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Using Point of View Video Modeling to Teach Math to Students with Autism Spectrum Disorder in Saudi Arabia

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USING POINT OF VIEW VIDEO MODELING TO TEACH MATH TO STUDENTS WITH AUTISM SPECTRUM DISORDER IN SAUDI ARABIA

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USING POINT OF VIEW VIDEO MODELING TO TEACH MATH TO STUDENTS

WITH AUTISM SPECTRUM DISORDER IN SAUDI ARABIA

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ABSTRACT

USING POINT OF VIEW VIDEO MODELING TO TEACH MATH TO STUDENTS WITH AUTISM SPECTRUM DISORDER IN SAUDI ARABIA

By

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Dissertation supervised by Dr. Temple S. Lovelace

The utilization of academic skills plays a significant role in an individual's function in society. For countries who are still developing an effective base of evidence-based practices, such as Saudi Arabia, single-subject research can be a powerful tool in discovering best practices for students with autism spectrum disorder (ASD). The purpose of this study was to determine the effectiveness of point-of-view video modeling (POVM) in improving the math skills (addition with regrouping) of elementary participants with ASD. A multiple baseline across participants design was used to examine the effectiveness of the intervention on each participant's ability to solve two-digit by two-digit and one-digit by one-digit addition with regrouping problems, their ability to successfully access the video on an iPad, and their ability to generalize a learned skill to a new skill (three-digit by two-digit or two-digit by two-digit). Results demonstrated the effectiveness of POVM on improving all participants' solving addition performance across all problem types. A significant difference was found in the increase of digits correct per minute and steps completed between the baseline and intervention phases for each participant. Generalization of solving addition problem performance to untrained math skills (three-digit by two-digit and two-digit by two-digit) was evident for each participant and resulted in a strong effect size measure. All participants maintained their ability to solve addition with regrouping problems and using all required steps for regrouping to solve each problem. Overall, evidence supported that participants with ASD can independently engage in addition with regrouping problems following the intervention. Future researchers can replicate this study for examining different math skills or other content that impact the academic performance of participants with ASD.

DEDICATION

This dissertation is dedicated wholeheartedly to my family and friends who have been a source of strength and inspiration. Special feelings of gratitude towards my loving and supportive parents who, through their words of encouragement, have helped me intellectualize my childhood fantasy into an academic study that will eventually become a career. They have also molded me into the person that I am today and even more. I am genuinely thankful for your support. I also dedicate this dissertation to my brothers and sisters for their love and ever-present support in my endeavors towards learning.

I also dedicate this dissertation to my soulmate, my wife Mona. Studying abroad has been challenging for both of us. However, I am thankful for your patience and continual inspiration all through my academic journey. Your words of encouragement and continued support have ensured that I give it all it takes to finish what I have started.

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Chapter I

Introduction

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by impairments in an individual's communication, interaction, repetitive behaviors, restricted activities and interests (American Psychological Association, 2013; National Institute of Mental Health, 2016; Volkmar & McPartland, 2014). These characteristics present difficulties for individuals in the areas of social relations, academic performance, and independence (Schall, Wehman, & McDonough, 2012). In addition, most students with ASD experience difficulties with problem-solving, sequencing, self-regulating, and planning, which negatively affect their academic performance (Buggey, 2012; Weitlauf et al., 2014).

Students with ASD are eligible to get academic and functional life skill instruction under the Individuals with Disabilities Education Improvement Act (IDEIA) through high school graduation or the age of 21 (IDEA, 2004). Upon graduation, students with ASD often receive less support and experience difficulty engaging in an independent lifestyle, securing stable employment, and achieving their goals in society (Hendricks &Wehman, 2009). Buggey (2012) states that instruction for students with ASD concentrates on enhancing aptitudes related to social and behavioral abilities with a heavy emphasis on improving basic skills. Behavioral and social skills are essential for all students with disabilities, including students with ASD. However, supporting sufficient math skills in students with ASD is rare even as the number of jobs that require some knowledge of arithmetic keeps increasing (Buggey, 2012).

Individuals with ASD have difficulty developing functional academic skills including mathematic skills (Burton, Anderson, Prater, & Dyches, 2013). To address this skill gap, researchers have promoted the use of evidence-based practices (EBPs) for individuals with disabilities including ASD (Spooner, Knight, Browder, & Smith, 2011). Simpson (2005) defined EBPs as effective practices that meet the following requirements: (1) they must be systematic, (2) used with fidelity, and (3) customized to fit the individual needs of the learner. In order to support effective practices with individuals with ASD, researchers found promising results in interventions that used the single-subject methodology (Odom et al., 2003). Within this methodology, there are many practices that provide effective strategies for teaching individuals with ASD.

The difficulties in educating children with ASD are numerous, however, there are some promising methods. One method that has received much consideration in the literature is the use of modeling (Buffington, Krantz, McClannahan, & Poulson, 1998; Charlop, Schreibman, & Tryon, 1983; Tryon & Keane,1986). Modeling consists of an individual, such as a student, watching a live model (a peer or adult model) demonstrate a target behavior. The student is prompted to imitate that target behavior (Stahmer, Ingersoll, & Carter, 2003). Charlop et al. (1983) showed that modeling that used a peer as a model was more effective compared to the traditional instructional methods (i.e., trial and error) in improving the ability of children with ASD to label tasks. Outcomes of their study indicated that all four individuals with ASD learned through peer modeling. Moreover, maintenance and generalization of correct responding to labeling tasks were observed when the children learned through observing their peers rather than by trial and error instruction. Tryon and Keane (1986) used peer modeling to promote independent play for individuals with ASD. In their study, the participants observed a peer model demonstrate appropriate play with unknown toys. In each case, each participant with ASD was successful in imitating play skills. From this modeling literature Charlop et al. 1983; Tryon and Keane,1986, came video modeling (VM), which commonly includes the individual watching a video of a model demonstrating a target behavior and later imitating that behavior.

In Vivo Modeling and Video Modeling

Traditional modeling is done through two methods. The first is delivered through in vivo modeling (IVM) and the second is video modeling (VM). IVM consists of having an individual watch a live model performing a target behavior (Charlop, Le, & Freeman, 2000). VM consists of an individual watching a video of a model demonstrating a target behavior (Charlop et al., 2000). Thelen, Fry, Fehrenbach, and Frautschi (1979) demonstrated that both IVM and VM were successful in teaching new behaviors (as cited in Charlop et al., 2000, p. 538). However, Thelen et al. (1979) preferred VM over IVM for several reasons. First, a video can deliver that modeled behavior in different naturalistic settings, which may prove difficult for IVM which is typically done in a facility or a classroom. Second, with VM, the educator has more control over the intervention than with IVM. Third, VM allows for greater use because a live model does not have to be available every time the intervention is needed. Finally, tapes can be reused with other students (as cited in Charlop et al., 2000, p. 538). Lastly, Graetz, Mastropieri, and Scruggs (2006) found that VM is also more cost-effective and less time consuming than IVM. Moreover, a study conducted by Charlop et al. (2000) indicated that VM led to faster acquisition of tasks than IVM.

There is a wide literature base for VM as an effective intervention to enhance academic skills for individuals with ASD (Spencer, Mechling, & Ivey, 2015). There are a number of literature reviews that have investigated and evaluated what researchers have done to show the effectiveness of VM when using it with individuals with ASD (Ayres & Langone, 2005; Delano, 2007; Hitchcock, Dowrick, & Prater, 2003; Machalicek et al., 2008; Prater, Carter, Hitchcock, & Dowrick, 2012; Tetreault& Lerman, 2010; Shukla-Mehta, Miller, & Callahan, 2010). Dowrick (1999) was among the first to demonstrate the utility of VM with children with ASD. Dowrick (1999) observed video self-modeling (VSM) to be effective in different settings with different subjects, including individuals with ASD. In VSM, the individual with ASD serves as his or her own model for the target behavior. VM has also been extended to non-academic skill areas, such as a vocational workshop, walking, and communication (Donovan, Green, & Hartley, 2010). As the field of VM has grown, it includes point-of-view video modeling (POVM), which utilizes a video from the vantage point of the person. POVM has shown to be an effective intervention with individuals with ASD in modeling different skills (Kagohara et al., 2012; Jowett, Moore, & Anderson, 2013; Shrestha, Anderson, & Moore et al., 2013; Yakubova, Hughes, & Hornberger, 2015; Yakubova, Hughes, & Shinaberry, 2016).

Video Modeling and Video Prompting

Both video prompting (VP) and video modeling (VM) are types of video-based intervention (VBI). VP uses short video clips to teach the target behavior to a student one step at a time.VM in the other hand VM is a video recording of an adult or a peer modeling a target behavior in one video clip. There are many studies that have examined the effectiveness of using VP to teach children with developmental disabilities including

ASD different skills such as preparing food (Sigafoos et al., 2005), cleansing (Kellems & Morningstar, 2012; Sigafoos, O'Reilly, Cannella et al., 2007), daily living tasks (Cannella-Malone et al., 2006; Cannella-Malone, Brooks, & Tullis, 2013; Gardner & Wolfe, 2013), and multi-step math calculation skills (Kellems et al., 2016). VP can be effective interventions to teach varied skills to individuals with developmental disabilities. Each of the types of VBI can be used individually or combined to create appropriate interventions depending on the individual's ability and skill levels. Ultimately, the type of VBI used is based upon an individual's ability to: (a) attend to the video (both visually and cognitively), (b) imitate behaviors observed on the video, (c) match every item from the video to the particular item, and (d) hear the audio (Kellems et al., 2016). There are two studies comparing VM and VP to find out which strategy is more effective in teaching daily living skills to individuals with ASD (Cannella-Malone et al., 2006; Gardner & Wolfe, 2013). Cannella-Malone et al. (2006) compared VM and VP and found that VP was effective while VM was not effective in teaching daily living skills. The other study conducted by Gardner and Wolfe (2013) showed more effectiveness for VP and somewhat effectiveness for VM when teaching daily living skills. It can be concluded that VM is for shorter and easier tasks that are more fluid and usually don not need to be broken down into many smaller steps (Kellems et al., 2016). VP is used for extended and more complicated tasks that are easier to master if they are broken down into smaller steps. The individual will successfully complete one step before being given the next step depending on the severity of the individual's disability and the nature of skills given (Kellems et al., 2016). According to Hughes & Yakubova

(2016), VM is considered to be a good option for skills taught in a natural setting (e.g., math class) or skills that are do not contain separate steps (addition with regrouping).

Significance of the Study

This study investigated the effectiveness of POVM in improving the academic skills of elementary school students with ASD. POVM is a specific type of VBIs where the orientation of the video is from the perspective of the model (Hine & Wolery, 2006). POVM is traditionally done with the clip showing the hands of the model demonstrating the target behavior. POVM has been shown to be effective when teaching academic skills (Kagohara et al., 2012; Jowett et al., 2013; Moore et al., 2013; Yakubova et al., 2015; 2016).

The use of academic skills and knowledge in everyday activities plays a significant role in an individual's function in society (Pennington, 2010). According to Pennington (2010), a majority of studies in academic skills emphasize the literacy of students with ASD as opposed to other major areas such as academic performance in other subject areas or functional skill development. There are limited studies that focus on the role of instructional strategies on the academic performance of students with ASD in mathematics (Burton et al., 2013; Jowett et al., 2013; Yakubova et al., 2015; 2016). Early mathematic skills are one of the solid predictors of later academic performance (Duncan et al. 2007). It is important to encourage individuals with ASD to have access to appropriate grade-level and advanced mathematics instruction (Browder et al. 2012). Teachers often consider mathematics as a difficult subject matter for children with ASD (U.S Department for Education, 2014). There are only four studies that focus on math acquisition skills using video modeling (Burton et al., 2013; Jowettet al., 2012, &

Yakubova et al., 2015; 2016). Burton et al. (2013) taught money skills to three male students with ASD between 13 and15 years old. Jowett et al., (2012) focused on teaching early basic numeracy skills to a male five years old. Yakubova et al. (2015) looked at teaching problem-solving skills with mixed fractions with unlike denominators to three male students with ASD between 17 and 19 years old. Yakubova et al. (2016) focused on teaching addition, subtraction, and number comparison skills to four male students with ASD between five and six years old.

Importance of EBPs and SSR in Saudi Arabia. For countries who are still developing an effective base of EBPs, such as Saudi Arabia, single-subject research (SSR) can be a powerful tool in discovering best practices for students with disabilities, including students with ASD. Currently, there was only one study done in the Middle East and Gulf countries that compared VM and life modeling to improve motor imitation skills for young children with ASD in Bahrain (Ahmad, 2015). Ahmad (2015) measured motor imitation skills on a sample of 10 students with ASD four to seven years old who were divided into two experimental groups. The first group received VM and the second group received reciprocal modeling based upon their scores on a motor imitation skills rating scale. Outcomes of the study demonstrated that there were no significant differences between the groups in the post-test scores; however, the group that used VM was the highest in maintaining the motor imitation skills they learned. Apart from this, there are no other studies that focuse on the use of VM to teach academic skills to individuals with ASD in the Middle East. In Saudi Arabia, Alqahtani (2015) used visual aids including VM and other video cues to teach motor skill acquisition to young children with ASD. Alqahtani (2015) developed an educational program based on the visual strategies involved in learning basic motor skills in children with ASD. Using the Childhood Autism Rating Scale, Second Edition (CARS-2), Alqahtani found that visual strategies through activities have helped improve the ability of children with ASD to express their basic needs and motor skills and become more independent (2015). Both studies were conducted using rating scales, which is a less effective methodology when looking at the effectiveness of an intervention with individuals with developmental disabilities (Ahmed, 2016; Alqahtani, 2015). According to Byiers, Reichle, and Symons (2012), single-subject designs (SSDs) give an appropriate substitute to experimental group designs for the aim of empirically determining the effectiveness of an intervention.

Fraenkel and Wallen (2006) stated that "studies involving single-subject designs that show a particular treatment to be effective in changing behavior must rely on replication across individuals rather than groups–if such results are be found worthy of generalization" (p. 318). SSR offers a powerful and useful methodology for developing the practices or interventions that benefit individuals with disabilities and their families (Horner et al., 2005). Horner et al. (2005) also concluded that SSR should be used for any systematic policy for promoting the development of EBPs in education, especially in the special education field. SSDs are an optimal method for both researchers and therapists who work with small populations such as individuals with ASD in examining EBPs. The strong internal validity of well-implemented SSDs studies allows for an analysis of visual data to support reliable conclusions (Byiers et al., 2012). Due to the limited research on academic math skills among students with ASD across all school grades, SSR provides causal, or functional, relationships between independent and dependent variables (King, Lemons, & Davidson, 2016). Therefore, the current study investigated the effectiveness of a POVM intervention addressing academic skills for students with ASD using SSD. This study is unique in that it can add to the research base of implementing video modeling through SSR using multiple baseline design in the Middle East.

Problem Statement

There is limited research that investigates the use of POVM to teach students with ASD academic skills including math acquisition (Burton et al., 2013; Jowett et al., 2012, & Yakubova et al., 2015; 2016). This proposed study investigated the effectiveness of POVM in teaching mathematic skills to students with ASD in an academic setting. To achieve this objective, the study examined the efficacy of POVM on students' abilities to solve numeric problems (addition with regrouping) in a classroom in Saudi Arabia.

Research Questions

For this research, the major focus was on the following questions:

1. To what extent is the POVM intervention effective in teaching students with ASD emerging math skills (addition with regrouping)?
2. To what extent will the effects of POVM intervention on emergent math skills (addition with regrouping) for students with ASD maintain over time?
3. 3. To what extent will the skills learned in POVM intervention generalize to more complex math problems?
4. 4. What is the social validity of using POVM intervention with students with ASD and their teachers?

Chapter II

Review of Literature

Multiple Definitions of Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that prevents one from fully engaging in social interactions, clearly communicating one's ideas, and/or perceiving information (National Institutes of Mental Health, 2016). According to the National Institute of Mental Health (NIMH) (2016), ASD is the name for a group of developmental disorders in which there is a wide range, or 'a spectrum,' of symptoms, skills, and levels of disability. However, ASD manifests itself in a variety of forms (e.g., self-imposed social isolation, deficiency of social-emotional reciprocity, and inability to start and maintain relationships), which greatly complicates the ability to articulate a universal definition (McCleery, 2015).

Similarly, ASD as described in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) is a mental disorder characterized by antisocial behavior, deficits in social-emotional reciprocity, lack of nonverbal communication, absence of connection between the verbal and nonverbal elements of communication, inability to develop and maintain relationships with others, development of repetitive patterns of behavior, and propensity toward stereotyped speech and routines, among others (American Psychiatric Association [APA], 2013). Prior to 2013, clinicians used the Diagnostic and statistical manual of mental disorders, fourth edition, text revision (DSM-IV-TR) to diagnose three independent disorders that were seen as part of a group of pervasive developmental disorders (PDDs). These PDDs later became known as ASD in the transition under the DSM-5. What was previously characterized in the DSM-IV-TR as an ‘‘umbrella’’ of PDDs with subcategories is now a single disorder that includes a spectrum of characteristics (APA, 2013; Volkmar & McPartland, 2014). This change stipulates that the ASD does not include discrete disorders under one umbrella term but is a single disorder with varying presentations and severity of behavior (APA,2013). Concern about limitations in identifying the reliability of subcategories was worrisome to many diagnosticians. Thus, these limitations were prompting this change (Volkmar & McPartland, 2014).

With this change from the categorical description of discrete disorders to the spectrum, diagnosticians were expected to view ASD as a continuum of mild to more severe symptoms (APA, 2013). Many clinicians found that identifying individuals with ASD was difficult given the many variations in symptoms and behaviors, especially considering the complications brought about by the numerous comorbid conditions described for children considered to have ASD, which occur at varying times and at different developmental levels for children (Levy, Mandell, & Schultz, 2009). This problem continues even after the introduction of the DSM-5 because the newer criteria mandate that symptoms be present from early childhood, even if the child does not have obvious symptoms until social requests exceed his or her capacity to respond to circumstances. This is problematic because it is often difficult to identify or describe social inadequacy in early childhood (Young & Rodi, 2013). In spite of the criteria changes in the DSM-5 that encourage earlier diagnosis, these criteria may lack the specificity for higher functioning children, especially if they have a comorbid disease to be diagnosed even as they grow older (APA, 2013).

The DSM includes core symptom domains and diagnostic features. A change from the DSM-IV-TR to the DSM-5 was a reduction in the core symptom domains (see Table 2.1). The core symptom domains for ASD were reduced from the previous three to two: (1) impaired social communication and social interaction and (2) restricted, repetitive behaviors, interests, or activities (APA, 2013). Autistic disorder, Asperger syndrome, and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) were consolidated into a single ASD classification as well. This change oversimplifies the core symptom identification, making it more difficult to determine what behaviors may constitute an ASD and confuse providers. The description of the criteria does take the variability of functional impairment into consideration by addressing the effects of context such as the individual's environmental and developmental stages. Behaviors indicative of these core symptoms may be present but may be difficult to distinguish in certain contexts, or the individual characteristics may be less obvious in certain environments or during certain developmental stages. Thus, the manifestations of the disorder are exceptionally varied (Young & Rodi, 2013).

Table 2. 1

Comparison of the Diagnostic Criteria for ASD Across DSM Versions

	DSM-5	DSM-IV-TR	
Diagnostic Classification	Autism Spectrum Disorder (ASD)	Pervasive Developmental Disorders (PDD)	Key Differences
Diagnostic Subcategories	None *(However, it is specified that individuals with a well-established DSM-IV diagnosis of Autistic Disorder, Asperger Syndrome, or PDD-NOS should be given the diagnosis of ASD).*	1. Autistic Disorder 2. Asperger Syndrome 3. Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) (1–3: ASD) 4. Rhett's Syndrome 5. Childhood Disintegrative Disorder (CDD)	In DSM-5: ▪ There are no diagnostic subcategories, reflecting research indicating a lack of reliability across clinicians in assigning subcategories. ▪ ASD encompasses Autistic Disorder, Asperger Syndrome, and PDD-NOS. Rhett's Syndrome and CDD are no longer included in the ASD diagnosis.
Requirement for Diagnosis	Must meet at least 4 behavioral criteria overall.	Must meet at least 5 behavioral criteria overall,	In DSM-5: ▪ It is now specified that behavioral criteria can be met based on historical reports.
Age of Onset	Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities or may be masked by earned strategies in later life).	Delays or abnormal functioning in at least one of the 3 behavioral must be present prior to age 3 years.	In DSM-5: ▪ Symptoms do not have to be apparent before age 3.

The Current Definition of Autism Spectrum Disorder

According to APA (2013), the diagnostic features related to an ASD in the DSM-5 have four major criteria: (a) continuous impairment in interaction and communication that are reciprocal and social in nature, (b) patterns of activities, interests, and behaviors that are restricted and repetitive, (c) symptoms that are persistent from early childhood, and (d) symptoms that interfere with everyday functioning. These criteria also include a requirement that the individual's symptoms impede functioning, especially in social and occupational areas. In addition, social communication deficits should not be related to an individual's intellectual development. Children with ASD lack the ability to interact with others in effective ways, such as difficulty with inconsistent routines, problems with planning, organization, and coping, which cause difficulty in academic and home situations (APA, 2013).

Functionally, individuals with ASD may have difficulty with contextual aspects of their environments, including their interactions with others (APA, 2013). Age and environmental context can affect a child's perception of the situation and the presentation of characteristics of ASD. Learning for younger children who are not in school usually takes place through social interaction with peers in the playground or with parents at home (APA, 2013). If the environmental context is not conducive to social interaction and enhancement of social communication, this may have an impact on behaviors and, in turn, the appropriate diagnosis (APA, 2013).

According to APA (2013), the DSM-5 includes a new diagnosis of social (pragmatic) communication disorder, which may confuse diagnosticians and prevent accurate diagnosis of children with a potential ASD. The diagnostic features in social communication disorder may interfere with ASD under the determination of verbal communication deficits. Children with social communication deficits could get a diagnosis of social (practical) communication disorder instead of a diagnosis of ASD (APA, 2013; Young & Rodi, 2013).

