (2) put on the headphones (3) open the video clip, and (4) watch the video clip.

The self-monitoring video. The researcher created an approximately one minute and a half video clip using VSM to only show the participants footage of themselves reading fluently. The researcher used the apps, Video Joiner and Perfect Video, to edit the video clips and add any text or sounds to enhance video production. The VSM videos were saved in the researcher's computer under a file labeled with the participant's name, so each participant had their own file showing their final videos throughout the intervention phase. The participants viewed these videos at the beginning of each intervention session.

Likert scale checklist. A Likert scale checklist contained a table consisting of five prompts to measure social validity, and the checklist was typed to eliminate any possibility of misunderstanding or misreading due to unclear handwriting. The information was organized into a table format, as shown in Appendix A. The checklists were emailed to the participants' parents at the beginning of implementing the maintenance phase. The parents returned the checklists to the researcher at the end of the maintenance phase. The researcher answered and provided explanations when participants asked questions upon receiving the checklist. As for the comments, the participants provided their comments to the researcher verbally during a short virtual meeting at the end of the study. None of the participants provided more than one answer to one prompt.

Research Design

The present study employed a single-subject research design methodology, using a-multiple baseline design across participants. Unlike group research, which typically involves studying large numbers of participants, a Single-Subject Design (SSD) targets a

fewer number of participants to evaluate the effect of a variety of interventions in applied research (Richards et al., 2014).

SSD is a scientific design methodology that is implemented to establish a functional relationship between the dependent and independent variables (Cakiroglu, 2012). SSD is used to define fundamental principles of behavior and develop evidence-based practices by allowing researchers to document causal relationships between independent and dependent variables (Horner et al., 2005). SSD has several essential features that make the design comparable to other experimental research designs, which include the following: (a) the operational definition of study characteristics, (b) the use of baseline or intervention conditions, (c) the individual participant as the unit of analysis, (d) visual analysis, (e) the repeated and systematic introduction of interventions, (f) the repeated measurement of target behaviors, and (g) experimental control (Cakiroglu, 2012). Commonly, these features can be found in all single-subject research designs and compose the basic template for which all variations are based (Cakiroglu, 2012). By implementing an SSD, the effectiveness of different intervention conditions presented to the participant can be evaluated (Guthrie, 2017). In literacy research regarding children with ASD, evidence of single-subject design's adequacy in recognizing effective interventions and educational practices has been reported (Guthrie, 2017).

The multiple baseline design allows for demonstrating the academic interventions' effects on a skill that cannot be reversed, reading fluency (Hua et al., 2012). A multiple baseline design was appropriate for this study because (a) it does not require the withdrawal of an intervention, and (b) it provides robust experimental evidence after a few sessions (Byiers, Reichle, & Symons, 2012). This study design

included three phases, a baseline phase followed by treatment or intervention and a final maintenance phase. In this design, the baseline phase was introduced simultaneously to each participant, and the intervention was introduced to each participant sequentially.

Baseline data were collected simultaneously from all participants (in this case, four participants). When a stable state of responding was observed in the baseline condition, the independent variable (VSM and PD) was applied to the first participant. When a steady state of responding was achieved with the introduction of the independent variable for the first participant, the independent variable was then applied to the second participant, while the third and fourth participants remained at the baseline. The third participant remained at the baseline until the second participant reached a steady-state response. At that time, the independent variable was applied to the third participant. This procedure was followed for all remaining participants in the study (Richards et al., 2014).

Only one session was completed per day. The maintenance phase followed the same procedures as those in the baseline phase. The researcher administered the reading probes daily without the implementation of the intervention. The participants started the maintenance phase in the same order as they started the intervention phase, which was sequentially based on their performance in the intervention phase. However, the researcher ended the maintenance phase for all participants at the same time (Evertson, & Weinstein, 2006).

Independent Variable

Intervention. The independent variable was a treatment package consisting of two interventions: VSM and PD. The independent variable was implemented three times a week with at least one day in between. The intervention phase lasted for approximately

eight weeks. Each instructional session lasted for about 30 minutes per day during the intervention phase.

Video self-modeling. VSM (a form of observational learning) allows for individuals to observe themselves in a video in which they perform a target behavior successfully (Buggey, 2009). This strategy allows individuals to view themselves as emitting the target behavior successfully (Marcus & Wilder, 2009). The VSM strategy consists of multiple steps (Robson, 2015; Wu & Gadke, 2017; Wu et al., 2018), and those steps were divided into three stages (i.e., recording the video, editing the video, and viewing the video by the participant prior to the next intervention session). During the recording stage, the researcher completed the following:

1. The researcher met with each participant individually and virtually through the Zoom application.
2. The researcher ensured that the participant was provided with the appropriate equipment for the session (e.g., iPad), and the researcher had the editing software in her device.
3. The researcher prompted each participant to read the provided reading probe.
4. The researcher set up the device to record the participants' reading footage.
5. The researcher video recorded the participant reading until the participant had read approximately 100 correct words.
6. The researcher stopped recording.
7. The researcher gathered the materials and ended the session.

After each session, the researcher created the videos to use during the next VSM sessions. The researcher (a) opened the prior recording of the participant reading, (b)

trimmed and merged the scenes using Video Joiner software to show only the participant's fluent reading, and (c) added music and comments to the videos as a positive reinforcement using Perfect Video software. The researcher completed these steps for each participant in the study. During the viewing stage, the researcher met with the participant online in the next session and showed the final product (i.e., finished video) for each participant individually before starting the next reading session.

Phrase drill. In PD (corrective feedback intervention targets reading fluency), students are provided with several opportunities to practice the misread words in an accurate context (Begeny et al., 2006). The immediate feedback on errors improves the response accuracy of students and promotes the generalization of correct reading within the context of a sentence or phrase (Utley, 2017). The textbook probes were used as reading probes during this variable's implementation. The PD strategy consists of multiple steps (Noltemeyer et al., 2014). The researcher followed this procedure:

1. The researcher retained one hard copy of the reading probe and emailed a soft copy of the same reading probe to the participant prior to each session (one minute before the start of the session).
2. The researcher instructed the participant to read the reading probe.
3. The researcher used a highlighter on the researcher's hard copy to highlight mistaken or unknown words during the participant's reading.
4. The researcher pointed to each highlighted word while pronouncing it for the participant.
5. The researcher pointed to a word and asked the participant to repeat each word.

6. The researcher read phrases or sentences containing each word error to the participant.
7. The researcher instructed the participant to read the sentence containing the marked word back aloud three times.
8. The researcher instructed the participant to read the grade-level reading probe to calculate WCPM and EPM.

Dependent Variable

Oral reading fluency. The primary dependent variable in this study was ORF. ORF is defined as the ability to read connected text quickly, accurately, and expressively; it is measured by calculating the correct words read per minute (Guthrie, 2017). Each participant received a score that represented the words they correctly read during a 1-minute probe. This score was recorded for each session in all three phases. As the WCPM is the measure of words read correctly in a 1-minute context (Guthrie, 2017), the score indicated the participants' ORF level (Reisener et al., 2014). The WCPM was calculated by subtracting the number of errors per minute from the total number of words read in 1 minute. A word was considered correct when it was read correctly without any external assistance in the range of 1 to 3 seconds from reading the previous word or when it was self-corrected by the participant independently within 3 seconds (Guthrie, 2017).

Errors Per Minute. EPM was the second dependent variable for the study. EPM is the number of errors in a passage that was read by the participant for one minute. The researcher marked any error in a probe with a slash (/) during the participant reading (Shinn & Shinn, 2002). A word was considered incorrect if the participant mispronounced the word, took more than 3 seconds to read the word, substituted the

word with another, or omitted the word (Begeny et al., 2006). Additionally, one error was recorded if the participant mispronounced a proper noun, and if the participant skipped a line or a sentence in the reading (Guthrie, 2017; Robson, 2013). On the other hand, repetition of words, self-correction, insertion, and dialect differences were not counted as errors (Guthrie, 2017; Shinn & Shinn, 2002). Further, errors were not corrected during the reading due to maximizing participant reading and minimizing administrated talking during the assessment.

