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The Impact of Peer-Mediated Video Modeling on the Mathematics Achievement of High School Students

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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MS, Walden University, 2009

BS, Loyola University Maryland, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

A significant percentage of US students are not reaching expected proficiency on mathematics content. As a response, educators have been urged to use more evidence-based practices; however, due to the lack of readily available strategies, these efforts have been thwarted. In related fields, video modeling (VM) has been successful in teaching behavioral skills through edited video clips that allow target populations to observe models successfully performing featured tasks. Stemming from Bandura's social learning theory, the intent of VM is to increase the frequency of the modeled behavior through observational learning. Despite the many studies that have shown success with VM, it continues to be overlooked in education because of the lack of support surrounding its ability to teach educational content and the related technology components. The purpose of this research project was to use a single subject multiple baseline design to examine the impact of VM on the math achievement of students. The sample included 3 students, ages 16-17, and used visual analysis, percentage of nonoverlapping data points (PND), and effect sizes (ES) to analyze the results and identify significance in the outcomes. Results of the study revealed that VM had a significant impact on 1 participant after treatment and on 2 participants after maintenance. Social validity was measured through modified behavior intervention rating scales, which demonstrated that while the teacher participant did not find the treatment to be acceptable, all of the student participants did. Contribution to social change was established within this study by analyzing an effective technology-based strategy that can be used to both increase math achievement among US students and assist them to become contributing and competitive professionals in society.

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Dedication

There are many people in my life who provided me with the encouragement, love, and support I needed to make my dream of completing this research, in pursuit of my doctorate degree, a reality. The first and most important of these individuals is my husband, Patrick, who sacrificed endless date nights and allowed us to put our lives on hold in order to support me in achieving my dream. His high levels of expectations provided me with critically needed motivation to persevere through one of the hardest times of my life and my gratitude for his steady support is immense. Thank you Patrick!

Secondary recognition is to my parents. My father, who sadly passed away suddenly at the near end of this journey, was my biggest cheerleader. His pride in my ambition to become a published researcher was limitless and although his loss was the biggest tragedy I have ever faced, it gave my work in the field a higher purpose and I know that he will be with me as I continue to make an impact in this world. Despite the loss of my father I am fortunate to have had the steady presence of my mother, whom I also think of as my best friend, from beginning to end in this journey. Her unconditional love and support through every step of this milestone helped to light my way and I am thankful for all of the long phone calls and motivational pep talks that helped to keep my biggest dream within reach.

My husband and parents were a large part of my support system but I would be remiss if I did not also acknowledge the remainder of my steadfast supporters. My brother, Ryan, my mother-in-law, Maureen, all of my sisters and brothers-in-law (or soon to be), my extended family, and my closest friends can also be credited to my

achievement of completing this milestone. In some way all of these individuals made sacrifices as a result of my dream and I could never have survived without the frequent check-ins, study breaks, and laughs that they shared with me that helped to keep me grounded.

Lastly, I would like to extend my sincere gratitude to my dissertation chair, Dr. Little, who gave me an immense amount of confidence about my work and was always an email away. His passion for the field and excellence as an educator, clinician, and editor is undefinable and I am thankful for the opportunity to have collaborated with him on this project.

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Chapter 1: Introduction to the Study

Introduction

The National Assessment of Educational Progress stated that (NAEP) only 26% of 12th-grade students achieved proficiency on national assessments in the area of mathematics in 2013 (as cited in Harris, 2013). As a result of this concern the National Council of Teachers of Mathematics (NCTM) and the Common Core State Standards (CCSS) have identified computational fluency as one of their curriculum focal points within their framework of national standards (Achieve, Inc., 2001; NCTM, 2001). In both frameworks the complexity of fluency increases across each grade level and requires students to reach mastery with all operations and with all types of rational numbers (i.e., whole numbers, integers, fractions, decimals, etc.) by the end of Grade 8 and with complex numbers by Grade 12(NCTM, 2006). In addition to this requirement students are also obligated to use computation methods grounded in understanding in order for them to demonstrate their proficiency through accuracy, efficiency, and flexibility (NCTM, 1989). As demonstrated through the NCTM and CCSS frameworks, computational proficiency is an essential component of mathematics and its ability to foster strong conceptual understanding of complex thought processes has made it an important component to all rigorous curriculums (NCTM, 1989).

As a result of these expectations, many research-based studies have been conducted to identity various instructional strategies to use within mathematics classrooms to help increase fluency achievement across all grade levels (Eckert, Codding, Truckenmiller, & Rheinheimer, 2007). Current findings have highlighted several effective instructional techniques for improving fluency such as flexible grouping, self-monitoring strategies, peer-mediated interventions, and the incorporation of various forms of technology (Eckert et al., 2007; Hall & Stegila, 2003). Although none of these technology-based interventions have been proven to be evidence-based, several strategies that have become increasing popular in the field of education have shown promise to be effective instructional tools. One of these treatments identified in the literature is video-based instruction (VBI). VBI includes several different treatment styles including video modeling (VM), video self-modeling (VSM), computer -based video instruction (CBVI), and problem-based video instruction (PBVI; Rayner, Denholm, & Siafoos, 2009). Most of these VBI treatments have demonstrated success in recent research studies; however they have yet to be validated as evidence-based in part due to the numerous covariables that exist among the independent and dependent variables involved in these studies and their lack of focus on social validity (Bellini & Akullian, 2007; Raynor et al., 2009).

In addition to the deficiency of evidence-based strategies, few researchers have analyzed the impact of peer-mediated strategies in concurrence with the use of technology to increase academic achievement (Gagnon & Maccini, 2007). There are no studies on the impact of VBI on computational proficiency with mathematics students (Gagnon & Maccini, 2007). As originally explored through the idea of learning from observation, using video technology for modeling behaviors emerged with potential due to its ability to allow individuals to visualize their potential success by viewing a video.

According to Bandura (1997), this experience has a greater impact on behavior change in comparison to traditional verbal instruction.

As outlined by McCoy and Hermansen (2007), peer-mediated VM uses the same process as VM; however, it additionally includes the use of a model that is the same age and/or gender as the participants involved in the treatment. According to Reichow and Volkmar (2010) and Strain, Schwartz, and Bovey (2008), the use of peer-mediated models for children is a recommended practice for effective instruction because it is more naturalistic and it can decrease the difficulty with participant generalization that can often exist when adults provide direct instruction. In spite of its limited use in mathematics classrooms, VM has demonstrated success in many current for its ability to change behavior in various clinical and educational contexts and across a wide variety of populations (Cihak & Schradrer 2008; Goodwyn, Hatton, Vannest, & Ganz, 2013; Gul & Vuran, 2010; Krouse, 2001; O'Brien & Wood, 2011). O'Brien and Wood (2011) used VM in order to evaluate its effectiveness with promoting cooperative discussion skills with high school students. O'Brien and Woods found that the simple technological intervention of VM could effectively promote the use of group discussion skills among high school students with learning difficulties. In addition, VM strategies have been used in clinical settings to educate patients and in higher learning instructional settings to increase learner understanding on a targeted area of knowledge (Choi & Lang, 2011; Krouse, 2001). VM change behavior with individuals diagnosed with autistic spectrum disorder (ASD), as well as similar pervasive development disorders, and with individuals diagnosed with emotional, behavioral, and anxiety disorders (Biederman & Freedman, 2007; Cihak & Schrader, 2008; Goodwyn et al., 2013). In light of the limited research on the use of VBI techniques and their potential impact on academic achievement the intent of this study was to provide evidence for the potential use of peer-mediated VM with students who are struggling to reach levels of mandated proficiency in their mathematics classes. I aimed to identify if there was a relationship between peer-mediated VM and the levels of proficiency that high school students demonstrate with solving two-step equations, a skill that requires proficient levels of computational fluency.

Statement of the Problem

The purpose of this study is to determine if VM has the ability to increase the proficiency of high school students' achievement on solving two-step algebraic equations with rational numbers. The dependent variable is academic achievement on the targeted skill as assessed through daily probes and the independent variable is the application of the VM treatment.

Four key gaps were found within the literature on VBI: (a) no form of VBI has received enough validation to be considered an evidence-based treatment, (b) few scholars have effectively reported on the social validity of the treatment, (c) few researchers have used VM in an academic setting, and (d) no scholars used mathematics achievement as the dependent variable. As a result of the limited studies in the field that have used VBI techniques, I endeavored to address all of these key areas. Addressing these areas was accomplished by (a) including a social validity test within the scope of the study to determine if the treatment is acceptable for high school classroom use and (b) provide treatment in a mathematics classroom in order to directly measure the impact of VM on student's academic proficiency. As suggested by Bellini and Akullian (2007) in order to establish VM as an evidence-based practice scholars must become more attentive to the covariation between the characteristics of participant descriptives and the intervention features (i.e., treatment setting, data collection protocol, and video making procedures),. As a result, Chapters 3 and 4 of this project include detailed descriptions of the techniques and characteristics of the study from making the videos to collecting and analyzing the data.

Nature of the Study

In this study, I used a quantitative, single-subject, multiple baseline design to measure the impact of the VM treatment. Kratochwill et al. (2010) stated that single-subject designs are adaptations of interrupted time-series designs and have been documented to provide rigorous evaluation of the effects of interventions in experimental studies. Single-case experimental designs are becoming more popular and acceptable ways to conduct research in the field of education (Barger-Anderson, Domaracki, Kearney-Vakulick, & Kunina, 2004). Researchers have demonstrated success with the use of single-case designs in educational settings because they use a personalized data collection process that can accommodate a variety of instructional strategies and research variables in the classroom setting and academic skills (Barger-Anderson et al., 2004; Gay, 1987; Kratochwill et al., 2010).

A single-case design was used to determine whether a relationship exists between the instructional strategy of peer-mediated video modeling and academic achievement in the skill area of fluency with integer operations. The central goal of single-subject designs is to identify whether a causal relationship exists between a researcher-manipulated independent variable (i.e. an intervention) and a change in a dependent variable (i.e. acquisition of a targeted skill or behavior). In single-subject designs each participant serves as his or her own control and the performance measured before the intervention is compared to the performance during and after the intervention (Horner et al., 2005). Several highlights of using single-subject designs include using individual participants as the unit for comparative analysis, the detailed description of the research process, the baseline comparison condition, the visual analysis used to document treatment changes, and the enhanced social validity (Horner et al., 2005).

In addition to using a single-case design I used a multiple baseline design across three different participants to collect three separate sets of data. Multiple baseline designs occur when researchers stagger the introduction of the independent variable across multiple conditions. In multiple baseline designs the baseline (A) is determined by collecting continuous data points across participants before, during, and after the introduction of the targeted intervention (B) in order to identify whether the treatment of the independent variable has a significant impact on the dependent variable across multiple subjects and for an extended amount of time as measured within the maintenance phase (C) 1 month posttreatment (Barger-Anderson et al., 2004). Multiple baseline designs provide numerous sets of data for the researcher to analyze the impact that the independent variable had on the dependent variable. Adding phase repetition across participants not only increases the statistical power of the experiment but enhances the internal validity of the study as well. When using a multiple baseline design the researcher can conduct the staggered phases across different subjects, settings, or participants. Multiple baseline designs are fitting for research in the educational field and can help examine new techniques and strategies effective in the area of teaching (Barger-Anderson et al., 2004). I used an across participants' design to measure the proficiency changes across three different high school students. Using this design, I identified the impact of the independent variable (VM treatment) on the dependent variable (proficiency with solving two-step algebraic equations) across all students (Barger-Anderson et al., 2004). According to Barger-Anderson et al., (2004), a multiple baseline structure should be the design of choice when it is not possible for the subjects to return to their original baseline after introducing the independent variable. As the participants in this study were not able to return to their original baseline after administration of the intervention a multiple baseline is best suited for this study.

The results of the single-subject design employed in this study were used to determine the effectiveness of peer-mediated video modeling as an instructional strategy to increase students' proficiency with operations involving integers (Barger-Anderson et al., 2004). As suggested by Horner (2005), another highlight of using single-case designs is the requirement of a meticulous description of the research process. The process of meticulously describing the participants, the setting, and the design of the experiment increases the likelihood that the study will be repeated in future cases to either provide additional empirical support for the strategy or as an instructional strategy to increase academic achievement in educational settings (Horner, 2005). As also discussed by Barger-Anderson et al. (2004), replicating single-subject design studies helps to generalize the results of the study to additional settings as well as provides additional validation for the results obtained in the original experiment.

Purpose of the Study

The main purpose of this study was to determine whether VM can improve the mathematics achievement of high school Algebra students in the skill area of solving two-step algebraic equations with rational numbers. Secondary purposes of this study included the desire to provide continued validation for the use of peer-mediated and VBIs in academic settings and to provide information surrounding the social validity of using VBIs in academic settings for the purpose of increasing achievement.

Research Questions

1. Will the Algebra students increase their accuracy in solving two-step equations with rational numbers subsequent to the implementation of a peer-mediated video modeling intervention?

H_o1: The Algebra students will demonstrate less than 80% achievement on solving two-step equations with rational numbers over their baseline, as measured by daily probes.

$H_1$1*:* The Algebra students will demonstrate at least 80% achievement on solving two-step equations with rational numbers over their baseline, as measured by the daily probes.

2. Will the Algebra students maintain the increase in accuracy on solving two-step equations with rational numbers as observed in the peer-mediated VM intervention 1 month posttreatment?

H_o2*:* The Algebra students will not maintain an achievement level of at least 60% on solving two-step equations with rational numbers, as measured by the maintenance phase probes.

$H_1$2*:* The Algebra students will maintain an achievement level of 60% or more on solving two-step equations with rational numbers, as measured by the maintenance phase probes.

3. Will the teacher administering the treatment score the modified Behavior Intervention Rating Scale (BIRS) with an average rating of 4 or above indicating that the teacher finds the intervention acceptable?

$H_0$3: The average rating of the teacher's modified BIRS will be less than 4 indicating that the teacher believes the VM intervention is not acceptable for classroom use.

$H_1$3: The average rating of the teacher's modified BIRS will be a 4 or above indicating that the teacher believes the VM intervention is acceptable for classroom use.

4. Will the students receiving the VM treatment score the modified Children's Intervention Rating Profile (CIRP) with an average rating of 4 or above indicating that they find the intervention acceptable?

$H_0$4: The average rating of the student's modified CIRP will not be 4 or above indicating that they believe the VM intervention is not acceptable.

$H_1$4: The average rating of the student's modified CIRP will be 4 or above indicating that they believe the VM intervention is acceptable.

Theoretical Construct

The theoretical framework that I used to support this research study was Bandura's social learning theory. Bandura's (1997) social learning theory, also known as social cognitive theory, is grounded on the premise that human cognition can influence behavior through the observation of others. The roots of Bandura's learning theory were established in conjunction with Bandura, Ross, and Ross' (1961) BoBo doll experiment. Bandura et al. (1961) revealed that children can learn aggressive behavior through the observation of adult models. At this time, beliefs about aggressive behaviors in children were dominated by the idea that behavior was the product of direct reinforcers and punishers (Bandura, 1997). The Bandura, Ross, and Ross experiment gained support which has since produced an impact on the field of psychology (Zimmerman & Schunk, 2003).

In Bandura et al.'s (1961) experiment, 24 preschool-aged children were divided into three groups and were exposed to either a video of adult models exhibiting aggressive behaviors towards a plastic doll, a video of adult models exhibiting nonaggressive behaviors towards the same doll, or were not exposed to a video model at all (Bandura et al., 1961). After treatment all three groups of children were observed in a generalized setting in the absence of the adult models (Bandura et al., 1961). In the experiment, the group exposed to the aggressive behavior reproduced significantly higher levels of aggressive behaviors than the group exposed to nonaggressive models and to the control group (Bandura et al., 1961). Following the publication of the Bandura et al. (1961) study, Bandura, Ross, and Ross (1963) conducted a follow-up study to identify the degree to which film-mediated aggressive models could be identified as sources of imitative behavior. Bandura et al. (1963) found similar findings from the first experiment that filmed aggression can create aggressive reactions in children.

Additional follow-up studies have been conducted to simulate the process of learning behavior through observation (e.g., Bandura, 1965; Bandura & Mischel, 1965; Bandura & Whalen, 1966). The premise that learning has a social context is now widely accepted (Brooks, 2009). Many researchers conduct studies in the field that continue to emphasize Bandura’s theoretical underpinnings about observational learning and social modeling (Brooks, 2009). Demırbaş and Yağbasan (2006) incorporated educational activities based on social learning theory in seventh grade classes at three different schools to try to improve scientific attitudes. Demırbaş and Yağbasan revealed that educational activities based on social learning theory were effective in improving students' scientific attitudes (Demırbaş & Yağbasan, 2006). This study, along with many other experiments that have supported the theory that children can learn through exposure to models, have influenced the designs of educational instructional models and strategies that are used in schools and in clinical settings (Boyce, 2011; Brooks, 2009; Chen & Bryer, 2012; Novotney, 2010; Siegel, Galassi, & Ware, 1985).

In addition to the theoretical basis of behavior in the previously discussed studies I also discovered that modeling is not only a response imitation but that it is possible for individuals to create new behaviors that expand upon what they have observed through the idea of self-reflection (Bandura, 1977). This component of observational learning can be supported through the idea of self-efficacy, and individuals have the ability to adjust their own behavior based on not only external stimuli but on internal self-determination as well (Bandura, 1997).

In this study, I used Bandura's social learning theory and the idea of self-efficacy to support the instructional strategy of VM in order to increase student's academic achievement in the area of mathematics. Similar to the findings of Siegal et al. (1985), I incorporated the idea of learning through social learning theory variables such as peer-mediated video modeling in order to increase academic achievement.

Definition of Terms

Computer-based video instruction (CBVI): CBVI is similar to VBI but includes the use of a computer in the modeled film in order to teach participants how to use technology devices appropriately. As described by Mechling and Cronin (2006), "CBVI involves providing instruction within realistic, interactive learning environments through incorporation of video captions and computer-based instruction" (p. 235). This intervention can be used to teach individuals how to use various forms of communication devices and how to interact with specific technological software. In a study conducted by Mechling and Cronin (2006), children diagnosed with autism were videotaped using their assistive communication devices to order food at a restaurant. While watching the video the participants were given the same device and were able to practice hitting the same buttons while watching the video playback.

Feedforward: Feedforward is a method of teaching a behavior or skill that only highlights the future desired behavior. With both VM and VSM, the researcher must videotape until enough footage of the model performing the target behavior positively is obtained. Although this technique requires the researcher to manipulate the footage, the expectation is that the individual viewing the video will be more likely to perform the behavior without negative behaviors present because those behaviors are not modeled on the video clip.

In vivo techniques: In vivo techniques, referenced throughout this research project, differ from typical VBI strategies because they do not involve the use of video playback. In vivo techniques involve witnessing a live action performance of a certain skill. Although the use of in vivo techniques are not typically considered to fall under the umbrella of VBI strategies, many studies include this term in their review of the literature because it is typically used in comparisons with VBI techniques (Bellini & Akullian, 2007).

Peer-mediated intervention: Another aspect of VBI is the use of peers. Using peers similar in age or identical in gender as the individual(s) receiving the instruction is identified in the literature as peer-mediated. As discussed by Gardner et al. (2001), peer-mediated interventions have demonstrated their ability to "(a) improve students' opportunities to response, (b) increase on-task behaviors, (c) provide immediate feedback on correct and incorrect responses, and (d) facilitate academic achievement and skills" (p. 24). Peer-mediated interventions consist of group contingencies among peers similar in age that foster positive interactions as they attempt to reach a common goal (Gardner et al., 2001). In this research project the term peer-mediated describes the type of VBI intervention used. Although the peers modeling the skills on film will not have direct communication with the participants in the study, the participants will be learning the skill through the direct instruction of the model peers. Research has shown that peer-based messages can be a highly effective tool for communication in an academic setting therefore making peer-mediated VM a better option for relaying skill procedures in this project (Gardner et al., 2001)

Problem-based video instruction (PBVI): PBVI is an instructional strategy used to teach critical thinking and decision making skills. Video clips used in PBVI feature problem-based scenarios that require critical thinking and analysis to solve. PBVI is a common strategy used in academic settings and is well suited for use with peer-mediated group instruction (Choi & Yang, 2010). Studies featuring the use of PBVI have demonstrated that video can be an effective tool to present authentic scenarios for the purpose of enhancing student satisfaction, empathy, and learning achievement in problem-based instruction (Choi, 2007; Choi et al., 2011).

Real time: When creating a video-modeled film the producer of the video must use feedforward or real time. When using real time video the editing process takes no longer to render than the length of the original video clip itself. For example, when editing a 30-minute video clip, it should take no longer than 30 minutes to extract the actual video clip.