The Increase in the Prevalence and Incidence of ASD

The Centers for Disease Control and Prevention (CDC) continues to report alarming increases in the numbers of children who are diagnosed with ASD across the United States (CDC, 2014). It is estimated that 1 in 68 children were diagnosed with ASD in 2010 (CDC, 2014). This represents a 30% increase from 2008, when the incidence was 1 in 88, and a 60% increase from 2006, when the incidence was reported to be 1 in 110 children (CDC, 2014). According to CDC (2019), the most recent prevalence of ASD reported was estimated to be 1 in 59 children diagnosed with ASD. McPartland, Reichow, and Volkmar (2012) have suggested that the ‘‘autism epidemic’’ has less to do with a true rise in prevalence than with greater awareness, clarification and expansion of the idea of what constitutes ASD, over identification of the disorder, or use of the ASD label to establish service eligibility. As a result of the increased incidence and concerns about overdiagnosis, new guidelines for the identification of ASD were introduced in the fifth edition of the (DSM-5) by APA in May of 2013 (Regier, Kuhl, & Kupfer, 2013). However, rather than increasing specificity for diagnosis and limiting overdiagnosis, these guidelines may only serve to decrease eligibility for services for some children who may previously have been considered to be on the autism spectrum and are still in need of services (Volkmar & McPartland, 2014).

ASD is currently listed among some of the most common psychological disorders for learners (Gilmartin, 2014). As a result, it warrants attention in terms of future research since the rates of ASD worldwide have sharply increased since 2000 (CDC, 2016). A recent report by the CDC (2016) identified an increase in the frequency of autism-related occurrences in children. As the recent data in the United States regarding the incidence of ASD development shows, there has been a steep increase in the number of ASD cases; the rate of ASD incidence has accelerated, changing from 0.67% to 1.47% (CDCP, 2016). There has been a nearly 20% increase over the past 10 years (CDC, 2016). Due to the increased numbers of ASD, research is warranted and in demand to investigate the effectiveness of interventions and identify teaching instructions for students with ASD (Burton et al., 2013).

The prevalence of ASD in Saudi Arabia. The prevalence of ASD in Saudi Arabia has not been widely researched with only a limited number of studies available. An epidemiology systematic review of prevalence of ASD in Arab Gulf countries (i.e., Bahrain, Kuwait, Qatar, Saudi Arabia, Sultanate of Oman, and United Arab Emirates (UAE)) focused on studies from 2007-2013 and found that there were only four studies about prevalence of ASD from UAE, Saudi Arabia, Oman, and Bahrain. The prevalence of ASD was 1.4 per 10,000 in Oman, 29 per 10,000 for ASD in UAE, and 4.3 per 10,000 in Bahrain while in Saudi Arabia the prevalence was 1 in 167 which estmated approximately 28.6% of Saudi patients (Salhia, Al-Nasser, Taher, Al-Khathaami, & El-Metwally, 2014). The Saudi study that conducted by Al-Salehi, Al-Hifthy, and Ghaziuddin (2009) documented the characteristics of patients and reasons for referral based on DSM-IV criteria supplemented by information obtained from parent and child interviews, rating scales, and examination of school and hospital records (Salhia et al., 2014). According to Bin Battal (2016), 1,464 students with ASD were receiving special education services in the year 2015 in Saudi Arabia. There are no data on the number of school-age students with ASD in Saudi Arabia. Without information that is available in the number of students with disabilities who are receiving services without information on the specific disability type is based on the estimated prevalence of the United States Department of Education in 2009 for students between the ages of six and seven; it is estimated that there are 35,000 students with ASD in Saudi Arabia (Bin Battal, 2016).

Learning Models and ASD

Grandin (2009) observed that there are three autistic/Asperger cognitive types. First, visual thinkers who need to think in pictures and see things, either in their mind or physically in order to process information. Visual thinkers do better with geometry and trigonometry, but they have difficulty with algebra. Grandin is one of those individuals who thinks in pictures. Grandin (2009) stated that "for my work, visual thinking is very important. I can see everything in my head and then draw it on paper" (p. 1439). The second type of thinker is a pattern thinker who is excellent in math but may struggle with reading or writing. They can see relationships and patterns between numbers, but they are limited in reading and writing essays. Lastly, word and fact thinkers have a capacious memory for verbal language facts, such as information concerns film stars and sporting events. They usually have more difficulty drawing what they can see (Grandin, 2009).

Visually-based interventions. Instructional interventions used in classrooms must be evidence-based practices (EBPs) according to current legislation such as the Every Student Succeeds Act (ESSA) of 2015 (Haller, Hunt, Pacha, & Fazekas, 2016) and

IDEA 2004 (Simpson, Myles, & Ganz, 2008). Video-based instruction, an evidence-based practice, such as video modeling, is perhaps more appropriate and effective than other interventions for individuals with ASD (Bellini & Akullian, 2007; Delano, 2007b). Research has shown that many individuals with ASD learn and retain information best when it is visually presented (Dettmer, Simpson, Myles & Ganz, 2000). For instance, Bryan and Gast (2000) hypothesized the reason young adults with ASD responded to visual learning maybe because they sometimes have difficulty comprehending and paying attention to auditory stimuli. Because of this, presenting information visually is recommended for individuals with ASD (Hodgdon, 1995). Students with ASD learn best through visual means such as visual schedules (Mesibov & Shea, 2008), visually-based scripts (Simpson et al., 2008), and video-based instructions (e.g. Apple, Billingsley, & Scwartz, 2005; Burton et al., 2013; Delano, 2007; Jowett et al., 2012; Kagohara et al., 2012; MacDonald, Clark, Garrigan, & Vangala, 2005; McCoy & Hermansen, 2007; Moore et al., 2013; Odom, Collet-Klingenberg, Rogers, & Hatton, 2010; Reichow & Volkmar, 2010; Simpson, Langone, & Ayres, 2004; Taylor, Levin, & Jasper, 1999; Wang & Spillane, 2009; & Yakubova et al., 2015; 2016).

Several visually-based interventions have been used with varying degrees of success with individuals with ASD. Some of these interventions include visual cues (Ganz, Bourgeois, Flores, & Campos, 2008), visual supports (Dettmer et al., 2000), video modeling (e.g., Apple et al., 2005; Burton et al., 2013; Delano, 2007; Jowett et al., 2012; Kagohara et al., 2012; MacDonald et al., 2005; McCoy & Hermansen, 2007; Jowett et al., 2013; Odom et al., 2010; Reichow & Volkmar, 2009; Simpson et al., 2004; Wang & Spillane, 2009; & Yakubova et al., 2015; 2016), and picture activity schedules (e.g., Bryan & Gast, 2000; Spriggs, Gast & Ayres, 2007). Dettmer et al. (2000) conducted a study using visual supports to promote the task transition of two elementary-aged boys with ASD. The study was based on research supporting the theory that individuals with ASD are visual thinkers and respond better to visual stimuli compared to auditory stimuli. Dettmer and colleagues used the single-subject reversal design (ABAB) to examine the effectiveness of using visual supports to decrease the time the two children spent transitioning between activities. They found that using visual supports decreased the amount of elapsed time between receiving instructions and starting the next activity. Ganz et al. (2008) investigated the effectiveness of a multicomponent and visually cued imitation strategy using the single-subject design method (i.e., multiple baseline across four subjects). While the students with ASD were playing, trainer did not provide any prompt. Outcomes of the study showed that there was an increase in students' imitation skills using visual cues, while there was a decrease in physical prompts.

The impact of technology on visually-based interventions. Technology has simplified the production of visually-based interventions such as video-based interventions (VBIs). The technological advances in the types of devices providing visual stimuli has increased the portability and accessibility for students with disabilities (Kellems & Morningstar, 2012). One example of such an advance in technology is the opportunity to upload videos onto a small device. For example, a tablet, such as an iPad, can easily be carried around and used throughout the day. A recent meta-analysis study concluded that because small devices are more affordable, accessible, and socially acceptable compared to other electronic devices, they are gaining in popularity, making users feel more comfortable using these devices and less stigmatized by their presence

(Kagohara et al., 2012). Students interact daily with personal devices, such as tablets and music players which have the capability to deliver VBI while integrating some unique interactive features. The use of these devices is not limited to particular age group. Students as young as five and six commonly use devices such as iPods, iPads, and computers (Kellems & Morningstar, 2012).

VBIs using iPads have been associated with positive outcomes when used by individuals with ASD in various situations targeting a broad range of skills and behaviors (Burton et al., 2013; Hart & Whalon, 2012; Jowett et al., 2012; Neely, Rispoli, Camargo, Davis, & Boles, 2013). Video-based approaches have addressed challenges displayed by individuals with ASD such as a lack of attention and eye contact and a failure to process social stimuli (Schmidt & Bonds-Raacke, 2013). These strategies respond to the stimulation of selectivity by helping students focus and maintain attention to relevant stimuli (Shipley-Benamou, Lutzker, & Taubman, 2002) and can enhance a child's ability to independently complete new or complex directions by summarizing the content to only vital information (Williams, Goldstein, & Minshew, 2006). The repetitious ability of video-based strategies allows students to review cues, decrease reliance on teacher prompts, and increase independence (Hodgdon, 1995). Additionally, VBIs improve students' ability to switch their attention between tasks (Quill,1995; 1997; 1998) and make abstract concepts more concrete (Peeters, 1997).

Academic Outcomes for Students with ASD

According to the APA (2013), ASD has adverse impacts on the academic outcomes of the individuals in schools, as well as their independence in their lives. In support of this, Schall et al. (2012) noted that ASD affects the overall quality of the individuals' life. In addition to struggling with daily life skills, individuals with ASD often experience difficulties in executive function (EF). EF refers to a set of cognitive processes that are necessary to control and coordinate other cognitive abilities (Kim & Cameron, 2016). Difficulties in EF skills can have negative effects on the academic performance of students with ASD (Weitlauf et al., 2014). Weitlauf et al. (2014) reported that there is a need to maximize the academic outcomes of students with ASD by adopting appropriate instructional models. One such approach is the provision of academic as well as functional life skills instruction to the students with ASD. However, there is less research on academic skills in comparison to functional skills (Pennington 2010; Spencer et al. 2015). Much of the research on ASD has focused on behavior, communication, and social skills (Petursdottir & Carr, 2012; Banda, Hart, & Liu-Gitz, 2010).

Even though the diagnostic criteria for ASD does not indicate its impact in the area of academic functioning; impairments in social communication and engagement in restricted, repetitive, and stereotypic behaviors may contribute to academic challenges which can impact future academic achievement (Estes, Rivera, Bryan, Cali, & Dawson, 2011). Deficits in the areas of imitation and observational learning are well documented and can limit a student's ability to watch others in an effort to learn skills necessary in an academic setting (Plavnick & Hume, 2013). Delayed or limited receptive and expressive communication may also affect academic performance (Norbury & Bishop, 2002). In the past decade, an increased attention and concern on emphasis examining the cognitive profile of students with ASD has been on to better understand the impact of the cognitive profile on academic performance (e.g., Schwartzberg &Silverman, 2019; Noterdaeme, Wriedt, & Hohne, 2010). Although results have not been critical on all aspects of cognitive functioning, several characteristics of the cognitive profile have emerged that may impact both academic achievement and impact the development of academic supports (Fleury et al., 2014).

Barriers to academic performance for students with ASD. According to Lynch and Irvine (2009), children with ASD may develop at a different rate compared to children that do not have ASD. Humphrey and Lewis (2008) argued that due to these development differences and the traditional characteristics of ASD, children with ASD find it difficult to comprehend new things. Humphrey and Lewis found that poor comprehension levels ultimately affected their learning trajectory and capacity. Impaired understanding influences how children with ASD grasp new concepts in the classroom (Humphrey & Lewis, 2008). Children with ASD may find it difficult to comprehend extensive facts, and concepts (Lynch & Irvine, 2009). Impaired executive functioning also impedes proper learning. Thus, executive dysfunction negatively affecting the academic outcomes of children with ASD (Happe, Booth, Charlton, & Hughes, 2006).

Factors that affect academic skills. EF includes three common areas (a) working memory, (b) inhibition, and (c) set-shifting, such as attention and self-monitoring, which are common difficulties or challenges for students with ASD and have an effect on academic performance including mathematics (Happe, Booth, Charlton, & Hughes, 2006; Hume, Loftin, & Lantz, 2009; Kim & Cameron, 2016; MacDonald, Dickson, Martineau, & Ahearn, 2015). Working memory is defined as the ability to code, keep, and manipulate incoming information. Students with ASD possess a deficit in their working memory (Rockwell, Griffin, & Jones, 2011). The term working memory describes a person's ability to process data over a long period of time (Alloway, Rajendran, & Archibald, 2009). As described by Alloway et al. (2009), deficits in working memory are connected to deficits in verbal and memory functions. A review of literature investigated the role of working memory with students with ASD and indicated that individuals with ASD had lower working memory than the control group of neurotypical individuals, especially on tasks that demanded cognitive flexibility, planning, and a greater working memory load (Kercood, Grskovic, Banda, & Begeske, 2014). Working memory has a determined relationship with math performance (Bull & Scerif, 2001). Set-shifting is defined as the ability to switch attention between tasks or strategies which include attention, self-monitoring, planning, and cognitive flexibility. Individuals with ASD typically exhibit executive dysfunction on these skills which has an effect on mathematic performance (Kim & Cameron, 2016; MacDonald et al., 2015). Moreover, individuals with ASD have difficulty with focusing and shifting the focus of their attention. According to Goldstein, Johnson, and Minshew (2001), in comparison to typical participants, participants with ASD showed significant deficits on attention and cognitive flexibility. Inhibition is the ability to think before doing a task (Toll, Van der Ven, Kroesbergen, & Van Lui, 2011). In other words, "it is the ability to deliberately inhibit dominant, automatic, or prepotent responses when necessary" (Miyake et al., 2000, p. 57). Miyake et al. (2000) mentioned to that inhibition combines the previous factors (working memory and set-shifting) which involve some inhibitory processes to function properly (e.g., overlooking previous information in the working memory or shifting to a new mental set of information). EF plays an essential role in the acquisition of information; the better attention individuals have by keeping information in their minds and manipulating it, the better level individuals acquire knowledge and skills inside their classrooms (Pellicano, 2012). As a result, EF including its three areas of cognitive abilities has a direct impact on a student's academic performance in mathematics contents (Bull & Scerif, 2001).

Technology-Based Academic Interventions

A growing number of studies have investigated diverse applications of technology-based interventions with children with ASD (e.g., Burton et al., 2013; Jowett et al., 2012; Kagohara et al., 2012; Pennington, 2010; Yakubova et al., 2015; 2016). According to Goldsmith and LeBlanc (2004), the development of new journals that focused on the use technology in education indicates its increased integration into the classroom (e.g., the Journal of Computer Assisted Learning, the Journal of Special Education Technology, the Journal of Educational Multimedia and Hypermedia, etc.). Clinicians and parents report that children with ASD were motivated by using technology and researchers have noted the importance of devising interventions that take advantage of this strong interest (Pennington, 2010).

The use of technology in schools emerged in the mid-nineteenth century (Cuban, 1986). Textbooks and a chalkboard are considered the earliest forms of technology. As decades passed, other technology began to be integrated into the classroom. For example, radio and film were a part of teaching in the first half of the 1900s, and in the 1940s, overhead projectors were the impressive audio-visual media device (Amin, 2010). Towards the 1950s, television and tape recorders were being utilized in classrooms and by the 1970s, schools had started using computers in classrooms (Amin, 2010; Cuban, 1986). Later, televisions and home videos were used to provide educational materials to students (Nugent, 2005).

The use of technology as an EBP has been a focus of research since the early 20th century (Amin, 2010; Ross, Morrison, & Lowther, 2010). As a new technology, computers were mostly used for drill and practice programs, such as math computation games or reading comprehension activities (Abbott, 2001). By the 1990s, the use of computers in the classroom was increasing as they aided in student learning and the World Wide Web became a useful tool for accessing information. In the first decade of the twenty-first century, students and teachers began to use handheld devices such as tablets and phones (Abbott, 2001; Crichton, Pegler, & White, 2012). More recently, a variety of handheld technologies such as iPods, laptops, and smartphones have been used by teachers at schools to increase engagement and student learning (Banister, 2010; Donovan et al., 2010; Franklin, 2011; Granberg & Witte, 2005; Hill, 2011; Li & Pow, 2011).

Today, technology has become widely used in many K-12 classrooms, but very few studies have focused on the effect of technology in the elementary and middle school's mathematics class settings. Technology can be essential for creating authentic learning opportunities for students at schools (Allsopp, Kyger, & Lovin, 2007). In addition, there is a growing foundation of studies that show a positive relationship between technology, student learning, engagement, and mathematics performance (Alagic, 2003; Carr, 2012; Hamilton, 2007; Hubbard, 2000; Park, 2008; Rosen & Beck-Hill, 2012).

As the effectiveness of technology use with mathematics instruction increases, the demand for assistive technology grows (Demski, 2008). Special education teachers, parents, administrators, and other school personnel have begun to look for everyday technology that will assist in meeting the diverse needs and requirements of each student who requires assistive technology (McMahon, 2014). Douglas, Wojcik, and Thompson (2012) define assistive technology (AT) as a range of products or devices that improve the capabilities or limitations of a student with a disability. AT as a form of support in the educational process can help to bridge the performance gap between student challenges and learning (Douglas et al., 2012). Alquraini (2011) argued that technology should be considered as a tool to support students with special needs' engagement in the regular class and access to the general curriculum. Types of technology that can be used with students are both low technology (e.g., highlight tape, manila file folders, and photo albums) and high technology (e.g., adaptive communication devices, switches, and others). Saudi Arabia has established significant investments in technology deployment to develop frameworks and resources for special education (Fakrudeen, Miraz, & Excell, 2013).

Technology as a motivation tool. There are many benefits of using technology in the classroom with students, including students with ASD. Due to children being able to master the use of technology from a young age, it is a helpful tool for them in school (Oien, 2014). Technology allows each student to receive instruction at a specific level and speed. According to Bouck, Savage, Meyer, Taber-Doughty, and Hunley (2014), the nature of technology can benefit students with ASD due to their differences in attention and motivation from typically developing peers. In addition, students seem more involved and show fewer behavioral issues when attending a lesson supported by technology (Mechling, Gast, & Cronin, 2006; Pennington, 2010). Not only do students display a higher level of motivation and attention while using technology but also they receive immediate feedback on their learning experience (Pennington, 2010). Moreover, motivation has been found to increase through the application of technology by giving students the support they need to learn effectively, which would increase understanding that will connect students to the real-world (Davis, 2015).

Using iPads in the classroom. An iPad is a type of tablet, a small computer that is designed for portability and does not have an external keyboard or separate processing unit (Ostashewski & Reid, 2010; Yavich & Davidovich, 2019). It is designed with an easy to use touch LCD (liquid-crystal display) screen onto which data can be inputted with either fingertips or a stylus (Ostashewski & Reid, 2010). The iPad can be an engagement strategy for teachers to possibly foster motivation and understanding for students which resulted resulting in greater knowledge and retention of information (Sullo & Association for Supervision and Curriculum, 2007). According to research, the iPad is a primary choice for educational purposes in schools (Attard, 2013; Ensor, 2012; Larkin, 2014; & Palmer, 2013). With the iPad, students are afforded the ability to self-direct their learning through apps and features that can be utilized during mathematics instruction or during student cooperation time (Cannella-Malone et al., 2013). Students can continue to learn while the teacher assists other students and can move at their own pace as they direct themselves to the learning objective using their iPad (Davis, 2015). Technological advances, such as iPads, are leading to the development of an increasing number of computer-based devices and software applications to be used in teaching for individuals with developmental disabilities including ASD (Ramdoss et al., 2012). The iPad can also be used as a tool to teach new skills to individuals with ASD. In four studies, each of which used a multiple baseline design, the researchers found success with the use of an iPad as an instructional aid. Jowett et al. (2012) evaluated the effectiveness of point-of-view video modeling (POVM) using iPads to teach a 5-year-old boy with ASD basic numeracy skills. Results indicated that the iPad was effective in identifying and writing the Arabic numbers 1-7. Similarly, Kagohara et al., (2013) investigated the use of POVM on an iPad to teach spelling of words skills to two adolescents with ASD. Both participants scored 76–100% correct on the words task analysis and became successful in checking the spelling of words when using the word programs via iPad. Results indicated that POVM on an iPad was an effective tool for teaching spelling of words. In another study, Yakubova et al. (2015) investigated the effectiveness of POVM strategy on iPads to teach problem-solving skills with mixed fractions with unlike denominators to three adolescent male students with ASD. All participants reached 90 % accuracy or more during the intervention. The results suggest that the POVM intervention via iPad in increasing problem-solving performance for adolescent students with ASD was effective. Finally, Yakubova et al. (2016) examined the effectiveness of using POVM via an iPad to teach addition, subtraction, and number comparison skills to four kindergarten male students with ASD. All participants improved their accuracy on all skills during the intervention. The findings of their study suggested the effectiveness of using POVM via an iPad in teaching mathematic skills.

Neely et al. (2013) stated that classrooms have been implementing many technologies, particularly iPads, into their curriculum for children on the spectrum because they believe it improves their behaviors and learning to decrease negative behaviors in the classroom. Neely and her colleagues indicated that once the iPad was introduced, the level of negative behavior issues decreased, and the level of academic interest increased. The use of the iPad as a tablet computer to support interventions has increased among children with ASD (Dunham, 2011; Sennet & Bowker, 2009).

Technology like iPad has tremendous educational implications because it makes learning mobile and reachable (O'Malley, Lewis, & Donehower, 2013). The features of the iPad make it a suitable tool for classroom instruction (e.g., processor speed, storage capacity, mobility, physical size, Wi-Fi connection, camera availability, accessibility features) and offer favorable chances for innovative instructional interventions for teaching new academic skills. iPads can be an effective instructional tool to enhance learning and independence for individuals with ASD in the school setting.

Social Learning Theory and Video-Based Intervention

Video modeling is founded upon Bandura's social learning theory, which proposed that humans primarily learn behavior by watching and imitating the behavior of others, who serve as models for their own behavior (Bandura, 1977). This observational learning comprises four key components: attention, retention, production, and motivation (Bandura, 1986). These tenets of social learning theory may be instrumental in explaining the beneficial effects of VBI such as video modeling (VM) and point-of-view video modeling (POVM)for children with ASD (Corbett & Abdullah, 2005). The concept that humans can learn behaviors simply by watching others perform a behavior was first put forth by Albert Bandura over five decades ago. Bandura, Ross, and Ross (1961) reported that children imitated aggressive behavior if it was modeled for them (as cited in Artino, 2007, p. 5). This groundbreaking study set the stage for Bandura's social learning theory, which stated that humans can learn behaviors simply by watching others perform a behavior (Bandura, 1977).