Procedure

After obtaining consent from Duquesne University's IRB and permission from the Saudi school's principal to conduct the research, the classroom teacher was provided with the consent forms to distribute to parents. Consent was then obtained from participants' parents or guardians, and assent was also obtained from each participant. Once consent forms were returned, as outlined above, four students began to confirm eligibility and went through the inclusion procedures, such as confirming the ability to access the iPad.

Pretesting.

EVT-2. For each item in EVT-2, the researcher read the stimulus question to the participant as it appeared on the record form (Williams, 2006). The researcher repeated an item once at the participant's request or if the participant paused for 3 seconds. After introducing the item, the researcher asked the stimulus question: "What do you see?" or "What is this?" Furthermore, the researcher substituted alternatives for the stimulus questions when prompting on labeling items: (a) "What do you call this?" (b) "Tell me a name for what you see." (c) "Tell me one word for this." (Williams, 2006).

Although the EVT-2 is an untimed test, the researcher allowed for approximately 10 seconds for a response to each item using a timer to maintain a steady testing pace. If the participant did not respond within 10 seconds of hearing the stimulus question, the researcher said, "Let's go on," and checked "DK" (Do not know) on the record form (Williams, 2006). If the participant did not identify the item, the researcher moved to the next item unless the participant met the cap, five consecutive incorrect items (Williams, 2006).

Reading instructional level. The classroom teacher's textbook reading probes were used to determine the instructional reading level of all participants. The researcher made a decision regarding the participant's instructional reading level based on the participant's median score. In order to determine the participants' instructional reading levels, the researcher conducted the following steps:

1. The researcher administered three screening probes from the textbook at the participant's current grade level prior to pretesting.
2. The researcher determined whether to keep the participant on the current grade level if the participant score (i.e., the median score out of the three scores) was above the grade-level cut-off score.
3. The researcher stepped back one grade level when the participant's score on the screening probes scored at or below the grade-level cut-off score.
4. The researcher then conducted another screening probe at the new grade level and repeated the second step until the participant reached the appropriate grade level.

5. The researcher used the instructional reading–level passages in the intervention phase only.

Baseline. During the baseline phase, the researcher asked each participant to read the instructional reading–level probe without support for 1 minute in the virtual room, which was quiet and distraction-free. Reading fluency—calculated as WCPM—was calculated following the completion of the probe as well as EPM. The researcher used the AIMSweb standardized administration directions: "When I say 'begin,' start reading aloud at the top of this page. Read across the page" (Shinn & Shinn, 2002). The researcher demonstrated the procedure by pointing and saying, "Try to read each word. If you come to a word you don't know, I'll tell it to you. Be sure to do your best reading. Are there any questions?" If the participant did not have any questions, the researcher then said "Begin" and started the stopwatch when the participant said the first word (Shinn & Shinn, 2002). The AIMSweb directions were translated into the Arabic language to use with the participants before starting the study.

If the participant failed to say the first word of the passage after 3 seconds, the researcher told them the word, marked it as incorrect, then started the stopwatch (Shinn & Shinn, 2002). The researcher followed along on the hard copy, put a slash (/) through words read incorrectly, and at the end of 1 minute, placed a square bracket (]) after the last word and said, "Stop." Finally, the researcher immediately scored and recorded the number of WCPM and EPM. WCPM was calculated at the end of each session by subtracting the number of words read incorrectly (EPM) in 1 minute from the total number of words read in 1 minute (Shinn & Shinn, 2002).

Pre-intervention. The first video clips were created after each participant completed the baseline data-collection phase to avoid any exposure to the intervention procedures (Wu et al., 2018). Therefore, after establishing the baseline, each participant read a reading probe to create the videos for the first intervention session. The researcher prompted each participant to read the reading probe, and when the participant completed the probe, the researcher provided corrective feedback for the participants' errors by pronouncing the words correctly and instructing the participants to fluently read sentences that contained the errors. This reading aimed to make the participants read all the sentences in the text fluently without errors, so the researcher would have the ability to trim the errors and merge the fluent reading clips into one clip for each participant.

Intervention. All intervention sessions were video recorded. During the intervention phase, the researcher administered the treatment package for approximately eight weeks. Before the intervention session, the researcher prepared the reading probe and the video recorder for the participant. During the intervention session, the researcher let the participant view the video of the previous reading, implemented the PD, and ended the video recording. After finishing each session, the researcher edited the video and prepared it for the next intervention session.

Prior to each intervention session. Following the procedures that Wu et al. (2018) implemented, each participant had access to their prerecorded VSM tape containing a 60–90 second video that the researcher created from the previous session. The video was constructed so that each participant would hear themselves read approximately 100 words of a narrative passage at their instructional reading level (Wu et al., 2018). The probe used during the passage would be at the level determined during pretesting.

During the intervention session. Following the PD procedures mentioned in Noltemeyer et al. (2014), the researcher selected narrative reading texts from the reading textbook at the instructional reading level of each participant. Aligned with Noltemeyer and colleagues, the method was as follows:

(1) The researcher instructed the participant to read the text while following along on her copy.

(2) The researcher highlighted any word that was read incorrectly on her copy, pointed to the highlighted word, and read it to the participant ("The word is____").

(3) The researcher prompted the participant to read the highlighted word aloud ("What is the word?") and repeated this procedure for each highlighted word.

(4) The researcher prompted the participant to read the sentences with any highlighted word three times aloud, and if a sentence contained more than one highlighted word, the participant read each in isolation before reading the sentence aloud three times in a row.

(5) After the intervention, the researcher instructed the participant to read a grade-level reading probe to calculate WCPM and EPM (Noltemeyer et al., 2014).

After the intervention session. The researcher created videos similar to the videos in Wu et al.'s (2018) study. To trim and merge the scenes, the researcher used the Video Joiner app (Robson, 2015); therefore, the final videos only showed the participant's fluent reading. The Perfect Video app was used to add text at the beginning of the video (i.e., "You will see yourself reading perfectly."), comments (e.g., "Remember, always try to read as well as you did in the video."), written praise for fluent reading at the end of

the video (e.g., Nice job, great work, or look at how well you are reading!), and music. Once the video was played to the participant, and by the time the participant started reading in the video, three expected performances had appeared in the left corner of the video (i.e., reading with appropriate rate, reading accurately, and paying attention). By the end of each session, the participant had a 1 to 1.5-minute video of themselves reading at an appropriate rate fluently without errors.

Maintenance. The maintenance phase immediately followed the intervention. During the maintenance phase, grade-level ORF probes were used to calculate WCPM and EPM and to determine whether the change in behavior was maintained over time. All participants started the maintenance sessions sequentially, as they did in the intervention phase, and they received a minimum number of sessions during the maintenance phase (three sessions). This phase followed the baseline phase's procedures.

Fidelity of Implementation

An independent observer (i.e., the special education teacher in the school) collected fidelity data during 20% of the sessions across each baseline, intervention, and maintenance phase (Adams, 2012). An inter-observer agreement was used to (a) detect observer drift, (b) convince readers of the relative believability of the data, (c) determine the competence of new observers, and (d) judge whether the definition of the target behavior was clear, and the system was not too difficult to use (Cooper et al., 2007). The independent observer observed and evaluated the researcher's treatment integrity using procedural checklists that the researcher created and were identical to the researcher's scripts for the baseline, intervention, and maintenance phases (see Appendix B). Each one of those three phases had its own protocol checklist (i.e., Table B1 for the baseline,

Table B2 for the intervention, and Table B3 for maintenance). Procedural integrity was 100% for the researcher across sessions for all three phases in the study.