Single-subject, multiple baseline design: Single-subject research is experimental and its purpose is to document causal, functional relationships between independent and dependent variables (Horner et al., 2005). Basic single case designs involve repeated, systematic measurement of a dependent variable before, during, and after the administration of an independent variable such as applying an intervention (Kratochwill et al., 2010). Single case designs can provide evidence for the existence of causal relationships and are widely used in the clinical field of psychology and education (Kratochwill et al., year). The use of a multiple baseline design within a single-subject study involves an effect-replication option across multiple participants, settings, or behaviors (Kratochwill et al., 2010). In a multiple baseline design multiple instances of baseline measures (A) and intervention measures (B) are staggered across the participants. Multiple baseline designs provide the greatest potential for increasing internal and statistical-conclusion validity and were chosen for this study to provide more detailed data on how VM impacts academic achievement with mathematic-based skills (Kratochwill et al., 2010).

Video-based instruction (VBI): VBI is the all-encompassing term used to identify various forms of VBI techniques including video modeling, video self-modeling, computer-based video instruction, problem-based video instruction, video feedback, and feedforward (Rayner et el., 2009). VBI has been used in many diverse fields including education, psychology, and medical practice in order to provide instructional information to targeted individuals for a variety of purposes (Van Dam, 2012). In this research project, the term VBI was used to describe the various methods that have incorporated video technology featuring modeled behavior for the purpose of providing instruction or to teach targeted skills to specific individuals.

Video modeling (VM): In this study, the specific VBI technique used in the treatment phase was VM. As defined by Cihak and Shrader (2008), VM is the process of showing participants a video of an individual performing a targeted skill or behavior and then providing the participant with the opportunity to independently perform the targeted skill**.** VM uses an adult or a peer to perform a specific behavior or action in front of a camera (Bellini & Akullian, 2007). The video is watched by an individual for a selected number of sessions and then asked (or is expected) to imitate the behavior that was observed on the video (Bellini & Akullian, 2007).

Video perspective: When using VBI techniques the researcher has the option of either using the first person or the third person perspective when filming the video. If the first person perspective is chosen then the video is shot from behind the model. It only shows the model's hands and what can be seen from their perspective (Bellini & Akullian, 2007). If filmed from the third person perspective then the model is filmed from directly in front of them, which provides the viewer with a full picture of the model performing the selected target behavior.

Video self-modeling (VSM): VSM is similar to VM, but, instead of using a peer in the video, the individual targeted for the behavior change is featured in the film (Prater, Carter, Hitchcock, & Dowrick, 2012). This technique has proven to be effective with individuals diagnosed with ASD due to its ability to help individuals see themselves performing the targeted skill that makes their ability to mimic the behavior more likely to occur in response to viewing the video (Prater et al., 2012). Despite the increasing popularity of VSM, I chose VM for this study due to its acceptability for use within a classroom setting. Prater,

Limitations, Scope, Assumptions, and Delimitations

The purpose of this study was to determine whether VM can improve the proficiency of Algebra students with solving two-step equations that feature rational numbers. Within the scope of this objective there were limitations, assumptions, and delimitations present.

Limitations

There were two general limitations to this research project. One was the ability to generalize the results of the study to other students, classes, and schools. This project focused on one discrete skill in a specific content area. All of the students identified for the study were female students, close in age and socioeconomic status, who previously struggled in their mathematics courses. Although selecting this sample of students pinpointed the impact of VM with this specific population, it is difficult to generalize the results to other various content areas, grade levels, and cultures.

Another limitation to this study was the inability to eliminate the effects of regular instruction that will be going on in the participants' classes during the administration of the treatment. Therefore, the baseline data are expected to naturally increase and it will be necessary to measure the impact of the VM treatment based on trend changes of the slope instead.

Assumptions

One of the assumptions made during this research project was that the procedure of the research design would be administered as planned. This assumption included the postulation that the teacher selected students that are appropriate for the experiment and that the teacher correctly governed the VM treatment and obtained all baseline, intervention, and maintenance phase data with fidelity. I also assumed that all students and the administrator would provide honest reviews of the intervention's social acceptability. The final assumption was that all students completed the probes during each phase to the best of their ability.

Delimitations

This study was limited to high school Algebra students ranging in age between 15 and 16 each placed in a New York Regents Algebra course, which requires a passing grade in both the course and the Regents exam in order to graduate. The scope of the study involved three students in an Algebra class, regardless of their skill levels, previous Algebra exposure, or grade level. Another boundary placed within the scope of the experiment is the limit to a specific skill, within a specific context. Students in this study were assessed on their ability to solve two-step equations with rational numbers only. No other skills were assessed and no other subject areas were used to analyze the impact of the treatment. Additionally, it is important to note that all of these students had prior instruction on assessed skill as it has been conceptually developed since elementary mathematics classes.

Significance of the Study

This research project is unique in its determination of whether the use of peer-mediated video modeling can significantly impact the academic proficiency of mathematics' students. This approach offers an exclusive perspective on the use of VM because it combines peer-mediated instruction and technology which are two instructional techniques that have received support for increasing academic achievement in the field of education (Gagnon & Maccini, 2007; Hall & Stegila, 2003). As a result of the increasing expectation for students to master conceptual mathematical skills, the demand for empirically supported strategies for instruction is also increasing.

Consequently, this study aimed to identify peer-mediated video modeling as an effective method to increase student mastery in the content area of mathematics. In this project VM strategy was used to target a computational fluency skill, a content area that has been identified by the NCTM and the CCSS as a focal point in comprehensive mathematics education (NCTM, 2000).

Social Change

This research project seeks to achieve social change by providing evidence-based research on a potential treatment technique that can be used in the field of education psychology to increase student's capacity to learn via electronic media. Online coursework and schools have gained much popularity in education and the use of VM in traditional classroom settings can strengthen student's ability to succeed academically in online programs. In addition to conditioning students to learn via various mediums, this study also aimed to validate VM as an evidence-based treatment. This validation will ultimately assist students in reaching and maintaining expected levels of proficiency in mathematics education. Expand on how this will affect social change as well as who will be affected.

Summary

Chapter 1 provided an introduction to this research project which included background information about the problem, the purpose of the study, the theoretical basis, the research hypotheses, the scope, the social significance, and a definition of the important terms. The chapter identified the need for additional evidence-based strategies in the field of education for the purpose of increasing academic achievement. Triggered by the lack of students achieving mastery with mathematics standards, this study sought to identify an effective instructional technique that can be used in schools across the nation to increase students' self-determination and ability to meet proficiency standards.

Along with the primary purpose of determining if peer-mediated VM has the potential to increase mathematics proficiency; several supplementary purposes were also identified throughout the chapter. Additional motives to the study include providing further proof that VBI techniques such as VM should be validated as evidence-based practices and that these techniques are socially valid according to both the administrators and the students within the context of classroom instruction.

Chapter 2 will provide a review of the literature surrounding the development of VBI in the field of psychology, education, and clinical practice. The literature review will discuss the foundation and development of social learning theory in order to demonstrate how it has helped produce the use of instructional techniques involving VBI such as VM. The chapter will additionally provide a detailed account of the widespread studies that have included the theory of social learning and the profound impact of utilizing technology-based practices such as VBI to teach targeted skills and behaviors. Chapter 3 will then provide a detailed description of the methodology used in this study which will then be followed by details of the data analysis in Chapter 4 and conclusions and future suggestions in Chapter 5.

Chapter 2: Literature Review

Introduction

The purpose of this study was to determine if peer-mediated video modeling can improve the computational fluency of high school Algebra students. With this study, I also provide support for the use of technology-based instruction models in academic settings as well as contribute to the research in the area of VM and its ability to alter behavior in diverse settings. Additionally, I sought to provide further support towards the need for validated, evidence-based strategies that have demonstrated their ability to increase mathematics achievement.

In this chapter I explore the history of the use of evidence-based instructional strategies in academic settings and the increasing need for effective interventions. I also examine the support surrounding the use of peer-mediated video modeling with the purpose of changing behavior in various settings. In addition, the theories that have supported observational learning, such as social learning theory are addressed, as well as how the recent introduction of electronic media has used these theories to expand research in the area. In order to highlight this progression the chapter begins with an overview of early video modeling studies and progresses to the current research involving video-based instruction (VBI) conducted in both academic and alternative settings with the purpose of changing behaviors across diverse settings.

The following research databases were used to collect information about the study: Academic Search Premier, ERIC, PscyArticles, PsycBooks, PsychINFO, and Psychology: a SAGE Full text collection. The following keywords were used: *video* *modeling, peer-mediated instruction, mathematics, video self-modeling, video-based instruction, instructional strategies, math instruction, social learning theory,* and *academic achievement.* Studies that involve the use of electronic media as an instructional model range in date from 1961 to 2012. As a result this literature review includes articles outside of the standard 5-year window for the purpose of illustrating the extensive development that the use of electronic media in the field of education has made.

A Historical Perspective of Electronic Media

The origins of video modeling and its ability to change the behavior of individuals across various contexts can be traced back to the introduction of electronic media (Palmer, 2003). The purpose of electronic media, delivered via radio, television, or through movies, has served as a method to either convey information or to educate individuals (Palmer, 2003). The notion of learning through observation, originally studied by Bandura, revealed that individuals can learn behaviors through observation (Bandura, 1977). Support for this theory was originally presented in Bandura's famous Bobo doll experiment in 1961 (Bandura, Ross, & Ross, 1961). Many television shows and movies began to use this information to drive the educational nature of their programs (Palmer, 2003). One of the first pioneers in this field is the long-running television program Sesame Street features puppets that convey educational content and social behaviors to children (Palmer, 2003).

Electronic Media and Low SES Children

Despite the increase of electronic media as a means to convey educational content via television programs, commercials, and movies, most producers did not begin their ventures with the same vision as Sesame Street pioneer Morrisett (Palmer, 2003). While working as an experimental psychologist for the Carnegie Corporation, an educational philanthropic foundation, Morrisett became interested in finding new ways to close the achievement gap for disadvantaged youth by increasing access to educational content (Palmer, 2003). After achieving only minimal success on multiple experiments designed to reverse the educational trend for minority and low socioeconomic children Morrisett teamed up with television producer Cooney who shared Morrisett's vision for assisting disadvantaged youth and helped fundraise, write, film, and air the pilot of the first episode of Sesame Street (Palmer, 2003). Although most critics were uncertain of the program's potential, after statistics from the first season revealed that viewers of the show included over half of the world's 12 million pre-school-aged children, it was evident that Sesame Street had significant potential to help Morrisett's dream come true (Palmer, 2003).

Many experimental studies began to incorporate Sesame Street in their research endeavors in order to analyze the impact that educational programs had on the academic achievement of its young viewers (Walsh, 1995). Results of these studies consistently demonstrated the positive gains that exposure to educational programs, such as Sesame Street, have on academic development, social development, and school-readiness in children (Fisch, Truglio, & Cole, 1999). For example, Wright and Hutson (1995) published a longitudinal study that examined the impact of Sesame Street on school readiness by tracking 250 low-SES children from ages 2 to 5 and 4 to 7. The study collected data using multiple measures of intelligence and achievement across regular intervals. The results after 3 years revealed that children who watched educational programs spent more time engaged in educational activities (Wright & Hutson, 1995). Long-term results of this study revealed similar findings. Children who spent time watching educational programs not only performed higher on standardized achievement measures but also received higher ratings by their teachers on their overall adjustment to the school setting (Wright & Hutson, 1995). In addition to these findings, a correlational analysis published by Zill, Davies, and Daly (1994) used data from approximately 10,000 parents in a national survey to analyze the impact of educational programs, such as Sesame Street, on letter recognition and conversation skills of young children. Based on parental reports, the study revealed that the children who viewed Sesame Street were more likely to recognize letters and tell connected stories when compared to the children who did not view Sesame Street (Zill et al., 1994).

The results of these studies and the remarkable success of Sesame Street are still visible in many educational programs on television. Read to Learn, for example, is a program specifically designed to promote school readiness in young children that utilizes electronic media to engage students in innovative learning experiences ("From Sesame Street to Transmediaville: The Future of Ready to Learn," 2010). Sesame Street has over

50 years of evidence-based research that support its ability to increase school readiness in all pre-school-aged children, and has paved the way for educational programs delivered via electronic media (Palmer, 2003). According to Schultz (2012), Sesame Street is a global manifestation of Bandura's work on observational learning that demonstrates how video-based instruction can directly impact millions of children's lives. Despite Sesame Street's success, few researchers explored the relationship between video modeling and behavior prior to the 21st century (Creer & Miklich, 1970; Dowrick & Raeburn, 1977; McClure, Chinsky, & Larcen, 1978). However, once developed, the use of electronic media for the purpose of increasing academic and social skills quickly grew in popularity across diverse settings and populations.

Video-Based Interventions

Soon after the introduction of educational programming via electronic media the instructional strategy known as video-based intervention (VBI) began to emerge in the fields of education and psychology. Although there are different ways to implement VBI, the general concept is to alter behavior or teach skills through the process of observing others' behavior that is modeled on a video (Goodwyn, Hatton, Vannest, & Ganz, 2013). The purpose using of VBI extends from two premises; (1) observational learning is a basic learning mechanism that has the ability to teach new skills and (2) visual supports are optimal components of the learning process (Darden-Brunson, Green, & Goldstein, 2008).

VBIs can be implemented using a wide variety of technologies including computers, tablets, smart phones, and DVD players. In addition to the multiple modalities of VBI, there are also a wide variety of types of interventions involving the use of video to model behaviors such as video modeling (VM), video self-modeling (VSM), and video feedback (VF) (Goodwyn, et al., 2013). Although all of these strategies differ slightly, they all involve positive instructional approaches which allow for participants to observe demonstrations of a targeted behavior (Ayers, Maguire, & McClimon, 2009).

Another component of VBI is the use of electronic media. Because videos are viewed as recreational stimuli they can help to increase engagement, interest, and motivation with resistant and/or reluctant learners (Goodwyn et al., 2013). Studies involving VBI have revealed their ability to alter various behaviors across diverse contexts and with differing populations (Brecht & Ogilby, 2008; Choi, 2007; Choi & Yang, 2011; Tan, Tan, & Wettasinghe, 2011; Wilcox & Jacobs, 2010). Tan et al. (2011) assessed the effectiveness of VBI with preservice teachers to provide evidence and argue for the benefits of using video technology for a teacher preparation course. In their study, preservice teachers with little classroom experience were instructed to watch video clips of effective teaching practices and then were asked to reflect on their learning through detailed blog entries. Results were analyzed based on the depth of the participants' responses and they indicated that the participants were capable of engaging in reflection beyond a surface level after viewing the microskills video (Tan et al., 2011). These results provide support for the use of VBIs for the purpose of modeling new skills and effective teaching practices.

Additional adaptations to VBI that provide further support for instruction delivered via video include video-based supplemental instruction (VSI) and problem-based video instruction (PBVI). As described by Wilcox and Jacobs (2010), VSI is a course delivery system designed to provide students with additional academic support by supplying access to additional video-based lectures that re-teach and enhance the learning content of their regular course. VSI was originally adapted as a variation of supplemental instruction (SI) which provides students with an extra face-to-face course component to support another course. With VSI students have the ability to view the additional content that would be provided in the SI component via video, giving them the flexibility to watch the content whenever, wherever, and as frequently as they need. Wilcox and Jacobs (2010) explored the validity of VSI by analyzing students' overall grades in courses at the University of Missouri-Kansas City featuring VSI from 1997 through 2004. Data collected on the outcome of courses equipped with VSI demonstrated that students enrolled in the VSI component of the course were more likely to earn A's and B's (66.6%) when compared to the students enrolled in the course without the VSI component (53.27%) even though the students enrolled in the VSI course has significantly lower ACT scores (20.34) then the control group (25.67) of students (Wilcox & Jacobs).

Choi (2007) and Choi and Yang (2010) revealed similar results when utilizing another VBI: problem-based video instruction (PBVI). In these studies, university students were studied in order to explore the effectiveness of PBVI. In Choi's 2007 research PBVI was used in comparison to text-based instruction (TBI). In the study groups of students were randomly selected to either receive PBVI or TBI in an exercise that involved viewing (PBVI) or reading (TBI) about real life situations and reacting to them through group discussions (Choi, 2007). After the exercise, selected students from each group were asked to discuss their levels of perceived learning as a result of the video or text prompts (Choi, 2007). Results revealed that "the use of video more positively affected students' perceived learning in terms of comprehension and retention" (Choi, 2007, p. 6).

In a follow up study, PBVI was used to identify its effect on students' satisfaction, empathy, and learning achievement when compared to problem-based text instruction (PBTI) (Choi & Yang, 2010). Results of the study revealed significant differences between the students' satisfaction, empathy, and achievement in the PBVI groups as compared to the PBTI groups. Choi and Yang concluded that video can be an effective medium to present real life situations and enhance student success (Choi & Yang). Although VSI and PBVI are only variations of VBI, their documented success with assisting higher level learners through information delivered electronically provides additional support for instructional strategies such as VBI, where information is distributed via an electronic source.

The Beginnings of Video Modeling

Although VBIs have been used in numerous studies with diverse populations across multiple settings, the first documented study involving the use of video to alter behavior was a video modeling study. Video modeling (VM) is a type of VBI that involves having an individual watch a model on a video perform a target behavior with the intention of having the individual subsequently perform the modeled behavior by him or herself independently (Goodwyn, Hatton, Vannest, & Ganz, 2013). The use of video modeling for the purpose of altering behavior is useful across many contexts and can be used to teach new or alter old behaviors, skills, or processes (Baker, Lang, & O'Reilly, 2009). As noted by Darden-Brunson, Green, and Goldstein (2008), "VM has been used effectively in a variety of settings, with various populations, to teach many types of behavior, including social interaction, communication, community skills, and motor skills" (p. 241).

According to Arslanyilmaz (2010), a way to model covert cognitive processes is through the practice of VM because the video model has the option to use a think aloud technique which allows the model to explain his or her thought process as the targeted behavior is performed. Although the concept of video modeling did not originally include this component, its foundations were derived from Bandura's social learning theory (Bandura, 1977). As outlined in Chapter 1, Bandura's theory is based on the belief that individuals have the ability to learn through observation (Bandura, 1965, 1967). In video modeling, individuals are expected to learn through observation, via exposure to the target behavior by electronic media, which is meant to increase interest, engagement, and flexibility (Dowrick, 1991). When coupled with technology, observational learning becomes an interactive learning strategy that can be used to assist individuals in gaining relevant academic, social, and behavioral-based skills. As additionally suggested by Dowrick (1991), Bandura also believed that the process of video modeling contains the fundamental elements of self-efficacy because it provides individuals with a clear picture on how to best perform skills, which strengthens one's own belief in their capability to complete a task.

Experimental studies involving video modeling began with the work of O'Connor (1969, 1972) whose study outcome demonstrated an increase in peer interactions among six preschool-aged children after viewing a film that documented scenarios of positive interactions among similarly aged peers. In O'Connor's (1969) first study a 23 minute staged film that featured six models of similar age to the study's participants was shown to 3 of the 6 participants who were all described as "social isolates" (p. 327). After a single viewing of the film it was found that the participants in the experimental group increased their level of social interaction to the level of the nonisolates that were featured in the staged film. The 23-minute film yielded higher and more efficient results when compared to the alternative procedures that were being used at the time of the research (O'Connor, 1969). In O'Connor's second study (1972), the modeling intervention was used in conjunction with shaping to determine whether (1) modeling, (2) shaping, (3) both modeling and shaping, or (4) neither (control) was more effective in increasing socially acceptable behaviors of socially isolated participants (O'Connor, 1972). The results of the study revealed that participants within the modeling only group attained the most differential increase in social interaction behaviors as identified through classroom observation (O'Connor, 1972).

After publication of O'Connor's work other studies began to use the same technique, first identified as symbolic modeling and later as filmed modeling (Evers & Schwartz, 1973; Evers-Pasquale & Sherman, 1975; Jakibchuk & Smeriglio, 1976; Keller & Carlson, 1974). These studies included samples with preschool-aged participants and targeted behaviors involving increasing social skills or decreasing social isolation from peers. Although these early studies demonstrated success with VBI, all of the experimental designs only involved brief observations that took place before and after the data collection. Methodological improvements were made in subsequent studies by using a multiple baseline across participants design (Ballard & Crooks, 1984). Ballard and Crooks used a 14 minute video that modeled socially acceptable interactions among preschool-aged children with six participants similar in age to the video models. Results revealed significant increases in the amount of social engagement among four of the six participants and, through closer examination, also revealed that there was also significant variability among the succession of sessions in the children's day-to-day social interactions (Ballard & Crooks).