Bandura (1982) studied children's ability to acquire a vast array of skills by observing others performing the skills. He found that observers will imitate behaviors with or without the presence of reinforcement and will generalize the behavior to new settings. He argued that attention and motivation were essential to observational learning. Bandura also found that one will not be able to imitate the behavior if he or she was not presence to the setting. According to Bandura (1982), people were most likely to pay attention to a model that they perceived as competent, and similar to themselves in some way, such as physical characteristics, age, and ethnicity. Another aspect of the social learning theory was the idea of indirect learning experiences. Students did not actually complete a task but rather watched others successfully complete it. Bandura noted that the more characteristics the model and the student had in common, the more successful the task completion. Using vicarious experiences as an intervention opened the door for students to model desired behaviors (Bandura, 1982). Research building on Bandura's findings has reinforced that modeling is an effective method for teaching young adults with ASD (Charlop et al., 1983; Maheady, Mallette & Harper, 2006; Robertson & Weismer, 1997).

According to Bonnet (2013), VM is defined as a technique that is used to teach a target skill that is modeled by another individual. The model performs the target task while his or her movements and words are video recorded. The target student watches the video clip of the target skill(s) and is expected to imitate the behavior of the model who was observed in the video clip.

The effectiveness of Video-Based Intervention. Several reviews of social skills interventions for individuals with ASD have identified VBI as an intervention that meets criteria for EBPs (Bellini & Akullian, 2007; Odom et al., 2010; Reichow & Volkmar, 2009; Tetreault& Lerman, 2010; Shukla-Mehta et al., 2010; & Wang & Spillane, 2009). The purpose of VM interventions is to develop an individual's ability to remember, imitate, and generalize target behaviors (Hitchcock et al., 2003; McCoy & Hermansen, 2007).

One of the first studies using VBI with children with ASD was published by Charlop and Milstein in 1989. Participants in this study included three boys (two seven-year-olds and one six-year-old) who had been diagnosed with ASD (based on criteria from the DSM-III) and who also had severe delays in communication skills. Conversation scripts were filmed with adult models that included age appropriate language and child-centered topics. The participants were slowly exposed to parts of the conversation and asked to repeat what was modeled in the video. When they mimicked the video successfully, they were given a reward and introduced to additional lines and subsequently to additional scripts with different conversations. After as little as three sessions and at most six, all three participants were able to sustain communication as measured by a specific criterion. The children were also able to maintain progress for up to 15 months following the treatment (Charlop & Milstein, 1989).

VBIs have been successful in teaching a wide range of skills to individuals with ASD: social and communication skills, functional living skills, and appropriate behavioral functioning (Bellini & Akullian, 2007; Delano, 2007; McCoy & Hermansen, 2007;Odom et al., 2010; Reichow & Volkmar, 2009; Tetreault& Lerman, 2010; Shukla-Mehta et al., 2010; Wang & Spillane, 2009). With respect to social skills, VM interventions have been effective in teaching a wide array of such skills: giving and receiving compliments (Apple et al., 2005), sharing (Simpson et al., 2004), securing attention, initiating comments and requests (Thiemann & Goldstein, 2001), verbal and motor play behaviors (D'Ateno, Mangiapanello, & Taylor, 2003), pretend play (MacDonald et al., 2005), unscripted play statements (Taylor et al., 1999), and academic skills (Jowett et al., 2012; Kagohara et al., 2012; Yakubova et al., 2015; 2016).

Video-based intervention types. There are four subtypes of VBI, including: (a) video-modeling (VM), (b) video self-modeling (VSM), (c) video prompting (VP), and (d) point-of-view video modeling (POVM). Both VM and VSM follow a sequence of expected steps in which: (a) an individual is instructed to watch a video, (b) a video is presented in which the target skill is modeled by an adult, peer, or, in the case of VSM, the individual himself, (c) an instructor provides prompts and reinforcement for attending to relevant stimuli, and (d) when presented with the opportunity to do a behavior, the person imitates the modeled behavior (Bellini & Akullian, 2007). VP divides more complex tasks into smaller steps and teaches the student one step at a time which allows the student to watch a step and complete the step before watching the next step until the task is complete (Cannella-Malone et al., 2006; Kellems et al., 2016). POVM varies from the other three modalities in that, rather than watching an individual perform the target behavior from the vantage point of someone sitting near that person, the POVM allows the viewer to assume the vantage point of the model. POVM is thought to be potentially beneficial as it allows the individuals to see a picture of the final project as well as to view the materials and steps of the behavior as they would if performing it by themselves (Hine & Wolery, 2006).

Point-of-view video modeling. POVM is a video of what the recipient of the instruction would actually see if he or she is engaged in the social behaviors (e.g., Tetreault& Lerman, 2010; Shukla-Mehta et al., 2010) and academic skills (Burton et al., 2013; Jowett et al., 2012; Kagohara et al., 2012; & Yakubova et al., 2015; 2016). This form of VM may include hands demonstrating the skill and using the VM procedure's relevant materials or other individuals connected to performing the skill or behavior (McCoy & Hermansen, 2007). POVM involves video recording of a target behavior with step-by-step instructions from the first-person perspective (Allen, Wallace, Greene, Bowen, & Burke, 2010).

When using POVM, the learner views the entire clip of the target task prior to being asked to engage in the task (Katsioloudis, Fantz, & Jones, 2013). This form of VBI is not as widely used as other forms of VBI. Therefore, there is less research available concerning its effectiveness (Shrestha et al., 2013). However, it is suggested that POVM may improve stimulus control guiding the viewer's attention to the specific movements or elements of the task within the image (Jowett et al., 2012). Kouo (2016) argues that POVM has the capacity to manage the deficits of students with ASD. For example, Kouo indicates that this form of VBI would be useful in boosting attention and concentration levels in children that have ASD by eliminating irrelevant environmental stimuli. McCoy and Hermansen (2007) argue that, unlike other VBI strategies, POVM could be more effective in boosting the learning outcomes of students with ASD.

Three main perspectives can be used with POVM: the subjective, reportorial, and objective (Katsioloudis et al., 2013). The subjective point of view shows a task being completed from the observer's perspective. To capture this view, the instructor would wear a camera mounted to his or her head and film their hands completing the task (Katsioloudis et al., 2013). An instructional video shot from the reportorial point of view shows the task as seen from an observer standing next to the instructor (Katsioloudis et al., 2013). To film this point of view, a camera would be placed next to the instructor (i.e., left or right) facing the student (Katsioloudis et al., 2013). The objective point of view mimics face-to-face instruction; the camera focuses on the task as seen by the viewer (Katsioloudis et al., 2013). POVM is an intervention that can be used to help teachers individualize instruction and help students gain access to instruction through multiple viewings and individualized pacing (Shrestha et al., 2013).

Video-based intervention procedures. According to Odom et al. (2014), VBI procedures comprise of five significant steps. In the first step, instructors are expected to determine the skill, or the behavior they want to teach, and explain it thoroughly so that accurate data may be gathered during the intervention process (McCoy & Hermansen, 2007). In the second step, instructors are expected to assemble relevant equipment such as cameras, and video recorders. In the third step, instructors are required to plan for the VBI (Wong et al., 2014). In the fourth step, instructors are expected to gather the baseline data. The skills that a learner is familiar with and those that they are not familiar with are examples of baseline data needed during VBI (Wong et al., 2014). The final step is making the video. In this step, instructors record the behaviors and skills they want to teach.

Video-Based Intervention and Academic Instruction for Students with ASD

The National Center for Professional Development on Autism Spectrum Disorder included VBI in the category of modeling as an EBP (Franzone & Collet-Klingenberg, 2008). To be considered an EBP for individuals with ASD, the evidence must be established through peer-reviewed research in scientific journals using quasi-experimental design or two randomized studies, five single-subject design studies from three different investigators or research groups, or a combination of these two designs (Coyle & Cole, 2004). Nevertheless, there are difficulties for individuals with ASD in adjusting to the general training setting. Regularly, these difficulties are not scholastic, but instead include attempting to keep homework sorted out, finishing their plan (e.g., task note pad) toward the day's end, or properly progressing inside the lobbies of their school (Coyle & Cole, 2004). These sorts of authoritative and school-based aptitudes are basic for the accomplishment of any student (Coyle & Cole, 2004).

Some children with ASD have difficulties with memory and may find it hard to recall facts easily (Boucher, Mayes, & Bigham, 2012). Through VBI, children get an opportunity to review content multiple times. Repetition refines the memory of students with ASD; therefore, it makes it easier for them to recall information (Bonnet, 2013). Additionally, children with ASD can be easily distracted by environmental stimuli (Pennington, 2010). In a classroom setting, they may fail to focus on what a teacher is saying, and instead, choose to focus on noises produced within the setting. The content aired through VBI can be edited to reduce possible distractions from environmental stimuli. Displaying the content through VBI increases the ability of students with ASD to attend to instructional materials. Bellini and Akullian (2007) concluded that the use of

VM can help students with ASD to grasp academic instruction easily. Thus, VM can improve their academic outcomes.

Video-Based Intervention and math instruction. According to the National Center for Educational Statistics (2015), students with disabilities do not have sufficient grade level math skills. Schulte and Stevens (2015) stated that students with disabilities in third through seventh grades have lower achievement in mathematic concepts than students without disabilities. Mayes and Calhoun (2006) pointed out that students with ASD have challenges with mathematics. Williams, Goldstein, Kojkowski, and Minshew (2008) found that approximately 25% of students with ASD prefer vocabulary to mathematics. Some of the common challenges in which a majority of students experience difficulties in mathematics are associated with semantic memory and procedural challenges (Geary, 2004). Students with ASD presented lower WISC-III scores in the domain of arithmetic and researchers found that 67% of students with ASD also exhibited learning difficulties including mathematics (Mayes & Calhoun, 2003, 2006).

Teachers are required to use EBPs to help students with disabilities in meeting their needs (IDEA, 2004). Traditionally, teachers have used direct instruction and/or discrete trial training interventions to teach math skills to students with ASD (Happe et al., 2006). Although direct instruction has been effective in increasing discrete skills such as identifying numbers, rational counting, memorization of mathematical facts, and memorization of mathematics procedures for typical students, students with ASD still struggle with math concepts because direct instruction requires the use of EF (Happe et al.,2006). According to Whitby (2014), students with ASD exhibit executive dysfunction. EF is an essential aspect in the development of academic achievement (Clark, Prichard,

& Woodward, 2010; Will, Fidler, Daunhauer, & Gerlach-McDonald, 2016). EF including (a) working memory, (b) inhibition and (c) shifting, has an effect on mathematics performance (Happe et al., 2006). According to Schwartzberg and Silverman (2019) individuals with ASD regularly have deficits in working memory that can lead to challenges in understanding academic skills and progress including mathematics skills. Research indicated that children who experience difficulty in switching and inhibiting skills have lower math skills (Bull & Scerif, 2001; May, Rinehart, Wilding, & Cornish, 2013).

In order to improve the cognitive processing and the EF skills, modeling and visual supports as two of 11 EBPs have been identified by experts (Wong et al., 2014). VBIs improve students' ability to switch their attention between tasks (Quill,1995; 1997; 1998) and make abstract concepts more concrete (Peeters, 1997). POVM is a combined intervention that includes modeling and visual supports and can be an effective approach to teach academic skills including mathematics (Franzone & Collet-Klingenberg, 2008; Schwartzberg &Silverman, 2019). VBIs including POVM through the use of technology (iPad), have enabled visual related content to be used in developing visual stimuli that children with ASD can easily relate to (Sherer et al., 2001). Mathematical skills are taught to children with ASD through the use of the iPad. Exposure to technological tools at an early age can provide an advantage for young children with ASD as they use video modeled content to understand mathematical concepts and principles (Gardner & Wolfe, 2014).

Summary

Students with ASD need specific interventions to acquire academic skills that are important to be successful in their schools and independently function as much as possible for their lifetime. Without academic skills, individuals with ASD will not be independent and ready for finishing all stages of their schooling and then proceed to college studies when they finish. Achieving performance in school is very important for the academic perspective, but further than that, it is essential for the improvement of self-efficacy (Bandura, 2001). With well-developed math skills, academic achievement will be easier for individuals with ASD as they move through school, take tests, and ultimately get a job and become members of the society (Pennington, 2010). There are many EBPs to teach academic skills. As technology impacts pedagogy, it can provide greater access to quality instruction for students with ASD. VBI is one of the leading technology-based interventions that has been shown to be effective in teaching academic skills to individuals with ASD, and it is gaining greater use in the area of mathematics.

Chapter III

Method

The purpose of this study was to determine the effectiveness of point-of-view video modeling (POVM) on improving the math skills of participants with ASD when completing mathematic tasks. The following research questions were addressed: (1) to what extent was POVM intervention effective in teaching participants with ASD who struggle with math skills (addition with regrouping)?, (2) to what extent did the participants with ASD maintain over time the effects of POVM on emergent math skills (addition with regrouping)?, (3) to what extent did the participants with ASD learn simple to more complex math problems in POVM generalize to more complex math problems?, and (4) what was the social validity of using point-of-view video modeling with participants with ASD and their teachers? This chapter presents the methods for this research study including a description of the overall design, implementation, and plan for analysis.

Participants and Setting

Four elementary male participants, enrolled in an alternative school for boys with ASD in Riyadh, Saudi Arabia, were selected for this study. The participants were recruited after obtaining approval by the Institutional Review Board (IRB) at Duquesne University. Recruitment of potential participants of this study occurred by sending a formal invitation letter to the Ministry of Education. The Ministry of Education then sent the formal invitation and recruitment materials to the school. After receiving permission to conduct the study, the researcher contacted the principal requesting permission to recruit teachers who were interested in having the study conducted in their classrooms. The researcher met with teachers to explain the research procedures, distribute the consent forms, and recruit student participants for the study. The teachers sent the parental consent forms home to the parents asking for permission for their child to participate in this study. After receiving the parents' permissions, the teachers met with the eligible participants and distributed the assent forms. After obtaining the forms, the researcher screened potential participants using the inclusion criteria.

There were two sets of inclusion criteria for this study presented in Table 3.1. In the first set of criteria, the researcher evaluated participant eligibility according to the following: (a) school enrollment, (b) no prior experience with video modeling or point-of-view video modeling, (c) meeting the ASD diagnostic criteria according to Diagnostic and Statistical Manual of Mental Disorders-5, (d) the individualized education program (IEP) math goals and objectives similar to the research objectives for the current study, (e) receiving special education services in the area of mathematics, (f) demonstrating conceptual understanding, such as processing math problems (addition with regrouping), (g) teacher's recommendation based on classroom scores and formative measures, (h) no vision or hearing impairments, (i) willingness to participate in the study, and (j) parental permission to participate in the study.

Participants who met previous inclusion criteria were further screened for prerequisite abilities necessary to complete the study intervention: (a) identify numbers and count numbers from one to 20, (b) have not learned to complete two-digit by one-digit addition problems with regrouping ,(c) engage in a task for three minutes when seated, (d) attend to the iPad and gaze at a video display on iPad screen, (e) has independent range of motion to interact with the iPad, and (f) has the requisite fine motor skills to write and operate the iPad. An assessment of identifying numbers from one to10 and direct observation while using the iPad was demonstrated to all participants who met the first inclusion criteria in their classrooms.

Table 3. 1

Inclusion Criteria for Participants

Inclusion Criteria Stage 1	Inclusion Criteria Stage 2
a) school enrollment, b) no prior experience with video modeling or point-of-view video modeling, c) meeting the ASD diagnostic criteria according to the Diagnostic and Statistical Manual of Mental Disorders (5 Edition) d) IEP math goals and objectives similar to the research objectives for the current study, e) receiving special education services in the area of mathematics, f) demonstrating conceptual understanding, such as processing math problems, g) teacher’s recommendation based on classroom scores and formative measures, h) no vision or hearing impairments, i) willingness to participate in the study, and j) participants parents’ permission.	a) identify numbers and count numbers from 1 to 20, b) have not learned to complete two-digit by one-digit addition problems with regrouping, c) engage in a task for 3 min when seated, d) attend to the iPad and gaze at a video displays on iPad screen, e) has an independent range of motion to interact with the iPad, and f) fine motor skills

After screening seven participants, all of them met the first inclusion criteria set. However, there were three participants excluded from the study because they did not meet the second inclusion criteria set. Two participants could not identify numbers (1-

20), and one participant was not able to engage in a task for a minimum of three minutes when seated. Therefore, four participants were included in this study, and all had difficulty solving addition with regrouping in their math classes. Muhammed, Salem, Eaid, and Khaleel were four boys aged from 10 to 12.5 years old and were in third through sixth grade. Table 3.2 contains all the demographics of the participants.

Table 3. 2

Participants' Characteristics

Name	Gender	Age	Diagnostic Criteria-DSM	Diagnosis	Grade level	IQ scores
Muhammed	Male	12	DSM-5	ASD	6th	81
Salem	Male	10	DSM-5	ASD	3rd	NA
Eaid	Male	12.5	DSM-5	ASD	5th	NA
Khaleel	Male	12	DSM-5	ASD	4th	92

Materials

Math probes. Each student was provided with random math probes during pre-assessment, baseline, intervention, maintenance, and generalization. All math probes used across all phases were generated through http://www.interventioncentral.org. Intervention Central is a website that provides teachers and schools with free resources and worksheets to help learners who struggle with their academic work in their classrooms.

Daily activity sheets. During the intervention, each student was given an activity sheet that provided them with five practice problems that reflected the skill learned during the video model (two-digit by one-digit addition problems with regrouping and two-digit by two-digit addition problems with regrouping). The first practice problem included the problem modeled during the video clip. There were two types of daily activity sheets. One was lined, and the other one was unlined. The lined paper was used as a reminder for the participants to utilize correct place value. The lines served as a prompt and were faded out after the participant successfully demonstrated correct place value in three consecutive sessions.

iPad. During each intervention session, participants accessed the video clip on an iPad. To assure that participants were familiar with the iPad, a training phase was implemented so that they could access the video clip. During training sessions, the researcher asked participants to (1) turn on an iPad, (2) access a video clip, (3) put on headphones, and (4) watch the video (Appendix A).

POVM math clips. Before conducting intervention sessions, the researcher created fourteen video clips (eight clips related to two-digit by one-digit problems with regrouping and eight clips related to two-digit by two-digit addition problems with regrouping) using POVM. These clips were recorded using the researcher's iPhone and a smartphone stand. The researcher used a written script that outlined the steps for completing two-digit by one-digit addition problems with regrouping or two-digit by two-digit addition problems with regrouping. Clip times were one minute and 10 seconds for two-digit by one-digit and one minute and fifty seconds for two-digit by two-digit. After the recordings were complete, the researcher transferred the video clips to the iPad for each session during the intervention phase and used iMovie software to edit the video clip. The clips were randomized for use with each participant according to their skill level.

Experimental Design

The researcher used a single-subject design to conduct this study. A single-subject design was used because it allows for a researcher: (1) to focus intensively on the target behavior of the participants, (2) to discover functional relationships between the intervention (independent variable) and the outcomes (dependent variable), (3) to study strong and consistent effects that have social importance, and (4) to indicate that the effectiveness of the intervention was established and other confounding variables were controlled (Horner et al., 2005; Hammond & Gast, 2010).

The researcher used a multiple baseline across four participants design in this study. The multiple baseline design was preferred for several reasons: (1) it reduces the ethical issues present in the use of withdrawal or reversal designs, which requires an intervention to be removed when it was working effectively, (2) it allows for the demonstration of a functional relationship between the independent variable (IV) and dependent variable (DV) by replicating the intervention effects with two or more participants, (3) it promotes the ability to use an intervention with more than one person simultaneously, and (4) it is useful when the progressing level of the target behavior could not be reversed, which is a requirement with other single-subject designs (Cooper, Heron, & Heward , 2007; Richards, Taylor, & Ramasamy, 2014). The multiple baseline across participants is one of the most universal designs implemented in school settings, because educators are able to overcome implementing effective interventions with more than one student at the same time (Cooper et al., 2007; Hammond & Gast, 2010).

In this design, one target behavior was chosen for each of the four participants (Cooper et al., 2007). After steady responses were established under baseline conditions for at least one participant, the independent variable was introduced to the individual with the most stable baseline, and they were moved to the intervention phase of the study. The other participants remained in the baseline phase (Cooper et al., 2007). When stable responses were attained for the first participant in the intervention phase, the independent variable was applied to the second participant who had the most stable baseline. This process was completed for the remaining two participants in the study for the intervention, maintenance, and generalization phases. (Cooper et al., 2007). A multiple baseline across subjects design is instrumental in ensuring replication of the effects of the intervention on the dependent variable (Byiers et al., 2012).

Pre-Intervention Assessments

In order to determine a student's ability to access the video clip via iPad, the researcher offered a training sequence to each participant using a multiple-opportunity method in order to indicate their level of mastery with accessing the video clip.

Math probe procedure. All participants were referred by their teachers due to their difficulty with addition problems, specifically addition with regrouping. In order to assess their performance in these skills, the researcher developed a pre-intervention math probe worksheet generated using www.interventioncentral.org. The math probe included twelve addition problems consisting of six problems of two-digit by one-digit (e.g., 17+6) and six problems of two-digit by two-digit (e.g., 18+13). This pre-test was timed and administered by the researcher in a quiet room with each participant individually. Pencils and erasers were provided to all participants. The researcher directed participants with verbal prompts after presenting the pre-test by saying, "Please work on these math problems for the entire time until I tell you to stop." The researcher collected pre-test sheets and marked them to find out each participant's current level of performance in addition with regrouping problems. Based on these results, the researcher started the baseline phase with two-digit by two-digit for three participants and two-digit by one-digit for one participant.

Accessing video model procedures. Prior to beginning the baseline phase, each participant needed to demonstrate a criterion of 100% mastery in accessing the video clip. The researcher showed each participant the prompt checklist (Appendix A) and verbally prompted them to access the video clip on the iPad using steps in the task analysis: (1) turn on an iPad, (2) access a video clip, (3) put on headphones, and (4) watch the video. The researcher asked each participant to complete the four steps for three consecutive times within 15 second limits for each step. The researcher recorded the participant's performance using a plus sign (+) or minus sign (-) for each step that was correctly or incorrectly completed (Cooper et al., 2007). If the participant was able to successfully access the video clip three consecutive times within the time limit, the researcher began the baseline with the participant.