Inter-rater Reliability

Inter-rater reliability is known as the degree to which two observers or more report the same observed values after measuring the same events (Cooper, Heron, & Heward, 2007). In this study, the independent rater (i.e., the classroom teacher) scored the participants' oral reading fluency (ORF) using the researcher-created audio recordings, and the inter-rater agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements multiplied by 100. The percentage of the agreement should be 95% or higher across sessions (Richards et al., 2014). The researcher provided the training to the independent rater regarding the usage of audio recording and the scoring method (via the Zoom platform) until the independent rater demonstrated adequate performance and confidence.

Social Validity

In the current study, a 5-point Likert scale checklist (1 = *strongly disagree* to 5 = *strongly agree*) created by the researcher was used to measure social validity. The checklist consisted of negative and positive statements to ascertain whether or not the participants with ASD were satisfied with the use of VSM and PD instruction to help them read stories fluently. The researcher sent the forms to the participants via email, collected the completed forms, and documented the results. Statements included but were not limited to the following:

- "The new strategy helped me to read more words correctly,"
- "I liked using the new strategy,"

- "The new strategy is easy to use,"
- "I feel comfortable using the new strategy,"
- "I am bored with using the new strategy technique,"
- "The new strategy helped me to read with an appropriate rate" (see Appendix A).

Data Analysis

Visual analysis and descriptive statistics were implemented to analyze the data in this study. The participants in the study were independent of each other; therefore, each participant was the unit of analysis. Visual analysis—a descriptive method—is one of the earliest forms of data analysis, and it is widely used in the literature (Harrington & Velicer, 2015; Kratochwill & Levin, 2015). Visual analysis of each data point on a graph was used to determine (a) if changes occurred in the reading fluency of each participant and (b) the extent to which the differences could be attributed to the treatment package (VSM and PD) (Huddle, 2014). Visual analysis is quick to yield hypotheses and draw conclusions. The analysis requires less effort and fewer tools to create and interpret graphs, and it comprises a wide range of formats (Kratochwill & Levin, 2015). Visual analysis has three properties that can help in analyzing the data within and between conditions—level, trend, and variability (Lane & Gast, 2013).

Level (i.e., the average of the data points within each phase) was calculated during analysis to demonstrate a functional relationship between the intervention and the participant's performance, as well as to locate patterns (Kalis, 2012). The data level is associated with its position on a graph that is divided into three segments (e.g., high, moderate, and low level) or five levels based on the Y-axis (Cooper et al., 2007). A trend links to the direction of the data points, which can increase, decrease, or show no trend.

The slope is used to identify the strength of the trend. The absence of a trend (i.e., zero trends) in the data shows there is no increase or decrease on average for the targeted behavior over time during the three phases (Harrington & Velicer, 2015). Variability—the third property—can explain how the data are spread or differ from each other, and the graphs can be considered stable (i.e., the difference between each data point and the next one is minimal) or variable, the difference between each data point and the next one is significant (Cooper et al., 2007). In the case of having a substantial variability of the behavior in the three phases, the conclusions regarding the effects of the intervention can be significantly impaired (Harrington & Velicer, 2015).

To further analyze the data, descriptive statistics including mean and effect size were calculated. ORF mean scores have been proven to be valid and reliable measures to summarize reading performance for struggling readers in schools (Barth et al., 2012). Additionally, an effect size calculation (statistical procedure) was used to supplement visual analysis, compare the outcomes within and between participants, and provide an index of treatment strength (Shackett, 2017). Effect size between the baseline and intervention was calculated using Nonoverlap of All Pairs (NAP). NAP summarizes data overlap between each Phase A data point and each Phase B data point, baseline and intervention (Parker & Vannest, 2009). NAP has been developed to avoid shortcomings of currently existing overlap-based effect size methods used for single case designs (Wu, Gadke, & Stratton, 2018).

NAP is the result of the number of comparison pairs without an overlap, which is then divided by the total number of comparisons (Parker & Vannest, 2009). All intervention data points were compared with all baseline data points for overlap to

determine a valid effect size (Bryant et al., 2015). Some advantages of NAP include better discrimination among results from a large group of studies, minimal human error in calculations compared to other hand-calculated indices, stronger validation than R^2 (i.e., the leading effect size in publication), and a stronger validation by visual judgments (Parker & Vannest, 2009). NAP ranged from weak effects (0–0.65), medium effects (0.66–0.92), to strong or large effects (0.93–1.0). If NAP transformed into a zero-chance level, it would range from weak effects (0–0.31), medium effects (0.32–0.84), to large or strong effects,0.85–1.0 (Parker & Vannest, 2009). According to Bryant et al. (2015), when the intervention score is higher, the result will be 1.0; however, if the intervention score is the same as the baseline score, 0.5 is awarded. A lower intervention score is 0. In the end, all the results (i.e., point values) were summed and then divided by the total number of comparisons. The resulting quotient was multiplied by 100 to give the NAP percentage (Bryant et al., 2015).

Chapter 4

Results

This study's purpose was to evaluate the effectiveness of the treatment package regarding video self-monitoring (VSM) and phrase drill (PD) on the oral reading fluency (ORF) skills of students with autism spectrum disorder (ASD). The effect of this treatment package on the dependent variables, word correct per minute (WCPM) and errors per minute (EPM), were evaluated. The participants' demographics are first reviewed and followed with an interpretation of the results. This study's statistical results are presented and addressed, and the number of sessions for all participants is introduced. This chapter also includes the study reliability, treatment integrity, as well as descriptive statistics (i.e., the statistical results of the data analysis for each participant, nonoverlap of all pairs [NAP], and social validity results).

Sessions

The number of sessions in this study for each participant during all three phases is presented in Table 2. During each phase, each participant remained in the designated phase until the data points showed stability with low variability before they moved into the next phase. As shown in Figure 1, all four participants started in the first phase simultaneously. Ali was the first participant to start the intervention phase, and the remaining participants followed him sequentially. Similarly, Ali was the first participant to start the maintenance phase, and the rest of the participants followed in the same order. The study concluded after Ahmed finished the third session in the maintenance phase. All sessions were conducted on the same day for all participants throughout the study.

Table 2

The Participants' Number of Sessions for Each Phase

Participants	Baseline	Intervention	Maintenance
Ali	5	18	9
Sarah	8	17	7
Khalid	11	16	5
Ahmed	14	15	3

Demographics

Four participants with ASD were examined in the current study. All the participants were Middle Eastern children residing in Riyadh, Saudi Arabia, and in fourth grade. In this study, males outnumbered females in the sample (i.e., three out of four were male), with 75% percent being male and 25% female, as shown in Table 3.

Table 3

Participants Demographics

Participants	Age	Gender	Race	TD	GL	IRL
Ali	9.6	Male	ME	ASD	Fourth	Third
Sarah	11.2	Female	ME	ASD/SLD	Fourth	Second
Khalid	10.2	Male	ME	ASD/SLD	Fourth	Second
Ahmed	9.1	Male	ME	ASD/ADHD	Fourth	Second

Note. ME = Middle Eastern; SLD = specific learning disability; ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder; TD = type of disability; GL = grade level; IRL = instructional reading level.