The Multifarious Nature of Video Modeling

Since the introduction of video modeling in the early 1970's its use has grown in popularity with diverse populations of individuals and within various fields of study such as mental and physical health and education. Video modeling has become prevalent in the medical field for the use of patient self-care, prenatal and post-natal care, rehabilitation, and increasing patient awareness as well as with changing or providing precautions for health related behaviors such as smoking and sports related injuries (Krouse, 2000; Magill-Evans, Harrison, Benzies, Gierl, & Kimak, 2007; Mitchko, Huitric, Sarmineto, Hayes, Pruzan, & Sawyer, 2007; Novotney, 2010). In a meta-analysis conducted by Krouse (2000), 40 different research studies on the use of video instruction for patients were found. Videos in the study were used with patients in order to assist in decision making regarding treatment options, to reduce pre-procedural anxiety and improve coping skills, and to teach self-care practices. Although results revealed a diverse range of research designs it was found that all of the studies revealed positive treatment outcomes. Additionally, no specific effect sizes were reported but the results of the studies revealed that the patients who were exposed to videotape models demonstrated better treatment compliance, received higher scores on post-tests, had the ability to retain more information, and had reduced anxiety about treatment procedures as compared to the control patients (Krouse). Consequently, conclusions reported that "video modeling has potential benefits for clinical practice in facilitating knowledge acquisition, reducing preparatory anxiety, and improving self-care" (Krouse, p.748).

In addition to Krouse's (2000) findings Novotney (2010) discusses the success of a mobile multimedia system called the "Coping Cart," that is used in Kosair's Children's Hospital in Louisville. The cart, which is equipped with an iMac and webcam, allows patients to create videos about their hospital stays and coping experiences that are then viewed by themselves and by other young patients. According to Novotney (2010), the "Coping Cart" is a powerful real-life example of video modeling that allows patients to see their peer's model behaviors that are essential for recovery in place of listening to doctors and nurses convey the same information.

In addition to patient self-care, video modeling has also been used in the medical field to inform or instruct others about appropriate care procedures. Magill-Evans et al. (2007) studied the effect of video modeling on parent education with first-time fathers. Fathers received feedback from video of them interacting with their infants at 5 and 6 months of age. Results revealed that the participants within the intervention group displayed more skills in fostering cognitive growth and were able to maintain their sensitivity to infant cues when the baby was 8 months old as compared to the control group of fathers. Information-based videos have also been used within the Center for Disease Control (CDC) as a means to inform athletic coaches about concussions and to provide information about how to best prevent, recognize, and better manage sports-related injuries (Mitchko et al., 2007). Results of this pilot study revealed that video modeling was an effective method to convey important information about health-related risks associated with certain sports (Mitchko et al.).

Video modeling has also become a popular intervention for training individuals for careers in the field of education. Although research in teacher education is limited, the findings thus far have supported its use in preparing teachers to implement effective practices in their classrooms (Dieker et al., 2009; McDonald, 1971). In an early study conducted by McDonald, teacher aptitude and ability to learn a skill via observational learning was assessed. Teacher interns (*n* = 121) from Stanford's education program were assigned to one of three groups; (1) video modeling, (2) written modeling, or (3) no modeling (control). Within these groups all of the participants received the same instructions on how to teach a certain skill but the video group also received video instruction and the text group received a scripted version of the video (McDonald). Afterwards, the participants were given mock classroom conditions to deliver the taught skill to sample students and results of teacher aptitude were measured based on student discussion and performance. Results revealed that the participants within the video modeling group produced significantly higher performance frequencies than the written modeling group and the control group (McDonald).

A more recent study (Dieker et al., 2009) explored the effectiveness of training professionals for the workforce using video models across three different university sites and three different content areas. Three different videos were produced and used with teachers in order to (1) refine the process of creating video models and (2) gather information about teacher aptitude and the feasibility of video use. Results provided preliminary data about reliable ways to create web-based videos that captured exemplary implementation of targeted practices as well as demonstrated the ability for video models to enhance the learning of prospective and practicing teachers (Dieker et al.). Findings in these studies support the use of video modeling in teacher education and highlight the potential for video modeling to help educators move beyond didactic instruction and into more student-centered and reflective practices with their students (Dieker et al.).

Video Modeling and Academic Achievement

Although the foundation of research on video modeling primarily focused on pre-school aged children and its ability to help increase social behavior, current research has expanded to include diverse populations and has grown to include its impact on student's academic achievement, engagement, and peer interaction on academic-based tasks (Cihak & Bowlin, 2009; Montgomerie, Little, & Akin-Little, 2014; O'Brien & Wood, 2011). As discussed earlier Bandura's social learning theory has provided a strong theoretical base for the use of video-modeling (1969). According to Bandura learning emphasizes the ability to acquire information through the process of observing a model without experiencing the behavior firsthand.

In addition to the support of behaviorist Bandura, video modeling and video self-modeling has also been supported by the sociocultural view of learning and language development. Vygotsky, the founder of social development theory, which hypothesizes that social interaction plays an important role in the development of cognition, has also supported the process of modeling. Vygotsky described learning as a transformation that occurs within the zone of proximal development (ZPD) that is also facilitated through the guidance of a more skilled person, similar to the process of video modeling (Hitchcock et al.).

Support from Bandura and Vygotsky encouraged researchers to examine the potential that VM and VSM could have on increasing the academic and behavioral skills for students at risk for school failure. Although video models demonstrated success with increasing academic readiness in the early 1970's it was not until the end of the 20th century that researchers began exploring the use of the model in schools. Today, there are several studies in the literature that highlight the use of VBI models in academic settings (Cihak & Bowlin, 2009; O'Brien & Wood, 2011).

O'Brien and Wood (2011) explored video modeling with peer models in order to evaluate its ability to promote cooperative discussion skills with high school students. They utilized a multiple baseline research design across participants by exposing staggered groups of students to video clips that modeled effective group discussions. Success of the study was measured based on the student's levels of interaction and engagement within subsequent group discussions. Results indicated that the simple technological intervention of VM could effectively promote the use of group discussion skills among high school students with learning problems (O'Brien & Wood, 2011). Additional studies in the area of VM have also investigated the impact of video instruction on increasing academic performance on newly learned skills. Cihak and Bowlin (2009) used handheld computers to teach geometry skills to high school students with learning disabilities. The study included three participants who were given handheld computers with video clips of geometry-based skills that they were instructed to view at home after pre-intervention data were collected (Cihak & Bowlin, 2009). Students were encouraged to view the video as many times as necessary and did not move on to new skills until the previous skill had been mastered and assessed. Results revealed that all three participants were able to acquire and maintain the geometry skills that were taught via the video models (Cihak & Bowlin).

A meta-analysis' on the use of school-based VBI was published in 2003 (Hitchcock, Dowrick, & Prater). In their analysis 18 studies that included the use of VSM with the purpose of improving student outcomes were examined. Results of all 18 studies documented moderate to strong outcomes in support of the VBI model. Through use of video modeling the studies documented its ability to increase speech fluency, frequency of verbal responses, appropriate use of hand raising, and cooperative classroom behavior. Results also documented VBIs ability to decrease inappropriate behaviors in the classroom and occurrences of fights. Consequently, Hitchcock et al. concluded that "video self-modeling can be used successfully to support student's communication, behavior, and academic performance in educational settings" (p.43).

Video Modeling and Social Skills

According to Gul and Vuran (2010), video modeling is one of the most effective methods in teaching social skills because, as emphasized by Bandura, it is driven by the theory of observational learning. Although original research involving video modeling included pre-school aged children with the objective of increasing social skills with their peers, current research has since evolved. Recent studies have documented success involving participants with social and/or emotional disorders that inhibit social interaction such as autism and oppositional defiant disorder (Gul & Vuran, 2010; McClure, Chinsky, & Larcen, 1978). In Gul and Vuran's meta-analysis 21 studies involving the use of video modeling with a purpose of teaching social skills were analyzed for acceptability. In the majority of the studies the participants fell within the age range of 3-15 and 79% of the participants were also diagnosed with autism or Asperger's syndrome. Despite the similarities in populations, however, the compiled studies focused on widespread social skills such as reducing inappropriate behaviors (14%), identifying and expressing feelings (10%), appropriate motor and verbal play skills (19%), social interaction (19%), conversation and communication skills (19%), and initiating communication (19%). Results supplied critical information about the use of VM for teaching social skills, especially within the population of individuals diagnosed with autism (Gul & Vuran). In 24% of the studies the effectiveness of VM was compared to alternative models, in 24% VM was compared to teaching models, and in 52% of the studies the effectiveness of one VM was practiced. Overall outcomes for all three investigative styles revealed that VM is an acceptable method for teaching appropriate social skills to adolescents.

McClure, Chinsky, and Larcen (1978) assessed social problem solving skills using video modeling in their VM study. McClure et al. (1978) used 185 third and fourth grade children in one of four designated groups that signified the type of instruction delivery received; (1) no treatment (control), (2) video modeled tapes, (3) video modeled tapes and discussion exercises, and (4) video modeled tapes and role-play exercises. Two different types of measurements were used before and after treatment to identify if the problem solving skills of the participants had improved. The first measurement was a standardized assessment called Problem Solving Measurement, which was used as a pretest and posttest and the second measurement was an observational tool entitled the Friendship Club. The Friendship Club was developed by the researchers, taught to the observers, and used to measure the development of social problem solving with the participants. Within the Friendship Club students were given five different scenarios with three correct answers that challenged the students to identify appropriate ways to create a friendship with a peer. Student's responses to the scenarios were scored based on the participant's problem solving techniques. Results revealed that the student's problem solving skills increased as a result of all three of the treatments. Although neither treatment increased significantly more than any other the participants exposed to the VM and role playing therapy received slightly higher scores (McClure et al., 1978). Results demonstrated that VM is an effective tool that can be used to increase socially appropriate behavior and that role playing has the ability to reinforce social skills by allowing for internalization of the skill (McClure et al., 1978).

Video Modeling and Life Skills

One of video modeling's most exceptional accomplishments is its ability to increase individual's functionality in the real world. Studies have documented that individuals can acquire and heighten their adaptability to real world tasks with the assistance of VM (Biederman & Freedman, 2008, Mechlin & Cronin, 2006). From basic day-to-day living skills such as food shopping or ordering take out to academic based skills such as writing essays or calculating percentages using videos to model behaviors can be effective in changing behaviors (Mechling & Cronin). Mechling and Cronin's study used computer-based video instruction (CBVI) to teach high school students with intellectual disabilities how to order at a fast-food restaurant using an augmentative, communication device. Results indicated an increase in ability to order food for two of the three participants after the first treatment and for the third participant after the second treatment. Performance was maintained for each participant and results indicate that CBVI has potential to provide instruction to individuals lacking necessary life skills (Mechling & Cronin).

Video Modeling and Autism Spectrum Disorders

The most dynamic research on the use of VBI has been its success with the autism population (Gul & Vuran, 2010). Autism, as described in the fifth edition of the *Diagnostic and Statistical Manual (DSM-V)*, is a neurodevelopment disorder that is characterized by several criterion including; (a) persistent deficits in social communication and social interaction across multiple contexts; (b) restricted, repetitive patterns of behavior, interests, or activities, and (c) symptoms that are present in the early developmental period (APA, 2013). Individuals diagnosed with autism spectrum disorders (ASD) have difficulty with many social aspects such as communication, expression, and interaction with others. As a result, the process of video modeling has proven to be an effective method to teach diagnosed individuals to alter inappropriate behavior and learn applicable ways to interact with their environment (Darden-Brunson, Green, & Goldstein, 2008).

One of the first studies using VM with children diagnosed with ASD was published by Charlop and Milstein in 1989. Participants in this study included three boys (two 7-year-olds and one 6-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. Participants were slowly exposed to parts of the conversation and then asked to repeat what was modeled in the video and when participants mimicked the video successfully they were given a reward and then introduced to additional lines and then subsequently to additional scripts with different conversations. After as little as three sessions and at most six all three participants were able to improve in their ability to sustain communication as measured by specific criterion. The children were also able to maintain progress for up to 15 months following the treatment (Charlop & Milstein). Despite significant breakthroughs, research on the relationship between VM and autism would not be further developed until the 21st century. However, it would be these succeeding studies that would break ground on the profound impact that alternative forms of video-based instruction, such as video self-modeling (VSM), have on increasing social skills in individuals diagnosed with autism.

Video Self-Modeling

Video self-modeling (VSM) is a type of VBI that is similar to VM. In VSM the target participant serves as the model and then views him or herself on the video performing the targeted behavior accurately and independently (Dowrick, 1991). Based on Bandura's theory of self-efficacy, watching oneself on a video should be more meaningful than watching others. This theory has triggered researchers in the field to use VSM interventions to test this conjecture. In recent literature Bandura noted that the advantage of seeing oneself perform a task successfully provides clear information about how to perform the skill best and in turn strengthens personal beliefs in their capability (1997). The term self-modeling was first introduced in the early 1970's in a study by Creer and Miklich who conducted research with a boy that was hospitalized with asthma. In the study a video of the boy was made that documented his positive behaviors (Creer & Miklich, 1970). Although the boy's behavior had not changed prior to the use of the video, the boy's behavior changed drastically as a result of watching himself role play the behaviors on film (Creer & Miklich).

In a subsequent study Dowrick and Raeburn (1977) used VSM with a 4-year-old participant diagnosed with hyperactivity and mental retardation. They sought to determine if VSM could impact the participant's ability to remain self-directed and engaged with his toys for a longer period of time. Results of the study concluded that the VSM intervention helped to increase the participant's time engaged with toys in addition to the support that his medication supplied.

Although research involving VSM grew slowly in the 20st century, its succession has consistently revealed that Bandura's theories about observational learning and self-efficacy can have profound impacts on behavior. As highlighted by Hitchcock et al. (2003), "research has documented that video self-modeling is an effective means for improving academic skills and social behaviors across a wide range of participants, settings, and variables" (p. 36).

VM Versus VSM: Does the Model Matter?

The use of electronic media as a therapeutic intervention has demonstrated success in many VBI studies across various settings and populations. As a result current researchers are now debating which method is most effective. Although early VM studies have produced positive results for altering behavior with adult and peer models (Evers & Schwartz, 1973; Evers-Pasquale & Sherman, 1975; Jakibchuk & Smeriglio, 1976; Keller & Carlson, 1974; O'Connor, 1969, 1972), other researchers in the field have reported that when the participant serves as the model they are able to acquire the target skill in a shorter period of time (Cihak & Schrader, 2008).

Today research involving video modeling and video self-modeling is most prevalent within the ASD population due to its exceptional ability to increase socially appropriate behaviors. Much success however, has also been documented on the use of VM in academic settings with the purpose of teaching new skills and increasing academic readiness in young children. As a result of the conflicting successes with both models of VBI Sherer et al. (2001) sought to identify the difference in effectiveness between the uses of peer models versus self-models. Sherer et al. identified five children diagnosed with autism to compare the effectiveness of VM to VSM based on overall increase in conversation skills. They used peer models in the VM intervention and the children were videotaped for the VSM portion (Sherer et al.). A multiple baseline was used to identify the participant's rate of improvement). Based on the results of the participant's progress with both the VM and the VSM model Sherer et al. concluded that VM and VSM were equally successful in their ability to increase conversation skills. Earlier support for this conclusion was also found by Schunk and Hanson (1989), who resolved that both peer modeling and self-modeling can be equally effective in their ability to raise levels of self-efficacy.

As a result of the effectiveness of both VM and VSM the debate over the most effective model continues to be the center of many video-based instruction studies. Because various characteristics of a model may have the ability to influence attention the debate over the effectiveness of VM and VSM has been justified by researchers. Based on Bandura's belief that a person is more likely to succeed by watching either themselves or others that closely resemble self, many researchers have argued that because VSM utilizes the participant as the model the target behavior is likely to be acquired quicker. Conversely, many VM studies have purposely used models that are relatable to the participants (i.e., similar age, race, gender, etc.) to increase participants confidence in their ability to mimic the modeled behavior (Richards, Heathfield, & Jenson, 2010). Consequently, many researchers have suggested that a high degree of similarity between the participant and the model may lead to greater imitation (Richards et al.). Because VSM capitalizes on this generalization by having the participant serve as the model it has been argued that VSM has the ability to more efficiently help participants acquire targeted behaviors. These results, however, are also largely dependent on the population and the type of skill being targeted in the intervention (Richards et al.). For example, while VSM has proven to be the most effective method to increase social behaviors in individuals diagnosed with autism, VM has been identified as a more efficient model to use in academic settings because a single video can be used across unlimited classrooms (Richards et al). As a result of the success that has been documented with both models and their diverse applications across many fields, decisions on which intervention to use should be selected based on the population and targeted skill.

Technology and 21st Century Learner

When Sesame Street first aired almost a half of century ago in 1969 it received only one hour of air time. Today children have access to educational programs via electronic media all day, every day (Adams, 2006). Despite the fact that research has shown that educational programs, such as Sesame Street, support academic and social development, today's fast-paced technologically advanced world has also changed our children's learning styles and preferences (Adams, 2006). According to Blair (2012), our fast-paced society has created "a dramatic shift" in the schools (p. 8). Today children expect to be entertained as they learn. They prefer audio books to real books, video games to movies and television, and infotainment (information that is delivered in an entertaining way) to drill and practice problems (Adams, 2006). These changing styles of learning have made it important for educators to seek new and innovative ways to tap into children's learning preferences. Blair stated that 21st century learners are highly interactive and they demand quick access to new knowledge. They are capable of engaging in learning at a whole new level and with the world at their fingertips, they need teachers to re-envision the role of technology in the classroom (Blair, 2012).

Although the recent demand for technology from school officials and global learners seems new, it has been a priority for government officials since the turn of the century. As early as 2002 President George W. Bush created an initiative known as the No Child Left Behind Act (NCLB) that addressed the need to cultivate goals for technology implementation in our schools. Specific goals under Part D of Title II brought national attention to the needs for schools to invest in technology for the education of all students (Understanding the no child left behind act of 2001, 2012). The objectives of the goals included (1) the need to improve student academic achievement through the use of technology, (2) the need to assist students in crossing the digital divide by ensuring that every student is technologically literate before finishing eighth grade, and (3) the need to encourage the integration of technology resources with teacher training and curriculum development in order to establish research-based instructional methods that can be implemented as best practices (Understanding the no child left behind act of 2001, 2012).

Subsequent to NCLB, The International Society of Technology in Education (ISTE) partnered with the United States Department of Education (USDOE) in order to develop the National Educational Technology Standards for Students (NETS*S). These standards, originally created in 2007, sought to assess the skills and knowledge that students need to learn effectively and live productively in a global and digital world. The student standards include six pillars that focus on (1) creativity and innovation; (2) communication and collaboration; (3) research and information fluency; (4) critical thinking, problem solving, and decision-making; (5) digital citizenship, and (6) technology operations and concepts (ISTE, 2007). The NET*S standards have helped to validate the increasing demand for instructional strategies that feature technology-based tools.

Fortunately, because the availability of technology is increasing, dissemination of information is easier than ever and has helped to build a bridge between evidence-based practices and technology in schools (Dieker et al., 2009). As a result of the closing gap and the national standards and laws such as NCLB and ISTE, many school districts are mandating their teachers to incorporate the use of technology into their instruction, and have begun to enhance the technological capabilities in their schools to make their demands more feasible for teachers. In a Maryland school district the superintendent plans to have a device in the hands of every student by the 2015-2016 school year (Digital Classrooms, 2014). District school officials say this endeavor will help their schools keep up with technology that allows students to become learners 24 hours a day and 7 days a week so that they can successfully compete in the 21st-century global marketplace (Digital Classrooms, 2014). Incentives such as this one can help pave the way for the use of technology-based instruction models (i.e. video modeling) in schools across the nation.

Mathematics Proficiency

In addition to the need for enhanced technological support in our nation's classroom instruction, the need for an increase in the mathematics proficiency is another government concern. As recently highlighted by the National Assessment of Educational Progress (NAEP) a significant percentage of students across the United States are not demonstrating a basic level of proficiency in mathematics (Eckert, Codding, Truckenmiller, & Rheinheimer, 2007). According to Gibson (2008), being successful in math is a key factor in predicting success academically and professionally.

The Common Core State Standards

As a result of the growing expectations for academic proficiency, state and local districts have been working to develop more cohesive and rigorous student learning expectations (NCTM, 2007). Most recently, the Common Core State Standards (CCSS) were developed to support these mandates. The CCSS were created as a state-wide effort by state leaders in 2009 (CCSS, 2013). Designed to provide schools with consistent, real-world learning goals the standards are expected to ensure that all students will graduate high school highly prepared for college, career, and life (CCSS, 2013). Since 2010, the standards have been adopted by more than 46 states across the nation and have been described as rigorous, student-centered, and research-based (Implementing the common core state standards: The role of the elementary school leader, 2013). Under the mathematics curriculum, students are expected to reach certain levels of mastery within identified areas which will be measured through bi-annual standardized tests. Consequently, the mathematics standards follow a logical progression of skills that spiral from kindergarten through grade 12 and emphasize areas of focus in (1) real-world application, (2) conceptual understanding, and (3) computation fluency (CCSS, 2013). These foci, which were identified based on decades of research and feedback from the field of education, have been acknowledged as critical components for success in mathematics.