If a participant was unable to attain the criterion of 100% mastery, the researcher instructed the participant on how to access the video clip using the steps provided on the prompt checklist, using a least-to-most prompting instruction (Cooper et al., 2007). The researcher modeled each step on the chain by pointing to the button on the iPad and asked the participant to complete the first step. If the student was able to complete the step, the researcher provided verbal reinforcement. If the participant was unable to complete the step, the researcher completed the step and then prompted the participant for the next step. If the participant was unable to complete steps with gesture prompts, the researcher prompted the student to complete each step on the chain. This procedure continued until the participants were able to attain 100% mastery.

Baseline Procedures

The baseline phase did not include any instruction from the researcher. It required a minimum of three baseline data points to establish dependent measure stability (Kazdin, 2010). At the beginning of each baseline session, all participants received the same instruction: ‘‘Each of you will get a worksheet with addition problems. Please work on the problems for the entire time until I tell you to stop.’’ The participants were given a math probe for two minute time limit. After baseline data was stable with respect to level and trend using visual analysis, the researcher moved the first participant to the intervention phase. Baseline conditions remained in effect for the remaining participants (Cooper et al., 2007). In order to probe for generalized knowledge to a novel problem type, the researcher gave a three-digit by two-digit probe to three of the participants (Muhammed, Salem, and Eaid) to test their abilities to solve problems with regrouping during the baseline.

Intervention Procedures

The independent variable, POVM instruction, was delivered through an instructional video clip via an iPad. The POVM instructional clip was a mirror of the instructional steps needed to complete the addition problem with regrouping. The specific steps utilized in completing single-digit regrouping was a mirror of the instructional steps as presented in the Second Grade Mathematics Textbook (Ministry of Education of Saudi Arabia, 2016).

Each intervention session was completed during each participant's math class period. The required activities for each session were completion of the procedural checklist, completion of intervention math probes, completion of the video model exercise (accessing the VM and watching the VM), and completion of the intervention activity. During each session, the researcher implemented the following steps:

1. Materials for the session: The research had the following materials available on the desk: math probe, intervention activity, iPad, procedural checklist, pencils, eraser, video access checklist, and data recording sheets for accessing video and for completing the steps in regrouping.
2. Completion of the math probe: The researcher sat down by the participant one-on-one and presented the session's math probe to each participant. In each session, the researcher said: "Please work on the problems for the entire time until I tell you to stop." The researcher used his phone to time this probe for two minutes. The researcher told the participant to stop by saying, "Time is finished." The researcher collected the probe. While the participant was completing the math probe, his hands and the math probe were videotaped from behind to create a recording of the session. The researcher used his phone to videotape the participant and saved the recording using the appropriate identification number for each participant and the session number with the date for each session.
3. Accessing the clip: The researcher presented the iPad and the visual checklist for accessing the video clip to the participant (Appendix A). If the participant forgot to access the video, the researcher verbally prompted the participant to use the checklist by saying, "Use these steps to access the video."

4. POVM instruction: In preparation for the participant to access the instructional clip, the researcher stated the following prompt, “Now you will watch a video that helps you to solve an addition problem.” The participant watched the selected video for that session. For each video type (two-digit by one-digit or two-digit by two-digit addition with regrouping) the following steps were shown: (1) add the numbers in the ones column, (2) if the sum is 10 or greater, write the ones digit under the ones column, (3) write the tens digit on top of the tens column, (4) add the numbers in the tens column including the number you placed on top of the tens column (i.e., carried), and (5) write the sum of the numbers under the tens column. The researcher allowed the participant to rewatch the video up to two times, upon request, prior to completing the activity sheet.
5. Activity sheet completion: After watching the video, the researcher presented an activity sheet that had five two-digit by two-digit or two-digit by one-digit addition with regrouping problems. This activity sheet was completed to assess how well the student was learning. The first problem on the activity sheet began with the instructional model that was presented in the video. If the participant was unable to complete a step on the instructional sheet, the researcher prompted the participant to do the next step. Participants asked to rewatch the video clip to recall what steps they missed.
6. Ending the session: The participant received verbal reinforcement for completing the session with the researcher. After the participant finished his activity sheet, the researcher said, “Good job!” or “Excellent.”

The Maintenance Phase

The maintenance phase established the current skill level of each participant to see if they were able to retain the ability to complete the same level of problems (two-digit by-two-digit or two-digit by-one digit) that was the focus of their intervention. The researcher completed three sessions during the maintenance phase. The researcher repeated step two from the intervention procedure in addition to having materials (math probe, pencil, and eraser) ready for each participant without giving the video clip. The participants were given a two minute time limit to finish each probe. The researcher presented the participants with the same prompt as during the baseline phase: “Each of you will get a worksheet with addition problems. Please work on the problems for the entire time until I tell you to stop.’’

The Generalization Phase

Similar to the maintenance phase, the researcher conducted a session to determine if the participants were able to complete novel math problems that included three-digit by two-digit and two-digit by two-digit addition problems with regrouping. The researcher provided a new timed probe worksheet that focused on three-digit by two-digit addition problems with regrouping to three of the participants (Muhammed, Salem, and Eaid) and a two-digit by two-digit addition with regrouping probe to the other participant (Khaleel). Similarly, the researcher repeated step two from the intervention procedure in addition to having materials (math probe, pencil, and eraser) ready for each participant. The generalization phase was implemented to see if participants could generalize their learning to novel problems that represented more difficult, untaught material.

Dependent Variables

This study had three dependent variables: (1) digits correct per minute, (2) percentage correct of regrouping steps completed per session, (3) percentage correct of VM access steps completed per session.

Digits correct per minute. This dependent variable was used to measure the total digits correct per minute for each session across all of the phases of the study (baseline, intervention, maintenance, and generalization). Digits correct per minute were measured using daily timed math computation probes. There were two types of digits correct per minute.

Digits correct per minute for two-digit problems. The main dependent variable in this study was the percent of digits correct per minute for two types of math problems (two-digit by two-digit and two-digit by one-digit) during baseline, intervention, and maintenance phases. These two types of problems were given to the participants due to their pre-assessment probe results that showed their current level in addition with regrouping skill. In order to provide probes that were appropriate to their current skill level, three participants (Muhammed, Salem, and Eaid) were asked to complete a two-digit by a two-digit probe which contained 12 problems that required regrouping (e.g., 15+28). One participant (Khaleel) was asked to complete a two-digit by one-digit probe that also contained 12 problems (e.g., 16+5). After each participant completed their two-minute timing probe, the researcher counted all the math problems attempted by the participant. Permanent product recording was used for collecting data on each participant's response accuracy. After administering the probe, the researcher collected each participant's response sheet. At the end of each session, the researcher reviewed each problem and marked each digit as correct or incorrect based on digits-correct and calculated the percentage of digits correct methodology (Codding, Eckert, Fanning, Shiyko, & Solomon, 2006). For each participant, the researcher recorded the total digits correct per two minutes on the data sheet and in a Microsoft Excel sheet. If a participant skipped a problem, the problem was counted as incorrect. Each participant received a score of digits correct out of total digits possible for each probe. A percentage was reported for each participant and recorded for each session during each phase of the study.

Digits correct per minute for three-digit problems. Probing for generalized knowledge to a novel problem type, the researcher gave a three-digit by two-digit probe to three of the participants (Muhammed, Salem, and Eaid) in order to test their ability to solve problems with regrouping during the baseline and the generalization phase. The probe contained six problems, and the participants were only timed for one minute during the baseline. During the generalization phase, the probe contained 12 problems of three-digit by two-digit. This probe was only given two times to Muhammed, six times to Salem, ten times to Eaid during the baseline phase, and one time during the generalization phase to all participants. The procedures for scoring these probes were the same as those for the two-digit by two-digit probes.

Percentage correct of regrouping steps. The second DV was the accuracy of steps required for completing the regrouping steps for each problem. Each participant had a mastery criterion of 100% for five to eight consecutive sessions and this DV was measured using an observational checklist based upon a task analysis (see Appendix B). This task analysis was created using the essential components of the steps for regrouping and based upon the published curriculum that the school implements (Cooper et al., 2007). This task analysis (see Table 3.3) was used to collect data during all sessions. Percentage correct was calculated by dividing how many steps were completed correctly by the number of total steps. The checklist included a list of the steps in the task to indicate if the step was completed. The researcher used a (+) if the step was completed, or a (-) if the step was not completed correctly.

Table 3. 3

Task Analysis for Multi-digit Addition with Regrouping

Step	Description
1	Add the numbers in the ones column.
2	If the sum is 10 or greater, write the ones digit under the ones column
3	Write the tens digit on top of the tens column.
4	Add the numbers in the tens column including the number you carried
5	Write the sum of the numbers under the tens column

Percentage correct of VM access steps per session. The third dependent variable measured the percentage of total steps correctly completed to access the video on the iPad. The participant was given a checklist (Appendix A) and required to complete each of the four steps with a criterion of 100% correct. The researcher recorded the percentage of steps correctly completed per session. This dependent variable was only collected during the intervention phase.

Treatment Fidelity

Fidelity of the intervention implementation was assessed by an adapted treatment fidelity checklist developed by Lacava (2008) (see Appendix C). The fidelity checklist had nine steps that were divided into three sections, planning, intervention, and session analysis. The steps for planning were: (1) confirm the behavior for teaching, (2) collect the correct equipment, (3) select the correct video recording for the session, (4) test the video, (5) arrange the environment for watching the video. The step for intervention was: (6) show the video and complete the activity sheet. The steps for session analysis were: (7) monitor participant progress (record and evaluate the individual session and compare it to past sessions), (8) troubleshoot if the student is not making progress, (9) adjust the use of instructional supports (prompting and video use). The researcher used the checklist to confirm the steps needed for procedural fidelity with the intervention and he replicated the same procedure of treatment fidelity as used by other studies (e.g., Kellems & Morningstar, 2012).The researcher used self report method to assess the treatment fidelity by using the checklist for implementing POVM intervention (Collier-Meek, Fallon, & Gould, 2018; Kellems & Morningstar, 2012; Lane, Bocian, Macmillan, & Gresham; Sanetti & Kratochwill, 2009). An independent observer (a graduate student) completed the treatment fidelity for steps five to seven. The researcher and the independent observer checked mark steps that were implemented and gave a score of one for each step. If the step was not implemented, they gave a score of zero. If the step was not applicable to be implemented, they wrote “not applicable” (N/A). In the end of the intervention for each participant, the researcher and the independent observer calculated the percentage of all data collected

Interscorer Agreement (ISA)

Data was collected through the completion of the math probe worksheets during each phase of the study. In order to determine that the researcher correctly assessed the numbers of digits correct, a second copy of the probes were assessed by a first trained assistant (a math retired professor). This assistant, an independent scorer, randomly selected a minimum of 50% of the probes for each phase per participant and assessed the digits correct. Once this assessment was completed, the scorer checked the percentage of digits correctly recorded by the researcher. ISA was calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100%. The minimum criterion for ISA was 80% (Cooper, Heron, & Heward, 2007; Richards, Taylor, & Ramasamy, 2014).

Interobserver Agreement (IOA)

The reliability of the data collected was assessed by a second trained assistant (the graduate student). The researcher video recorded all participants while they were completing the math probe. The observer randomly selected 30% of the video recording clips during all phases for each participant. The second assistant used the observational checklist (Appendix B) to calculate the percentage of correct regrouping steps completed for each participant during at least 30 % of the sessions during the intervention phase. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100 %. The minimum criterion for interobserver agreement (IOA) was 80% (Cooper, Heron, & Heward, 2007; Richards, Taylor, & Ramasamy, 2014).

Social Validity

A social validity assessment was conducted to assess the social significance and appropriateness of the procedures by the participants and their teachers. At the end of the study, each participant and their teacher completed a social validity (SV) questionnaire adapted from Rhinehart (2011). Each of these questionnaires was administered and written in Arabic. The SV questionnaire used for the participants included a 5-point Likert-type scale (i.e., 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree) and picture-based Likert-type scale, adapted from Reynolds-Keefer, and Johnson (2011),that can be more understandable for younger participants (Appendix D. English version participant; Appendix E. Arabic version participant). Each teacher completed an SV questionnaire that just included the word-based ratings (Appendix F. English version teacher; Appendix G. Arabic version teacher). Each of the SV questionnaires was given so each participant could rate their perceptions of the POVM intervention. The questionnaire provided the opportunity for the following feedback: (1) the POVM intervention using iPad was easy to implement, (2) the POVM intervention using iPad was enjoyable to implement, (3) the POVM intervention using iPad was enjoyable for the participant, and (4) the POVM intervention using iPad was effective in improving math skills of each participant.

Data Analysis

The current study was conducted in the participants' classrooms. The procedure of collecting data involved four phases: baseline, intervention, maintenance, and generalization. The researcher employed the following procedures for data analysis: visual analysis and calculating improvement rate difference (IRD) for significance.

Visual analysis. Visual analysis involved examining several features of the data to make a decision on the effectiveness of the POVM intervention to teach addition with regrouping. This process consisted of evaluating six characteristics of dependent variables (digits correct per minute and percentage correct of regrouping steps completed per session) data patterns between- and within- each phase (baseline, intervention, maintenance, and generalization): (a) level, (b) trend, (c) variability, (d) immediacy of effect, (e) overlap, and (f) consistency of data patterns (Kratochwill et al., 2013).

Level. Level was used to compare between the baseline and the intervention phases and was calculated as the mean of all data points within each phase. The level change, or mean change, of each phase was calculated by subtracting baseline mean from intervention mean.

Trend. Trend was visually determined. Trend can be positive, negative, or flat.

Variability. Variability refers to the session-to-session differences in data values (Alberto & Troutman, 2009; Kratochwill et al., 2010). For this study, variability was visually assessed within phase and across all phases.

Immediacy of effect. Immediacy of effect refers to the degree of the change in data pattern between two phases. Immediacy was calculated by comparing the last three data points in the baseline to the first three data points in the intervention (Kratochwill et al., 2013).

Overlap. Overlap was measured by calculating the percentage of nonoverlapping data (PND) between the intervention and the baseline (Kennedy, 2005). Obtaining the

PND was through these steps: (1) identifying the highest point in the baseline phase, (2) drawing an imaginary line through the data at the value of the point identified in step one, (3) counting the number of data points in the intervention phase below the line, and (4) dividing the number of points from step 3 by the total number of data points in the intervention phase (Wolery, Busick, Reichow, & Barton, 2010). Scruggs, Mastropieri, and Casto (1987) provided the following estimated benchmarks for the effectiveness using the PND: a very effective treatment when PND is 90% and higher, an effective treatment when PND is from 70% to 90%, and a questionable or not an effective treatment when PND is less than 0.70.

***Consistency of data patterns*.** Consistency of data patterns from all phases (baseline, intervention, maintenance, and generalization) was visually compared to determine consistency of data across same phases (Kratochwill et al., 2013).

Chapter IV

Results

This study investigated the effectiveness of point-of-view video modeling (POVM) on improving the ability of four participants with autism spectrum disorder (ASD) to learn addition with regrouping in Riyadh, Saudi Arabia. The following research questions were addressed: (1) to what extent is the POVM intervention effective in teaching students with ASD emerging math skills (addition with regrouping)?, (2) to what extent will the effects of POVM intervention on emergent math skills (addition with regrouping) for students with ASD maintain over time?, (3) to what extent will the skills learned in POVM intervention generalize to more complex math problems?, and (4) what is the social validity of using POVM intervention with students with ASD and their teachers? This study was conducted in Riyadh, Saudi Arabia. Moreover, this study evaluated the degree of social validity of POVM using iPad intervention for study participants and their teachers. The results for each research question will be presented in this chapter, in addition to the results for (1) treatment fidelity, (2) interscorer agreement (ISA), and (3) interobserver agreement (IOA).

Treatment Fidelity

Treatment fidelity of the POVM intervention was assessed using a revised treatment fidelity checklist developed by Lacava (2008) (see Appendix C). The researcher completed steps one through four before starting the intervention phase. These steps were: (1) confirming the behavior for teaching, (2) collecting the correct equipment, (3) selecting the correct video recording for the session, and (4) testing the video, During the intervention phase and before implementing the POVM, the researcher reviewed the relevant steps five to seven of the checklist. These steps were: (5) arranging the environment for watching the video, step six of implementing the POVM, (6) showing the video and complete the activity sheet, and step seven of analyzing, (7) monitoring participant progress by recording and evaluating the individual session and compare it to past sessions. The researcher documented completion of each step as each step was delivered during the intervention phase. Steps eight and nine of the checklist, (8) troubleshooting if the student is not making progress and (9) adjusting the use of instructional supports, were not applicable for implementing the POVM due to the level of each participant's progress. The researcher successfully completed checklists that corresponded with planning and implementing POVM during all the sessions throughout the study. Data collection from treatment fidelity by the researcher was 100% for all participants. Moreover, the second assistant (the graduate student) observed the researcher while implementing the POVM during the intervention phase and completed steps (five to six) of the checklist for 40% of sessions for all participants during each session. The second assistant observed the researcher when analyzing each participant's progress after finishing each session during the intervention phase for 40% of sessions for all participants. Data collection from the treatment fidelity for steps (five to seven) by the second assistant was 100% for all participants.

Interscorer Agreement (ISA)

Interscorer agreement was assessed through the analysis of how two independent scorers evaluated the math probes completed by each participant. These probes contained 12 addition problems that required regrouping. Prior to scoring the sheets, the researcher made a copy of the probe for scoring by a trained independent assistant (scorer). For all participants, the independent scorer randomly selected the following: 50% of the probes completed during the baseline phase, 52% of the probes completed during the intervention phase, 67% of the probes completed during the maintenance phase, and 100% of the probes completed during generalization phase. This study also examined the ability of each participant to generalize their new skill to a more difficult, but untrained problem type. The independent scorer selected 100% of Muhammed's generalization baseline of three-digit probes because he was given only two sessions of three-digit during the baseline. He was only given two probes because he was ready to be moved to the intervention phase. Moreover, giving him a complex problem (three-digit by two-digit) with his low performance in two-digit by two-digit could make him frustrated. The independent scorer randomly selected 50% of Salem's and Eaid's generalization baseline. However, Khaleel did not receive any probe for the generalization baseline. The researcher used his pre-assessment probe. These participants were given multiple probes because interscorer agreement for the baseline phase for all participants had a mean of 89% (83.3% to 100%) and 100% for the generalization baseline for Muhammed, Salem, and Eaid. Interscorer agreement for intervention, maintenance, and generalization phases was 100% for all participants.

Interobserver Agreement (IOA)

The reliability of collected data through observing agreement was assessed by a second trained assistant (the graduate student). The researcher video recorded all participants while they were completing their probes. The videos only showed their hands and the math probe. In order to score the steps, each participant took in completing the math probes, the observer used the same observational checklist as the researcher utilized during the study (Appendix B). The observer randomly selected 30% of video recording clips across the baseline and the intervention phases of two-digit (two-digit by two-digit and two-digit by one-digit) for all participants (Muhammed, Salem, Eaid, and Khaleel). For generalization baseline, the observer selected 30% of recorded videos across the three-digit by two-digit only for Muhammed, Salem, and Eaid. Due to the limited number of sessions in the maintenance and generalization phases, 100% of the phases were scored for all participants. Interobserver agreement was 100% for all participants across all phases.

Social Validity

Two social validity (SV) questionnaires were given to the participants and their teachers. The SV questionnaire that was completed by the participants included a five-point Likert scale with text and accompanying emojis for each selection (see Appendix D. English version; Appendix E. Arabic version). The questionnaire had the following selections: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. The emojis were used in order to make the scale more understandable for the younger participants. As additional support, the questionnaire was orally administered by the researcher. The participants indicated their answers by circling the appropriate emoji and accompanying text after the researcher read the question. The scale was read in Arabic and each participant completed a scale written in Arabic. The classroom teacher of each participant also completed a SV questionnaire (see Appendix F. English version; Appendix G. Arabic version). Their SV questionnaire included the same five-point Likert-type scale that the participant questionnaire contained, however, their questionnaire did not include emojis. The scale was written in Arabic.

Participants SV results by question. Four students completed this scale and their results shown in Table 4.1. For statement one "Doing addition problems using videos on iPad was easy", all participants circled the emoji accompanying with a "strongly agree" phrase after the researcher read the question that associated with a mean score of 5 out of 5. Participants also circled the same emoji for the next statement "I enjoyed watching the videos on the iPad" with a mean score of 5 out of 5. Similarly, they circled the same emoji for statement "I liked learning how to solve addition problems from video clips using an iPad", "I learned how to do addition problems after watching videos", and "I will use video clips to learn more math problems in the future" with mean scores of 5 out of 5.

Table 4. 1

Social Validity of POVM for Participants (N=4)

Statement	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Mean
1. Doing addition problems using videos on the iPad was easy.					100% (4)	5
2. I enjoyed watching the videos on the iPad.					100% (4)	5
3. I liked learning how to solve addition problems from video clips using an iPad.					100% (4)	5
4. I learned how to do addition problems after watching videos.					100% (4)	5
5. I will use video clips to learn more math problems in the future.					100% (4)	5

Teachers SV results by question. Four teachers completed this scale and their results shown in Table 4.2. For statement one on ease of implementation, the mean score was 4.75 out of 5. The mean score for statement two was 5 out of 5 indicating that all teachers strongly agreed to the statement. Three teachers strongly agreed to the statements three, four, five, six, and seven while one teacher only agreed to them with mean scores of 4.75 out of 5 across these statements. Finally, all teachers strongly agreed to statements eight and nine with mean scores of 5 out of 5.

Table 4. 2

Social Validity of POVM for Teachers (N=4)

Statements	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	Response Mean
1. The video modeling intervention using an iPad was easy to implement.				25% (1)	75% (3)	4.75
2. The video modeling intervention using an iPad seemed to be enjoyable for the student.					100% (4)	5
3. My student correctly answered addition regrouping problems when using video modeling intervention.				25% (1)	75% (3)	4.75
4. My student maintained their math skills in addition with regrouping.				25% (1)	75% (3)	4.75
5. My student successfully generalized their math skills in a variety of other types of addition with regrouping problems.				25% (1)	75% (3)	4.75
6. I will use this intervention in teaching other content areas and skills to students with ASD.				50% (2)	50% (2)	4.5
7.I will use the procedures (steps and prompts) used in video modeling.				25% (1)	75% (3)	4.75
8.Using several video clips helped my students to instruct the math with regrouping problems.					100% (4)	5
9.Overall, I am very satisfied with the result of using video modeling intervention using the iPad.					100% (4)	5

Dependent Variables

This study had three dependent variables (DVs). Each participant had scores representing digits correct per minute for two-digit problems and three-digit problems, percent of regrouping steps, and percent of video clip access steps.

Digits correct per minute.