Reliability

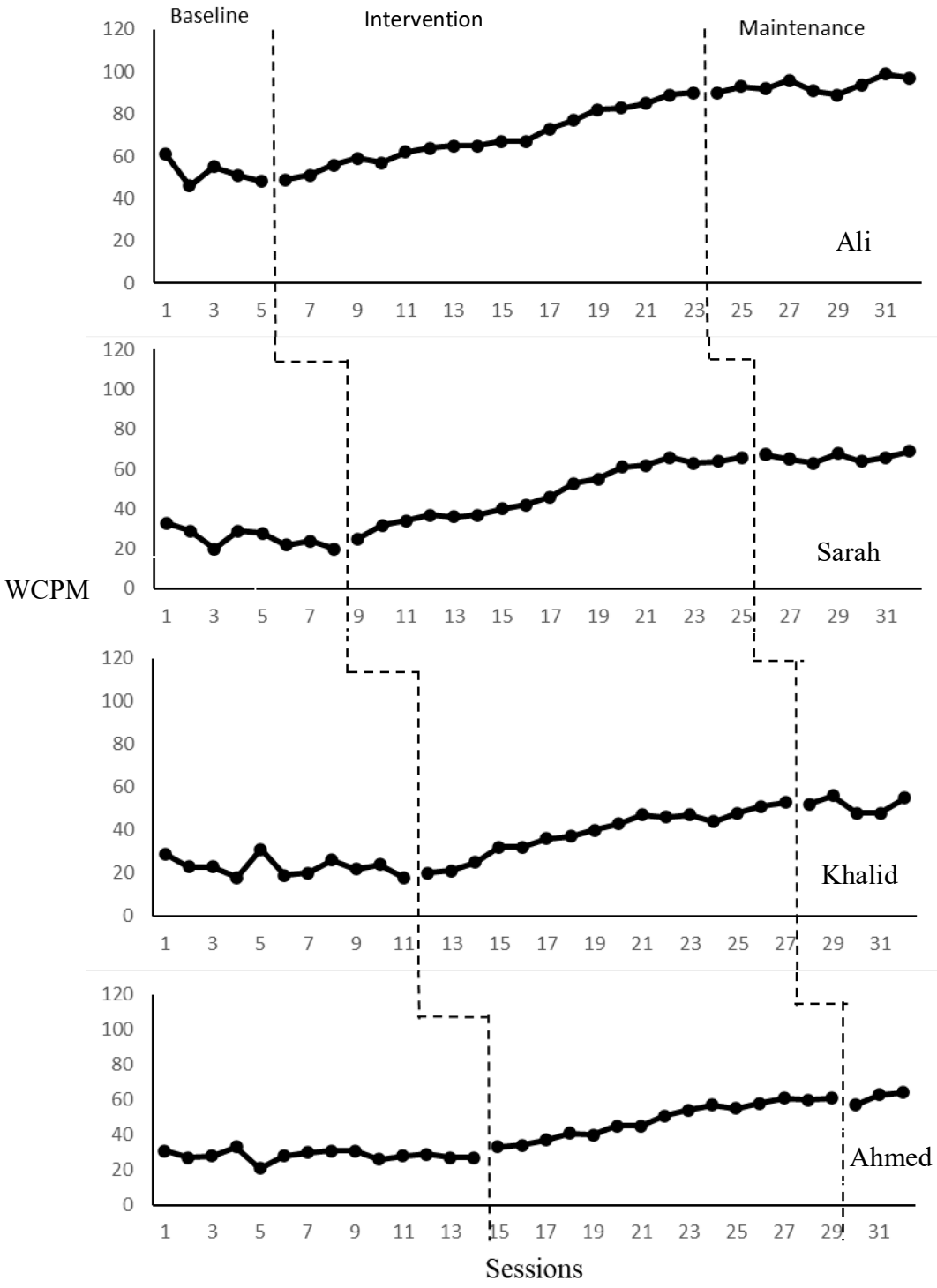
During the study, the researcher administered all sessions and collected all the data. The researcher recorded the dependent variables for the study (WCPM and EPM) during each session. All the sessions were audio-recorded and later reviewed by a trained independent inter-rater (i.e., the classroom teacher) to evaluate for quality data collection. The inter-rater reviewed the data collected, as well as the audio recordings. For the inter-rater reliability, the observer-reviewed sessions comprised approximately 40% of the sessions, and these sessions were randomly selected to establish inter-rater reliability. The number of sessions that were reviewed independently was 51 out of 128 sessions, and the observer documented the dependent variables for each assigned session that was chosen randomly after listening to the session recording. The inter-rater agreement for WCPM and EPM had a mean agreement of 98.3%, which ranged from 94 to 100.

Treatment Integrity

Interobserver agreement. The observer (i.e., the special education teacher) applied a protocol checklist reliability of data sheet for all the three study phases (i.e., baseline, intervention, and maintenance), as mentioned in Chapter 3. In order to compute the Interobserver Agreement (IOA), the agreement of steps completed for each session was divided by the total number of steps to be completed in a session, and the output of the division equation was multiplied by 100 to obtain an IOA percentage (Utley, 2017). Hence, IOA was collected for approximately 20% of the study. The baseline, intervention, and maintenance each had an agreement of 100%.

Figure 1

Participants' WCPM for Baseline, Intervention, and Maintenance



Note. WCPM = word correct per minute.

Descriptive Analysis

Table 4 presents the Expressive Vocabulary Test, Second Edition (EVT-2) results gathered from the administered tests before the baseline. Data for each participant was graphed for visual analysis, as shown in Figure 1. In addition, the data variability average for each participant for all three phases in the study (as described in Chapter 3) is presented in Table 7. The mean, median, and range of WCPM and EPM for all three phases in each phase for all four participants were calculated to show the change of reading performance (as shown in Table 5 and Table 6), in addition to the trend and the level, if applicable. Moreover, NAP was calculated between the baseline and the intervention phases only for each participant for WCPM and EPM.

Expressive Vocabulary Test, Second Addition

Table 4

EVT-2 for Each Participant

Score	Ali	Sarah	Khalid	Ahmed
Raw Score	100	93	91	98
Standard Score	92	78	80	92
Confidence Interval	84–101	71–87	73–89	84–101
Percentile	30	7	9	30
Age Equivalent	8:2	7:6	7:4	8:0
Grade Equivalent	2.7	2.0	1.8	2.5
GSV	162	158	157	161

Note. GSV = growth scale value.

On the EVT-2 and based on Table 4, Ali earned the highest raw score (i.e., 100) and earned a 92 as the standard score. His expressive language equivalent was 8 years, 2 months. Sarah earned a 93 as her raw score and a 78 as the standard score: the lowest standard score of all participants. Her expressive language equivalent was 7 years, 6 months. Khalid earned a 91 as his raw score and an 80 as the standard score. His expressive language equivalent was 7 years, 4 months. As for Ahmad, he earned a 98 as his raw score (close to Ali's raw score) and the same standard score as Ali: a 92. Ahmed's expressive language equivalent was 8 years, 0 months.

Visual Analysis

Words Correct Per Minute.

Ali. Ali was the first participant to start the baseline, intervention, and maintenance phases. During the baseline phase, data points (shown in Figure 1) demonstrated an overall decrease in trend (mean = 52.2 and median = 53) with low-to-moderate variability. Ali started the treatment package after showing three downward data points, and WCPM during the intervention phase was variable with low-to-moderate levels (mean = 68.9 and median = 66). Based on the intervention results, Ali gained 16.7 WCPM (32% increase) in mean and 13 WCPM (24.5% increase) in the median, which indicates an increase compared to the baseline phase.

In the maintenance phase, Ali's WCPM continued to be variable with low-to-moderate levels and a mean equal to 93.4 and a median equal to 93. The statistical maintenance results indicate that the participant maintained at least the same reading performance as the intervention phase or even showed an increase in performance. In Table 5, the highest WCPM for Ali in the baseline is 61 based on the range values, which

is considered an outlier; the lowest value is 46. By eliminating the WCPM scores that are lower than 61 from the 18 WCPM scores in the intervention phase, the number of remaining scores exceeding 61 is 13; dividing 13 by 18 produces 0.72, which equals 72% when multiplied by 100. Thus, the NAP-based effect size of the package intervention that combines VSM and PD on WCPM is 72%.