Computation fluency has also been recognized as a curriculum focal point within the Principles and Standards for School Mathematics by the National Council of Teachers of Mathematics (NCTM, 2006). According to NCTM (2006), curriculum focal points are considered to be major instructional goals that identify desirable learning expectations within each identified grade. Under the Number and Operations strand, fluency in computation is identified as a curriculum focal point from grade 2 through grade 6. Beginning with fluency with addition and subtraction facts in grade 2 the content progresses to include multiplication and division in grade 4 and to include operations with rational numbers (fractions and decimals) by grade 6 (NCTM, 2006). Similarly, the complexity of fluency also increases across each grade level within the CCSS and ultimately expects students to reach mastery with all operations and with all types of rational numbers (i.e., whole numbers, integers, fractions, decimals, etc.) by the end of grade 8 and with complex numbers by grade 12 (CCSS, 2014). Both instructional frameworks also expect students to develop an awareness of computation that is grounded in understanding. Furthermore, students are expected to demonstrate their proficiency with computation fluency by exhibiting accuracy, efficiency, and flexibility (NCTM, 1989). Consequently, it is evident that computational fluency is an essential component of mathematics proficiency that helps to build strong conceptual understanding of complex mathematical thought processes (NCTM). As a result this research project will focus on targeting student's proficiency with computation fluency, specifically with rational numbers due to its alignment with high school objectives and testing expectations.

Mathematics Driven Research

Despite the recent national focus on improving math proficiencies, American students have historically had difficulty applying proper mathematical principles when attempting to solve math problems (Schroeder, 1993). Therefore, regardless of the CCSS and the Principles and Standards for Mathematics, the field of education is in need of more evidence-based research that is focused on mathematics proficiency. Although the recent standards will help to provide educators with direction on objectives, teachers still need research based instructional models to be successful in implementing the standards in their classrooms. A recent literature review revealed that although current studies have documented some success with student centered, peer mediated, and technology based interventions in the content area of mathematics, many of the studies are outdated or have little to no support in any follow up studies (Anderson, 2007; Fasko, 1994; Gagnon &

Maccini, 2007; Greenfield & McNeil, 1987; Main & O'Rourke, 2011; O'Malley, Jenkins, Wesley, Donehower, Rabuck, & Lewis, 2013; Rowan-Kenyon, Swan, & Creager, 2012; Siegel, Galassi, & Ware, 1985).

In 2007 Anderson described the process of learning mathematics as a complex endeavor that involves "developing new ideas while transforming one's way of doing, thinking, and being" (p. 7). Anderson's study explored the enculturation aspect of learning mathematics through a survey that provided evidence about the different ways in which students develop identities as mathematics learners based on their classroom experiences. Through his data collection Anderson summarized that in order for individuals to develop their mathematical identity they need to be engaged and to have an imagination. Future studies involving the acquisition of math skills highlight these identities through the use of evidence-based interventions such as peer tutoring and peer-mediated instruction (Fasko, 1994; Rowan-Kenyon, Swan, & Creager, 2012). Rowan-Kenyon et al. examined the premise that students' early perceptions of their math capability strongly influence the broadening or narrowing of their interest in the content area and their future career choices. Data were obtained from 5th, 7th, and 9th-grade students as part of a longitudinal study. Findings revealed that the infusion of peer-mediated based strategies and extrinsic motivators are strong precursors for the broadening of mathematics interest in middle school students. Fasko (1994) combined the use of peer-mediated instruction with math recall practice which fostered engagement by pairing students up with peers in order to practice and perfect fluency with multiplication facts. The peer tutoring sessions occurred two to three times a week and last for about 15 to 20 minutes. Data from the post assessment probes and worksheets indicated that the intervention demonstrated; (1) improvement in fluency for six of the eight students; (2) that all students showed some degree of improvement on worksheets during intervention; and (3) that the treatment promoted retention over several weeks (Fasko, 1994).

Despite the success of these studies there has been minimal research on the effectiveness of using VBIs for the purpose of increasing mathematics proficiency. A recent meta-analysis conducted on video modeling and academic performance included only two studies that used math-related content in their modeling (Hitchcock et al., 2003). Schunk and Hanson (1989) utilized an ANOVA and MANCOVA between-groups design in order to assess the effectiveness of self-modeling tapes versus peer models and video-tape controls in the area of math achievement. Results demonstrated that self-model tapes (videos that displayed the child learning how to solve a problem and then practicing it) highlighted progress in the acquisition of arithmetic skills, which also raised self-efficacy as documented by student self-ratings (Schunk & Hanson, 1989). In the second study, four boys diagnosed with attention-deficit/hyperactivity disorder (ADHD) were exposed to video modeled tapes in order to increase four target behaviors; (1) math performance, (2) fidgeting, (3) distractibility, and (4) vocalization (Hitchcock et al., 2003). A multiple baseline across participants was used within the participant's general education classrooms and results of the study indicated results similar to those yielded by Schunk and Hanson (1989).

Since the publication of Hitchcock et al. (2003), research involving VBIs and mathematics achievement has also been minimal. In 2009, Cihak and Bowlin explored the use of video modeling via handheld computers in order to improve geometry skills in high school students with learning disabilities. The results of their study yielded positive gains for all three participants. Subsequent studies involving mathematics skills and electronic media include Main and O'Rourke (2011) and O'Malley et al., 2013. Main and O'Rourke explored new directions for traditional mathematics lessons by studying the effectiveness of using handheld game consoles to enhance mathematics skills and O'Malley et al. explored the effectiveness of using iPads to build math fluency. Although results of both studies were successful and technology proved to be an effective mode of acquiring math skills neither of them used video modeling as their intervention. Nevertheless, their use of technology-based instruction to enhance the acquisition of math skills still provides additional support to the research in the field. As a result of the limited research that involves VBI for the attainment of math skills and the current need for more evidence-based strategies in the field of education this research study will utilize the video modeling strategy with middle school aged special education students in order to determine its effectiveness in increasing the computational fluency.

Peer-Mediated Instruction and Video Modeling

As a result of NCLB the concept of peer-mediated interventions has gained popularity in the field of education. As outlined by Greenwood and Hops (1981), peer-mediated interventions consist of group-based contingencies that foster positive interactions between peers as they work together to achieve a common goal. Peer-mediated practices are student-centered in nature and thrive on the premise that they require students to take on a more active role in their learning by interacting with their peers in order to reach deeper levels of understanding. Research has shown that peer mediated instruction "improves students' opportunities to respond, increases on-task behaviors, provides immediate feedback on correct and incorrect responses, and facilitates academic achievement" (Gardner et al., 2001, p.220). Peer-mediated instruction has also demonstrated success with improving social behaviors and classroom behavior (Gardner et al.).

Peer-mediated instruction can be used in many modalities and it can teach students to become highly effective educators for their fellow students. It can be used in group discussions, tutoring sessions, within the writing process, or through student-led instruction. There are several studies that have demonstrated its success in the field of education. Gardner et al. (2001) used a peer-mediated after school program to increase academic achievement with at-risk African-American boys. The after-school program was created through a partnership with a local church and The Ohio State University's College of Education for African-American males attending an urban elementary school (Gardner et al.). The program included the use of several academic interventions including peer tutoring, which was used for computation fluency and was designed to allow both the tutor and the tutee to change roles as they worked with flash cards to memorize multiplication facts. Results revealed an increase in both reading and math achievement based on pretest and posttest scores. In reading the student's average grade level equivalence increased from 2.4 to 3.5 and in math the students improved their math fact accuracy by 52.5% and their fluency at math facts by 35.7% (Gardner et al.).

In another study conducted on the use of peer-mediated tutoring the effects of Classwide Student Tutoring Teams (CSTT) was used within high school math classes to determine if the intervention could improve classroom grades for mildly handicapped students and their nondisabled peers (Maheady, Sacca, & Harper, 2001). A multiple baseline design was used and the CSTT intervention was introduced sequentially within each class of participants. The intervention design consisted of small groups of heterogeneous students who worked together to teach one another the math content on a given practice sheet and assigned points for correct answers. Evidence of the intervention's success was measured by weekly content quizzes and classroom grades (Maheady et al., 2001). The mildly disabled and nondisabled students in both Grade 9 and Grade 10 classes were able to demonstrate significant increases in their weekly math test performance, the number of students receiving A's substantially increased, and the number of failing students was completely eliminated (Maheady et al., 2001).

A more recent study involving peer-mediated instruction also reported positive gains for student achievement (Richards, Heathfield, & Jenson, 2010; Scruggs, Mastropieri, & Marshak, 2012). In Scruggs et al. (2012), a classwide peer tutoring model was used to track the academic achievement of middle school social studies students.

Results were similar to Maheady et al. (2001) and the students demonstrated positive gains on their posttest data when compared to the control group in the study.

Peer-Mediated Video Modeling

Additional studies in the area of peer-mediated instruction have grown to incorporate technology in the delivery of their instruction. Referred to as peer-mediated video modeling, the intervention combines the practice of peer-mediated instruction with the video modeling strategy. As explained by McCoy and Hermansen (2007) peer-mediated video modeling uses the same process as VM however it additionally includes the use of a model that is the same age and gender as the participants. According to Reichow and Volkmar (2010) and Strain, Schwartz, and Bovey (2008), the use of peer-mediated models for children is a recommended practice for effective instruction because it is naturalistic and it can decrease the difficulty with participant generalization that can often be associated with adult-mediated instruction. Research has also documented the success of utilizing peer models in video modeling (Richards, Heathfield, & Jenson, 2010).

Richards et al. (2010) utilized a classwide peer-modeling intervention which utilized a video modeling strategy to increase on-task rates of students in third through sixth grade. A multiple baseline design across three classrooms was used to expose groups of students to a video with similar peer models demonstrating appropriate on-task behaviors (i.e., working quietly and diligently, ignoring classmate’s interruptions, etc.). Results revealed an increase of on-task rates of 7% for Classroom A, 17% for Classroom

B, and 12% for Classroom C (Richards et al.). Success was also contributed to the coaching procedures that were used following the exposure to the videos as well as to the multiple video models that were purposely selected to be relatable to the participants (Richards et al).

As evidenced through these studies the idea of children learning from their peers is applicable in a wide variety of educational approaches (Bar-Eli & Raviv, 1982). Peer-mediated instruction encourages students to think and learn together and invite students to model, critique, and assist one another throughout their learning. Furthermore, given the difficulties associated with planning instruction for diverse student bodies, it is not surprising that teachers increasingly rely on peer-mediated learning methods, where student's work together to support each other's learning in place of solely relying on the teacher to deliver the instruction (Fuchs, Fuchs, Hamlett, Phillips, Karns, & Dutka, 1997). Subsequently, many school advocates are hopeful that the increase in student-centered learning strategies (such as peer-mediated instruction) will assist in supporting today's 21st century learners with diverse needs and high capabilities to succeed in math related fields (Fuchs et al., 1997).

Methodology

This research study will utilize a single-case design, which is also commonly referred to as single-subject design or N=1 (Barger-Anderson, Domaracki, Kearney-Vakulick, & Kubina, 2004). Single-case designs are quantitative in nature and consequently the research performed in this study should not be confused with the design used in qualitative case studies.

Single-case designs have demonstrated much success with research in educational settings because they use a personalized data collection process that can accommodate a wide variety of instructional strategies and research variables in the classroom setting (Barger-Anderson et al., 2004; Gay, 1987; Kratochwill et al., 2010). Kratochwill and Levin (1992) identified that single-case designs have been used in a variety of fields including education and psychology for over 40 years. Single-case designs are currently known for the important role they play in the identification of evidence-based practices within the special education field and for their relevancy in defining effective educational practices at the level of the individual leaner (Horner et al., 2005). According to Horner et al., the systematic and detailed analysis that is provided from single-case research is similar to randomized control-group designs and has contributed strong evidence-based research to the field of human behavior.

The nature of single-case research is experimental and its purpose is to document casual, functional, and correlational relationships between independent and dependent variables (Horner et al., 2005). In this research project a single-case design will be used in order to determine whether a relationship exists between the instructional intervention of peer-mediated video modeling and academic achievement with the specific skill of computational fluency.

The process of single-case designs has been compared to that of randomized control clinical trials (RCCT's) due to its similar ability to produce evidence-based practices in many diverse scholarly disciplines (Horner et al., 2005). Although single-case designs are organized differently than RCCT's both structures include a control and an experimental aspect that strengthen the reliability of the intervention (Horner et al., 2005). In single-case designs the data are collected and then organized and analyzed around each participant in the study (Barger-Anderson et al., 2004). Single case research uses small sample sizes that range from three to eight participants (Horner et al., 2005). Despite these smaller pools each participant becomes their own control, which leaves room for extensive quantitative analysis. Specifically, the way in which the baseline data for each participant are collected, the interventions are introduced, and results are documented provide a unique experimental design that allow the researcher to compare the effects of the intervention with performance during the baseline to identify treatment effects (Horner et al., 2005).

There are many different models that fall under the structure of single-case research. Some of the most commonly used are withdrawal design, reversal design, multiple baseline design, alternating treatments design, and multiple-probe design (Banger-Anderson et al., 2004). It is also possible for research projects to utilize two different designs such as Cihak and Schrader's (2008) study that compared the effectiveness of VM and VSM to determine if one strategy was more effective than the other. However, reversal designs are not typically used in studies involving the acquisition of new skills, because it would be both unethical and counterproductive to require a participant to unlearn a skill. As a result, this study will use a multiple baseline design.

Multiple baseline designs can be formatted to collect and analyze data across diverse settings and populations. There are three styles that multiple baseline research utilizes to examine treatment outcomes; (1) across behaviors, (2) across participants, and (3) across settings (Barger-Anderson et al., 2004). Multiple baseline designs that collect data across behaviors analyze treatment across differing behaviors. Multiple baseline designs across participants analyze the treatment outcomes across different individuals and the across settings style analyzes treatment outcomes within the context of different environments (Barger-Anderson et al., 2004).

This research study will use a multiple baseline design to collect data across participants. Although all three styles of multiple baseline designs are appropriate to identify whether a targeted intervention is successful, when working with a specialized population of participants the across participants is the most useful style for data collection and quantitative analysis (Barger-Anderson et al., 2004). In this type of design the baseline is determined by collecting continuous data points across different participants before, during, and after the introduction of the targeted skill in order to identify whether the treatment of the independent variable has a significant impact on the dependent variable across multiple subjects (Barger-Anderson et al., 2004). The outcomes of this research will produce information about the effectiveness of using peer mediated video modeling as an instructional strategy to increase mathematics proficiency with special education students.

In addition to the many crucial aspects associated with single-case designs, the process of meticulously describing the participants, the setting, and the design of the experimental research provides further validation of the thorough process that is necessary to carry out the experimental design (Barger-Anderson et al., 2004). This component, that is necessary for single-case design experiments, can also increase the likelihood that the study will be repeated in future cases to either provide additional empirical support for the strategy or to be used as an instructional strategy to increase academic achievement in educational settings (Horner et al., 2005).

Summary

Chapter 2 presented a historical perspective on electronic media and the development of its use as a way to educate individuals and influence behavior through the intervention of video-based instruction. Beginning with Morrisett's development of the educational program Sesame Street to current uses of technology such as iPads and handheld computers the chapter highlighted studies that documented the foundation and the progression of VBI from the early 1960's into the 21st century in the fields of education and psychology. In addition, the chapter also discussed the characteristics of 21st century learners and the increasing need for evidence-based interventions in the field of education to increase proficiency and prepare students for college and careers in our technologically advanced and fast-paced society. The chapter's highlights on the use of peer-mediated instructional models in schools provided support for the implementation of peer guided instructional strategies such as VM and research studies were discussed to document its success with increasing achievement and on-task behavior in schools.

Video modeling has been used by parents, teachers, therapists, and researchers in homes, in schools, and in community environments to teach a variety of skills and behaviors (i.e., self-care, daily living, academic, communication, and social skills). Originally erupting from Bandura's social learning theory, VM gained popularity out of the success of Sesame Street, the BoBo experiment, and the early research of Creer and Miklich (1970), Dowrick and Raeburn (1977), and McClure, Chinsky, and Larcen (1978). From these early progressions to its current success VM has been described as an essential observational learning component that has thrived in various populations and settings. Its early success with increasing socially appropriate behaviors within the ASD population triggered current research that has been conducted in diverse fields and with the purpose of altering different behaviors and teaching new skills. However, despite these recent developments in psychology and education VM research on academic-based skills, specifically in the content area of mathematics, is still limited. Consequently, this research study will use a multiple baseline design across participants to determine if VM can increase the computational fluency of high school mathematics students. A more in-depth discussion about the methodology of this research will be addressed in Chapter 3.

Chapter 3: Research Design

Introduction

The purposes of this study were to: (a) determine if the use of peer-mediated video modeling could impact the proficiency of mathematics achievement in high school students, (b) provide additional contribution to the discussion about whether VM should be identified as an evidence-based practice, and to (c) examine the social validity of the use of VM in a school setting. In this chapter all of these purposes are discussed in addition to the information that will be provided about: (a) the study sample, (b) the data collection and analysis, (c) the VM intervention, and (d) the assessments involved in the study. Additionally, Chapter 3 will also discuss the study's limitations and the ethical considerations that surrounded the research.

Research Design

This study used a single case design to evaluate the efficacy of VM on the proficiency of mathematics achievement in Algebra students in a classroom setting. According to Barger-Anderson, Domaracki, Kearney-Vakulick, and Kubina (2004), single-case experimental research has increased in popularity and acceptability for the purpose of conducting classroom based research. Specifically, this study used a multiple baseline, across-participants design that featured an AB design for each participant with varying baseline durations. AB designs are structured to first assess the target behavior or skill during baseline sessions and then follow with intervention sessions to test the impact of the treatment (Sharpley, 2007). Research involving multiple baselines within the AB structure begins the treatment sessions at different times in order to identify whether the treatment has a causal relationship achievement or not. In this study staggered intervention phases were used in order to identify whether the treatment influenced the participants' achievement. In this study Student A received the intervention after five baseline sessions, Student B received the intervention after 10 baseline sessions, and Student C received the intervention after 13 recorded (out of 15 attempted) baseline sessions (Sharpley, 2007).

The internal and external validity of this study was controlled during both the baseline and treatment phases of the data collection. Internal validity was maintained during these phases by guaranteeing that all of the participant's math classes maintained their normal daily classroom procedures. All three participants attended classes throughout the day as usual and each participant received the same math lesson, the same assignments, and equal academic support in their math classes. The external validity was controlled through the explicit and detailed description of the research design as described throughout this chapter.

Research Sample

The three students chosen for this study were selected by their mathematics teacher at the research site. As stated by Horner et al. (2005), single-subject designs typically involve multiple participants, ranging from three to eight, in a single study. In this study each student served as their own control. The baseline data in this study began in each class on the same day; however the introduction of the intervention phases was staggered. Starting the intervention phases at different times allowed for conclusions to be made in response to the effect of the intervention after each baseline phase was completed. If change in achievement was observed in each class after the beginning of the intervention phase then the cause of the change was credited to the treatment.

This study involved a sample size of three different high school students ranging in age from 15 to 16. All participants were enrolled in a credit recovery Algebra course at the research site under the direction of the teacher participant identified in the study. All students enrolled in the course had previously failed to pass either the Algebra course or the Algebra Regents Exam in the past. All of the data collection and implementation of the intervention was conducted by the same teacher who was certified in the state of New York and was qualified to teach in the subject area of mathematics. All of the students identified in the study attended the Junior/Senior high school that services female adolescents in Grade 7 through Grade 12 and is located within Suffolk County, New York. School enrollment at the research site fluctuates between 30 to 80 students over the course of the school year and class configurations are managed on a 6:1:2, 6:1:1, or 8:1:1 ratio (Data Warehouse, 2012-2013). All students are either residents of the residential treatment facility, group residence, or the day school program (Data Warehouse, 2012-2013). Graduates have the option to receive a standard local high school diploma or a New York Regents diploma (Data Warehouse, 2012-2013).

Research Setting

The same mathematics teacher at the research site implemented all of the data collection and intervention phases. All phases of the research were conducted in the same classroom under the supervision of the facilitating teacher and the same teacher's aide.

Instrumentation and Materials

The mathematics department at the research site used an iPhone 6 with a high-definition video mode that captures 1080 horizontal lines of resolution at 60 feet per second, to record the video model lessons. Windows Movie Make 2012 was used to edit and finalize all of the video model lessons.