Digits correct per minute for two-digit problems. The main DV in this study was the percent of digits correct per minute for two types of math problems (two-digit by two-digit and two-digit by one-digit) during baseline, intervention, and maintenance phases. These two types of problems were given to the participants due to their pre-assessment probe results that showed their current level in addition with regrouping skill. In order to provide probes that were appropriate to their current skill level, three participants (Muhammed, Salem, and Eaid) were asked to complete a two-digit by a two-digit probe which contained 12 problems that required regrouping. One participant (Khaleel) was asked to complete a two-digit by a one-digit probe that also contained 12 problems. After each participant completed their two-minute timing, the researcher counted all the math problems attempted by the participant. The researcher then determined the total possible number of digits that could be correct for the problems completed on that probe. If a participant skipped a problem, then the problem was counted incorrect. The researcher and the trained scorer scored the participant's probe. Each participant received a score of digits corrects out of total digits possible for each probe. A percentage was reported for each participant and recorded for each session during each phase of the study.

Digits correct per minute for three-digit problems. In order to probe for generalized knowledge to a novel problem type, three participants (Muhammed, Salem, and Eaid) were probed on their ability to complete three-digit by two-digit problems with regrouping during the baseline phase. The probe contained 6 problems and the participants were only timed for one minute. This probe was only given two times for Muhammed, six times for Salem, and ten times for Eaid during the baseline phase and one time during the generalization phase. The procedures for scoring these probes were the same as those for the two-digit by two-digit probes.

Percent of regrouping steps. The second DV measured each participant's accuracy related to their ability to complete the number of steps, in the correct order, to regroup. Each participant had a mastery criterion of 100% steps across intervention and maintenance phases. A task analysis shown in Table 4.3 was used to collect data during all sessions. Percentage correct was calculated by dividing how many steps were completed correctly by the number of total steps. The checklist included a list of the steps in the task to indicate if the step was completed. The researcher used a (+) if the step was completed, or a (-) if the step was not completed correctly (see Appendix B).

Percent of video access steps. The third DV was measured by the accuracy of following all steps provided in a checklist that were necessary to access the video on the iPad during the intervention phase. The participant had a criterion of 100% of correct steps completed and used a checklist to ensure that each step was completed correctly as presented in (Appendix A). The participant used the checklist to help himself with accessing the video clip by checking each step that he did until he found the video modeling clip. The researcher then collected the checklist to calculate the percentage correct of VM access steps per session that the participant used during the intervention phase.

Table 4. 3

Mean Percentage of Digits Correct (N=4)

Name	2x2 digits baseline	2x1 digit baseline	3x2 digits Baseline	IV	MA	GEN 3x2 digits	GEN-2x2 digits
Muhammed	8.0	N/A	5.0	60.5	90.7	69.0	N/A
Salem	8.4	N/A	28.4	67.2	56.7	64.0	N/A
Eaid	11.3	N/A	0.0	64.9	70.7	75.0	N/A
Khaleel	N/A	15.4	N/A	53.3	55.3	N/A	58.0

Note. IV = Intervention; MA = Maintenance; GEN = Generalization.

Individual Participant Summary

Muhammed, Salem, Eaid, and Khaleel had the following results for two-digit by two-digit with regrouping problems for the first three participants and two-digit by one-digit with regrouping problems. The results for all phases are reported by participants as showed in Table 4.3 and Figure 4.1. The consistency of data patterns across all baseline phases, intervention phases, maintenance phases, and generalization phases was similar among all participants (see Figure 4.1).

Digits correct per minute.

Muhammed.

Baseline. When solving two-digit by two-digit addition with regrouping problems during baseline, Muhammed's baseline responses were stable with little variability. During baseline, his mean performance was 8% during baseline with a negative trend.

Intervention. During the intervention phase, Muhammed's mean performance was 61% digits correct with a positive trend. This resulted in a positive change of 53%

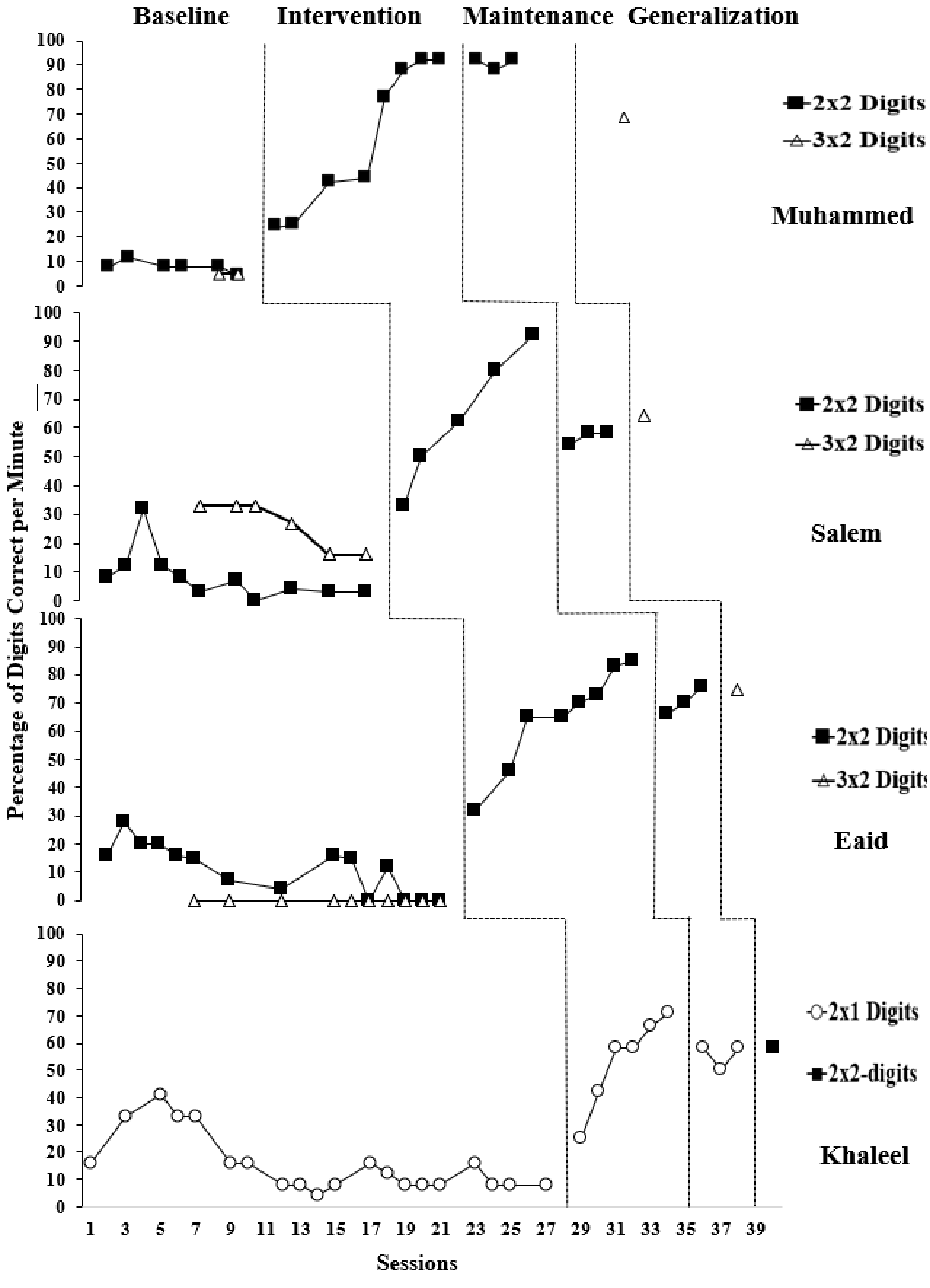

Figure 4. 1. Participants' percentage of digit correct per minute.

between his baseline and intervention phases. Muhammed had a sharp increase in his responses by 33% during the 11th session. Then, he continued this increase until he reached 92 % for the last two sessions of the intervention phase. The effect of the intervention on solving addition problems was immediate at 24%. The percentage of nonoverlapping of data (PND) was 100% across baseline and intervention phases.

Maintenance. During the maintenance phase, Muhammed's mean performance was 91% digits correct with a positive trend. This resulted in a mean change of 83% in level between the baseline of two-digit by two-digit and the maintenance. PND was 100% across the baseline and the maintenance phases.

Generalization. During the generalization phase, Muhammed mean of three-digit by two-digit probe responses was 69% while his baseline mean of two sessions was 5%. This resulted in a mean change of 64% in level between generalization baseline phase and generalization phase. PND was 100% across the generalization baseline and post-intervention generalization phases.

***Salem*.**

Baseline. When started solving two-digit by two-digit addition with regrouping problems during baseline, Salem's baseline responses had a moderate variability in the beginning and then were stabilized in the last two sessions. During baseline, his mean performance was 8.4% during baseline with a negative trend.

Intervention. During the intervention phase, his mean performance was 67.2% with a positive trend. This resulted in a positive change of 58.8% between his baseline of two-digit by two-digit and intervention phases. The effect of the intervention on solving addition problems was immediate at 46.7%. PND was 100% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Salem maintained his performance in addition with regrouping with a mean of 56.7% which resulted in a mean change of 48.3 % in level between the baseline of two-digit by two-digit and the maintenance. PND was 100% across the baseline and the maintenance phases.

Generalization. During the generalization phase, Salem's baseline mean of three-digit probe responses was 28% and three-digit probe generalization mean was 64% which resulted in a positive change of 36%. PND was 100% across the generalization baseline and post-intervention generalization phases.

Eaid.

Baseline. When started solving two-digit by two-digit addition with regrouping problems during baseline, Eaid's baseline responses had a little variability in the beginning and then were stabilized in the last three sessions. During baseline, his mean performance was 11.3% during baseline with a negative trend.

Intervention. During the intervention phase, Eaid's mean performance was 64.9% with a positive trend. This resulted in a positive change of 53.6% between his baseline and intervention phases. The effect of the intervention on solving addition problems was immediate at 47.6%. PND was 100% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Eaid maintained his performance with an increase in two-digit by two-digit addition with regrouping with a mean of 70.7% which resulted in a mean change of 59.4% in level between the baseline of two-digit by two-digit and the maintenance. PND was 100% across the baseline and the maintenance phases.

Generalization. During the generalization phase, Eaid's baseline mean of three-digit probe responses was 0% and three-digit probe generalization mean was 75%. PND was 100% across the generalization baseline and post-intervention generalization phases.

Khaleel.

Baseline. When started solving two-digit by one-digit addition with regrouping problems during baseline, Khaleel's baseline responses had a moderate variability in the beginning and then were stabilized in the last three sessions. During baseline, his mean performance was 15.4% during baseline with a negative trend.

Intervention. During the intervention phase, his mean performance was 53.3% with a positive trend. This resulted in a positive change of 37.9% between his baseline and intervention phases. The effect of the intervention on solving addition problems was immediate at 33.6%. PND was 83.33% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Khaleel maintained his performance with an increase in two-digit by one-digit addition with regrouping with a mean of 55.3% which resulted in a mean change of 39.9% in level between the baseline of two-digit by one-digit and the maintenance. PND was 100% across the baseline and the maintenance phases.

Generalization. During the generalization phase, Khaleel generalized solving two-digit by two-digit addition with regrouping problems with a score of 58% comparing to his pre-assessment results.

Table 4. 4

Percentage of Regrouping Steps Completed.

Name	2x2 digits baseline	2x1 digit baseline	3x2 digits Baseline	IV	MA	GEN 3x2 digits	GEN 2x2 digits
Muhammed	0	N/A	0	100	100	100	N/A
Salem	0	N/A	0	100	100	100	N/A
Eaid	0	N/A	0	100	100	100	N/A
Khaleel	N/A	0	N/A	100	100	N/A	100

Note. IV = Intervention; MA = Maintenance; GEN = Generalization.

Regrouping steps.

Muhammed, Salem, Eaid, and Khaleel had the following results for using regrouping steps to solve addition with regrouping. The results for all phases are reported by participants as showed in Table 4.4 and Figure 4.2. The consistency of data patterns across all baseline phases, intervention phases, maintenance phases, and generalization phases was similar among all participants (Figure 4.2).

Muhammed.

Baseline. When solving two-digit by two-digit problems during baseline, Muhammed had a stable baseline of regrouping steps completed with a mean of zero percent with flat trend and no variability.

Intervention. During the intervention, Muhammed showed a substantial increase from zero percent during baseline to 100 % during the intervention. He had a mean of 100%. PND was 100% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Muhammed maintained using all regrouping steps to solve two-digit by two-digit with a mean of 100 %. PND was 100%

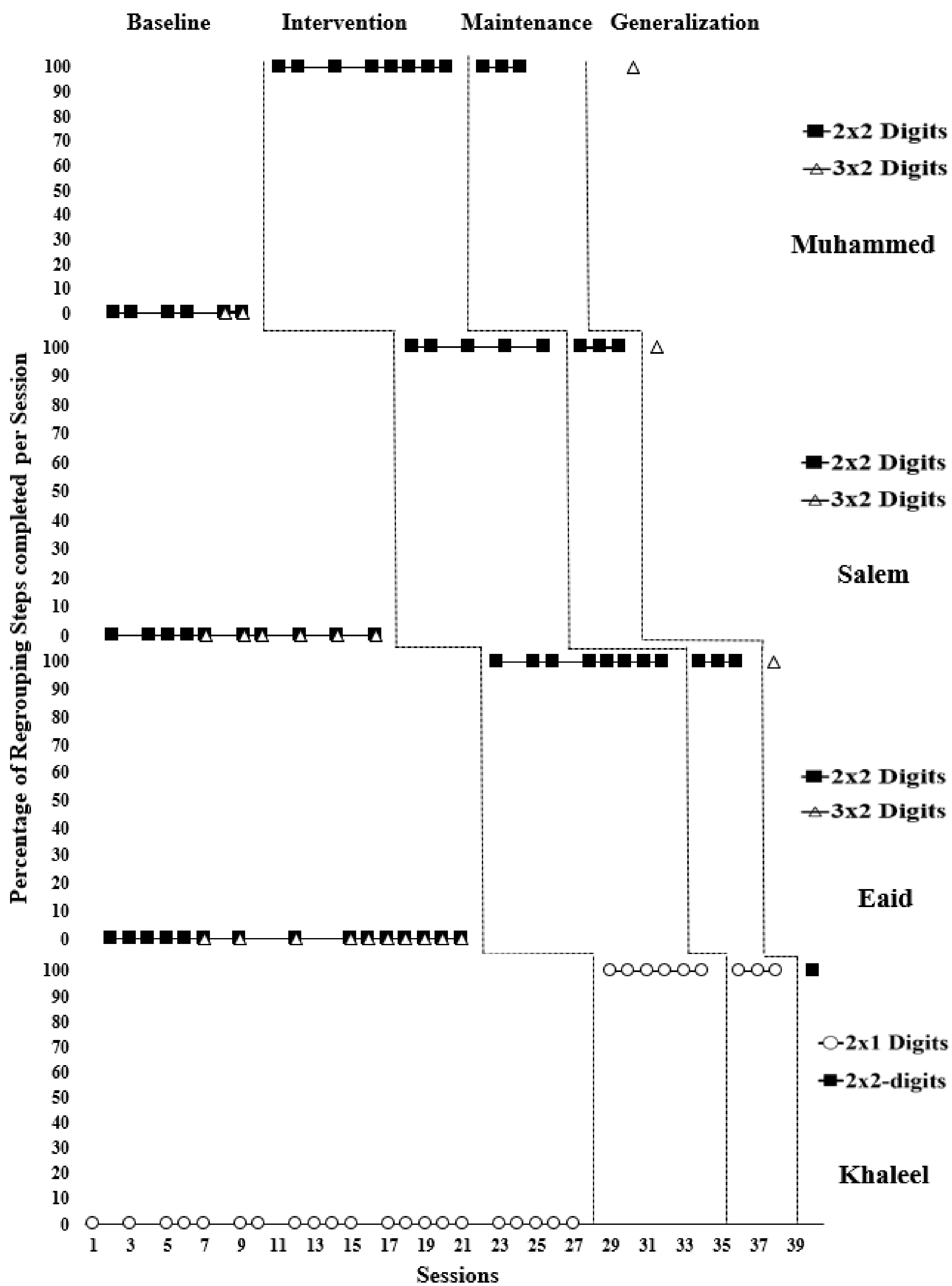

Figure 4.2. Participants' regrouping steps completed per session.

across the baseline and the maintenance phases.

Generalization. During the baseline of solving three-digit by two-digit problems, Muhammed's baseline mean was 0% and post-intervention generalization mean was 100% resulted in a mean change of 100% between the two phases. PND was 100% across the generalization baseline and post-intervention generalization phases.

Salem.

Baseline. When adding two-digit by two-digit problems during baseline, Salem had a stable baseline of regrouping steps completed with a flat trend and no variability. He showed an extreme increase in following all steps from 0 % during baseline to 100 % during the intervention.

Intervention. During the intervention, the percentage of regrouping steps completed was 100%. PND was 100% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Salem maintained completing all regrouping steps in addition with regrouping to solve two-digit by two-digit with a mean of 100%. PND was 100% across the baseline and the maintenance phases.

Generalization. During the baseline of solving three-digit by two-digit problems, Salem's baseline mean was 0% and post-intervention generalization mean was 100% which resulted in 100% change between the baseline and the generalization phases. PND was 100% across the generalization baseline and post-intervention generalization phases.

Eaid.

Baseline. When solving two-digit by two-digit problems during baseline, Eaid had a mean of 0% with a stable baseline of regrouping steps completed that had a flat trend and no variability.

Intervention. During the intervention, the percentage of regrouping steps completed was 100%. PND was 100% across the baseline and the intervention phases.

Maintenance. During the maintenance phase, Eaid maintained using all regrouping steps to solve two-digit by two-digit with a mean of 100 %. PND was 100% across the baseline and the maintenance phases.

Generalization. During the baseline of solving three-digit by two-digit problems, Eaid's baseline mean was 0% and post-intervention generalization mean was 100% which resulted in a change of 100% between the baseline and the generalization phases. PND was 100% across the generalization baseline and post-intervention generalization phases.

Khaleel.

Baseline. When solving two-digit by two-digit problems during baseline, Khaleel had a mean of 0% with a stable baseline of regrouping steps completed that had a flat trend and no variability.

Intervention. During the intervention, Khaleel had a mean of 100% in regrouping steps completed with PND of 100% across the baseline and the intervention phases. . This resulted in a mean change of 100%.

Maintenance. During the maintenance phase, Khaleel maintained completing regrouping steps to solve two-digit by two-digit with a mean of 100 %. PND was 100% across the baseline and the maintenance phases.

Generalization. During the generalization phase, Khaleel successfully generalized using regrouping steps to solve two-digit by two-digit addition with regrouping problems with a percentage of 100%.

Accessing the VM clip. For accessing VM in the iPad, the researcher administrated training sessions on how to access a video clip on the iPad. During each session of the intervention, participants were given the checklist of accessing the VM clips. All VM clips were randomly assigned to each participant by the researcher.

Muhammed.

Intervention. During the intervention phase using the checklist associated with pictures showing each step, Muhammed mastered the skill during each session with 100%. In all eight sessions, he scored 100% completing all steps to locate the video clips on the iPad.

Salem.

Intervention. During the intervention phase, Salem mastered locating his video clips using the checklist that associated with pictures showing each step until finding the clip with 100% mastery. In each session, he scored 100% completing all steps to locate the video clip on the iPad.

Eaid.

Intervention. Eaid mastered locating his video clips during the intervention phase using the hint sheet that associated with pictures showing each step until finding the clip with 100% mastery. In each session, he scored 100% completing all steps to locate the video clip on the iPad.

Khaleel.

Intervention. During the intervention phase, Khaleel mastered locating his video clips using the checklist that associated with pictures showing each step until finding the clip with 100% mastery. In each session, he scored 100% completing all steps to locate the video clip on the iPad.

Chapter V

Discussion

This study examined the effects of point-of-view video modeling (POVM) on improving the ability of elementary participants with autism spectrum disorder (ASD) to learn math skill (addition with regrouping). The research questions were: (1) to what extent is the POVM intervention effective in teaching students with ASD emerging math skills (addition with regrouping)?, (2) to what extent will the effects of POVM intervention on emergent math skills (addition with regrouping) for students with ASD maintain over time?, (3) to what extent will the skills learned in POVM intervention generalize to more complex math problems?, and (4) what is the social validity of using POVM intervention with students with ASD and their teachers? This chapter presents (a) a discussion of the results of the previous four research questions, (b) the limitations of the study, (c) the implications of the study, and (d) recommendations for future research.

This study implemented POVM intervention to four male elementary school participants with ASD (third grade, fourth grade, fifth grade, and sixth grade). According to the Ministry of Education of Saudi Arabia (2016), addition with regrouping was presented in Second Grade Mathematics Textbook, none of the participants were introduced to this skill (addition with regrouping) previously according to their teachers' recommendations and concerns.

The Effectiveness of POVM

Based on the visual analysis of the data collected throughout this study, POVM intervention provided a significant increase in all participants' abilities to solve math problems that contained addition with regrouping. The multiple baseline across participants showed the functional relationship with the POVM intervention.

Before implementing the POVM intervention, all participants struggled to solve two types of math problems that required adding with regrouping (two-digit by two-digit and two-digit by one-digit) based on their pre-assessment probe that was given at the beginning of the study.

During the baseline, all participants demonstrated low levels of performance either by incorrect answering or skipping the problems due to the complexity of steps of the math problem. They could not visualize it with their own fingers for two minutes which was not enough for them to finish all problems in time. Variability was noticed during the first three sessions for Salem, Eaid, and Khaleel. This variability was due to giving the same math probe in these sessions which led the participants to memorize the previous answers to the probe. To reduce the variability, the researcher gave random probes and added more sessions to stabilize the baseline performance (Cooper et al., 2007; Drea, Hardman, & Hosp, 2007; Kratochwill et al., 2013). As a result, the variability of these participants decreased in the remaining sessions during the baseline. Future researchers and educators may take this into their consideration when creating math probes by giving a random probe for each session. In addition to answering addition probes, participants were observed for completing regrouping steps during the baseline. All participants' scores of completing regrouping steps were zero percent, which indicated they had not been introduced to these steps before.