Table 5

WCPM Mean, Median, and Range for Each Participant

Participant		WCPM mean	WCPM median	Range
Ali	Baseline	52.2	53	46–61
	Intervention	68.9	66	49–90
	Maintenance	93.4	93	89–99
Sarah	Baseline	25.6	26	20–33
	Intervention	48.2	46	25–66
	Maintenance	66	66	63–69
Khalid	Baseline	23	23	18–31
	Intervention	38.9	41.5	20–53
	Maintenance	51.8	52	48–55
Ahmed	Baseline	28.4	28	21–33
	Intervention	48.8	51	33–61
	Maintenance	61.3	63	57–64

Note. WCPM = words correct per minute.

Sarah. Sarah was the second participant to start the baseline, intervention, and maintenance phase. During the baseline phase, data points in Figure 1 showed an overall decrease in trend and levels with low-to-moderate variability. Sarah began the treatment

package after having at least two downward data points, and the variability between the last three data points is low. In the baseline, the mean and median equal 25.6 and 26, respectively. In the intervention phase, Sarah's result for the mean is 48.2, and the median is 46. According to the baseline and intervention results, Sarah's mean and median scores increased considerably—almost doubling. She gained 22.6 WCPM (46.9% increase) in mean and 20 WCPM (43.4% increase) in the median.

During the maintenance phase, Sarah's statistical results indicate that she kept the same reading performance level with improvement in her overall reading (mean = 66 and median = 66). In Table 5, the highest WCPM for Sarah in the baseline is 33 based on the range values; the lowest value is 20. Applying the same procedures on calculating NAP, the NAP-based effect size of the package intervention that combines VSM and PD on WCPM is 88%.

Khalid. Khalid was the third participant to start the baseline, intervention, and maintenance phase. During the baseline phase, data points from Figure 1 showed an overall decrease in trend with low-to-moderate variability (mean and median = 23). After having at least two downward data points, Khalid started the treatment package. The WCPM during the intervention phase was variable with low-to-moderate levels (mean = 38.9 and median = 41.5). Based on the statistical results from the baseline and intervention phases, Khalid gained 15.9 WCPM (40.9% increase) in mean and 18.5 WCPM (44.6% increase) in the median.

In the maintenance phase, Khalid's statistical results (mean = 51.8 and median = 52) indicate that the participant maintained at least the same reading performance as the intervention phase or even showed an increase in reading. From Table 5, the highest

WCPM for Khalid in the baseline is 31 based on the range values; the lowest value is 18. Applying the same procedures on calculating NAP, the NAP-based effect size of the package intervention that combines VSM and PD on WCPM is 81%.

Ahmed. Ahmed was the last participant to start the baseline, intervention, and maintenance phases. In the baseline, data points in Figure 1 showed low-to-moderate variability and an overall decrease in trend and levels. Ahmed started the treatment package after having at least two downward data points. The mean and median scores for Ahmed in the baseline phase are 28.4 and 28, respectively. During the intervention phase, Ahmed's results for the mean is 48.8, and the median is 51, which indicates an increase in the mean and median scores. Ahmed gained 20.4 WCPM (41.8% increase) in mean and 23 WCPM (45.1% increase) in the median.

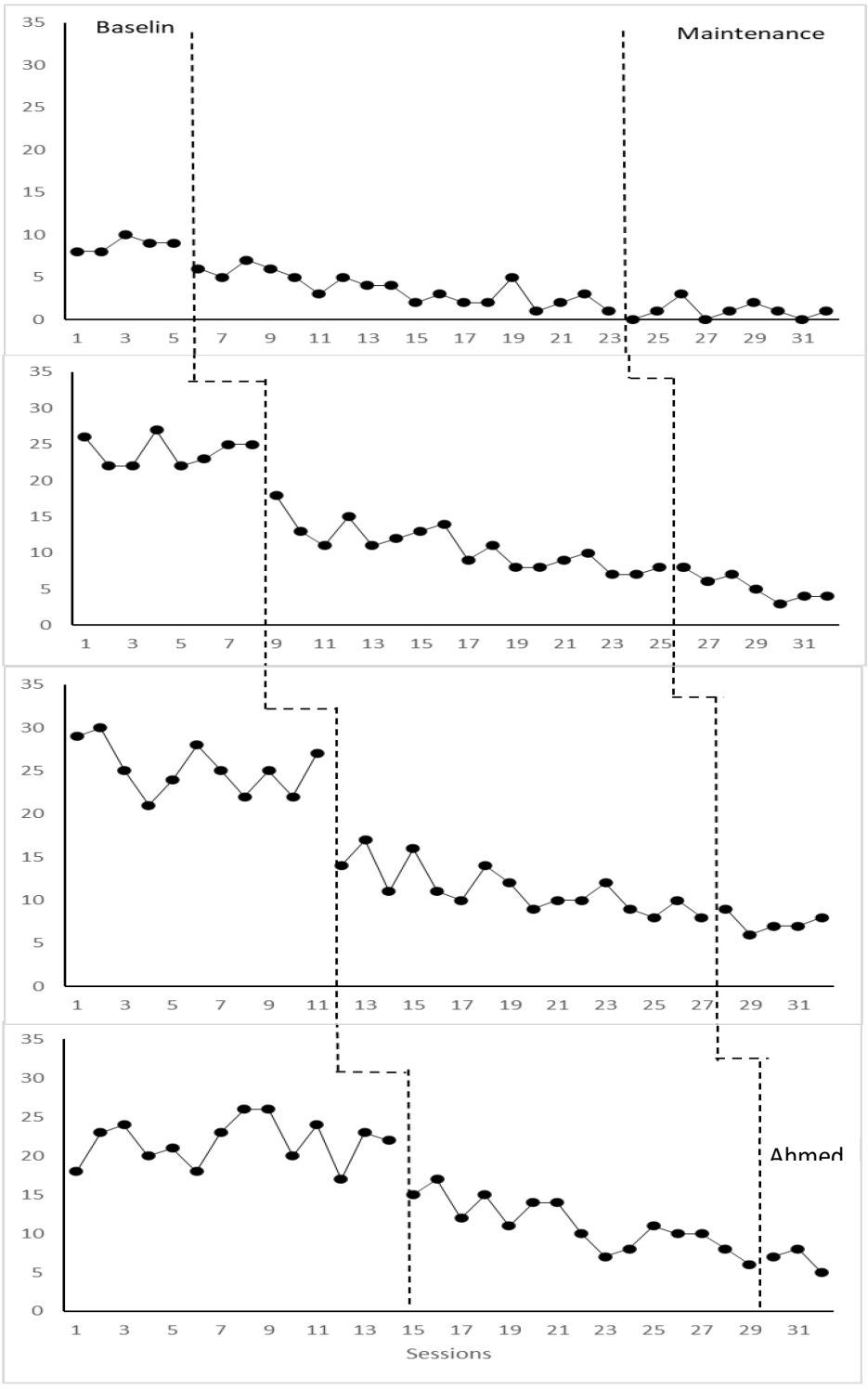
As for the maintenance phase, Ahmed's statistical results indicate that he at least maintained his reading performance (mean = 61.3 and median = 63). According to Table 5, the highest WCPM for Ahmed in the baseline phase is 33 based on the range values; the lowest value is 21. The NAP-based effect size of the package intervention that combines VSM and PD on WCPM, for Ahmed, is 93%.