In order to maximize similarity between the study participants and the video model, the model selected for the target skill video was also a student enrolled in the school. The model was not a member of the participant's math classes but was relatable to the research participants. The two videos used in the intervention featured the same skill (with varying levels of complexity), were the same duration, and used identical sequencing of sample problems to teach the targeted skill as was delivered during the baseline phase for each participant. During the intervention phase the same videos were shown to the study's participants during every day of the treatment phase via a desktop computer within the student's regular classroom.

During the baseline phase the teacher provided 5 minutes of direct instruction that featured the procedure for solving two-step equations with rational numbers. After instruction the teacher provided the students with a probe to complete independently. All probes used to assess progress included two problems that featured the same skill taught during the direct instruction and no student was administered the same probe more than once. During the intervention phase the teacher played the video that featured instruction of the targeted skill in place of delivering direct instruction. After viewing the video the students were asked to complete the skill probe. During both the baseline and intervention phases all classes also received the same skill-based probes. All students' answers were scored against a rubric and were reported by the number of points out of 10. All student scores were de-identified and reported to the researcher as percentages. The rubric provided students with 2 points for each correct answer, 1 point for each correct step shown, and 1 point for checking each answer for a total of 5 points for each problem and 10 possible points for each probe.

The social validity of this study was measured by implementing modified versions of the Behavior Intervention Rating Scale (BIRS) and the Children's Intervention Rating Profile (CIRP). The BIRS used for this study was a modified version of the Intervention Rating Profile-15 (IRP-15) that featured 24 questions that were rated on a Likert type scale that ranged between a 1 (strongly disagree) and a 6 (strongly agree). The assessment was designed to measure the rater's perception of treatment acceptability and perceived effectiveness for classroom interventions (Elliot & Treuting, 1991). The BIRS has been used across many school-based studies for the purpose of assessing the social validity of various treatments (Erchul et al., 2009; Gertz, 1994; Miller, DuPaul, & Lutz, 2002). The BIRS total score ranges from 24 to 144 and its internal consistency is reported to be .97 (Carter, 2007). Higher mean item scores (i.e., 5 or 6) are associated with greater acceptability and lower mean scores (i.e., 1 or 2) are associated with lower acceptability to the intervention (Elliot & Treuting, 1991). As disclosed by Pearson, the BIRS assesses three factors of the intervention: acceptability, effectiveness, and time (cited in Sheridan, n.d.). On the original assessment these factors account for 73.6% of the total variance. Adaptations were made to this scale to reflect the academic basis of the intervention as opposed to the behavior basis that is highlighted in the original BIRS. The modified BIRS was completed by the teacher administering the VM treatment and it took approximately 10 minutes to complete. The researcher scored and analyzed the results of the BIRS assessment. A sample of the BIRS that was used in this study can be found in Appendix A.

In addition to the BIRS, the CIRP was used to measure the student's acceptability of the VM treatment. The CIRP has been used to measure the acceptability of various interventions with results that have suggested acceptable levels of reliability and validity (Cowan & Sheridan, 2003). The CIRP used consisted of seven self-report items that were related to the perceived fairness and expected effectiveness of a treatment (Carter, 2007). The questions on the CIRP were originally written on a fifth-grade reading level and have an internal consistency of .75 to .89 (Carter, 2007). Items on this instrument were originally rated on a Likert scale ranging in selection from 1 (agree very much) to 6 (disagree very much). As opposed to the BIRS, lower scores on the CIRP signify higher acceptability (Cowan & Sheridan). For comparison purposes the CIRP responses were reverse-coded so that higher mean items signified greater acceptability and could be easily compared to the results of the BIRS. Additional adaptations to the scale included the rewording of several items in order to reflect the academic basis of the intervention as opposed to the behavioral basis that it was originally created for. A sample of the modified CIRP used with this study can be found in Appendix B.

Treatment

The treatment approach that was used in this study was VM. The same teacher, who was highly qualified to teach mathematics in the state of New York, conducted the treatment phases for all students. There was no specific training required for the teacher to administer the VM treatment. The teacher participant was responsible for delivering standard instruction during the baseline phase and used her own classroom equipment to show the video clips to her classes of student participants during the treatment sessions.

During the baseline phase the teacher provided 5 minutes of direct instruction that featured the procedure for solving problems involving the target skill. After instruction the teacher provided the students with one of the baseline probes to complete independently. For this phase the teacher administered five probes to Student 1, 10 probes to Student 2, and 15 probes to Student 3. Each baseline probe included two problems that featured operations with rational numbers, the same skill that was taught during the direct instruction phase of the research.

After the baseline phase each student began the treatment phase at staggered intervals. During the treatment phase each student viewed the video as identified in the

VM treatment calendar located in Appendix C. After viewing the video the students completed an assigned probe, similar to the baseline probes, which featured the target skill. The set of probes developed by the mathematics department at the school include 25 different treatment probes (15 baseline, 5 intervention, 5 maintenance) that featured two different two-step equations on each probe. A sample of the assessment probes can be found in Appendix D. The number of correct answers out of 10 questions determined the students' scores. The correct number out of 10 determined the reported raw scores. The teacher administering the treatment followed the treatment calendar to keep track of each student's schedule and to ensure that they were not be assessed using the same probe more than once.

A student from the same school modeled the video for the treatment phase. The video model was chosen by the participating teacher and was not enrolled in any of the classes in which the VM was used. The video model was given two model problems and 5 minutes to demonstrate how to solve the problems involving the target skill while being videotaped. During the video instruction the student model was encouraged to use a think aloud strategy to work through the problem and justify each step.

During the maintenance phase the teacher asked students to complete probes that featured the target skill each day for one week. There was no instruction provided to the students during this phase of the treatment. Each student began this phase one month after the cessation of their VM treatment phase.

In this study each student served as their own control. The baseline data in this study began with each student on the same day; however, the introduction of the treatment phase was staggered for each student. Starting the intervention phases at different times allowed for conclusions to be made in response to the effect of the intervention after each baseline phase was completed. If change in achievement was observed in each student's scores after the beginning of the intervention phase then the cause of the change could be credited to the introduction of the treatment.

Treatment Fidelity

As discussed by Bellini, Akullian, and Hopf (2007), the fidelity of treatment can be increased by asking administrators of the treatment to keep a log on daily implementation of video use. In order to increase the fidelity of treatment in this study a chart was used to collect data on the days that the videos were shown to document how much of the video was played and how well the students attended to the video on each day. A sample of the data log that was completed for the purposes of this study can be found in Appendix C.

Data Collection

The data collection procedure is presented in the following chart to highlight and organize the information.

Table 1

Data Collection Protocol

Establishing the Baseline	1. The teacher will introduce the target skill and provide direct instruction to students on the targeted skill for no more than 5 minutes. 2. The teacher will administer a short 2 problem probe to the students. 3. Student's probes will be scored out of 10 and documented appropriately. 4. Baseline schedule: a) Student A will begin VM treatment after 5 days of baseline. b) Student B will begin VM treatment after 10 days of baseline. c) Student C will begin VM treatment after 15 days of baseline.
VM Treatment	1. Immediately following completion of the baseline data collection for the VM treatment will begin. a) Student A's sessions will begin after 5 days of baseline instruction and will continue for 5 days. b) Student B's sessions will begin after 10 days of baseline instruction and will continue for 5 days. c) Student C's sessions will begin after 15 days of baseline instruction and will continue after 5 days. 2. During the treatment phase the teacher played the modeled video during class. The teacher only provided prompts to redirect the student's attention when it was necessary. 3. After viewing the video the teacher provided the students with probes 16-20 in order for 5 consecutive days.
Post Treatment Data Collection Procedure	1. After treatment, data was collected using probes 21-25 1 month later. 2. Each student completed 5 days of post treatment sessions which all began 1 month after their last intervention session.

The treatment phase data was used to determine if hypothesis 1 was accepted.

H_a^1: The Algebra students will demonstrate at least 80% achievement on solving two-step equations with rational numbers over their baseline, as measured by the daily probes.

H_1^1: The Algebra students will demonstrate less than 80% achievement on solving two-step equations with rational numbers over their baseline, as measured by daily probes.

Maintenance Phase

Maintenance for the VM treatment was measured 1 month post treatment. The maintenance phase was identical to the post treatment procedure. Each student completed a 2 question probe that included questions that addressed the target skill. The maintenance phase data is presented in a line graph in Chapter 4 and was used to accept or reject hypotheses 2.

H_a^2: The Algebra students will maintain an achievement level of 60% or more on solving two-step equations with rational numbers, as measured by the maintenance phase probes.

H_1^2: The Algebra students will not maintain an achievement level of at least 60% on solving two-step equations with rational numbers, as measured by the maintenance phase probes.

Social Validity

The social validity of this study was measured using a modified version of the BIRS and the CIRP. Both data inventories were completed by the teacher and the student participants after the conclusion of the maintenance phase. Results of these measurements are featured in Chapter 4 and provide information about the acceptability of the VM treatment for classroom use. Copies of the modified versions of these scales can be found in the appendices. The results obtained from these inventories were used to accept or reject hypotheses 3 and 4.

H_a^3: The average rating of the teacher's modified BIRS will be a 4 or above indicating that she believes the VM intervention is acceptable for classroom use.

H_1^3: The average rating of the teacher's modified BIRS will be less than 4 indicating that she believes the VM intervention is not acceptable for classroom use.

H_a^4: The average rating of the participants modified CIRP will be 4 or above indicating that they believe the VM intervention is acceptable

H_1^4: The average rating of the participants modified CIRP will not be 4 or above indicating that they believe the VM intervention is not acceptable.

Data Analysis

The descriptive data for each student included de-identified raw data for each student as well as information about student demographics including age, gender, ethnicity, and the identification of any special education services mandated by an individualized education plan. All of this data was used to inform further research in the area and improve internal validity. As suggested by Horner et al., (2005), it is possible to achieve internal validity in single-subject research designs by providing meticulous information about the treatment and treatment conditions so that future researchers can duplicate the design. Additionally, by including several different classes of participants the external validity of this study was also increased.

The achievement data collected on the daily probes was illustrated using visual analysis of several line graphs. According to Horner et al. (2005), the researcher can interpret the trend and the variability of performance in the data through the use of visual tools such as graphs. This research study used double line graphs to aid in data analysis. These graphs provide systematic visual comparisons of the impact of the treatment across several conditions throughout the baseline and intervention phases (Horner et al., 2005). Excel, a Microsoft software program, was used to develop the graphs.

On the graphs the *x*-axis was used to display the days that the probes were administered and the *y*-axis display the student's raw score on each probe. The graphs clearly show phase changes between baseline, treatment, and maintenance and the data points for each class were represented separately. Any trend changes on the graphs can be identified by any sudden, gradual, or non-existent change within the slope of the graph and from the distances between the data points and the mean. In this study the change in slope within the intervention and maintenance phases helps to demonstrate the impact of the VM treatment. A positive slope from the mean demonstrates an increase in achievement on the target skill and a negative slope demonstrates a decrease in achievement. It was predicted that the achievement on the targeted skill would increase as a result of implementation of the VM intervention.

When collecting baseline data the goal was to achieve a relatively stable baseline that was within 10-20% of the mean. If stability was not demonstrated, more data points would have been collected before introducing the phase change. The phase changes within each graph allow the reader to interpret the impact of the intervention on the student's achievement. Changes in the mean can be interpreted across phase changes in order to analyze the impact of the student's achievement when the intervention is introduced and removed. The effect sizes of these changes were measured using a confidence interval of 95% and Cohen's *d* which were calculated by subtracting two means and then dividing them by the sum of their deviations. Larger effect sizes demonstrate higher levels of statistically significant results. For this study Cohen's *d* was used between the student's baseline and post treatment phases and between the baseline and maintenance phases.

In addition to the use of graphical representation and Cohen's *d* the percentage of non-overlapping data points (PND) was also used to analyze treatment effectiveness. The PND of the study was calculated by counting the number of intervention points that exceeded the highest baseline point (non-overlapping) in order to create a ratio between the higher points and the total points (Parker, Hagan-Burke, & Vannest, 2007). The ratio of the non-overlapping points was then divided and multiplied by 100 in order to create a percentage.

The PND in this study was used to determine what impact VM had on the student's mathematics achievement between baseline and post treatment phases. Typically if 70% of the intervention points are above the baseline, the intervention is considered to be successful. However, in this study the hypothesis is set to 80% in order to remain consistent with the research in the VM and VSM field.

Research Limitations

The largest limitation in this research study was the generalization of the study's results to larger and more diverse populations. This study only included 3 students and the data collection was limited to one mathematics course within one school. All three participants used in the study had similar demographic characteristics. All of these factors narrowed the possibility of generalizing the results of the study to other groups of students.

In addition to the limitation on student demographics this study was also limited to collecting data on one skill in one subject area. Although the rationale for focusing on one subject and one skill was discussed in Chapter 1, this still contributed to an area of limitation. Consequently, future suggestions for this study include expanding the skill areas and the subject areas with this intervention.

An additional limitation to the study was the length of the data collection. Although the short duration of the intervention and maintenance phase provided enlightening information to the field of psychology and education, its short 5 days of treatment could not address the long-term effects of utilizing the intervention. As a result a more extensive longitudinal study will be discussed within Chapter 5 under future suggestions.

Protection for Participants

This research study carefully adhered to all of the American Psychological Association's (APA) ethical principles and standards in order to protect all participants involved in the research from any maleficence. As mandated under APA's ethical standard of informed consent, the researcher obtained consent from the parents/guardians of the participants used as video models (APA, 2010). During data collection for this study the researcher only received the de-identified raw data, and no personal or identifying information about the participants in the study was revealed. Participants in the study were categorized and only identified as Student 1, Student 2, or Student 3 throughout the study.

The researcher kept two copies of all of the de-identified data and related documents. One set of documents are located in a locked file cabinet in the researcher's home office and the other are located in a secure and locked location at the research site. All of the documents are organized in folders labeled Student1, Student 2, and Student 3.

The staff at the research site was also provided with the contact information of all the individuals on the research committee so that any concerns or questions could be shared.

No compensation was offered to the participants or to the staff for participating in this research. As requested, a copy of the final dissertation will be provided to staff, so information regarding the intervention can be used in future intervention plans.

Summary

Chapter 3 discussed all aspects of the research project including the sample, the data collection and analysis, the VM intervention, and the assessments. As outlined in the chapter the sample of student participants in this study was chosen by staff at the research site and the intervention phases were implemented by the same teacher participant, a mathematics teacher at the school. The students selected for the study were all taking the same mathematics course and had no severe learning disabilities and were not identified as gifted and talented in the subject area of math. In order to provide explicit information, clearly identify the study's parameters, and to increase internal validity all of the participant's descriptive statistics (gender, age, ethnicity, etc.) have been reported in narrative form.

In addition to the study's sample, Chapter 3 discussed the research setting and the procedures that were used to collect data during the baseline, intervention, and maintenance phases of the study. Modified versions of the BIRS and CIRP and a treatment fidelity log were used to accurately assess the acceptability of the study and increase social validity.

In addition to these components the study's potential limitations and the ethical considerations surrounding the research were also discussed. Throughout the study careful attention was devoted to adhering to all APA ethical codes in order to safeguard the protected population that was used in this study. The limitations surrounding this study, as discussed within the chapter, mainly include the inability to generalize its results to the larger, more diverse populations and to different skill, levels of instruction, and different academic subject areas. The researcher recognizes these limitations and will use them to inform studies conducted in the future.

Chapter 4: Results

Introduction

The purpose of this study was to determine whether VM was able to increase the proficiency of high school students' achievement on solving two-step algebraic equations with rational numbers. The dependent variable identified in the research was the academic achievement of the student participants and the independent variable was the application of the VM treatment. The dependent variable was measured through daily probes that assessed the target skill through baseline, intervention, and maintenance phases of the research. The study also measured the social validity of VM to determine whether the teacher and the student participants perceived the intervention as a practical instructional strategy for increasing academic achievement. Chapter 4 includes a full description of the study's sample, data analysis, and a discussion of the research questions and hypotheses. The fidelity of the VM treatment is also discussed.

Description of Sample

The mathematics teacher at the research site selected student participants from her Algebra courses during the summer program of the 2014-2015 school year. The three participants chosen had to: (a) be female adolescents between the ages of 15 and 18, (b) have previously failed a Regents Algebra course and/or exam, (c) not be classified for special education services within the state of New York, and (d) have a record of good attendance, high levels of coursework assignment completion, and the ability to attend to both direct instruction and video instruction for a minimum of 2 minutes. The 2 minute timeframe selected based on Buggey's (2007) research that a video intervention may not be successful if the participant cannot successfully attend to the video for at least 2 minutes.

The sample that was selected included three White female adolescents all between the ages of 16 and 18. The specific student demographics are provided in Table 2. All three participants were enrolled in a summer Regents preparation course for Algebra 1 due to previously failing the NY Regents exam and/or course. None of the participants had current special education classifications. Two of the three participants were residential students at the treatment facility where the school is housed. The third participant was enrolled as a day school student and was transported to and from the school on a daily basis from her home in New York City. During the data collection for this research project the students continued to receive regular instruction in their mathematics courses and their performance on the daily probes was not calculated into their overall grade for the semester.

Table 2

Student Participant Demographics

Student	**Gender**	**Age**	**Ethnicity**
Student 1	Female	16 yr. 8 mo.	White
Student 2	Female	17 yr. 1 mo.	White
Student 3	Female	17 yr. 6 mo.	White

Analysis of the Data

This research project used a quantitative, single-subject, multiple baseline design that was performed across three participants. As suggested by Sharpley (2007), the design included the scattering of baseline data collection points. This was achieved during data collection by collecting Student 1's baseline data for five sessions, Student 2's baseline data for 10 sessions, and Student 3's baseline data for 15 sessions. It is important to note that although Student 3 received 15 consecutive sessions of baseline probes the student refused to complete the skill probes during two sessions. As a result, Student 3's baseline data was observed for 13 sessions and the probes that she refused to complete were omitted from her overall data. Aside from this exception, the patterns of the students' baseline performances were viewed to be reasonably stable (Figures 1-3). Visual analysis of the students' data was used to determine the changes in the level of performance, the trend or slope, the effect size, and the percentage of nonoverlapping data points (Kratochwill et al., 2010). Each student's achievement is represented on a double line graph (Figures 1-3). A double line graph was used to depict the raw scores of each probe, which is displayed with black solid lines, and the mean score for each phase, which is displayed with red dotted lines. On each graph the *y*-axis represents the student's score on each probe and the *x*-axis indicates the session number. The current phase (baseline, intervention, and maintenance) is also displayed on the *x*-axis of each graph.

Variables

This research project used a multiple baseline, across participants design to investigate the impact of VM on student's proficiency with solving two-step equations with rational numbers across time. The dependent variable for the study was the raw score on the completed skill-based probes and the independent variable was the application of the VM treatment. A sample of the baseline probes can be viewed in Appendix D. Each probe featured two problems that were each scored out of 5 points for a total of 10 possible points. Each student received 1 point for showing each of the two steps necessary to solve every problem, 2 points for every correct answer, and 1 point for showing work that proved their answer was correct. The student's raw scores were used to identify their progress on each line graph.

The design of the data collection featured three different phases (baseline, treatment, and maintenance) and contained a minimum of five data points for each phase. As suggested by Kratochwill et al. (2010) double line graphs were constructed to provide visual support for the data collected during all three phases of the research (see Figures 1-3). The *y*-axis within the figures represents the raw score that the student achieved on each of the skill-based probes and the *x*-axis identifies the session number and the phase of each data point. Double line graphs were used to highlight the dependent variable and the mean score for each phase. The dependent variables are represented with solid black lines and the averages are represented with dotted red lines. The figures for each student can be found in Figures 1-3.

Research Questions 1 and 2

The first research question examined whether the VM intervention had an effect on the student's academic achievement. In order to reject the null hypotheses for Research Question 1, the student must have reached at least an 80% improvement over their baseline performance. The second research question examined whether the participant maintained the intervention level of performance following 1 month posttreatment. In order to reject the null hypothesis of Research Question 2, the student must have maintained at least a 50% level of performance over their baseline performance. The changes in the student's performance, trends, the percentage of non-overlapping data points (PND), and the effect size (ES) are discussed as part of both the visual analysis and the statistical analyses. Statistical analysis of the PND was identified by calculating the percent of intervention points that did not overlap with the highest baseline data point (Bellini, Akullian, & Hopf, 2007). According to Bellini et al. (2007), PND scores that are equal to or above 90% are considered to be very effective, scores that are between 70% and 90% are considered effective, scores between 50% and 70% are considered questionable, and anything below 50% is considered to be ineffective. A visual analysis of the PND for each student can be found in Tables 3, 5, and 7.