During the intervention, all participants showed an increase in solving addition problems overall the intervention phase. When participants engaged in training during the intervention, they experienced multiple opportunities to correctly complete math problems that required regrouping. Muhammed's performance increased gradually during the intervention. Muhammed showed moderate increase during the first four sessions of the intervention phase because he was adding the ones column and writing the sum of it on the right side of the problem during the seventh, eighth, ninth, and tenth sessions, then write the answer as shown in the video clip which led to taking more time to solve as many as he can during the two minutes probe. After watching the video clip for four sessions, he stopped writing the sum of the ones column on the side of the problem; as the result, Muhammed had a sharp increase in his responses by 33% during the 11th session. Then, he continued this increase until he reached 92 % for the last two sessions of the intervention phase. Eaid's performance was noticed due to his high score mean of 67.2% among all participants during this phase. The researcher noticed that Eaid was self-competitive due to his questions about his progress. In each math probe, Eaid tried to answer more problems than the previous probe. On the other hand, Khaleel scored the lowest score of 53.3 % among all participants. Khaleel was drawing the numbers instated of writing them regularly comparing to his writing answers during the baseline. The researcher prompted him to stop and continue answering the other problems. It may result due to the use of a thick marker by the researcher during demonstrating the video clips that showed how to solve the addition with regrouping problems. Future researchers or educators may use a pencil instead of a marker. In addition to answering addition probes correctly, participants were observed for completing regrouping steps during the intervention. All participants showed an increase in using regrouping steps with 100% overall the intervention phase. These results showed that all participants visually memorized all steps of regrouping which let to reach the mastery level for following all these steps. When participants engaged in training during the intervention, they experienced multiple opportunities to correctly complete all regrouping steps due to the systematic nature each intervention session. Percentage of nonoverlapping of data (PND) for all participants showed a very effectiveness of the POVM intervention when solving addition with regrouping problems. PND indicated a score of 100% (PND > 90%) for Muhammed, Salem, and Eaid while PND indicated a score of 83% (PND > 70%) for Khaleel. PND scores were averaged together for the full multiple baseline design which resulted in 95.83% (PND > 90%). Therefore, PND showed that POVM is a very effective intervention according to Scruggs et al., (1987). For using regrouping steps, all participants' PND scores of 100% between the baseline and intervention phases which indicated a very effective POVM intervention. Moreover, all participants kept their mastery level of accessing all video clips on the iPad that used during this study which indicated that all the participants had previous experience using the iPad. In summary, the implementation of POVM resulted in positive increasing trends for all participants. All participants had a quick gain on their experience of using regrouping steps to do addition problems correctly after watching POVM clips.

Evidence of Maintenance

All participants maintained their performance during these phases compared to the baseline phases. Muhammed had the highest score mean among all participants even though his score mean during this phase was higher than his score mean during the intervention. His progress was similar to his last two sessions of the intervention. Salem and Khaleel had the lowest score mean during this phase. Even though Salem maintain his performance overall compare to the baseline phase, his performance during maintenance was lower than his performance during the intervention. During the three maintenance sessions, Salem was sick and in bad mood when he answered the math probes. In these sessions, he dropped his pencil three times, and he lacked concentration when responding to math problems compare to his performance during the intervention. Khaleel maintained his progress even though his score mean during this phase was higher than his score during the intervention. For regrouping steps, all participants maintained using regrouping steps solving three addition math probes with regrouping with 100% mastery level during this phase. Students with ASD will benefit by maintaining their math skills in the future in their classroom where they can independently solve problems involving addition with regrouping using POVM.

Both findings from intervention and maintenance phases are consistent with and extend to previous research on mathematic skills that showed an increase in participants' performances using POVM (Burton et al., 2013; Jowett et al., 2013; Yakubova et al., 2015; 2016). Yakubova et al. (2015) used POVM to teach three high school participants with ASD how to work on word problems involving subtracting mixed fractions with uncommon denominators. Yakubova et al. (2016) conducted POVM with concrete-representational-abstract (CRA) concept to teach four young participants from the ages five to six addition, subtraction, and number comparison. These results also attempt to enhance the skills necessary for students to reach their appropriate grade-level since there are many students with ASD who have limited access to academic content (Newman, 2007).

Evidence of Generalization

Compared to his pre-assessment math probe, Khaleel successfully generalized untrained skill (two-digit by two-digit) after he learned to answer two-digit by one-digit math problems during the intervention phase. For the other participants (Muhammed, Salem, and Eaid), due to not having three-digit problems in the pre-assessment math probe, the researcher introduced a new math probe of three-digit by two-digit for one minute during the baseline of the study to examine the generalization of POVM intervention. All participants (Muhammed, Salem, and Eaid) successfully generalized what they learned (two-digit by two-digit) to answer three-digit by two- digit. As for using regrouping steps to answer addition problems, all participants generalized using regrouping steps solving one math probe that included three-digit by two-digit addition problems for Muhammed, Salem, and Eaid and two-digit by two-digit addition problems for Khaleel. Although Muhammed was absent for a week after he finished maintenance phase, he maintained his progress on using regrouping steps and generalized his performance to three-digit by two-digit problems.

This study added the generalization phase to the literature to assure that participants can generalize what skill that they learned to new and untrained math skills. This study met the purpose of conducting a VBI intervention which is to develop an individual's ability to generalize target behaviors (Hitchcock et al., 2003; McCoy & Hermansen, 2007). Previous studies (Burton et al., 2013; Jowett et al., 2013; Yakubova et al., 2015; 2016) did not examine if the participants transferred their learned skills to unlearned skills. Even though this study demonstrated one session during the generalization phase due to the time limit of the study, it got a favorable result. The future researcher may add more generalization sessions in order to have more accurate results.

Social Significance

All participants highly accepted using POVM intervention by choosing the emoji face that associated with the word strongly agree. They also expressed their feelings which were obvious when they were engaging with the intervention. Two of the participants showed joy in seeing their progress and were highly competitive to gain a high score.

The participants' teachers were impressed and proud of their students' results. Some of them told the researcher that they never thought their students could do these math problems. They favored the impact of the POVM on their students' performance when solving addition with regrouping and the use of POVM to teach other contents in mathematics. They admitted that it was their fault for not trying to teach such skills (addition with regrouping), and they always underestimated their students' abilities, especially when it came to teach academic skills. At the end of the study, two teachers came to the researcher to ask for a workshop on how to implement this type of intervention (POVM) even though they had previous knowledge of video modeling as a general concept. They had not used a single evidence-based practice (EBP) in their teaching of individuals with ASD within their classrooms. All previous results indicate how important the intervention was to both participants and their teachers. Results of participants and their teachers are consistent with and extend to previous research in the acceptance and the important of POVM when solving addition with regrouping (Yakubova et al., 2015). Future researchers should consider asking participants and their teachers about their perceptions before and after implementing the intervention so that they can compare both responses.

Limitations

Two limitations in this study were related to the nature of the single-subject design (e.g., sample size and generalization). According to Cooper et al. (2007), a single-subject design can include at least three participants establishing experimental control (Cooper et al., 2007; Kratochwill et al., 2013). Although this study used single-subject research with multiple baseline across participants (with four participants N=4) it is suggested to replicate this study with more participants in order to establish a strong experimental control (Horner et al., 2005).

In addition to the limitation on sample size, the generalization of the untrained math probe was a limitation in this study. The researcher could not use several math probes over several sessions due to the time-limit of this study to have stable responses; as the result, the math probe of an untrained math skill can be examined for at least three sessions.

A third limitation was the delay to conduct the generalization baseline; as a result, Muhammed (first participant) was only given two three-digit by two-digit math probes for one minute during two sessions. Future research may avoid having this by conducting the probe from the beginning of the generalization baseline.

A fourth limitation was using a pull-out method with each participant and worked one-on-one with the participants due to the distractions that prohibited each participant from concentrating in their own classrooms. It would be ideal to conduct the study within participants' classrooms. It may be possible in future research to conduct a replicated study in the natural environment to generalize the results.

A fifth limitation was giving the same math probe in the beginning of the study during the baseline. Due to having the same math probe, variability was increased for three of the four participants (Salem, Eaid, and Khaleel). Future researchers should prepare random math probes across all sessions during all phases. Using this procedure, the future researchers can minimize the variability of the data.

A sixth limitation was related to treatment fidelity data. The treatment fidelity checklist was used to assure the intervention was implemented with fidelity by the researcher himself for steps one to seven with 100%. In addition, the treatment fidelity data were collected by the researcher himself, but only for steps one through four. The second observer was only present for steps five through seven. This was done to minimize any impacts on student responding by having a second observer present. Although the second observer was in attendance for 40% of sessions with 100%, which meets guidelines for the assessment of treatment fidelity, it would have been more beneficial for a second observer to have been present for all steps to assure treatment fidelity.

The seventh and the last limitation of this study was the participants' absences during the baseline and intervention phases. Instead of having three days per week to conduct the study, the researcher had to present at school everyday to conduct the study. In future research, researchers should emphasize the importance of attending each day of school at the beginning of the study and can set a prize for attending everyday.

The Implications to the Field

Although there were several limitations, this study yielded important implications from findings. This study expanded the limited research in improving the academic mathematic skills of both young and high school students with ASD (Burton et al., 2013; Jowett et al., 2013; Yakubova et al., 2015; 2016). Teachers often consider mathematics to be a difficult subject matter for children with ASD (U.S Department for Education, 2014). In addition, acquisition of mathematic skills from early grades yields a solid foundation for success in the future by increasing individuals' independence during higher grades (Cihak & Foust, 2008). Thus, to improve the outcomes of elementary school students with ASD, adding large numbers that required regrouping should be included in students' individual educational plans (IEPs). Complex math problems usually are done through several steps (e.g., adding with regrouping) so that students can follow these steps to solve the math problems. Educators can use task analysis to simplify the complex math problems for their students with ASD. This study included a video-based intervention (VBI) to teach addition with regrouping to elementary students with ASD in Saudi Arabia. VBIs were considered as EBPs to improve the different skills of individuals with ASD (Bellini & Akullian, 2007; Simpson, 2005). Teaching students with ASD addition with regrouping problems using VBIs (e.g., the POVM) through iPad can improve students' performance which can be efficient and effective. Using POVM, teachers can deliver math problems examples in different naturalistic settings. With POVM, the educator has more control over the intervention. POVM allows for greater use and can be reused with other students.

For educators to use EBPs (e.g., VBIs), professional development is needed. Having a strong evidence-base of VBIs and their effectiveness compared to traditional teaching strategies, educators need training on developing VBIs to teach mathematics skills to students with ASD. In addition, this training should be integrated into pre-service teacher preparation programs to promote the use of VBIs in practice.

This study was the first study that used a single-subject design to examine the effectiveness of an intervention to individuals with ASD in the Middle East and Gulf countries. Therefore, single-subject research can be a powerful tool in discovering best practices for students with disabilities including students with ASD. Fraenkel & Wallen (2006) stated that "studies involving single-subject designs that show a particular treatment to be effective in changing behavior must rely on replication–across individuals rather than groups–if such results are be found worthy of generalization" (p. 318). Single-subject research offers a powerful and useful methodology for developing the practices or interventions that benefit individuals with disabilities and their families (Horner et al., 2005).

Technology (e.g., iPad) has been effective in teaching different skills including mathematics in schools (Fletcher-Watson, 2014; Odom et al., 2014). The findings of this study suggested that technology-based intervention was effective in teaching addition with regrouping problems. An iPad device with targeted math skills was given to each participant to watch independently. Therefore, educators have the flexibility to individualize their instructions for each student during the learning process. In addition, educators may need a technology training to use a device (e.g., iPad) and how they transfer video clips to the device and edit them before the start of an intervention, which depend on their background knowledge of implementing any VM interventions using iPad.

Recommendations for Future Research

Due to limited research on academic mathematics skills, replication of the current study may lead to a number of future research questions (Yakubova et al., 2015; 2016). For example, researchers may implement more sessions to assess untrained math skills during the generalization phase. Asking participants and their teachers about their attitudes regarding the intervention and its importance before and after implementing an intervention will have accurate results of the social validity of the intervention. In addition, future researchers may assess different mathematic skills, such as subtraction and multiplication with regrouping using POVM via iPad. Moreover, a variety of academic areas, such as reading, and writing may be examined by using POVM via iPad to teach students with ASD. Lastly, because of the lack of research on investigating the effectiveness of EBPs using single-subject design in developing countries (Saudi Arabia), researchers within these countries are encouraged to start using single-subject design methods to assess the use of EBPs to teach students with ASD.

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Appendices

APPENDIX A

Checklist to Access the Video Clip

Step	Action	description	Check (√)
1		**Turn on the iPad**	
2		**Access the video clip**	
3		**Put on headphones**	
4		**Watch the video clip**	

APPENDIX B

Observational Checklist

Student number: ____

Math task: ____

Recording keys: (+) step correctly completed and (-) step incorrectly completed

	Dates							
Task Analysis Steps								
1. Add the numbers in the one's column.								
2. If the sum is 10 or greater, write the one's digit under the one's column								
3. write the ten's digit on top of the ten's column.								
4. Add the numbers in the ten's column including the number you carried.								
5. Write the sum of the numbers under the ten's column								

APPENDIX C

Treatment Fidelity Checklist LaCava (2008)

Planning (Steps 1 – 5)					
Step 1. Confirm the Behavior for Teaching		**Yes**	**No**	**NA**	**Note**
1	Identify a target behavior (completing addition problems).				
2	Define and describe completing addition problems so that it is observable and measurable.				
Step 2. Collect the Correct Equipment		**Yes**	**No**	**NA**	**Note**
1	Acquire a video recording device				
2	Identify how the video will be played back				
3	Become familiar with the equipment and comfortable using it.				
Step 3. Select the Correct the Video Recording for the Session		**Yes**	**No**	**NA**	**Note**
1	Students complete as much of the skill as possible.				
2	Collect baseline data to identify the steps of the task analysis that the learner can complete without assistance.				
Step 4. Test the Video		**Yes**	**No**	**NA**	**Note**
1	Using Point-of-view video modeling				
2	Record a video that is satisfactory in quality and accurately reflects the steps of the task analysis				
3	Edit the video and remove any errors and prompts.				
4	Complete voice-overs				
Step 5. Arranging the Environment for Watching the Video		**Yes**	**No**	**NA**	**Note**
1	The video will be watched inside a quite classroom.				
2	Ensure that the materials for the performance of the task match those on the video				
Intervention (Step 5-6)					
Step 6. Showing the Video and Complete the Activity Sheet		**Yes**	**No**	**NA**	**Note**
1	Allow the student to watch the video and provide prompts necessary to gain and/or keep attention.				
2	Allow the student to watch the video an appropriate number of times before expecting the student to complete addition problems.				

Scoring Key: 1 = implemented; 0 = did not implement; NA = not applicable

Step 7. Monitoring Participant Progress		Yes	No	NA	Note
1	record and evaluate the individual session and compare it to past sessions.				
2	How often and when the learner watches the video when using the target behavior.				
3	If after collecting data on three to five occasions, participants are not making progress, researcher begins troubleshooting. If learners are making progress, instruction is continued until they have reached maximum proficiency.				
Step 8. Troubleshooting if the Student is Not Making Progress		**Yes**	**No**	**NA**	**Note**
1	Adjust intervention tactics to help the learner make progress by asking:				
	a. Is the student watching the video enough times per week?				
	b. Is the student watching the video, but not attending to the most relevant parts?				
	c. Is the student getting enough prompting from to complete the addition problems?				
	d. Is the student receiving the appropriate amount and type of reinforcement for performing, or attempting to perform completing addition problems)?				
	e. Is the video too complex? and				
	f. Does another task analysis need to be completed to make sure that the video includes the correct steps?				
Step 9. Adjusting the Use of Instructional Supports (prompting and video use).					

Scoring Key: 1 = implemented; 0 = did not implement; NA = not applicable

APPENDIX D

Social Validity Questionnaire for Student- English Version

Please circle one of the five choices that best describe the extent to which you agree or disagree with each of the seven statements below.

1	**Doing addition problems using videos on iPad was easy.**	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
2	**I enjoyed watching the videos on the iPad.**	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
3	**I liked learning how to solve addition problems from video clips using iPad.**	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
4	**I learned how to do addition problems after watching videos.**	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
5	**I would like to use video clips to learn more math problems in future.**	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree

APPENDIX E

Social Validity Questionnaire for Student- Arabic Version

استبيان الصلاحية الاجتماعية (نسخة الطالب)

يرجى وضع دائرة حول أحد الوجوه المبتسمة الخمسة التي تصف موافقتك أو عدم موافقتك مع كل عبارة من العبارات الخمسة التالية:

1. كان من السهل حل مسائل الجمع باستخدام مقاطع الفيديو على جهاز الآيباد.	 **أوافق بشدة** **أوافق** **غير محدد** **لا أوافق** **لا أوافق بشدة**
2. لقد استمتعت بمشاهدة مقاطع الفيديو على جهاز الآيباد.	 **أوافق بشدة** **أوافق** **غير محدد** **لا أوافق** **لا أوافق بشدة**
3. أحببت تعلم كيفية حل مسائل الجمع من مقاطع الفيديو باستخدام الآيباد.	 **أوافق بشدة** **أوافق** **غير محدد** **لا أوافق** **لا أوافق بشدة**
4. تعلمت كيفية القيام بحل مسائل الجمع بعد مشاهدة مقاطع الفيديو.	 **أوافق بشدة** **أوافق** **غير محدد** **لا أوافق** **لا أوافق بشدة**
5. سأستخدم مقاطع الفيديو بواسطة الآيباد لمعرفة المزيد من مسائل الرياضيات في المستقبل.	 **أوافق بشدة** **أوافق** **غير محدد** **لا أوافق** **لا أوافق بشدة**

APPENDIX F

Social Validity Questionnaire for Teacher- English Version

Please circle one of the five choices that best describe the extent to which you agree or disagree with each of the nine statements below. (1=Strongly Disagree 2=Disagree 3= Neutral 4=Agree 5=Strongly Agree)

Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The video modeling intervention using an iPad was easy to implement.	1	2	3	4	5
2. The video modeling intervention using an iPad was easy to implement.	1	2	3	4	5
3. The video modeling intervention using an iPad seemed to be enjoyable for the student.	1	2	3	4	5
4. My students got improved in addition regrouping skills when using video modeling intervention	1	2	3	4	5
5. I believe my students maintained their math skills in a variety of other types of math problems.	1	2	3	4	5
6. I will use this intervention in teaching other content areas and skills to students with ASD.	1	2	3	4	5
7. I liked the procedures (steps and prompts) that used in video modeling.	1	2	3	4	5

8. I liked having several video clips to instruct the math problem.	1	2	3	4	5
9. Overall, I was very satisfied with the result of using video modeling intervention using iPad.	1	2	3	4	5

Comments about the student's performance:

____

Name (optional): ____

APPENDIX G

Social Validity Questionnaire for Teacher- Arabic Version

استبيان الصلاحية الاجتماعية (نسخة المعلم)

يرجى وضع دائرة حول أحد الخيارات الخمسة التي تصف بشكل أفضل مدى موافقتك أو عدمها في كل عبارة من العبارات أدناه. (1 = لا أوافق بشدة 2 = لا أوافق 3 = غير محدد 4 = أوافق 5 = أوافق بشدة).

العبارات	لا أوافق بشدة	لا أوافق	غير محدد	أوافق	أوافق بشدة
1. كان من السهل تطبيق استراتيجية النمذجة بالفيديو بواسطة الآيباد.					
2. يبدو أن استراتيجية النمذجة بالفيديو بواسطة الآيباد أمرًا ممتعًا للطالب.					
3. أجاب طلابي بشكل صحيح على مسائل الجمع بإعادة التجميع عند استخدام استراتيجية النمذجة بالفيديو بواسطة الآيباد.					
4. حافظ طلابي على مهاراتهم في مسائل الجمع بإعادة التجميع.					
5. نجح طلابي في تعميم مهاراتهم في الجمع بإعادة على أنواع أخرى من الجمع بالتجميع.					
6. سأستخدم استراتيجية النمذجة بالفيديو بواسطة الآيباد في تدريس مجالات ومهارات أخرى للطلاب ذوي اضطرابات التوحد.					
7. سأستخدم الإجراءات (الخطوات والمطالبات الواردة في هذه الدراسة) والتي استخدمت في التمذجة بالفيديو.					
8. ساعد استخدام العديد من مقاطع الفيديو الطلاب على تعلم مسائل الجمع بإعادة التجميع في مادة الرياضيات.					
9. بشكل عام ، أنا راضٍ تمامًا عن نتيجة استخدام استراتيجية النمذجة بالفيديو بواسطة الآيباد.					

ملاحظات على أداء الطالب :

____

____

الاسم (اختياري) : ____________________

APPENDIX H

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

TEACHER CONSENT FORM-English Version

TITLE:

The Effectiveness of Using Point-of-View Video Modeling on the Addition Skills of Students with Autism Spectrum Disorders (ASD) in Saudi Arabia

INVISTGATOR:

Hamad Hamdi, PhD student in Department of Counseling, Psychology and Special Education at Duquesne University, hamdih@duq.edu.

ADVISOR:

Temple Lovelace, Associate Professor, Department of Counseling, Psychology and Special Education at Duquesne University, lovlacet@duq.edu or 01 (412) 396-4159

SOURCE OF SUPPORT:

This study is being performed as partial fulfillment of the requirements for the doctoral degree in School of Education at Duquesne University.

WHY IS THIS RESEARCH STUDY BEING DONE?

Your students will be asked to participate in a research project that seeks to investigate if point-of-view video modeling via iPad helps students with autism spectrum disorders solve math problems (e.g. addition with regrouping).

In order for your students to participate in this study, there will be two stages for screening your students. During the first stage, each student must: (a) school enrollment in elementary and middle classrooms; (b) no prior experience with video modeling or point-of-view video modeling, (c) meeting the ASD diagnostic criteria according to Diagnostic and Statistical Manual of Mental Disorders- IV-TR or the new DSM-5, (d) IEP math goals and objectives similar to the research objectives for the current study (e) receiving special education services in the area of mathematics (f) demonstrating conceptual understanding, such as processing math problems (e.g., addition with regrouping according to your recommendation based on classroom scores and formative measures, (g) no vision or hearing impairments, (h) willingness to participate in the study, and (i) parents' permission to participate in the study.

When each student meets previous inclusion criteria, he will be screened for the prerequisite abilities necessary to complete the study intervention: (a) identify numbers and count numbers from 1 to 20, (b) have not learned to complete two-digit by one-digit addition problems with regrouping ,(c) engage in a task for 3 min when seated, (d) attend to the iPad and gaze at a video displays on iPad screen, (e) has independent range of motion to interact with the iPad, and (f) has the requisite fine motor skills to write and operate the iPad.