Errors Per Minute

Ali. EPM were graphed to assist in the visual analysis of the data across the sessions for baseline, intervention, and maintenance (See Figure 2 and Table 6). Ali's mean and median scores were compared across all three phases. During baseline, he got the lowest average error score among all participants at low-to-moderate levels with a mean of 8.8 and a median of 9. As for the intervention, Ali EPM score dropped by 58% to 61% decrease for the mean and median respectively (mean = 3.7 and median = 3.5),

Figure 2

Participants' EPM for Baseline, Intervention, and Maintenance



Note. EPM = errors per minute.

with low-to-medium levels. During the maintenance, his average EPM was one error per reading for mean and median, and this score is the lowest among all participants. Ali, in some sessions, read approximately three passages (i.e., fourth grade passages) with no error. The statistical maintenance results indicate that the participant maintained at least the same reading performance as the intervention phase or even showed an increase in performance bases on EPM. Moreover, the NAP-based effect size of the package intervention that combines VSM and PD on EPM is 100%.

Table 6

EPM Mean, Median, and Range for Each Participant

Participant		EPM mean	EPM median	Range
Ali	Baseline	8.8	9	8–10
	Intervention	3.7	3.5	1–7
	Maintenance	1	1	0–3
Sarah	Baseline	24	24	22–27
	Intervention	10.8	11	7–18
	Maintenance	5.3	5	3–8
Khalid	Baseline	25.3	22	17–30
	Intervention	11.3	10.5	8–17
	Maintenance	7.4	7	6–9
Ahmed	Baseline	21.8	22.5	17–26
	Intervention	11.2	11	6–17
	Maintenance	6.7	7	5–8

Note. EPM = errors per minute.

Sarah. EPM were graphed to assist in the visual analysis of the data across the sessions for all three phases (Shown in Figure 2 and Table 6). During the baseline phase, data points in Figure 2 showed levels with low-to-moderate variability, and the mean and median for EPM equal 24. In the intervention phase, Sarah's result for the mean is 10.8, and the median is 11. According to the baseline and intervention results, Sarah's EPM mean and median scores decreased considerably. Her errors dropped by 13.2 WCPM (55% decrease) in mean and 13 WCPM (54% decrease) in the median.

During the maintenance phase, Sarah's statistical results indicate that she kept the same reading performance level with improvement in her overall reading and decrease in her EPM (mean = 5.3 and median = 5). Moreover, the NAP-based effect size of the package intervention that combines VSM and PD on EPM is 100%.

Khalid. EPM were graphed to assist in the visual analysis of the data across the sessions for the study (Shown in Figure 2 and Table 6). During the baseline phase, data points from Figure 1 showed an overall decrease in trend with moderate-to-high variability (mean = 25.3 and median = 22). Khalid median scores provides a better representation of EPM. The EPM during the intervention phase was variable with low-to-moderate levels (mean = 11.3 and median = 10.5). Based on the statistical results from the baseline and intervention phases, Khalid errors dropped by 14 EPM (55.3% decrease) in mean and 11.5 EPM (52.3% decrease) in the median.

In the maintenance phase, Khalid's statistical results (mean = 7.7 and median = 7) indicate that the participant maintained at least the same reading performance as the intervention phase and even showed a decreased in errors. Moreover, the NAP-based effect size of the package intervention that combines VSM and PD on EPM is 100%.

Ahmed. EPM were graphed to assist in the visual analysis of the data across the sessions for all three phases of the study (See Figure 2 and Table 6). In the baseline, data points in Figure 2 showed low-to-moderate variability, and the mean and median scores for Ahmed in the baseline phase are 21.8 and 22.5 EPM, respectively. During the intervention phase, Ahmed's results for the mean is 11.2, and the median is 11, which indicate an increase in the mean and median scores. Ahmed gained 10.6 EPM (48.6% decrease) in mean and 11.5 EPM (51.1% decrease) in the median.

As for the maintenance phase, Ahmed's statistical results indicate that he at least maintained his reading performance and EPM (mean = 6.7 and median = 7). Moreover, the NAP-based effect size of the package intervention that combines VSM and PD on EPM is 93%.

Data Variability

Words correct per minute.

Ali. Ali's data variability during the baseline is 7.7 (i.e., the highest in the study) due to the fact of having an outlier in the first baseline session. The value between the first and second sessions is 15 points, and this value is the highest among all participants. As for the intervention, the data variability was significantly less than the previous phase with a 2.6 points difference. Ali's maintenance variability slightly increased to 3.4, as shown in Table 7.

Sarah. Based on Table 7, Sarah's data variability is five points in the baseline phase which considered in the middle compared to other participants. This finding was due to less variability between the sessions (below five points). However, she showed the highest variability in her data points during the intervention compared to all participants,

with a value of 3.1. In maintenance, Sarah received the least variability in her data points with a value of three points for the same reason as in the previous phase. The average variability in the maintenance phase is approximately similar to the average variability in the intervention phase for Sarah.

Table 7

Average Data Variability

Participant	Baseline		Intervention		Maintenance	
	WCPM	EPM	WCPM	EPM	WCPM	EPM
Ali	7.7	0.8	2.6	1.5	3.4	1.2
Sarah	5	2.4	3.1	2.1	3	1.3
Khalid	5.5	3.4	2.7	2.7	4.7	1.3
Ahmed	3.2	3.5	2.5	2.4	3.5	2.5

Khalid. In the baseline phase, Khalid's data variability is similar to Sarah with a value of roughly 5.5. Furthermore, his data point variability was lower during the intervention compared to Sarah, with a value of 2.7. This finding was due to a difference (below five points) between all the sessions except one session. Last, Khalid received the highest average difference in results regarding the data points in the maintenance with a value of 4.7. This finding is attributed to having fewer sessions (as shown in Table 2) and a relatively high difference of values in that phase between three out of five data points (i.e., eight and seven points difference).

Ahmed. Ahmed showed the least variability between his data points in both baseline and intervention phases, earning 3.2 and 2.6 points, respectively, shown in Table

7. Although he showed a 12-point difference between two data points in the baseline phase, all the differences between his data points in both phases were equal or less than five points, except one that valued seven points. During the maintenance phase, Ahmed's average difference between his data points is 3.5 points.

Errors per minute.

Ali. Based on Table 7, Ali's data variability in EPM during the baseline is 0.8 (i.e., the lowest variability in the study) due to the fact of having similar scores in most baseline sessions with one to two differences between the sessions EPM scores. As for the intervention, the data variability was higher than the previous phase with a 1.5 points difference because he got the highest number of sessions in intervention phase as shown in Table 2. Ali's maintenance variability slightly decreased to 1.2, as shown in Table 7. Overall, Ali got the lowest variability in EPM for all phases among all participants.

Sarah. Sarah's data variability is 2.4 points in the baseline phase which is considered in the middle compared to other participants. Her intervention variability slightly decreased to 2.1. In maintenance, Sarah got the least variability in her data points for all three phases with a value of 1.3, as shown in Table 7. Sarah variability scores in all three phases were considered in the middle compared to other scores.

Khalid. Based on Table 7, Khalid's data variability in EPM during the baseline is 3.4 on average. Further, his data point variability was higher during the intervention compared to all participants, with a value of 2.7. Khalid's data variability, in the maintenance phase, is similar to Sarah with a value of roughly 1.3.

Ahmed. Ahmed showed the highest variability among all participants between his data points in both baseline and maintenance phases, earning 3.5 and 2.5 points,

respectively, shown in Table 7. This finding is attributed to having fewer sessions in the maintenance phase (as shown in Table 2) and a relatively high difference of EPM values in that phase between the three data points. During the intervention phase, Ahmed's average difference between his data points is 2.4 points.