Effect sizes (ES) were also used to provide further statistical support for the data. The ES index that was used to investigate the impact of the VM treatment was Cohen's *d*. Cohen's *d* is a popular and simple index of ES (Grice & Barrett, 2014). All effect sizes are reported using *d* and were derived by dividing the difference of the observation means (intervention-baseline and maintenance-baseline) by the baseline standard deviation (Jenson, Clark, Kircher, & Kristjansson, 2007). According to Matyas and Greenwood (1990), an effect size of .2 is typically classified as a small effect size, an effect size of .5 is a medium effect size, and an effect size of .8 or higher is identified as a large effect size. A visual analysis of the ES for each student can be found in Tables 4, 6, and 8.

Student 1's Data

Student 1 was a White female, age 16 years, 8 months. Data for Student 1 can be found in Figure 1 and in Tables 2 and 3. Student 1 had five baseline sessions, five treatment sessions, and five maintenance sessions.

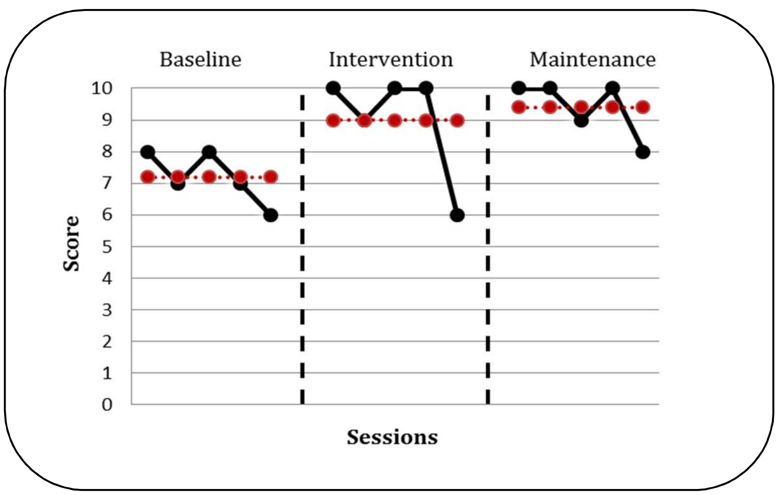

Figure 1. Student 1's achievement levels on skill probes.

Table 3

Student 1's Percentage of Non-Overlapping Data Points (PND)

Student	DV	PND (Intervention)	PNG (Maintenance)
Student 1	Probe Score	80%	80%

Table 4

Student 1's Cohen's d Effect Sizes

Student	**Baseline-Treatment**	**Baseline-Maintenance**
Student 1	1.48	2.84

Student 1's achievement scores are shown in Figure 1. Student 1's baseline level of performance (mean) was calculated to be 7.2. The baseline was found to be relatively stable over the five recorded sessions. During treatment Student 1's average achievement level was calculated to be 9. Despite the lower scores on the last probes within each phase, a pattern of increasing achievement can be observed when comparing the student's baseline data to her intervention data. Student 1's probes for session 5 and session 10 were examined to investigate their similar decrease in achievement and the student's loss of points both stemmed from errors with fraction computation. Based on this observation, it is important to note that the decrease in achievement at the end of each phase was not related to the skill being directly assessed. Student 1's PND can be found in Table 3. As stated earlier, Research Question 1 inquired whether the participant would increase her achievement by at least by 80% over baseline. According to Bellini et al. (2007) a PND of 80% is considered an effective intervention. Student 1's PND from baseline to intervention score was calculated to be 80% and therefore is considered to be an effective treatment for Student 1. Student 1's baseline to intervention achievement was calculated to have an ES of 1.48. According to Cohen (1977) an ES of anything above 0.8 is considered to have a large effect. The reported effect sizes for Student 1 can be found in Table 4.

Research Question 2 investigated whether the student participant could maintain at least a 50% level of achievement after removing the VM treatment for one month. Student 1's post-treatment achievement is shown in Figure 1. As stated above, Student 1's baseline level of performance (mean) was calculated to be 7.2. Her maintenance level of performance was calculated to be at 9.4. Student 1's baseline to maintenance PND score was calculated to be 80% and therefore is also considered to be an effective treatment. Student 1's baseline to maintenance achievement had an ES of 2.84. This ES also falls within the large effect range.

Student 2's Data

Student 2 was a White female, age 17 years, 1 month. Student 2's data can be found in Figure 2 and Tables 5 and 6. Student 2's data is presented in the same order as Student 1's addressing the first two research questions. The only difference between Student 1's and Student 2's data presentation is the number of baseline sessions.

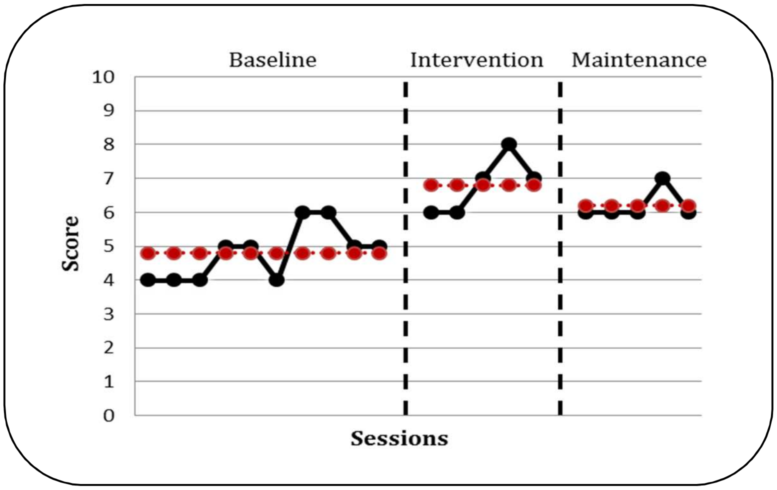

Figure 2. Student 2's achievement level on skill probes

Table 5

Student 2: Percentage of Non-Overlapping Data Points (PND)

Student	DV	PND (intervention)	PNG (follow up)
Student 2	Probe Score	60%	20%

Table 6

Student 2: Cohen's d Effect Sizes

Student	Baseline-Treatment	Baseline-Maintenance
Student 2	2.67	2.33

Student 2's achievement scores are shown in Figure 2. Student 2's baseline level of performance (mean) was calculated to be 4.8. The baseline was found to be relatively stable over the 10 recorded sessions. During treatment Student 2's achievement level was calculated to be 6.8. A pattern of increasing achievement can be observed when comparing the student's baseline data and intervention data. Student 2's PND can be found in Table 5. As stated earlier, the research question inquired whether the participant would increase her achievement by at least 80% over baseline. Student 2's PND from baseline to maintenance score was calculated at 60%. According to Bellini et al. (2007), PND scores that fall between 50% and 80% are considered to be questionable. Despite Student 2's questionable PND her baseline to intervention achievement had an effect size of 2.67 which is considered to be a large effect (Jenson et al., 2007). A visual analysis of Student 2's ES can be found in Table 6.

Research Question 2 investigated whether the student participant could maintain at least a 50% level of achievement once the VM treatment was removed for one month. Student 2's post-treatment achievement is shown in Figure 2. As stated above, Student 2's baseline level of performance (mean) was calculated to be 4.8. Her maintenance level of performance was calculated to be at 6.2. Student 2's baseline to maintenance PND score was calculated to be 20% which classifies the treatment to have been ineffective. Despite this classification, Student 2's ES when comparing her baseline to her maintenance achievement was a 2.33 which is considered to be a large effect.

Student 3's Data

Student 3 was a White female, age 17 years, 6 months. Student 3's data can be found in Figure 3 and Tables 7 and 8. Student 3's data results are the same as the previous participants with the exception of the number of baseline sessions. Student 3 had 13 baseline sessions before beginning the intervention phase.

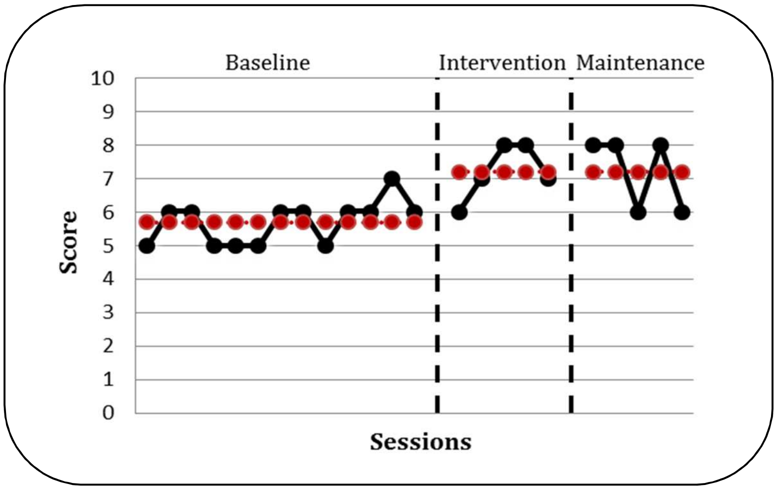

Figure 3. Student 3's achievement levels on skill probes

Table 7

Student 3's Percentage of Non-Overlapping Data Points (PND)

Student	DV	PND (intervention)	PNG (follow up)
Student 3	Probe Score	20%	60%

Table 8

Student 3's Cohen's d Effect Sizes

Student	Baseline-Treatment	Baseline-Maintenance
Student 3	2.21	1.85

Student 3's achievement scores are shown in Figure 3. Student 3's achievement baseline level of performance (mean) was calculated to be 5.69. The baseline was found to be relatively stable over the thirteen recorded sessions. During two of the attempted 15 sessions Student 3 refused to complete the assigned probe. Consequently, two of the attempted sessions were removed from the graphed data and the means were calculated based on the 13 sessions that had completed probes. During treatment Student 3's achievement level was calculated to be 7.2. Despite several overlapping performance points a pattern of increasing achievement can be observed when comparing the student's baseline data to her intervention data. Student 3's PND can be found in Table 7. Research Question 1 inquired whether the student participant would increase her achievement by at least by 80% over baseline. Student 3's PND from baseline to intervention score was calculated to be only 20% and therefore cannot be identified as effective based on the criteria for PND. However, Student 3's baseline to intervention achievement had an effect size of 2.21 which falls within the large effect size according to Cohen (1977). Student 3's ES analysis can be found in Table 8.

Research Question 2 investigated whether the student participant could maintain at least a 50% level of achievement once the VM treatment was removed for one month. Student 3's posttreatment achievement is shown in Figure 3. Student 3's baseline level of performance (mean) was calculated to be 4.93 and her maintenance level of performance was calculated to be at 7.2. Student 3's baseline to maintenance PND score was calculated to be 60% which makes the effectiveness of the treatment questionable. Student 3's baseline to maintenance achievement had an ES of 1.85 and, therefore, is also considered to have a large ES.

Social Validity

Research Questions 3 and 4 examined the social validly of the treatment and investigated whether the teacher and the student participants would find the VM treatment to be an acceptable strategy for instructional support in the classroom. Research Question 3 focused on the teacher's perceptions of the use of VM and used the modified BIRS to draw conclusions about its acceptability. The special education chairperson within the program administered the modified BIRS to the teacher participant. The modified BIRS contains 24 items and uses a 1-6 (strongly disagree-strongly agree) Likert based system to determine the social validity of the intervention (Martens, Witt, Elliott, & Darveaux, 1985). The total score on the profile can range from 24-144, with the higher the score the more acceptable the intervention (Lane et al., 2009). In this research project the mean score out of all 24 items was used to examine the validity of the treatment. Mean scores at or above 4 were identified to represent acceptability of the treatment (Cihak, Alberto, & Fredrick, 2007). The data from the teacher's modified BIRS can be found in Table 9.

Table 9

Modified Behavior Intervention Rating Scale (BIRS)

Reviewer	Raw Score	Mean Score
Teacher	93	3.875

The teacher participant scored the modified BIRS with a raw score of 93 and a mean score of 3.88. This mean score is less than the acceptability mean of 4, which signifies that the teacher participant did not find the VM treatment to be acceptable for classroom use. Specific interpretations of the teacher's score will be discussed in Chapter 5.

Research Question 4 investigated whether the student participants would score the modified Children's Intervention Rating Profile (CIRP) at a level of 4 or higher. The special education chairperson within the program administered the modified CIRPs to the student participants. The modified CIRP contains seven items and also contains a 1-6 (strongly disagree-strongly agree) Likert based system to rate the social validity of the intervention (Martens et al., 1985). The total scores can range from 7-42, with the higher the score the more acceptable the intervention (Lane et al., 2009). This research project used the mean scores of all rated items to identify the level of treatment validity. Mean scores at or above 4 are considered acceptable (Cihak, Alberto, & Fredrick, 2007). The data from the modified CIRP can be found in Table 10.

Table 10

Modified Children's Intervention Rating Profile (CIRP)

Reviewer	Raw Score	Mean Score
Student 1	29	4.14
Student 2	33	4.71
Student 3	31	4.43
Average	93	4.43

All three student participants' scores on the modified CIRP were higher than a mean of 4 indicating that they all found the VM treatment to be acceptable for classroom use as an instructional strategy. Student participant 1 scored the modified CIRP with a raw score of 29 and a mean score of 4.14. Student participant 2 scored the modified CIRP with a raw score of 33 and a mean score of 4.71. Student participant 3 scored the modified CIRP with a raw score of 31 and a mean score of 4.43. A thorough interpretation of the student's scores on the modified CIRP will be discussed in Chapter 5.

Treatment Fidelity

This research project utilized treatment fidelity data sheets in order to collect specific information about the administration of the treatment for each participant. As suggested by Bellini et al. (2007) it is recommended to provide specific charts to the administrators supervising the treatment in order to gain a better perspective regarding the fidelity of the treatment across participants. In the research project the supervising teacher completed a treatment fidelity data sheet for each participant during their treatment phases that documented if the student watched the entire video and if multiple or minimal cues were needed to encourage the student to attend to the video. The chart also included a blank section for any additional comments. The chart used in this research project can be found in Appendix A. The data collected from the community partner concerning treatment fidelity are displayed on Tables 11-13.

Table 11

Student 1's treatment fidelity chart

Session	Video Watched	Prompts	Comments
Session 1	Yes	Minimal	No prompts needed
Session 2	Yes	Minimal	No prompts needed
Session 3	Yes	Minimal	No prompts needed

Session 4	Yes	Minimal	No prompts needed
Session 5	Yes	Minimal	1 prompt needed

Table 12

Student 2's treatment fidelity chart

Session	**Video Watched**	**Prompts**	**Comments**
Session 1	Yes	Minimal	No prompts, seemed to enjoy seeing friend on video
Session 2	Partial	Multiple	Needed several prompts, Distracted by peers
Session 3	Yes	Minimal	No prompts
Session 4	Yes	Minimal	No prompts
Session 5	Partial	Multiple	Needed several prompts, Distracted by peers

Table 13

Student 3's treatment fidelity chart

Session	**Video Watched**	**Prompts**	**Comments**
Session 1	Yes	Minimal	No prompts
Session 2	Yes	Minimal	No prompts
Session 3	Yes	Minimal	1 prompt
Session 4	Yes	Minimal	No prompts
Session 5	Yes	Minimal	1 prompt

The data collected from the treatment fidelity data sheets revealed that Student 1 and 3 watched the entire video during each treatment session and Student 2 only failed to watch the entire video during one session. All of the participants needed at least one prompt throughout the intervention sessions to refocus on the video model. Student 1 needed one prompt during session 5, Student 3 needed one prompt during session 3 and session 5, and Student 2 needed several prompts during session 2 and session 5 due to peer distractions in the learning environment. Despite the minimal cues that were needed across the participants, the social validity test which was discussed in Research Question 4 revealed that all of the student participants found the treatment to be acceptable.

Conclusion

The analysis of the data provided within this chapter supported the research questions and hypotheses that were identified for this research project. The results for all three students displayed varying levels of increasing achievement. Student 1 increased their academic achievement by at least 80% PND and although Student's 2 and 3 did not reach the 80% PND level the ES for all students fell within the large effect range. Student 2 and 3's failure to meet the PND cutoff of 80% will be discussed within Chapter 5.

The data also revealed that Student 1 maintained her achievement through the maintenance phase with a PND of at least 80%. Similarly, Student's 2 and 3 failed to meet the 80% PND cutoff for the maintenance phase but all of the student's ES's also were reported to have large effects. Student 2 and 3's failure to meet the PND cutoff for the follow-up will be discussed within Chapter 5.

The acceptability of the VM treatment was established by all of the student participants as indicated by scores on the modified CIRP. Acceptability of the VM treatment by the teacher participant did not meet the designated cutoff of 4 or above, however, was relatively close. Interpretations of scores collected on the modified BIRS will also be discussed in the following chapter.

Based on the data collected on the treatment fidelity logs during the intervention phase fidelity with the treatment administration was established throughout the data collection sessions for all student participants. All of the feedback related to the treatment were positive and based on the teacher's comments the only negative actions during VM administration stemmed from the classroom environment and not the actual treatment. This information can provide additional support for the high acceptability of the VM treatment from the perspective of the student participants.

Chapter 5 will summarize the entire research project, outline the limitations of the study, and provide recommendations for future research with VM in the fields of psychology and education. Chapter 5 will also present a discussion about how this research project and the use of VM treatment in academic settings can have an impact on our society and our mission to promote social change.

Chapter 5: Summary, Conclusions and Recommendations

Introduction

The primary objective of this study was to determine whether VM could improve the mathematics achievement of high school Algebra students. The students' achievement in the research was measured by daily probes that assessed the target skill of solving two-step algebraic equations with rational numbers. Secondary purposes for conducting this study included the desire to provide information about the social validity surrounding the use of peer-mediated video-based interventions (VBIs) in academic settings as well as to provide continued validation for the effectiveness of VBIs in the field of psychology and education.

Chapter 5 provides a summary of the data reported in the previous chapter. Data summaries include the difference in achievement levels across phases for each student (reported through the PND and ES) and the results of the social validity measures obtained through the modified Behavior Intervention Rating Scale (BIRS) and the modified Children's Intervention Rating Profile (CIRP). Interpretations surrounding the achievement outcomes for each student and the social validity measures for both the students and teacher participant are also discussed. Further validation for the effectiveness of the treatment is revealed based on the results of the treatment fidelity forms completed by the teacher participant. The limitations of the study and additional information about how future research can address these limitations are also included. The chapter concludes by identifying the impact that this study and the use of VM have had on social change.

Bandura's theory of observational learning a theory that individuals can learn new skills via observation of others, has been used to drive instructional practices since its discovery (Bandura, 1997). The phenomenon of utilizing electronic media to teach skills was first recognized when Sesame Street, a television show that featured educational content, released its pilot season and received over 6 million viewers (Palmer, 2003). Since then, research has been published that illustrates the efficacy of VBIs for use with diverse populations to address various issues including maladaptive behaviors, academic deficits, daily living skills, and health awareness techniques (Brecht & Ogilby, 2008; Charlop & Milstein, 1989; Choi, 2007; Choi & Yang, 2011; Tan, Tan, & Wettasinghe, 2011; Wilcox & Jacobs, 2010). Despite these published studies, VBI treatments such as VM still lack complete acceptance as evidence-based treatments in the field of education. Reasons for the absence of validation stem from the hesitance of educators to embrace VM as a strategy for classroom use due to the technology components as well as the high number of variables that are used within each study that make it difficult to generalize to broader populations or replicate within classrooms (Dieker et al., 2009).

This research project addressed both of these problem areas by restricting the number of variables and by methodically reporting the procedures of the study to aid in duplication of the treatment in future research or classroom use. Social validity was also examined to identify the efficacy of the VM treatment as measured by the student and teacher participants.

Interpretations

This research project used a multiple baseline design to determine if high school students between the ages of 15 and 17 could increase their mathematics proficiency on the identified skill of solving two-step equations after receiving VM treatment in their classes. The first two research questions in this study targeted the impact of the treatment and the second two targeted the acceptance of the treatment among both the student and teacher participants. The data collected were analyzed using visual analysis, PND, levels of performance, and ES. PND scores were calculated by counting the number of treatment or maintenance scores that exceeded the highest baseline score, which was then converted to a percentage and used to accept or reject the null hypotheses for Research Questions 1 and 2. Cohen's d was used to calculate the ES and the results reported within the data analysis in order to provide additional information about the effectiveness of the treatment for each student.

Research Question 1 investigated whether the VM intervention could increase the student participants' achievement levels on the skill probes that targeted proficiency with solving two-step equations. In order for the null hypothesis to be rejected the nonoverlapping data points (PND) for each participant's treatment scores must have reached at least 80% when compared to their baseline scores. Research Question 2 investigated whether the student participants could maintain an improvement score of at least 50% once the treatment was removed for 1 month. In order for the null hypothesis to be rejected for Research Question 2 each participant's maintenance achievement levels must have revealed an improvement level of at least 50%, as measured by a PND analysis, when compared to their baseline. The specific levels of achievement, PND, and ES for each student are reviewed below.