WHAT WILL MY STUDENT AND I BE ASKED TO DO?

This study will be conducted by the researcher three times a week at your school, Autism Center. Each session will last for 45 minutes. The procedure that your students will be asked to do by the researcher in this study include:

- **Training phase:** Your students will need to demonstrate accessing the video clip. The researcher will show each student a checklist to access the video clip on the iPad and provide training sessions if needed.
- **Pre-intervention assessment:** Prior to starting baseline, your students will be assessed by the researcher for their performance in addition with regrouping base on your recommendations during screening process by giving a timed math probe (e.g., two-digit by two-digit and two-digit by one-digit addition with regrouping). This assessment will take place at their classroom during math class period.
- **Baseline phase:** The researcher will collect data in the skill they struggle with for five sessions by giving math probe includes (e.g., two-digit by one-digit addition with regrouping). Your students will not receive any type of help during these sessions. After baseline data are stable with respect to level and trend using visual analysis of a student's performance, the intervention will be applied to the first baseline while baseline conditions remain in effect for the other participants.
- **Intervention procedure:** Your student will be asked by the researcher to engage in doing math probe work sheet for two minutes, accessing the VM using the checklist as self-prompt when presented with iPad, watching VM, and doing activities for five addition with regrouping.
- **Maintenance phase:** The researcher will give your students a timed math probe (e.g., two-digit by one-digit addition with regrouping problems) for three sessions without using video modeling. This math probe will be done after finishing the intervention phase to maintain the skills that your students acquire during the intervention phase.
- **Generalization phase:** The researcher will provide a timed math probe work sheet to your students to answer different types of addition with regrouping problems (e.g., two-digit by two-digit and two-digit by one-digit addition with regrouping) in order to find out if students are able to generalize learned skills to different type of addition with regrouping problems.
- **Video Recording:** The researcher will record your student completing each step of the study. The only portions of your child that will be shown on the recording are your child's hands. A video camera will be placed behind your student and will capture them completing the worksheets and the video-modeling exercise. Your student's face, nor other parts of your student's body will be captured on camera.

For your participation, you will be asked to answer a short questionnaire to show the degree of satisfaction with using video modeling intervention with your students.

WHAT ARE THE RISKS AND BENEFITS OF THIS STUDY?

There are no risks associated with your participation in this study. Participation in this study will be an opportunity for you as a teacher who teaches students with ASD by providing an appropriate intervention. All information that shared during this study will be confidential. Your participation in this study is voluntary; you are under no obligation to participate. You may withdraw at any time. There are no minimal risks associated with your participation.

WILL I BE PAID FOR TAKING PART IN THIS RESEARCH STUDY?

There will be no compensation for your participation in this study, and there is no monetary cost to you when participating.

CONFIDENTIALITY:

Your personal information that you provide will be kept confidential at all times and to every extent possible. Your personal information associated with this research study will not be shared with others. Your real name will not be used in any documents resulting from this research. Your information will be recorded anonymously. A false name will be randomly selected and used with your data. All data will be stored in a locked cabinet to which only the researcher has access. All data will be destroyed within 2 years after the completion of the study.

RIGHT TO WITHDRAW:

You are under no obligation to give your permission for your consent to participate in this study, and you may withdraw your permission and participation at any time by notifying the researcher.

SUMMARY OF RESULTS:

A summary of the results of this research will be supplied to you, at no cost, upon your request.

VOLUNTARY CONSENT:

I am aware of the nature and extent of my participation in this study as stated above. I also understand that participating in this study is voluntary for me. I hereby confirm my participation in this study, and I give my consent to participate in this study. I acknowledge that I have received a copy of this consent statement.

I understand that should I have any further questions about my participation and my students 'participation in this study, I may contact Hamad Hamdi, hamdih@duq.edu and Temple Lovelace, lovlace@duq.edu or 01 (412) 396-4159. Should I have questions regarding protection of human subject issues, I may contact Dr. David Delmonico, Chair of the Duquesne University Institutional Review Board, at 412.396.1886.

Signature of participant **Date**

Printed name of participant

Signature of investigator **Date**

Printed name of investigator

APPENDIX I

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

TEACHER CONSENT FORM-Arabic Version

موافقة المعلم

العنوان:
فاعلية استخدام التمذجة بالفيديو في تعليم مهارات الجمع للطلاب ذوي اضطراب التوحد في المملكة العربية السعودية

الباحث:
حمد بن علي حمدي، طالب دكتوراه في قسم الإرشاد، علم النفس، والتربية الخاصة بجامعة دوكين بالولايات المتحدة الأمريكية، للتواصل عن طريق الايميل : hamdih@duq.edu

المشرف:
تامبل لوفليس ، أستاذ مشارك في قسم الإرشاد، علم النفس، والتربية الخاصة بجامعة دوكين بالولايات المتحدة الأمريكية، للتواصل عن طريق الايميل : lovlacet@duq.edu أو 4159-396 (412) 01.

مصدر الدعم:
يتم إجراء هذه الدراسة كجزء من متطلبات الحصول على درجة الدكتوراه في كلية التربية بجامعة دوكين بالولايات المتحدة الأمريكية.

لماذا يتم إجراء هذه الدراسة البحثية؟

سيطلب من طلابك المشاركة في هذه الدراسة البحثية والتي تسعى إلى معرفة ما إذا كانت النمذجة بالفيديو باستخدام الأيباد تساعد الطلاب الذين ذوي اضطرابات طيف التوحد على حل مسائل الرياضيات (على سبيل المثال ، الجمع مع إعادة التجميع).

لكي يشارك طلابك في هذه الدراسة ، هناك مرحلتان من التقييم لانضمام الطلاب. خلال المرحلة الأولى ، يجب على كل طالب: (أ) أن يكون ملتحقا بالمدرسة بالفصول الابتدائية أو المتوسطة؛ (ب) ليس لديه خبرة سابقة بنمذجة الفيديو ، (ج) الوفاء بمعايير تشخيص اضطرابات طيف التوحد وفقا للدليل التشخيصي والإحصائي للاضطرابات العقلية - IV-TR أو DSM-5 الجديد ، (د) أهداف الخطة التربوية الفردية المتعلقة بالرياضيات شبيهة بأهداف البحث للدراسة الحالية (هـ) تلقي خدمات التعليم الخاص في مجال الرياضيات (و) مما يدل على الفهم النظري ، مثل معالجة مشاكل الرياضيات (مثل الجمع مع إعادة التجميع وفقا لتوصية المعلم على أساس درجات طفلك (ز) عدم وجود مشكلة بالنظر أو ضعف في السمع ، (ح) لديه الرغبة في المشاركة في الدراسة ، و (1) لديه إذن من والده/ والدته بالمشاركة في الدراسة.

عندما يفي كل طالب بمعايير الانضمام في المرحلة الأولى، فإنه سيخضع لمزيد من التقييم للقدرات اللازمة لاستكمال المشاركة في الدراسة: (أ) معرفة الأرقام و العد من 1 إلى 20 ، (ب) لم يتعلم إكمال الرقم المكون من رقم واحد بالإضافة إلى مشاكل إعادة التجميع ، (ج) الانخراط في المهمة لمدة 3 دقائق عند الجلوس ، (د) لديه القدرة علة الانتباه إلى جهاز الأيباد ويستطيع التحديق في عروض الفيديو على شاشة الأيباد ، (هـ) لديه مهارة استقلالية في للتفاعل مع الأيباد ، و (و) لديه المهارات الحركية الدقيقة المطلوبة لكتابة واستخدام الأيباد.

ماذا سيطلب مني ومن طالبي/ طلابي فعله في هذه الدراسة البحثية؟

سيتم إجراء هذه الدراسة خلال ثلاث مرات في الأسبوع في مقر تدريسك (مركز التوحد). تستغرق كل جلسة حصة كاملة تقريبًا. يشتمل الإجراء الذي سيُطلب منك ومن طلابك القيام به في هذه الدراسة على ما يلي:

- **مرحلة التدريب:** سيحتاج كل طالب إلى إظهار معيار اتقان الوصول إلى مقطع الفيديو بنسبة 100٪ . سيقوم الباحث بعرض قائمة تحتوي على خطوات الوصول الى الفيديو على جهاز الأيباد وسيقوم بتقديم التدريب اللازم لهم اذا لزم الأمر.
- **مرحلة التقييم المبدئي:** سيتم تقييم جميع طلاب إلى أي درجة اتقان مهارة الجمع بالتجميع من خلال اجراء اختبار لتحديد المستوى والذي يتكون من مسائل الجمع التي تحتوي على رقمين مع رقم و رقمين مع رقمين.
- **مرحلة الخط القاعدي:** سيقوم الباحث بجمع البيانات في المهارة التي يواجه المشاركون في الدراسة لمدة خمس جلسات عن طريق إعطاء مسائل في الرياضيات (على سبيل المثال ، جمع رقمين مع رقم واحد مع إعادة التجميع). لن يحصل جميع المشاركين على أي نوع من المساعدة خلال هذه الجلسات.
- **مرحلة التدخل:** يسُطلب من المشاركين حل مجموعة من مسائل الرياضيات لمدة دقيقتين. وبينما يقوم الطالب بحل المسائل، سيقوم الباحث بتصوير بكميرا الفيديو والذي سيظهر فقط أيديهم وورقة حل مسائل الرياضيات دون أن يظهر وجوههم ليتم ملاحظتهم فيما بعد من قبل ملاحظ متدرب لتقييم دقة البيانات التي تم جمعها. وبعد ذلك سيعطون جهاز الايباد من أجل الوصول الى القيديو الذي يشرح كيفية حل مسائل الجمع بالتجميع. كما أن المشاركين سيقومون بنشاط لحل 5 مسائل جمع بالتجميع. خلال هذه المرحلة ، ستعمل مع طلابك في مساعدة الطلاب في حل مسائل النشاط.
- **مرحلة الاحتفاظ:** سيعطى طلابك يوميًا مسائل في الرياضيات (على سبيل المثال ، رقمين من خلال إضافة من رقم واحد بالتجميع) لثلاث جلسات دون استخدام النمذجة بالفيديو. سيتم إجراء هذه المرحلة بعد الانتهاء من مرحلة التدخل من أجل الحفاظ على المهارات التي يكتسبها طلابك خلال مرحلة التدخل.
- **مرحلة التعميم:** سيقدم الباحث ورقة اختبار إلى جميع الطلاب للإجابة على أنواع مختلفة من مسائل الجمع باستخدام إعادة التجميع (مثل: رقمين مع رقمين ورقمين مع رقم واحد) من أجل معرفة ما إذا كان جميع الطلاب قادرين على التعميم المهارات المكتسبة إلى أنواع مختلف من مسائل الجمع باستحدام إعادة التجميع.
- **تسجيل الفيديو:** سيقوم الباحث بتسجيل طالبك عند إكمال كل خطوة من الدراسة. يدي طالبك هب الأجزاء الوحيدة التي ستظهر في التسجيل. سيتم وضع كاميرا فيديو خلف طالبك وستلتقطها لاستكمال أوراق العمل ونمذجة الفيديو. لن يتم تصوير وجه طالبك، أو أي أجزاء أخرى من جسم طالبك أمام الكاميرا.

ما هي مخاطر ومزايا هذه الدراسة البحثية؟

ليس هناك أدنى من المخاطر المترتبة على المشاركة في هذه الدراسة البحثية

مشاركتك في هذه الدراسة تعد فرصة لك كمعلم يقوم بتدريس الطلاب من ذوي اضطراب التوحد من خلال توفير الاستراتيجية المناسبة. مشاركتك فى هذا البحث غير إجبارية؛ فأنت غير ملزم بالمشاركة. كما يمكنك الانسحاب في أي وقت. كما أنه لا يوجد حد أدنى من المخاطر المرتبطة على مشاركتك في هذه الدراسة.

هل سيتم الدفع لطالبي/ طلابي على المشاركة في هذه الدراسة البحثية؟

لن يكون هناك أي تعويض لمشاركتك في هذه الدراسة ، كما أنه لا توجد تكلفة مالية عليك عند المشاركة.

السرية:

لن يتم مشاركة أي معلومات تتعلق بك في هذا البحث مع الآخرين. كما لن يتم استخدام الاسم الحقيقي لك أي مستندات ناتجة عن هذا البحث وسيتم تسجيل معلوماتك باسم مستعار. كما سيتم تخزين جميع البيانات في خزانة مقفلة لا يستطيع الوصول إليها إلا الباحث. كما أنه سيتم مسح جميع البيانات في غضون سنتين بعد الانتهاء من الدراسة.

الحق في الانسحاب من الدراسة البحثية:

أنت غير ملزم بإعطاء موافقتك على المشاركة في هذه الدراسة ، ويمكنك سحب موافقتك على مشاركتك في أي وقت عن طريق إخبار الباحث بذلك. يمكنك أيضًا طاب سحب بيانات طلابك بالكامل من الدراسة أو عدم السماح باستخدام أي بيانات تم جمعها في التقرير النهائي للنتائج.

ملخص النتائج:

سيتم تقديم ملخص لنتائج هذا البحث لك ، دون أي تكلفة ، عند الطلب.

إقرار الموافقة الطوعية:

أنا على دراية بطبيعة مشاركتي ومشاركة طالبي/ طلابي في هذه الدراسة كما هو مذكور أعلاه والمخاطر المحتملة الناشئة عن ذلك. أتفهم تماماَ أن المشاركة في هذه الدراسة طوعية. كما أنني أقر بموجب ذلك مشاركتي في هذه الدراسة ، وأوافق على مشاركة طالبي/ طلابي في هذه الدراسة. كما أقر بأنني تلقيت نسخة من بيان الموافقة هذا.

أتفهم أنه إذا كان لدي أي أسئلة أخرى حول مشاركة طفلي في هذه الدراسة ، يمكنني التواصل مع الباحث / حمد حمدي على hamdih@duq.edu أو على، كما يمكنني التواصل مع المشرفة تامبل لفليس على: lovlace@duq.edu أو على 396-4159 (412) 01. وإذا كان لدي أسئلة تتعلق بحماية حقوق المشاركة في الدراسة البحثية ، فيمكنني الاتصال بالدكتور ديفيد ديلمونيكو ، رئيس مجلس المراجعة المؤسسية بجامعة دوكين ، على 1886-396-(412)01 .

توقيع المعلم ________________ **التاريخ** ________________

اسم المعلم ________________

توقيع الباحث ________________ **التاريخ** ________________

اسم الباحث ________________

APPENDIX J

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

Parental Permission Form-English Version

TITLE:
The Effectiveness of Using Point-of-View Video Modeling on the Addition Skills of Students with Autism Spectrum Disorders (ASD) in Saudi Arabia

INVESTIGATOR:
Hamad Hamdi, PhD student in Department of Counseling, Psychology and Special Education at Duquesne University, hamdih@duq.edu.

ADVISOR:
Temple Lovelace, Associate Professor, Department of Counseling, Psychology and Special Education at Duquesne University, lovelacet@duq.edu or 01 (412) 396-4159

SOURCE OF SUPPORT:
This study is being performed as partial fulfillment of the requirements for the doctoral degree in School of Education at Duquesne University.

WHY IS THIS RESEARCH STUDY BEING DONE?

Your child is being asked to participate in a research project that seeks to investigate if point-of-view video modeling via iPad helps students with autism spectrum disorders solve math problems (e.g., addition with regrouping).

In order for your child to participate in this study, your child must: (a) school enrollment in elementary and middle classrooms; (b) no prior experience with video modeling or point-of-view video modeling, (c) meeting the ASD diagnostic criteria according to Diagnostic and Statistical Manual of Mental Disorders- IV-TR or the new DSM-5, (d) IEP math goals and objectives similar to the research objectives for the current study (e) receiving special education services in the area of mathematics (f) demonstrating conceptual understanding, such as processing math problems (e.g., addition with regrouping according to teacher's recommendation based on classroom scores and formative measures, (g) no vision or hearing impairments, (h) willingness to participate in the study, and (i) your permission to participate in the study.

When your child meets previous inclusion criteria, he will further screen for prerequisite abilities necessary to complete the study intervention: (a) identify numbers and count numbers from 1 to 20, (b) have not learned to complete two-digit by one-digit addition problems with regrouping ,(c) engage in a task for 3 min when seated, (d) attend to the iPad and gaze at a video displays on iPad screen, (e) has independent range of motion to interact with the iPad, and (f) has the requisite fine motor skills to write and operate the iPad.

WHAT WILL MY CHILD BE ASKED TO DO?

This study will be conducted three times a week at Autism Center. Each session will take approximately a class period. The things your child will be asked to do in this study include:

- **Training phase:** Your child will need to demonstrate accessing the video clip. The researcher will show your child a checklist to access the video clip on the iPad and provide training sessions if needed.
- **Pre-intervention assessment:** Prior to starting baseline, your child will be assessed for their performance in addition with regrouping by giving a timed math probe (e.g., two-digit by two-digit and two-digit by one-digit addition with regrouping).
- **Baseline phase:** The researcher will collect data in the skill they struggle with for five sessions by giving math probe includes (e.g., two-digit by one-digit addition with regrouping). Your child will not receive any type of help during these sessions.
- **Intervention procedure:** Your child will be required to engage in doing math probe work sheet
  for two minutes, accessing the VM using the checklist as self-prompt when presented with iPad, watching VM when verbally prompted, and doing activities for five addition with regrouping problems for approximately a class period per session. While your child is doing the math probe, your child will be video tabbed showing only his hands and the math sheet without showing his face.
- **Maintenance phase:** Your child will daily be given math probe (e.g., two-digit by one-digit addition with regrouping problems) for three sessions without using video modeling. This math probe will be done after finishing the intervention phases to maintain the skills that your child acquires during the intervention phase.
- **Generalization phase:** The researcher will provide a timed math probe work sheet to your child to answer different types of addition with regrouping problems that are similar to the pre- intervention assessment (e.g., two-digit by two-digit and two-digit by one-digit addition with regrouping) in order to find out if your child is able to generalize learned skills to different type of addition with regrouping problems.
- **Social Validity:** Your child and your child’s teacher will be given a short questionnaire that will ask them questions related to their thoughts about the effectiveness and usability of using VM in teaching addition with regrouping skills.
- **Video Recording:** The researcher will record your child completing each step of the study. The only portions of your child that will be shown on the recording are your child’s hands. A video camera will be placed behind your child and will capture them completing the worksheets and the video-modeling exercise. Your child’s face, nor other parts of your child’s body will be captured on camera.

WHAT ARE THE RISKS AND BENEFITS OF THIS STUDY?

The benefits of participating in this study is thatyour child will have an opportunity to learn to solve addition with regrouping math problems as well as learn .how to incorporate iPad use in learningThere are minimal risks associated with this participation but no greater than those encountered in everyday life. Due to the nature of the autism spectrum disorders, there may be times that the student feels uncomfortable due to changes in daily routine. He may feel bored or frustrated during this study. Every effort will be made to recognize any distress or discomfort of the student by preparing environment and given a break time for all students during this study.

WILL MY CHILD BE PAID FOR TAKING PART IN THIS RESEARCH STUDY?

There will be no compensation for your child's participation in this study, and there is no monetary cost to you or your child when participating.

CONFIDENTIALITY:

Your child's participation in this study and any personal information that you or your child provides will be kept confidential at all times and to every extent possible. No records of your child in this research will be shared with others. Your child real name will not be used in any documents resulting from this research. Your child information will be recorded anonymously. A false name will be randomly selected and used with your child data. All data will be stored in a locked cabinet to which only the investigator has access. All data will be destroyed within after the completion of the study.

RIGHT TO WITHDRAW:

You are under no obligation to give your permission for your child to participate in this study, and you may withdraw your permission at any time by notifying a member of the research team. You may also choose your child's data completely withdrawn from the study or allow any data collected to be used in the final visual analysis.

SUMMARY OF RESULTS:

A summary of the results of this research will be supplied to you, at no cost, upon request.

VOLUNTARY CONSENT:

I have read the above statements and understand what is being requested of me and my child. I also understand that my child's participation is voluntary and that I am free to withdraw my permission for my child at any time, for any reason.

On these terms, I agree that I am willing to allow my child to participate in this research project.

I understand that should I have any further questions about my child's participation in this study, I may contact Hamad Hamdi, hamdih@duq.edu, and Temple

Lovelace, lovlacet@duq.edu or 01 (412) 396-4159. Should I have questions regarding protection of human subject issues, I may contact Dr. David Delmonico, Chair of the Duquesne University Institutional Review Board, at 412.396.1886.

Parent / Legal Guardian's Signature	**Date**
Researcher's Signature	**Date**

APPENDIX K

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

PARENTAL PERMISSION FORM-Arabic Version

موافقة ولي/ة أمر

العنوان:
فاعلية استخدام التمذجة بالفيديو في تعليم مهارات الجمع للطلاب ذوي اضطراب التوحد في المملكة العربية السعودية

الباحث:
حمد بن علي حمدي، طالب دكتوراه في قسم الإرشاد، علم النفس، والتربية الخاصة بجامعة دوكين بالولايات المتحدة الأمريكية، للتواصل عن طريق الايميل : hamdih@duq.edu أو 01412-680-0958

المشرف:
تامبل لوفليس ، أستاذ مشارك في قسم الإرشاد، علم النفس، والتربية الخاصة بجامعة دوكين بالولايات المتحدة الأمريكية، للتواصل عن طريق الايميل : lovlacet@duq.edu أو 396-4159 (412) 01.

مصدر الدعم:
يتم إجراء هذه الدراسة كجزء من متطلبات الحصول على درجة الدكتوراه في كلية التربية بجامعة دوكين بالولايات المتحدة الأمريكية.