Social Validity

Table 8

Likert-Type Scale for all Participants

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The treatment package helped me to read more words correctly.	100%	0%	0%	0%	0%
I liked using the treatment package techniques.	50%	50%	0%	0%	0%
I feel comfortable using the treatment package techniques.	50%	25%	25%	0%	0%
I am bored with using the treatment package techniques.	0	0	25%	50%	25%
The treatment package is easy to use.	75%	25%	0%	0%	0%

At the end of the study, a Likert-type scale form was distributed online via email to the participants. The results are presented in Table 8. All participants strongly agreed that the treatment package helped them in their reading, and they all agreed that they like the use of VSM and PD techniques—especially when they saw themselves reading

fluently in the videos. Three out of four participants felt comfortable using these treatment-package techniques; the fourth participant chose to be neutral (i.e., chose *neutral* regarding using VSM and PD techniques during the study). However, all participants strongly agreed that the treatment package was easy to use.

Chapter 5

Discussion

This chapter presents a synthesis of the study's results. The current chapter begins with an overview of the study followed by a discussion of each research question, which pertains to video self-monitoring (VSM), phrase drill (PD) reading interventions, and oral reading fluency (ORF). Then study limitations, future research directions, and the conclusion are discussed.

Overview of the Study

The aim of the current study is to extend the literature by (a) examining the efficacy of the treatment package in improving ORF in students with autism spectrum disorder (ASD) and (b) assessing the social validity of the treatment package. The study three questions that are explored are as follows:

1. Is the treatment package significantly effective in improving oral reading fluency in students with ASD?

2. To what extent will the treatment package's effects on reading fluency skills for students with ASD be maintained over time?

3. To what extent is the treatment package containing VSM and PD intervention socially valid?

Four participants were chosen for this study. Each met the study criteria for inclusion (Table 3). This study utilized a multiple baseline design. The dependent variables were word correct per minute (WCPM) and errors per minute (EPM) and was calculated for all participants during the research's three phases: baseline, intervention,

and maintenance. Participants also completed the Expressive Vocabulary Test, Second Edition (EVT-2), was administered once at the beginning of the study, and social validity using the Likert scale was administered at the end of the study. The students' instructional reading level (shown in Table 4) was determined by taking the average score after reading three passages from the fourth grade before starting the baseline sessions. In order to fully address the research questions, all participants' results and performances are discussed and analyzed in the following section.

Research Questions

Question 1. The treatment package significantly improved the participants' ORF and reading level based on the participants' results from WCPM and EPM discussed in Chapter 5. According to the instructional reading levels depicted in Table 3, all participants in terms of ORF were two grade levels below their peers, except Ali, who was one grade level below. By the end of the study, all participants significantly improved their ORF, which is reflected in their instructional reading level improvement. Ali showed an increase between 25% to 32% in his WCPM; Sarah showed the highest increase of WCPM in the study, which was between 43% to 47%. Khalid demonstrated a rise in his WCPM, which ranged from 41% to 45%. Additionally, Ahmed (the last participant), having the highest size effect, showed an increase between 42% to 45% in his WCPM.

Further, Ali exhibited the highest decrease among participants with a drop between 58% to 61% in his EPM, and Sarah demonstrated a decrease of EPM in the study, which was between 54% to 55%. Khalid showed a decrease in his EPM, which ranged from 52.3% to 55.3%. Ahmed (the last participant), having the highest size effect,

displayed a decrease between 48.6% to 51.1% in his EPM. All participants improved at least one grade level or more in their instructional reading level, and the effect size in the study is medium to large (i.e., from 0.72 to 0.93).

Based on these findings, the treatment package containing VSM and PD is significantly effective in improving ORF for students with ASD. Consequently, the use of evidence-based practice (i.e., VSM and PD) is effective in improving ORF for students with ASD, as shown by increasing their WCPM and decrease for their EPM during the reading. The current results are in line with other studies using VSM (Decker & Buggey, 2014; Montgomerie et al., 2014; Robson, 2015) and PD (Barnes and Rehfeldt, 2013; Begeny et al., 2006; Guthrie, 2017; Jones et al., 2009; Jones and Wickstrom, 2002; Noltemeyer et al., 2014; Utley, 2017) techniques with children with disabilities.

Question 2. This study comprised three phases: baseline, intervention, and maintenance. Figure 1 demonstrates that all participants' WCPM data points during maintenance were at the same level as the last data points from the intervention phase or even more in some cases. In addition, Figure 2 shows that all participants' EPM data points during maintenance were at the same level as the last data points from the intervention phase. Table 5 presents the range of data points during each phase. During the maintenance phase, the lowest value in the range for the maintenance phase is very close to the highest value in the range for the intervention phase. This finding indicates that all participants' lower ORF scores for maintenance were approximately equal to or slightly less than their best performance during the intervention phase. Therefore, the effects of the combined reading fluency skills were maintained over time for students with ASD.

Question 3. The last research question was related to VSM and PD's social validity. As seen in Table 5, all participants agreed on the usefulness and the convenience of the treatment package. Although one participant (Ali) reported a neutral rating regarding the comfort of using VSM and PD, he did not show any sign of discomfort throughout the sessions. This could be due to the significant time he spent in the study's intervention phase; however, even with this extended time in intervention, he did not oppose the idea of using VSM and PD in the future to improve his reading performance. Thus, it can be inferred that the treatment package still had value for all participants, even in light of this rating.

Further, the questionnaire findings are associated with the concept of VSM being easy to be administered and used in addition to being inexpensive, and all we need is a digital recorder such as smartphones or tablet and simple video editing apps (Ayala & O'Connor, 2013). Even though no studies that implemented VSM on improving ORF discussed whether VSM is socially valid or not, the social validity outcomes in this study are in line with other studies using VSM with children with ASD targeting social skills (Chi, 2019; Kabashi & Epstein, 2017; Kabashi & Kaczmarek, 2017)

Data variability. Although one participant (Ali) had one outlier in his first session, this outlier did not significantly affect the study results or the participant's results. The effect size for the participant is medium and eliminating the outlier would not change the effect size or the data variability for him. The reason behind this outlier is not determined; however, Ali's following data points did not show a significant difference between them, which, in turn, did not affect his overall data. Hence, keeping this outlier or disregarding it would not significantly affect the study outcome. A few outliers' data

point that run contrary to the trend do not compromise the demonstration of experimental control (Cooper et al., 2007).

Overall Benefits of the Research

The study participants were students who struggle in reading at their grade level, and they were at least one grade level behind their peers. Ali instructional reading level was one grade level behind his class peers while the three participants (Sarah, Khalid, and Ahmed) were two grade level. After completing the study, all participants ORF increased between 13 WCPM to 23 WCPM on average between baseline and intervention. Additionally, their WCPM improved between 25% to 47% for all participants which was significant, and their reading level increased at least one grade level.

Moreover, the positive effect of the treatment package extended to reducing the errors per reading or EPM for all participants. The EPM improved between 48.6% to 61% for all participants, and this contributed to improve the ORF. The errors at the beginning of the study were double digits for all participant (i.e., from 10 to 30 EPM); however, at the end of the study, the EPM for all participants dropped to single digits, equal or less than nine EPM. One participant, Ali, had several sessions at the end of the study with zero EPM. Academic skills were not the only gain in this study, the participants attitude and self-esteem changed during the study.

The changed in behavior and attitude was noticeable from the participants and their parents' sides during and after the intervention sessions. For the participants, they started to have higher self-esteem and confidence in their attempts to read and emulate what they saw at the beginning of each intervention session. In addition, the participants were eager to begin the session and see themselves read fluently in the VSM video and

started to see themselves as fluent readers. As for the participants' parents, Khalid mother was happy that her child started reading more because he was showing signs of frustration while reading textbook passages due to making multiple errors (e.g., 25 to 30 per passage). Additionally, Ahmed's parents were asking about the treatment package and if their child's teacher can implement it after the end of the study because Ahmed showed signs of motivation and confidence to read more passages.