In Chapter 4 I revealed that Student 1 made significant progress as a result of the VM treatment. Student 1's achievement baseline mean was 7.2 and after treatment her performance mean increased to 9. Student 1's achievement PND from baseline to intervention was calculated to be 80% and the ES was 1.48. The PND results and the large effect size from baseline to treatment indicate that the VM treatment was very successful with increasing the achievement level for Student 1on the targeted skill. Consequently, the null hypothesis for Research Question 1 for this student was rejected.

Student 1 had similar results during the posttreatment phase. Her baseline level of performance of 7.2 rose to 9.4 during the maintenance phase. Based on visual analysis Student 1's baseline to maintenance, PND was identified to be 80% and her ES which was calculated using Cohen's d was 2.84. These data reveal that Student 1 maintained her success with the targeted skill after treatment was removed for an extended amount of time and, as a result, the null hypothesis for Research Question 2 was also rejected for this student. Further support for the effectiveness of the treatment for Student 1 can be observed through the graphical analysis of her results, reported effect sizes, and through the positive comments documented by the teacher participant on her treatment fidelity form which indicated that she attended to the video's well.

The progress for Student 2 also revealed that the VM treatment had an impact on the student's achievement. The baseline mean for Student 2was 4.8 and after treatment her level of performance was 6.8. Because of several overlapping points Student 2's PND from baseline to treatment was only 60%, but the ES of 2.6 reveals that there was a positive impact as a result of the VM. As the PND results are below the 80% threshold the null hypothesis cannot be rejected for Research Question 1. PND scores of 60% are still considered to reveal moderate treatment effects so the treatment's impact is observable. Additionally, the large effect size and a visual analysis of the student's increase in achievement provide further support that the VM treatment had a positive impact the student's achievement.

Similar to Student 2's achievement from baseline to treatment, her mean performance also revealed an increase from baseline to maintenance. Student 2's mean baseline level of 4.8 increased to 6.8 during the maintenance phase. Although these scores reveal a significant increase in performance, her baseline to maintenance PND was only 20%, which is not high enough to reject the null hypothesis for Research Question 2. Although the PND does not meet the hypothesis target for Research Question 2 the ES was 2.3. This shows that Student 2 maintained her success with her achievement after treatment was removed for an extended amount of time. It is also important to note that the results of the PND suffered from two higher than normal baseline session scores. Both the null hypotheses for Research Questions 1 and 2 were accepted for Student 2. However, a strong argument can be made in support of the effectiveness of the treatment.

This progress can be observed through the graphical analysis of the student's results in Chapter 4, the reported ES, and through the comments documented by the teacher participant on her treatment fidelity form which revealed that the only distractions from the videos stemmed from other students in the classroom.

The results of Student 3 also revealed an increase in achievement across all phases. Student 3's baseline level of performance was 5.69 and during treatment her mean level of performance was 7.2. The ES for this increase in performance was 2.22. Student 3's PND from baseline to treatment was 40%. A visual analysis of the student's scores shows that because one of the baseline data points was significantly higher than the others, the PND was severely affected. Nevertheless, because the PND did not meet the target threshold of 80% the null hypothesis for Research Question 1 was not rejected for Student 3. Despite these results, the large effect size that was calculated for this comparison still demonstrates growth in achievement.

Student 3's increase in achievement could also be observed from baseline to maintenance. Her baseline level of performance of 5.69 increased to 7.2 (the same as the treatment mean) during the maintenance phase. Based on visual analysis Student 3's baseline to maintenance PND score was 60% and her baseline to maintenance achievement ES was 1.85. Consequently, the data show that Student 3 was able to maintain her success with her achievement after treatment was removed for an extended amount of time. Specifically, because the PND was above 50% the null hypothesis for Research Question 2 can be rejected for Student 3. Further support for effective maintenance of the targeted skill can also be found in the large ES, a visual analysis of the increasing trends in performance, and the positive comments on the treatment fidelity forms which demonstrated compliance with attending to videos.

Despite the low PND percentages revealed for both research questions for Student 2 and for the second research question for Student 3, there is evidence of an overall positive impact based on both visual analyses of the increasing trends of achievement and through the very large effect sizes for each student. When the levels of performance for all students are combined the positive impact of the VM treatment is further validated. The baseline mean across all participants was 5.9, the treatment mean was 7.7, and the maintenance mean was 7.6. These levels of performance reveal that the treatment improved the overall achievement of the students on the target skill by 18% during treatment, and 17% posttreatment. Further confirmation of treatment impact is revealed through the average ES for all participants from baseline to treatment and baseline to maintenance which were 2.12 and 2.33, respectively.

Social Validity

The secondary purpose of this study was to gain validation for the efficacy of VBIs, such as VM, in conjunction with their use in classroom settings. I targeted the third and fourth research questions for this purpose by focusing on the social validity of the VM treatment. Specifically, Research Questions 3 and 4 investigated whether the student and teacher participants found the VM treatment to be acceptable for increasing academic achievement. Modified rating scales were used to measure the outcomes for both of these research questions. The adapted rating scales featured Likert scaled responses for a variety of questions concerning the acceptability of the VM treatment as an instructional strategy. The teacher participant's score was obtained from a modified BIRS and the data on student acceptability were collected through a modified CIRP that featured different questions but used the same scale descriptors (i.e. 1-Strongly Disagree, 6-Strongly Agree, etc.). In order to reject the null hypotheses proposed in Research Question 3 and 4 the teacher and the student participants had to receive a mean score of at least a 4 on the modified BIRS and modified CIRP respectively.

The teacher participant's average score on the modified BIRS was a 3.88, which fell short of the score needed to reject the null hypothesis for Research Question 3. An item analysis of the teacher's scale revealed that although the teacher generally seemed to enjoy the use of the VM intervention she did not believe that it was more effective than direct instruction particularly when taking into account all of the extra components involved with the VM strategy (i.e. making the videos, cuing the videos in class, etc.). It is also pertinent to note that while the researcher assisted the teacher participant with the major components needed to effectively administer the treatment, the teacher still struggled with the technological components. Furthermore, the teacher also noted that she had to ask the students for assistance in cuing the video for several of the treatment sessions. As mentioned throughout this project, the technological component of VBIs can often turn educators away from utilizing electronic media in their classrooms. It is arguable that this teacher felt burdened by the use of technology, especially since the site school normally had minimal technologically advanced features readily available for instructional use. As a result, it is arguable that the teacher participant's acceptability ratings could have been increased if more technological support was available within the school or if a more technological savvy teacher was chosen to administer the treatment.

Despite the failure of the teacher's scores to meet efficacy expectations as measured by the BIRS, there was significant difference in the outcome for the student scales. Results of the students' scales revealed that the participants' mean scores on the modified CIRP fell above the cutoff average of 4. Their combined average was calculated to be 4.4. The combined average indicates that the students found the treatment to be acceptable for classroom use. As a result the null hypothesis for Research Question 4 was rejected.

Limitations

The main limitation of this study is the restricted ability to generalize its results to other populations and settings. This limitation stems from the restrictiveness of the study's covariables. The second limitation is one that occurs in all education-based studies and involves the inability to eliminate the effects of the regular instruction that were ongoing within the participants' classes during the data collection. Although the procedures of the study directly related to both of these limitations were intentionally selected to meet the study's purposes, their impact on the outcome of the research are outlined below.

The primary purpose of this project was to analyze the impact of VM on the proficiency of high school Algebra student's ability to solve two-step equations with rational numbers. The study identified three female high school students from the same school who were close in age and socioeconomic status and had a history of struggling with Algebra-related coursework. The specific skill chosen from the content area of mathematics and the restrictive population of students identified for the study both placed limitations on the ability to generalize this study. Although selecting the identified sample of students and the specific targeted skill made it difficult to generalize the results to a broader population they were purposely selected based on the suggestions of previous authors who conducted VM studies within the literature. In Bellini and Akullian's (2007) meta-analysis, they suggested that future researchers should try to restrict the covariables to provide further validation surrounding the use of VBIs in order to support its identification as an evidenced based treatment. Consequently, in order to find a direct correlation of the impact of the VM treatment on student achievement it was necessary to restrict the population and the variables within the research.

Aside from the limitations related to the participant demographics there are also additional restrictions with the population. Because the study occurred in the eastern section of Long Island, New York and was performed by one teacher at an alternative high school, it is difficult to generalize the treatment effects to other adolescents in general education schools or in different parts of the country. While this study did reveal success with all of participants as measured by the ES, these results may not be directly transferrable to all populations of students.

The secondary limitation to this study is the inability to eliminate the effects of regular instruction that traditionally occur during academic studies. As described by Odle and Mayer (2009), it is not possible to obtain a perfectly controlled condition in an authentic educational environment, such as a school, due to the learning that naturally occurs within the school setting. Similar to any educational-based research conducted in a school there was ongoing instruction within the participants' classes throughout the treatment administration. This ongoing instruction was originally predicted to cause the data naturally increase; however, after performing a visual analysis of the baseline sessions, the results for all participants appeared to be relatively stable. As a result, although continued classroom learning may have placed limitations on the increasing trends, the reported PND and ES for each participant are hypothesized to be accurate representations of the impact that the VM treatment had on the student's increases in achievement.

Future Research Suggestions

Future research suggestions for this area of study are recommended to involve increasing the duration of the treatment phase and the lapse between the treatment and maintenance phases. Continued research is also suggested to include multiple or progressive target skills within the scope of the study. Even though large effect sizes were reported with all students, an increased amount of treatment sessions that feature a progression of skills and an analysis of these scores over time would provide extended support and additional information about the long term impact of using VM for academic achievement.

It would also be interesting to use the VM treatment in conjunction with other treatment methods, such as the flipped classroom model which has gained validity in the field of education. The flipped classroom approach, which features the direct instruction component of learning to occur before the classroom lesson, would provide students with the opportunity to watch modeled videos outside of the classroom which would increase their background information and better prepare them for the classroom instruction related to the previewed content. Further exploration of this topic could include the use of a VSM technique which would utilize self-modeled videos which would feature the participants as the video models. With this technique the video models would be filmed while achieving success with the skills targeted for the intervention for the purpose of maintaining success with that skill or to support success on a more complex skill. This approach has been supported by Bandura in the literature, which states that by using self as the model the self-efficacy of the participant develops intrinsically (Bandura, 1977). Consequently, VSMs potential as an academic instructional strategy should be explored.

Further suggestions for future researchers would be to alter the visual medium through which the VM treatment was presented. Instead of using a desktop computer it might be beneficial to use more transportable devices such as a smart phone or a tablet. Using more portable devices would increase the student's access to the treatment making it possible to repeat viewings of instruction and access instruction in multiple settings. Because the expectations for employment in today's workforce require proficiency with technological advances, exposing students to instruction via technological devices can help better prepare them for success in our quickly advancing world.

Social Change

The first social change component targeted in this study was to address the growing need within our society to communicate and learn through technology. Today's society is rapidly changing as a result of information technology and there is an increase in demand for a flexible labor force that can adapt to these changes (Choi and Yang, 2010). By incorporating technology-based learning strategies, such as the instructional strategy of VM, into classrooms teachers can increase their student's flexibility to learn via various mediums which will make them more prepared for the learning demands of higher level institutions and employment requirements in the labor force thereafter.

A secondary philanthropic effect of this research project was the desire to reduce the hesitation that is often seen by educators surrounding the use of technology-based strategies such as VM in classroom settings. This lack of confidence has been documented in the literature which shares that VBIs that have become stigmatized for their technology requirements (Bellini, Akullian, & Hopf, 2007; Hitchcock et al., 2003; Shipley-Benamou, Lutzker, & Taubman, 2002).

To address this problem, the research procedures included training the teacher participant on the corrective use of the VM treatment with the student participants.

During the study the teacher voiced some continued hesitation surrounding the technological components of the VM treatment, but with encouragement and continued support she expressed that she was glad that she tried it. I hope that my future in the field as a school psychologist will provide additional opportunities to conduct trainings and encourage educators to utilize VBIs such as VM in their classrooms. Not only will the continued use of such strategies decrease the amount of hesitation educators experience when utilizing VBIs but will also increase our student's ability to become flexible learners who are equipped to succeed in a quickly advancing society.

Conclusion

The low proficiency among school-aged mathematics students has surfaced as one of the contributing factors to our country's dwindling economy (Resmovits, 2011). With only about 26% of high school seniors meeting proficient levels on mathematics assessments it has been hypothesized that our nation's lack of a mathematically equipped workforce is a problem that could end up costing the country upwards of 75 trillion dollars (Resmovits, 2011). Having a strong foundation in mathematical thought processes is a key component to achieving success in today's rapidly changing world and we are doing out students a disservice if we do not equip them with the skills they need to be competitive in the 21st century. As a result of these deficiencies the primary focus of this research project was to provide support for an intervention that has been documented to be successful with teaching new skills in diverse contexts and with diverse populations. The hope of providing continued support for this treatment is to encourage future researchers and educators to utilize treatments, such as VM, that have revealed success within the literature.

The theoretical basis for all video based treatment modalities is Bandura's Social Learning (Bandura, 1977). Bandura suggested that children mimic what they witness their peers doing and then will consequently change their behavior. He also proposed that if the child could watch someone that he or she was personally acquainted with an increased efficacy could be achieved. In other words, if a person can observe someone with whom they have similarities with or a connection to achieve success; he or she is more likely to believe in their own ability to mimic their success. This idea is the foundation of the peer-mediated video modeling that was utilized within this research project. The student model that was videotaped performing the skill was a peer within the same school and age group of the student participants and is therefore identified as a peer model within the scope of this research project.

The overall purpose of this research project was to examine whether VM could positively impact the academic achievement of high school students who previously struggled with Algebra related content. The outcome of the study indicated that one out of three of the students increased their achievement from baseline to treatment as measured by having at least 80% PND and two out of three students maintained their increase in achievement one month posttreatment as measured by obtaining PND scores of at least 50%. Despite the outcomes measured by the PNDs, all three student's results produced very large effect sizes in both the baseline to treatment and the baseline to maintenance comparisons. Consequently, the VM treatment was successful with increasing the student's achievement with solving two-step equations.

The secondary purpose of this research project was to address the social validity surrounding the use of VM within educational settings. According to the results the teacher participant did not find the treatment to be acceptable, however, all three of the students did find the treatment to be socially valid. Scores used to obtain these conclusions were acquired from the modified BIRS and CIRP that were administered to the teacher and student participants. The mean level of the social validity scale for the teacher participant was 3.88, which fell just below of the hypothesized average of 4. The mean level of acceptance for the student participants was 4.43, which signified treatment acceptability.

Further validation for the positive findings of this research was also observed on the treatment fidelity forms that the teacher participant completed for each student. The fidelity forms noted that all three of the students were observed to attend to the videos and only needed minimal prompts to assist in regaining their attention after the learning environment was disrupted by other students.

This research project demonstrated how incorporating technology into instructional practices can be a successful method to increase academic achievement. This is an important discovery for the field of education because as reported by the National Assessment of Educational Progress there is a severe deficiency in the percentage of students who are meeting proficiency standards in the content area of mathematics (Harris, 2013). In addition to these deficits at the education level there has also become a growing need for mathematically and technologically competent individuals in our society's workforce. This combination of the need for an increase in rigorous mathematics academic development and technology savvy professionals has sparked the desire of governing bodies to require the use of technology-based mathematics strategies, such as the one used in the study, to be used for academic development in school's throughout the country. Despite the success demonstrated by VM, a technologically enhanced strategy, in this research there is still a critical need for future research to continue to provide validation for instructional strategies that involve technology to support student's mathematics achievement and increase their flexibility with learning through various technological mediums.

References

Adams, D. (1996). Wireless laptops in the classroom (and the Sesame Street Syndrome). *Communications of the ACM, 49*, 25-27. doi: 10.1145/1151030.1151049

American Psychiatric Association. (1994*). Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text revision). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

American Psychological Association. (2010). Ethical principles of psychologists and code of conduct. Retrieved from http://www.apa.org/ethics/code/index.aspx?item=11#802

Anderson, R. (2007). Being a mathematics learner: Four faces of identity. *Mathematics Educator*, *17*, 7-14. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ841557&scope=site

Arslanyilmaz, A., & Abbas, A. (2010). e-Learning in an undergraduate e-commerce course: Instructional benefits of using modeling-videos. *International Journal of Technology*, *Knowledge & Society*, *6*, 201-214. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=66384996&scope=site

Artino, A. R. (2007). Bandura, Ross, and Ross: Observational learning and the Bobo doll. *Online Submission.* Retrieved from http://files.eric.ed.gov/fulltext/ED499095.pdf

Ayers, K. M., Maguire, A., & McClimon, D. (2009). Acquisition and generalization of chained tasks taught with computers based video instruction to children with autism. *Education and Training in Developmental Disabilities, 44*, 493-508. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ883885&scope=site

Baker, S. D., Lang, R., & O'Reilly, M. (2009). Review of video modeling with students with emotional and behavioral disorders. *Education and Treatment of Children*, *32*, 403-420. doi:10.1353/etc.0.0065

Ballard, K. D., & Crooks, T. J. (1984). Videotape modeling for preschool children with low levels of social interaction and low peer involvement in play. *Journal of Abnormal Child Psychology, 12*, 95-110. doi:10.1007/bf00913463

Bandura, A. (1965). Influence of model's reinforcement contingencies on the acquisition of imitative responses. *Journal of Personality and Social Psychology*, *1*, 589-595. doi:10.1037/h0022070

Bandura, A. (1977). *Social learning theory*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Bandura, A. (1997). *Self-efficacy: The exercise of self-control.* New York, NY: Freeman.

Bandura, A., & Mischel, W. (1965). Modification of self-imposed delay of reward through exposure to live and symbolic models. *Journal of Personality and Social Psychology*, *2*, 698-705. doi:10.1037/h0022655

Bandura, A., Ross, D., & Ross, S. A. (1961). Transmission of aggression through imitation of aggressive models. *Journal of Abnormal and Social Psychology*, *63*, 575-582. doi: 10.1037/h0045925

Bandura, A., Ross, D., & Ross, S. A. (1963). Imitation of film-mediated aggressive models. *Journal of Abnormal and Social Psychology*, *66*, 3-11.

Bandura, A. (2007). Albert Bandura. In G. Lindzey, W. M. Runyan (Eds.), *A history of psychology in autobiography, Vol. IX* (pp. 43-75). Washington, DC: American Psychological Association.

Bandura, A., & Whalen, C. K. (1966). The influence of antecedent reinforcement and divergent modeling cues on patterns of self-reward. *Journal of Personality and Social Psychology*, *3*, 373-382. doi: 10.1037/h0023022

Bar-Eli, N., & Raviv, A. (1982). Underachievers as tutors*. The Journal of Educational Research*, *75*, 139-143. doi: 10.1080/00220671.1982.10885370

Barger-Anderson, R., Domaracki, J. W., Kearney-Vakulick, N., & Kubina, R. M. (2004). Multiple baseline designs: The use of a single-case experimental design in literacy research. *Reading Improvement. 41*, 217. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=15514761&scope=site

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions or children and adolescents with autism spectrum disorders. *Exceptional Children*, *73*, 264-287. doi: 10.1177/001440290707300301

Biederman, G. B., & Freedman, B. (2007). Modeling skills, signs, and lettering for children with down syndrome, autism and other severe developmental delays by video instruction in classroom setting. *Journal of Early & Intensive Behavior Intervention, 4*, 736-743. doi: 10.1037/h0100403

Blair, N. (2012). Technology integration for the "new" 21st century learner. *Principal*, *91*, 8-11.b

Boyce, T. E. (2011). Applying social learning theory. *Training Journal*, 31-34.

Brecht, H., & Ogilby, S. M. (2008). Enabling a comprehensive teaching strategy: Video lectures. *Journal of Information Technology Education*, 7IIP.

Brooks, L. (2009). Social learning by design: The role of social media. *Knowledge Quest*, *37*, 58-60. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ869042&scope=site

Bryan, T., Burstein, K., & Bryan, J. (2001). Students with learning disabilities: Homework problems and promising practices. *Educational Psychologist*. *36*, 167-180. doi: 10.1207/s15326985ep3603_3

Carter, S.L. (2007). Review of recent treatment acceptability research. *Education and Training in Developmental Disabilities.42,* 301-316. Retrieved from http://www.dddcec.org/etmrddv/TOC/tblecontents.htm.