لماذا يتم إجراء هذه الدراسة البحثية؟
يطلب من طفلك المشاركة في هذه الدراسة البحثية والتي تسعى إلى معرفة ما إذا كانت النمذجة بالفيديو باستخدام الأيباد تساعد الطلاب ذوي اضطرابات طيف التوحد على حل مسائل الرياضيات (على سبيل المثال ، الجمع مع إعادة التجميع). من أجل مشاركة طفلك في هذه الدراسة ، يجب على طفلك: (أ) أن يكون ملتحقا بالمدرسة بالفصول الابتدائية أو المتوسطة؛ (ب) ليس لديه خبرة سابقة بنمذجة الفيديو ، (ج) الوفاء بمعايير تشخيص ASD وفقا للدليل التشخيصي والإحصائي للاضطرابات العقلية - IV-TR أو DSM-5 الجديد ، (د) أهداف الخطة التربوية الفردية المتعلقة بالرياضيات شبيهة بأهداف البحث للدراسة الحالية (هـ) تلقي خدمات التعليم الخاص في مجال الرياضيات (و) ما يدل على الفهم النظري ، مثل معالجة مشاكل الرياضيات (مثل الجمع مع إعادة التجميع وفقا لتوصية المعلم على أساس درجات طفلك (ز) عدم وجود مشكلة بالنظر أو ضعف في السمع ، (ح) لديه الرغبة في المشاركة في الدراسة ، و (ط) لديه إذن منك للمشاركة في الدراسة.
عندما يستوفي طفلك معايير الانضمام السابقة ، فإنه سيخضع لمزيد من القدرات اللازمة لاستكمال المشاركة في الدراسة: (أ) معرفة الأرقام و العد من 1 إلى 20 ، (ب) لم يتعلم إكمال الرقم المكون من رقم واحد بالإضافة إلى مشاكل إعادة التجميع ، (ج) الانخراط في المهمة لمدة 3 دقائق عند الجلوس ، (د) لديه القدرة علة الانتباه إلى جهاز الأيباد ويستطيع التحديق في عروض الفيديو على شاشة الأيباد ، (هـ) لديه مهاراة استقلالية في للتفاعل مع الأيباد ، و (و) لديه المهارات الحركية الدقيقة المطلوبة لكتابة واستخدام الأيباد.

ماذا سيطلب من طفلي أن يفعل؟
سيتم إجراء هذه الدراسة خلال ثلاث مرات في الأسبوع في مقر تدريسك (مركز التوحد). تستغرق كل جلسة حصة كاملة تقريبًا. يشتمل الإجراء الذي سيُطلب منك ومن طلابك القيام به في هذه الدراسة على ما يلي:

- **مرحلة التدريب:** سيحتاج كل طالب إلى إظهار معيار اتقان الوصول إلى مقطع الفيديو بنسبة 100٪ . سيقوم الباحث بعرض قائمة تحتوي على خطوات الوصول الى الفيديو، ثم يطلب منهم شفهياً الوصول إلى مقطع الفيديو على الأيباد.

- **مرحلة التقييم المبدئي:** سيتم تقييم جميع طلاب إلى أي درجة اتقان مهارة الجمع بالتجميع من خلال اجراء اختبار لتحديد المستوى والذي يتكون من مسائل الجمع التي تحتوي على رقمين مع رقم و رقمين مع رقمين.
- **مرحلة الخط القاعدي:** سيقوم الباحث بجمع البيانات في المهارة التي يواجه المشاركون في الدراسة لمدة خمس جلسات عن طريق إعطاء مسائل في الرياضيات (على سبيل المثال ، جمع رقمين مع رقم واحد مع إعادة التجميع). لن يحصل جميع المشاركين على أي نوع من المساعدة خلال هذه الجلسات.
- **مرحلة التدخل:** يسُطلب من المشاركين بحل مجموعة من مسائل الرياضيات لمدة دقيقتين ، وبعد ذلك سيعطون جهاز الايباد من أجل الوصول الى الفيديو الذي يشرح كيفية حل مسائل الجمع بالتجميع. كما أن المشاركين سيقومون بنشاط لجمع 5 مع مسائل الجمع بالتجميع لمدة حصة كاملة لكل جلسة. في الوقت الذي يقوم فيه الباحث تصوير المشاركين بالفيدو لأيديهم أثناء الحل بدون إظهار وجهه.
- **مرحلة الاحتفاظ:** سيُطلب من جميع المشاركين أيضًا إجراء ثلاث جلسات يوميًا بدون استخدام نماذج الفيديو بعد إنهاء مرحلة التدخّل للحفاظ على المهارات المكتسبة.
- **مرحلة التعميم:** سيقدم الباحث ورقة عمل مسبقة التوقيت إلى جميع المشاركين للإجابة على أنواع مختلفة من الإضافة مع مشاكل إعادة التجميع (مثل رقمين مع رقمين ورقمين بإضافة رقم واحد مع إعادة التجميع) من أجل معرفة ما إذا كان جميع المشاركين قادرين على التعميم المهارات المكتسبة إلى نوع مختلف من الإضافة مع مشاكل إعادة التجميع.
- **الصلاحية الاجتماعية:** سيحصل طفلك ومعلم طفلك على استبيان قصير يطرح عليهما أسئلة تتعلق بأفكارهما حول فعالية وسهولة استخدام VM في التدريس بالإضافة إلى مهارات إعادة التجميع.
- **تسجيل الفيديو:** سيقوم الباحث بتسجيل طفلك إكمال كل خطوة من الدراسة. الأجزاء الوحيدة لطفلك التي ستظهر في التسجيل هي يدي طفلك. سيتم وضع كاميرا فيديو خلف طفلك وستلتقطها لاستكمال أوراق العمل ونمذجة الفيديو. سيتم تصوير وجه طفلك ، أو أجزاء أخرى من جسم طفلك أمام الكاميرا.

ما هي مخاطر ومزايا هذه الدراسة؟

هناك حد أدنى من المخاطر المترتبة علة المشاركة في هذه الدراسة البحثية ولكن ليس أكبر من تلك التي يواجهها في الحياة اليومية. بسبب طبيعة اضطرابات طيف التوحد ، قد يكون هناك أوقات يشعر فيها طفلك/ي بعدم الارتياح بسبب التغيرات في الروتين اليومي. سيتم بذل كل جهد للتعرف على ما يزعج طفلك/ي وتهيئته من خلال إعداد بيئة المناسبة خلال هذه الدراسة. أيضا ، من خلال المشاركة في هذه الدراسة ، سيكون لدى طفلك فرصة لتعلم كيفية حل مسائل الرياضيات.

هل سيتم الدفع لطفلي على المشاركة في هذه الدراسة البحثية؟

لن يكون هناك أي تعويض لمشاركة طفلك في هذه الدراسة ، كما أنه لا توجد تكلفة مالية عليك أو على لطفلك عند المشاركة.

السرية:

لن يتم مشاركة أي سجلات طفلك/ي في هذا البحث مع الآخرين. كما لن يتم استخدام الاسم الحقيقي لطفلك/ي في أي مستندات ناتجة عن هذا البحث وسيتم تسجيل معلومات طفلك/ي بشكل مجهول. كذلك سيتم تحديد اسم مستعار عشوائيًا واستخدامه في بياناته. كما سيتم تخزين جميع البيانات في خزانة مقفلة لا يستطيع الوصول إليها إلا الباحث. كما أنه سيتم مسح جميع البيانات في غضون ستة أشهر بعد الانتهاء من الدراسة.

الحق في الانسحاب من الدراسة البحثية:

أنت غير ملزم بإعطاء إذنك لطفلك/ي للمشاركة في هذه الدراسة ، ويمكنك سحب موافقتك في أي وقت عن طريق إخبار أحد أعضاء فريق البحث. يمكنك أيضًا اختيار سحب بيانات طفلك/ي بالكامل من الدراسة أو السماح باستخدام أي بيانات تم جمعها في التحليل النهائي للدراسة.

ملخص النتائج:

سيتم تقديم ملخص لنتائج هذا البحث لك ، دون أي تكلفة ، عند الطلب.

إقرار الموافقة الطوعية:

لقد قرأت المعلومات أعلاه وفهمت ما هو مطلوب مني وطفلي. أفهم أيضًا أن مشاركة طفلي طوعية و أن لي مطلق الحرية في أن أقوم بسحب إذني لطفلي في أي وقت ولأي سبب.

بناء على هذه الشروط ، أوافق على أنني مستعد/ة للسماح لطفلي بالمشاركة في هذا الدراسة البحثية.

أتفهم أنه إذا كان لدي أي أسئلة أخرى حول مشاركة طفلي في هذه الدراسة ، يمكنني التواصل مع الباحث / حمد حمدي على hamdih@duq.edu أو على 0958-680(412)01 ، كما يمكنني التواصل مع المشرفة تامبل لفليس على: lovlacet@duq.edu أو على 4159-396 (412) 01. وإذا كان لدي أسئلة تتعلق بحماية حقوق المشاركة في الدراسة البحثية ، فيمكنني الاتصال بالدكتور ديفيد ديلمونيكو ، رئيس مجلس المراجعة المؤسسية بجامعة دوكين ، على 1886-396-(412)01 .

توقيع ولي الأمر / الوصي القانوني : **التاريخ**

توقيع الباحث: **التاريخ**

APPENDIX L

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

Child's Assent Form-English Version

TITLE:
Doing Math Skills by Watching Video Clip on iPad

WHO IS DOING THE STUDY?

Hamad Hamdi

WHAT IS A STUDY?

When someone wants to ask a question about an important topic, they can decide to do a study. Sometime that important topic is something that someone is having trouble doing or something that they would like to do better. The person is called a participant. The person that wants to help them is called a researcher. In a study, the researcher follows specific steps to find more information and to hopefully help that person. The researcher also protects the participant to make sure that they are safe during the study.

WHY IS THIS STUDY BEING DONE?

In my study, I want to answer some questions about a new way that we can teach math. This study will see how a video on an iPad can help you to learn to add better. During our time together, we will ask you to watch a video and complete some math problems. We want to see if the video helps participants, or students like yourself, learn math in a better.

WHAT DO YOU HAVE TO DO?

In this study, I am going to ask you for your permission to complete some things. If you decide to work with me, I will ask you to:

- Work with me, the researcher, three days a week on learning how to complete addition problems
- Learn how to find and watch video clip on an iPad that will teacher you a new math skill. Even if you have not learned how to use an iPad, I will give a paper with pictures that will help you to turn on the iPad and find the video. I will teach you until you are able to do it on your own.
- Complete different types of math work sheets. There will be sometimes where you do not know the answers to the problems or how to complete the problems, that is ok.
- Record you completing the math worksheets. I will be using a video recorder, but I will only be recording your hands and the math worksheet while you are doing each problem.

HOW LONG WILL YOU BE IN THE STUDY?

This study will take approximately 4 weeks to complete – from start to finish. If you agree to be in this study, I will be working with you about 45 minutes each time that I come to your classroom. I will be in your classroom 3 times per week. Each time we meet, I will ask your permission to be a part of the study.

IS THIS STUDY HARMFUL? HOW IS IT HELPFUL?

This study focuses on some math skills that you may not know how to do. One of the good things about being a part of this study is that I will be teaching you a new way to do addition problems. That will be helpful to you so that you can continue to study new things in math. However, learning a new skill can sometimes be frustrating. If you choose to do this study, you may find it hard to do a new skill or you may even get bored completing so many math problems. However, if you feel uncomfortable, your teacher and myself will be in the room to support you.

Each time that you meet, I will ask if you still want to be a part of this study. You can tell me if you do not want to be a part of the study. That is ok, and we will support your decision and we will stop if you do not want to participate. It is your choice.

I may help you to learn something that will help you to solve math problems in the future.

WILL YOU GET PAID TO DO THIS STUDY?

There will be no money given to you for doing this study but doing the study will also not cost you anything.

ARE OTHER PEOPLE GOING TO KNOW WHAT YOU DID OR SAID?

The researcher will not tell anyone else about your answers or how you are doing in the study. This is called confidentiality. When I talk to other people about this study, I will not say what your name is or where you go to school. I will not take out your name on anything that you fill out for this study.

When I record you completing the math problem, I will always just show your hands and not your face. I will use that secret number for your name, so no one will know you. After I finish this study, I will erase them off the recording device (iPad).

CAN YOU QUIT IF YOU WANT?

Yes. You don’t have to start if you don’t want. If you start, and decide you don’t want to do it anymore, just tell me, or tell one of your parents and your teacher. Don’t worry; no one will be mad at you if you want to stop.

CAN YOU HEAR ABOUT WHAT HAPPENED?

After the study is completely over, we can provide you a description of what happened in this study. If you would like a copy, please feel free to email me or have a parent email me.

OK, WOULD YOU LIKE TO DO IT?

If you read or read to you and understand everything on this paper, and you understand that you don't have to participate if you don't want to, and you can quit anytime you want, then you can write your name below. If you still have questions, you can ask me by email at hamdih@duq.edu or my advisor Dr. Temple Lovelace, 01 (412) 396-4159. If you have questions about protecting you in the study, then the best person to contact would be Dr. David Delmonico, Chair of the Duquesne University, (01) 412.396.1886.

Would like to get started?

If you do want to get started and do the study, please circle your answer ("yes" or "no") below and sign your name.

YES **NO**

Child's Signature	**Date**
Parent/Legal Guardian's Signature	**Date**
Researcher's Signature	**Date**

APPENDIX M

DUQUESNE UNIVERSITY

600 FORBES AVENUE ♦ PITTSBURGH, PA 15282

Child's Assent Form -Arabic Version

موافقة الطفل على المشاركة في الدراسة البحثية

العنوان:
القيام بحل مسائل الرياضيات من خلال مشاهدة مقطع الفيديو على جهاز الأيباد
من سيقوم بعمل الدراسة؟
حمد حمدي،
ما هي الدراسة؟

عندما يرغب شخص ما في طرح سؤال حول موضوع مهم ، يمكنه أن يقرر إجراء دراسة. في بعض الأحيان ، يكون هذا الموضوع المهم شيئًا يواجه شخصًا ما مشكلة في فعله أو شيئًا ما يرغب في القيام به بشكل أفضل. هذا الشخص يسمى مشاركاً و الشخص الذي يريد مساعدته يسمى باحثًا. في الدراسة ، يتبع الباحث خطوات محددة للحصول على مزيد من المعلومات و مساعد المشارك في هذه الدراسة. يقوم الباحث أيضًا بحماية المشارك للتأكد من أنه في أمان أثناء تطبيق الدراسة.

لماذا يتم إجراء هذه الدراسة؟
في دراستي هذه ، أريد الإجابة على بعض الأسئلة حول طريقة جديدة يمكننا تدريس الرياضيات. سوف تنظر هذه الدراسة في كيف يمكن لمقطع فيديو على جهاز iPad مساعدتك على تعلم كيفية الجمع أفضل. خلال وقتنا معًا ، سأطلب منك مشاهدة فيديو وإكمال بعض مسائل الرياضيات. أريد معرفة ما إذا كان الفيديو سيساعد المشاركين أو الطلاب مثلك على تعلم الرياضيات بشكل أفضل.

ماذا يجب عليك فعله؟
في هذه الدراسة ، سأطلب إذنك لإكمال بعض الأشياء. إذا قررت العمل معي ، فسأطلب منك:

- ستعمل معي ثلاثة أيام في الأسبوع على تعلم كيفية إكمال مسائل الجمع.
- تعرف على كيفية الوصول إلى مقطع الفيديو ومشاهدته على جهاز iPad والذي سيعلمك مهارات جديدة في الرياضيات. حتى إذا لم تكن قد تعلمت كيفية استخدام جهاز iPad ، فسأعطيك ورقة تحتوي على صور تساعدك على تشغيل جهاز iPad والوصول إلى الفيديو. سأقوم بتعليمك حتى تتمكن من القيام بذلك بنفسك.
- استكمال أنواع مختلفة من أوراق العمل الرياضيات في الجمع. ستكون هناك أوقات لا تعرف فيها إجابات المسائل أو كيف تكمل المسائل هذا طبيعي
- تسجيلك بالفيديو أثناء اكمال أوراق عمل على عملية الجمع. سوف أستخدم كاميرا فيديو لذلك. مع العلم بأنني سوف أقوم بتسجيل يديك وورقة العمل أثناء حلك كل مسألة حسابية.

كم مدة الدراسة؟
سوف تستغرق هذه الدراسة ما يقارب 4 أسابيع لإكمالها - من البداية إلى النهاية. إذا وافقت على أن تكون في هذه الدراسة ، فسوف أعمل معك لمدة 45 دقيقة تقريبًا في كل مرة أذهب فيها إلى صفك الدراسي. سأكون في صفك 3 مرات في الأسبوع. في كل مرة نلتقي ، سأطلب إذنك اذا ما أردت الاستمرار في الدراسة.
هل هذه الدراسة ضارة؟ كيف تكون مفيدة؟

تركز هذه الدراسة على بعض مهارات الرياضيات التي قد لا تعرف كيفية القيام بها. أحد الأشياء الجيدة كونك جزءًا من هذه الدراسة هو أنني سأعلمك طريقة جديدة للقيام بمسائل الجمع. سيكون ذلك مفيدًا لك حتى يمكنك مواصلة دراسة أشياء جديدة في الرياضيات. ومع ذلك ، قد يكون تعلم مهارة جديدة أمرًا محبطًا في بعض الأحيان. إذا اخترت القيام بهذه الدراسة ، فقد تجد صعوبة في القيام بمهارة جديدة أو قد تشعر بالملل حتى إكمال العديد من مسائل الرياضيات. ومع ذلك ، إذا كنت تشعر بعدم الارتياح ، فسوف يكون معلمك وأنا في الغرفة لتقديم الدعم لك.
في كل مرة نلتقي فيها ، سوف أسأل ما إذا كنت لا تزال ترغب في أن تكون جزءًا من هذه الدراسة. يمكنك إخباري إذا كنت لا تريد أن تكون جزءًا من الدراسة. هذا أمر جيد وسأدعم قرارك وسنتوقف إذا لم تكن ترغب في المشاركة. هذا هو اختيارك.
قد أساعدك في تعلم شيء ما سيساعدك في حل مسائل الرياضيات في المستقبل.

هل سيتم الدفع لك مقابل المشاركة في الدراسة؟
لن تحصل على أي أموال مقابل إجراء هذه الدراسة ، كما أن إجراء الدراسة لن يكلفك شيئًا.

هل هناك أشخاص سيتم مشاركتهم هذه الدراسة؟
لن يخبر الباحث أي شخص آخر عن إجاباتك أو كيف تفعل في هذه الدراسة. وهذا ما يسمى بالسرية. عندما أتحدث إلى أشخاص آخرين عن هذه الدراسة ، لن أقول اسمك أو إلى أي مدرسة تذهب. لن أخرج اسمك على أي شيء تملؤه لهذه الدراسة.
عندما أسجل وأنت تكمل مسائل الرياضيات ، سأقوم دائمًا فقط بإظهار يديك وليس وجهك. سأستخدم رقماً خاصاً بدلاً لاسمك ، حتى لا يعرفك أحد. بعد أن أنهي هذه الدراسة ، سأقوم بمسحها عن جهاز (الأيباد).

هل يمكنك الانسحاب من الدراسة؟
نعم. ليس عليك البدء إذا كنت لا تريد. إذا بدأت ووقررت في أنك لا تريد أن تفعل ذلك بعد الآن ، أخبرني فقط ، أو أخبر أحد والديك أو معلمك بذلك. لا تقلق؛ لن يغضب أحد منك إذا كنت تريد التوقف.
هل تستطيع الاطلاع على نتائج الدراسة؟
بعد انتهاء الدراسة بالكامل ، يمكننا إخبارك بنتائج الدراسة أو يمكن أن نعطيك ورقة توضح النتائج ، ويمكنك الحصول على نسخة من النتائج إن أردت.
حسنا ، هل ترغب في القيام بذلك؟
إذا كنت تقرأ أو يقرأ عليك وتفهم كل شيء في هذه الورقة ، وتدرك أنك لست مضطرًا للمشاركة إذا لم تكن ترغب في ذلك ، كما يمكنك الانسحاب من المشاركة في أي وقت تريده ، يمكنك كتابة اسمك أدناه. إذا كان لا يزال لديك أسئلة ، فيمكنك أن تسألني أية أسئلة حول حمايتك في الدراسة ، كما يمكن الاتصال بـ د. ديفيد ديلمونيكو ، رئيس جامعة دوكويس ، في 412.396.1886 (01).
هل تود المشاركة؟
إذا كنت ترغب في البدء والقيام بالدراسة ، يرجى وضع دائرة حول (نعم) أو (لا) وكتابة اسمك أدناه.

نعم	**لا**
توقيع الطفل: ________	**التاريخ** ________
توقيع ولي/ة الأمر: ________	**التاريخ** ________
توقيع الباحث: ________	**التاريخ** ________

APPENDIX N

Approval Letter from the Ministry of Education to Conduct Research Study

المملكة العربية السعودية
وزارة التعليم
٢٨٠
الإدارة العامة للتعليم بمنطقة الرياض
إدارة التخطيط و المعلومات

وزارة التعليم
Ministry of Education

الرقم : ٦٧٩٨
التاريخ : ١٤٤٠/١/٢٠هـ
المرفقات : اختبار

تسهيل مهمة باحث

الاسم		السجل المدني
حمد بن علي احمد حمدي		١٠٤١١٩١٧٨٢
العام الدراسي	الدرجة العلمية	الجامعة
١٤٣٩/١٤٤٠ هـ	الدكتوراه	دوكين / امريكا
عنوان الدراسة: **فاعلية استخدام النمذجة بالفيديو بواسطة الأيباد في تعليم مهارات الجمع للطلاب ذوي اضطراب التوحد في المملكة العربية السعودية .**		
عينة الدراسة : معلم ، طالب .		

المكرم قائد المدرسة.. **وفقه الله**

السلام عليكم ورحمة الله وبركاته ، وبعد:

إشارة إلى قرار معالي وزير التعليم رقم ٣٨٧١٧٠٨٠ وتاريخ ١٤٣٨/٥/١٢هـ بشأن تفويض الصلاحيات لمديري التعليم ، وبناءً على قرارسعادة مدير عام التعليم بمنطقة الرياض رقم ٣٨٩٢٠٧٩٣ وتاريخ ١٤٣٨/٦/٢٣هـ بشأن تفويض الصلاحية لإدارة التخطيط والمعلومات لتسهيل مهمة الباحثين والباحثات ، وحيث تقدم إلينا الباحث (الموضحة بياناته أعلاه) بطلب إجراء دراسته، ونظراً لاكتمال الأوراق المطلوبة ، نأمل تسهيل مهمته .

مع ملاحظة أن الباحث يتحمل كامل المسؤولية المتعلقة بمختلف جوانب البحث ، ولا يعني سماح الإدارة العامة للتعليم موافقتها بالضرورة على مشكلة البحث أو على الطرق والأساليب المستخدمة في دراستها ومعالجتها. **وللمعلومية فإن طلب (إنهاء المهمه) يتطلب الرفع لنا من الجهات المعنية بتطبيق البحث بأن الباحث قد باشر تنفيذ أدوات بحثه حضورياً.**

شاكرين لكم وتقبلوا تحياتي..

مدير إدارة التخطيط و المعلومات

سعود بن راشد ال عبداللطيف