Implications of the Research

Even though several studies have been focusing on reading deficits in general, a limited literature has been documented on the literacy, reading interventions, reading difficulties, and reading skills including ORF of students with ASD (Asberg et al., 2008; O'Connor & Klein, 2004; Senokossoff, 2016). Within the limited literature that has focused on improving the reading performance of students with ASD few of the studies have discussed, targeted, and measured a fundamental reading skill, ORF, that facilitates comprehension (Reisener et al., 2014; Solari et al., 2017). Those few studies had examined the effects of using reading fluency interventions on students with ASD (Guthrie, 2017; Hua et al., 2012; Reisener et al., 2014; Utley, 2017). Due to the limited reading interventions for students with ASD, evidence-based practices in reading are required, and these practices should meet rigorous criteria (Accardo et al., 2017; Reutebuch et al., 2015). To improve the ORF for students with ASD, effective strategies for students with ASD must be utilized to effectively help those students.

It is well documented that visual support and error-correction strategies benefit individuals with ASD (Leach & Rodecki, 2013; Utley, 2017). One of the visual support or visual learning method is VSM which is proven in the literature to be effective with

individuals with ASD (Lee, Lo, & Lo, 2017). The other strategy, error-correction, is PD which is an effective error-correction procedure for individuals who struggle in reading including ASD (Guthrie, 2017). Further, VSM, recently, has emerged as being used in few studies to improve reading performance (Decker & Buggey, 2014; Montgomerie et al., 2014; Robson, 2015) and has not been explored with other evidence-based reading interventions such as PD. PD has been administered as an additional intervention in a package of interventions (Barnes and Rehfeldt, 2013; Jones et al., 2009; Jones and Wickstrom, 2002).

Thus, the study investigated the effect of both intervention in one treatment package to improve ORF which in turn improve the overall reading performance. This study adds to the literature regarding ORF intervention for students with ASD who struggle with reading as well as the role of VSM and PD in improving their overall reading performance, specifically WCPM and EPM. The study results confirm the positive and effective impact on ORF for students with ASD. However, new research should investigate the effect of VSM and PD, as stand-alone interventions to see their effects on ORF and EPM in isolation. In addition to that VSM could be paired with another effective error-correction procedure, and PD could be paired with another visual learning method to explore the effect of these strategies separately counting the effect of the new strategies.

Limitations and Future Research

Participants' sample size. The first limitation of this study is the small sample size. A small size sample (i.e., $n = 4$), which includes fourth-grade students, was handpicked for the present study due to the involved nature of the intervention. However,

this sample size is typical for single case research (Cooper et al., 2007). These students met the eligibility criteria for the study under single-case methodology and the multiple baseline design used in this study (See Table1). Although the participants presented as students with ASD who were at high risk for reading fluency difficulties were of various ages, a minimal variation in demographics emerged between them because the participants were from the same classroom with similar racial, religious, ethnic, and socioeconomic group.

Additionally, the study findings may not be generalized to fourth-grade students who are at different reading fluency rates or even students in other grades. Likewise, due to the previous limitation on the sample size, the findings cannot be generalized to a larger ASD population or even to a general population of struggling fluency readers without more research. Consequently, researchers should carry on with conducting more research to examine the effect of VSM and PD on students with ASD from different grades and expand their work to investigate other student groups from diverse populations, geographical areas, and ages.

Setting. Due to the COVID-19 epidemic, this study was conducted online using the Zoom software. All education institutions in Saudi Arabia, including public and private schools and universities, were switched to remote-only learning for the entire year. This condition could be a possible factor affecting the study and the participants. Some of these factors are (a) administering proven effective distance education practice for students with disabilities, (b) providing face-to-face (i.e., physically) education with E-learning method, (c) having insufficient materials that are suitable for students' needs, (d) incorporating IEP online through E-learning for students with disabilities, and (e)

affecting the "richness" of learning and teaching materials which could affect the education quality overall (Ayda, Bastas, Altinay, Altinay, & Dagli, 2020). Parmigiani, Benigno, Giusto, Silvaggio, and Sperandio, (2020) add more factors which are technologies (e.g., having adequate devices for online classes, low internet connectivity, and preparation for using both hardware and software without the family help especially for student with severe disabilities), instructor relationships with families, instructors' collaboration (e.g., classroom and special education teachers), and teaching method

Therefore, a possible future study could be a replication of this study in a face-to-face format. This would allow researchers to investigate if online classes affected the results of this study, or if online administration of reading interventions provide a promising path forward for supporting students in different settings.

Additionally, the researcher conducted the sessions during school time (during the reading and the art class time), so the participants could join the study session while attending the school online. Online school and classes come with the burden of technical issues, and these issues emerged during a few sessions. Technical issues could emerge from all sides, including from the researcher, the participant, and the school's online platform. For instance, in three sessions, one participant (Ahmed) started the session later than scheduled due to his Internet connection issues.

Conclusion

This study was implemented to determine the effect of a treatment package containing VSM and PD on students with ASD who have reading fluency difficulties by administering a multiple baseline design across participants. The participants were fourth-grade elementary school students with ASD with significant reading fluency

difficulties. Each had been declared eligible for special education. The current study uncovered three key findings: (a) the treatment package improved the participants reading level significantly, (b) all participants maintained the gains from the treatment-package implementation, (c) the treatment package is socially valid.

Based on the study findings, the intervention package was confirmed to positively affect the reading rate for participants with ASD. Because no previous studies have been conducted to measure the effect of the intervention package containing VSM and PD on students with ASD, this study adds to the literature. Furthermore, with the limited research of evidence-based reading interventions for students with ASD that targets improving reading skills—such as reading fluency—researchers should expand on the reading interventions for students with ASD and expand the sample size to include more students with ASD in future studies.

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Appendix A

Likert-type Scale for Children with ASD

ID	Statements	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
1	The treatment package helped me to read more words correctly.					
2	I liked using the treatment package techniques.					
3	I feel comfortable using the treatment package techniques.					
4	I am bored with using the treatment package techniques.					
5	The treatment package is easy to use.					
Comments						

Appendix B

Protocol Checklist for All sessions

Table B1

Protocol Checklist for Baseline Sessions			
Participant name:		Inter-observer name:	
Date: / /	Time:	Session#:	
#	The list	Completed	Not Completed
1	The researcher provides the directions to the participant prior to reading the probe.		
2	The participant begins reading when prompted by the researcher.		
3	The participant reads the passage.		
4	The researcher starts the stopwatch.		
5	The participant stops reading the probe when prompted.		
6	Observer notes behavior or circumstances outside the parameters of the protocol.		
Behavior Notes:			

Table B2

Protocol Checklist for Intervention Sessions			
Participant name:		Inter-observer name:	
Date: / /	Time:	Session#:	
#	The list	Completed	Not Completed
1	The participant switch on the iPad.		
2	The participant puts on the headphone.		
3	The participant attends to the VSM video clip.		
4	The participant begins reading the intervention prob when prompted by the researcher.		
5	The participant reads the probe.		
6	The researcher points out to the error words and pronounce it to the participant.		
7	The participant repeats the error words and their full phrase or sentences when prompted.		
8	The participant begins reading the next reading probe when prompted by the researcher to calculate WCPM.		
9	Observer notes behavior or circumstances outside the parameters of the protocol.		
Behavior Notes:			

Table B3

Protocol Checklist for Maintenance Sessions			
Participant name:		Inter-observer name:	
Date: / /	Time:	Session#:	
#	The list	Completed	Not Completed
1	The researcher provides the directions to the participant prior to reading the probe.		
2	The participant begins reading when prompted by the researcher.		
3	The participant reads the passage.		
4	The researcher starts the stopwatch.		
5	The participant stops reading the probe when prompted.		
6	Observer notes behavior or circumstances outside the parameters of the protocol.		
Behavior Notes:			