Charlop, M. H., & Milstein, J. P. (1989). Teaching autistic children conversational speech using video modeling. *Journal of Applied Behavior Analysis*, *22*, 275-285. doi: 10.1901/jaba.1989.22-275

Chen, B., & Bryer, T. (2012). Investigating instructional strategies for using social media in formal and informal learning. *International Review of Research in Open and Distance Learning*, *13*, 87-104. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=71275492&scope=site

Choi, H. (2007). The effect of problem-based video instruction on learner perceptions of learning and knowledge transfer. *Online Submission*. doi:10.1111/j.1467-8535.2006.00676.x

Choi, H., & Yang, M. (2011). The effect of problem-based video instruction on student satisfaction, empathy, and learning achievement in the Korean teacher education context. *Higher Education: The International Journal of Higher Education and Educational Planning*, *62*, 551-561. doi: 10.1007/s10734-010-9403-x

Cihak, D. F., & Bowlin, T. (2009). Using video modeling via handheld computers to improve geometry skills for high school students with learning disabilities. *Journal of Special Education Technology*, *24*, 17-29. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1002160&scope=site

Cihak, D. F., & Schrader, L. (2008). Does the model matter? Comparing video self-modeling and video adult modeling for task acquisition and maintenance by adolescents with autism spectrum disorders. *Journal of Special Education Technology, 23*, 8-20. Retrieved from http://www.tamcec.org/jset-index/does-the-model-matter-comparing-video-self-modeling-and-video-adult-modeling-for-task-acquisition-and-maintenance-by-adolescents-with-autism-spectrum-disorders/

Clearly, T. & Zimmerman, B. J. (2004). Self-Regulation empowerment program: A school-based program to enhance self-regulated and self-motivated cycles of student learning. *Psychology in the Schools*. *41*, 537-550. doi: 10.1002/pits.10177

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (revised edition). New York: Academic Press.

Cowan, R. J., & Sheridan, S. M. (2003). Investigating the acceptability of behavioral interventions in applied conjoint behavioral consultation: Moving from analog conditions to naturalistic settings. *School Psychology Quarterly*, *18,* 1-21. doi: 10.1521/scpq.18.1.1.20877

Creer, T. L. & Miklich, D. R. (1970). The application of a self-modeling procedure to modify inappropriate behavior: A preliminary report. *Behaviour Research and Therapy, 8*, 91-92. doi: 10.1016/0005-7967(70)90040-9

Dangwal, R., & Kapur, P. (2009). Learning through teaching: Peer-mediated instruction in minimally invasive education. *British Journal of Educational Technology*, 40, 5-22. doi: 10.1111/j.1467-8535.2008.00863.x

Darden-Brunson, F., Green, A., & Goldstein, H. (2008). Video-based instruction for children with Autism. In Luiselli, J. K. Effective practices for children with Autism: Educational and behavioral support interventions that work. (241-268). New York: Oxford University Press.

Data Warehouse (2012-2013). Madonna Heights School-school profile. Retrieved from http://www.city-data.com/school/madonna-heights-school-ny.html

Demırbaş, M., & Yağbasan, R. (2006). An evaluative study of social learning theory based scientific attitudes on academic success, gender and socio-economical level. *Educational Sciences: Theory and Practice*, *6*, 363-371. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=21558834&scope=site

Department of Education (ED), O. (2010). Transforming American education: Learning powered by technology. National Education Technology Plan, 2010. US Department Of Education.

Dieker, L. A., Lane, H. B., Allsopp, D. H., O'Brien, C., Butler, T., Kyger, M., & ... Fenty, N. S. (2009). Evaluating Video Models of Evidence-Based Instructional Practices to Enhance Teacher Learning. *Teacher Education and Special Education*, *32*, 180-196. doi: 10.1177/0888406409334202

Digital Classrooms (2014). Retrieved from http://articles.baltimoresun.com/2014-02-11/news/bs-ed-school-ipads-20140211_1_baltimore-county-superintendent-dallas-dance-digital-classrooms.

Dowrick, P. W., & Raeburn, J. M. (1977). Case study: Video editing and medication to produce a therapeutic self-model. *Journal of Consulting and Clinical Psychology*, *45*, 1156-1158. doi: 10.1037/0022-006x.45.6.1156

Dowrick, P.W. (1991). Practical guide to using video in the behavioral sciences. New York: Wiley.

Eckert, T. L., Codding, R. M., Truckenmiller, A. J., & Rheinheimer, J. L. (2009). Improving children's fluency in reading, mathematics, spelling, and writing: A review of evidence-based academic interventions. In A. Akin-Little, S. G. Little, M. A. Bray, T. J. Kehle (Eds.), Behavioral interventions in schools: Evidence-based positive strategies (pp. 111-124). Washington, DC US: American Psychological Association.

Elliot, S. & Treuting, M. (1991). The Behavior Intervention Rating Scale: Development and validation of a pretreatment acceptability and effectiveness measure. *Journal of School Psychology. 29,* 43-51. doi: 10.1016/0022-4405(91)90014-i

Evers, W.L. & Schwartz, J.C. (1973). Modifying social withdrawal in preschoolers: The effects of filmed modeling and teacher praise. *Journal of Abnormal Child Psychology, 1*, 248-256. doi: 10.1007/bf00917735

Evers-Pasquale, W., & Sherman, M. (1975). The reward value of peers: A variable influencing the efficacy of filmed modeling in modifying social isolation in preschoolers. *Journal of Abnormal Child Psychology, 3*, 179-189. doi: 10.1007/bf00916749

Fasko, S. (1994). The effects of a peer tutoring program on math fact recall and generalization. doi:10.18541/ser.2010.06.9.2.31

Fisch, S., Truglio, R. T., & Cole, C. F. (1999). The impact of Sesame Street on preschool children: A review and synthesis of 30 years' research. *Media Psychology*, *1*, 165-190. doi: 10.1207/s1532785xmep0102_5

Fuchs, L. S., & Fuchs, D. (1997). Enhancing students' helping behavior during peer-mediated instruction with conceptual. *Elementary School Journal*, *97*, 22. doi: 10.1086/461863

Fuchs, D., Fuchs, L. S., Thompson, A., Svenson, E., Yen, L., Otaiba, S. A., Yang, N., McMaster, K. N., Prentice, K., Kazdan, S. & Saenz, L. (2001). Peer-assisted learning strategies in reading. *Remedial and Special Education*, *22*, 15-21. doi: 10.1086/461923

From Sesame Street to transmediaville: The future of ready to learn. (2010). *Education Innovator*, *9*, 5-6. Retrieved from http://innovation.ed.gov/2011/02/11/from-sesame-street-to-transmediaville-the-future-of-ready-to-learn/

Gagnon, J., & Maccini, P. (2007). Teacher-reported use of empirically validated and standards-based instructional approaches in secondary mathematics. *Remedial and Special Education, 28*, 43-56. doi: 10.1177/07419325070280010501

Gardner, R., Cartledge, G., Seidl, B., Woolsey, M., Schley, G. S., & Utley, C. A. (2001). Mt. Olivet after-school program: Peer-mediated interventions for at-risk students. *Remedial and Special Education, 22*, 22-33. doi: 10.1177/074193250102200104

Gibson, C. M. (2008). The effect of adding drill and skill practice, using spatial, kinesthetic, and musical intelligences, with connected math project on mathematics achievement of 6th grade students. (Order No. 3320730, Walden University). ProQuest Dissertations and Theses, 219-n/a. Retrieved from http://search.proquest.com/docview/304411225?accountid=14872.

Goodwyn, F. D., Hatton, H. L., Vannest, K. J., & Ganz, J. B. (2013). Video modeling and video feedback interventions for students with emotional and behavioral disorders. *Beyond Behavior*, *22*, 14-18. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=91635663&scope=site

Green, V. A., Drysdale, H., Boelema, T., Smart, E., van der Meer, L., Achmadi, D., & ... Lancioni, G. (2013). Use of video modeling to increase positive peer interactions of four preschool children with social skills difficulties. *Education & Treatment of Children* (West Virginia University Press), *36*, 59-85. doi: 10.1353/etc.2013.0016

Greenfield, S. D., & McNeil, M. E. (1987). Improving math performance through a peer tutoring program. Retrieved from http://eric.ed.gov/?id=ED286735

Greenwood, C. & Hops, H. (1981). Group-oriented contingencies and peer behavior change. In P.S. Strain (Ed.) *Utilization of classroom peers as behavior change agents* (pp.189-259). doi: 10.1007/978-1-4899-2180-2_7

Grice, J. W., & Barrett, P. T. (2014). A note on Cohen's overlapping proportions of Normal distributions. *Psychological Reports*, *115*, 741-747. doi: 10.2466/03.pr0.115c29z4

Gul, S., & Vuran, S. (2010). An analysis of studies conducted video modeling in teaching social skills. *Educational Sciences: Theory and Practice*, *10*, 249-274. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ882728&scope=site

Hall, T., & Stegila, A. (2003). Peer mediated instruction and intervention. Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved January 22, 2014 from http://aim.cast.org/learn/historyarchive/backgroundpapers/peer-mediated

Harris, S. (2013). Latest reading, mathematics assessments show progress: Percentage of students in grades 4 and 8 scoring proficient or above is higher than in the 1990s. Retrieved from http://www.nagb.org/content/nagb/assets/documents/newsroom/naep-releases/2013-reading-math/2013-math-reading-release.pdf

Hitchcock, C. H., Prater, M. A., & Dowrick, P. W. (2004). Reading comprehension and fluency: Examining the effects of tutoring and video self-modeling on first grade students with reading difficulties. *Learning Disability Quarterly, 27*, 89-97. doi: 10.2307/1593644

Horner, R. H., Carr, E. G., Hale, J., Mcgee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-180. doi: 10.1177/001440290507100203

Hudson, S., Kadan, S., Lavin, K., & Vasquez, T. (2010, December 1). Improving basic math skills using technology. *Online Submission*. Retrieved from http://eric.ed.gov/?id=ED512698

Implementing the common core state standards: The role of the elementary school leader. (2013). Achieve, Inc. Retrieved from http://www.achieve.org/publications/implementing-common-core-state-standards-role-elementary-school-leader-action-brief

International Society for Technology in Education (ISTE, 2007). National educational technology standards for students. Retrieved from http://www.iste.org/standards/standards-for-students.

Ivory, T. S. (2007). Improving mathematics achievement of exceptional learners through differentiated and peer-mediated instruction. *Online Submission.* Retrieved from http://eric.ed.gov/?id=ED498376.

Jakibchuk, Z., & Smeriglio, V. L. (1976). The influence of symbolic modeling on the social behavior of preschool children with low levels of responsiveness. *Child Development, 47*, 838-841. doi: 10.2307/1128203

King-Sears, M. E. (2001). Institutionalizing peer-mediated instruction and interventions in schools: Beyond "train and hope." *Remedial and Special Education*, *22*, 89-101. doi: 10.1177/074193250102200203

Kinney, E. M., Vedora, J., & Stromer, R. (2003). Computer presented video models to teach generative spelling to a child with an autism spectrum disorder. *Journal of Positive Behavior Interventions, 5*, 22-30. doi: 10.1177/10983007030050010301

Koran, M. L., Snow, R. E., & McDonald, F. J. (1971). Teacher aptitude and observational learning of a teaching skill. *Journal of Educational Psychology*, *62*, 219-228. doi: 10.1037/h0031142

Kratochwill, T. R., & Levin, J. R. (1992). *Single-case research design and analysis: New directions for psychology and education.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M. & Shadish, W. R. (2010). Single-case designs technical documentation.

Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf

Kretchmar, J. (2008). Social learning theory. *Social Learning Theory -- Research Starters Education*, *1*. doi: 10.1007/978-1-4020-5614-7_3246

Krouse, H. (2001). Video modelling to educate patients. *Journal of Advanced Nursing, 33*, 748-757. doi: 10.1046/j.1365-2648.2001.01716.x

Lange, D. N. (1970). An application of social learning theory in affecting change in a group of student teachers using video modeling techniques. Retrieved from http://eric.ed.gov/?id=ED040131

Lester, M. A. (2000). What students said about interactive video instruction: Results of two surveys conducted by the West Suburban Post-Secondary Consortium. Retrieved from http://eric.ed.gov/?id=ED459685

Magill-Evans, J., Harrison, M. J., Benzies, K., Gierl, M., & Kimak, C. (2007). Effects of parenting education on first-time fathers' skills in interactions with their infants. *Fatherin*g, *5*, 42-57. doi:10.3149/fth.0501.42

Maheady, L., Harper, G. F., & Mallette, B. (1991). Peer-mediated instruction: A review of potential applications for special education. *Reading, Writing, and Learning Disabilities*, *7*, 75-103. doi: 10.1080/0748763910070202

Maheady, L., Sacca, M., & Harper, G. F. (1987). Classwide student tutoring teams: The effects of peer-mediated instruction on the academic performance of secondary mainstreamed students. The *Journal of Special Education*, *21*, 107-121. doi: 10.1177/002246698702100309

Main, S., & O'Rourke, J. (2011). "New directions for traditional lessons": Can handheld game consoles enhance mental mathematics skills?. *Australian Journal of Teacher Education*, *36*, 43-55. doi: 10.14221/ajte.2011v36n2.4

Matyas, T. A., & Greenwood, K. M. (1990). Visual analysis of single-case time series: effects of variability, series dependence, and magnitude of intervention effects. *Journal of Applied Behavior Analysis, 23*, 341-351. doi: 10.1901/jaba.1990.23-341

Martens, B. K., Witt, J. C., Elliott, S. N., & Darveaux, D. X. (1985). Teacher judgments concerning the acceptability of school-based interventions. *Topics in Early Childhood Special Education, 27*, 155-167. doi:10.1037/0735-7028.16.2.191

McClure, L. F., Chinsky, J. M., & Larcen, S. W. (1978). Enhancing social problem-solving performance in an elementary school setting. *Journal of Educational Psychology*, *70*, 504-513. doi:10.1037//0022-0663.70.4.504

Mechling, L. C., & Cronin, B. (2006). Computer based video instruction to teach the use of augmentative and alternative communication devices for ordering at fast food restaurants. *Journal of Special Education, 39,* 239-251. doi:10.1177/00224669060390040401

Mitchko, A., Huitric, M., Sarmineto, K., Hayes, G., Pruzan, M., & Sawyer, R. (2007). CDC's approach to educating coaches about sports-related concussion. *American Journal of Health Education*, *38*, 99-108. doi: 10.1080/19325037.2007.10598951

Mieux, D. (1993). Improving academic skills and study skills of elementary school at-risk students by peer and cross-age tutoring. Retrieved from http://eric.ed.gov/?id=ED376450.

Montgomerie, R., Little, S. G., & Akin-Little, A. (2014). Video self-modeling as an intervention technique for primary school aged children who have difficulty with oral reading fluency. *New Zealand Journal of Psychology*, 43, 18-27. Retrieved from http://www.parentcenterhub.org/repository/abstract72/

National Council of Teachers of Mathematics (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics, Inc.

National Council of Teachers of Mathematics (2001). Principles and standards for teaching mathematics. Reston, VA: National Council of Teachers of Mathematics, Inc.

National Council of Teachers of Mathematics (2006). Curriculum focal points for prekindergarten through grade 8 mathematics. Reston, VA: National Council of Teachers of Mathematics, Inc.

Neill, M., & Mathews, J. (2009). Does the use of technological interventions improve student academic achievement in mathematics and language arts for an identified group of at-risk middle school students?. *Southeastern Teacher Education Journal*, *2*, 57-65. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=41033892&scope=site

Novotney, A. (2010). Lights, camera, action!. *Monitor on Psychology*, *41*, 58-61. doi: 10.1037/e553242010-018

O'Brien, C., & Wood, C. L. (2011). Video modeling of cooperative discussion group behaviors with students with learning disabilities in a secondary content-area classroom. *Journal of Special Education Technology*, *26*, 25-40. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1001794&scope=site

O'Connor, R.D. (1969). Modification of social withdrawal through symbolic modeling. *Journal of Applied Behavior Analysis, 2*, 15-22. doi: 10.1901/jaba.1969.2-15

O'Connor, R.D. (1972). The relative efficacy of modeling, shaping, and combined procedures for the modification of social withdrawal. *Journal of Abnormal Psychology, 79*, 327-334. doi: 10.1037/h0033226

O'Malley, P., Jenkins, S., Wesley, B., Donehower, C., Rabuck, D., & Lewis, M. B. (2013). Effectiveness of using iPads to build math fluency. *Online Submission*. Retrieved from http://eric.ed.gov/?id=ED541158

Odle, T. & Mayer, R. (2009). Experimental research. Retrieved from http://www.education.com/reference/article/experimental-research/

Palmer, A. (2003, October). The street that changed everything. APA Monitor, *34*, 90-91. doi: 10.1037/e319112004-055

Parker, R. I., Hagan-Burke, S., & Vannest, K. (2007). Percentage of all non-overlapping data (PAND): An alternative to PND. *Journal of Special Education, 40*, 194-206. doi:10.1177/00224669070400040101

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education* (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Prater, M., Carter, N., Hitchcock, C., & Dowrick, P. (2012). Video self-modeling to improve academic performance: A literature review. *Psychology in The Schools*, *49*, 71-81. doi: 10.1002/pits.20617

Rao, K., Hitchcock, C. H., Boisvert, P. C., Kilpatrick, E., & Corbiell, C. (2012). Do it yourself: Video self-modeling made easy. *Teaching Exceptional Children*, *45*, 8. doi: 10.1038/nmeth0407-308

Rayner, C., Denholm, C., & Sigafoos, J. (2009). Video-based intervention for individuals with autism: Key questions that remain unanswered. *Research in Autism Spectrum Disorders,* 3, 291-303. doi:10.1016/j.rasd.2008.09.001

Resmovits, J. (2011). U.S. students' low math test proficiency could have consequences for GDP. Retrieved from http://www.huffingtonpost.com/2011/08/17/math-test-proficiency-naep-pisa_n_929498.html

Richards, L. C., Heathfield, L., & Jenson, W. R. (2010). A classwide peer-modeling intervention package to increase on-task behavior. *Psychology in the Schools*, *47*, 551-566. doi: 10.1002/pits.20490

Rowan-Kenyon, H. T., Swan, A. K., & Creager, M. F. (2012). Social cognitive factors, support, and engagement: Early adolescents' math interests as precursors to choice of career. *Career Development Quarterly*, *60*, 2-15. doi: 10.1002/j.2161-0045.2012.00001.x

Schroeder, K. (1993). All in the details. *The Education Digest*, *59*, 73-74.

Schultz, S. (2012). Using video self-modeling to increase the amount of social engagement time of young children with autism with siblings. (Order No. 3527769, Walden University). ProQuest Dissertations and Theses, 157. Retrieved from http://search.proquest.com/docview/1095158877?accountid=14872.

Schunk, D. H. (1995). Social origins of self-regulatory competence: The role of observational learning through peer modeling. Retrieved from http://files.eric.ed.gov/fulltext/ED381275.pdf

Schunk, D. H., & Hanson, A. R. (1989). Self-modeling and children's cognitive skill learning. *Journal of Educational Psychology*, *81*, 155-63. doi: 10.1037/0022-0663.81.2.155

Schunk, D. H., & Hanson, A. R. (1985). Peer models: Influence on children's self-efficacy and achievement. *Journal of Educational Psychology*, *77*, 313-22. doi 10.1037//0022-0663.77.3.313

Schunk, D. H., & Hanson, A. R. (1989). Self-modeling and children's cognitive skill learning. *Journal of Educational Psychology, 81*, 155-63. doi: 10.1037/0022-0663.81.2.155

Schwartz, I. S., & Baer, D. M. (1991). Social validity assessments: Is current practice state of the art? *Journal of Applied behavior analysis*, 24(2), 189-204. doi: 10.1901/jaba.1991.24-189

Scruggs, T. E., Mastropieri, M. A., & Marshak, L. (2012). Peer-mediated instruction in inclusive secondary social studies learning: Direct and indirect learning effects. *Learning Disabilities Research & Practice*, *27*, 12-20. doi:10.1111/j.1540-5826.2011.00346.x

Sharpley, C. E. (2007). So why aren't counselors reporting N = 1 research designs? *Journal of Counseling and Development*, *85,* 349-360. doi: /10.1002/j.1556-6678.2007.tb00483.x

Sherer, M., Pierce, K. L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schriebman, L. (2001). Enhancing conversation skills in children with autism via video technology: Which is better “self” or “other” as a model? *Behavior Modification, 25,* 140-158. doi: 10.1177/0145445501251008

Siegel, R. G., Galassi, J. P., & Ware, W. B. (1985). A comparison of two models for predicting mathematics performance: Social learning versus math aptitude–anxiety. *Journal of Counseling Psychology*, *32*, 531-538. doi: 10.1037/0022-0167.32.4.531

Sutherland, K. S., & Snyder, A. (2007). Effects of reciprocal peer tutoring and self-graphing on reading fluency and classroom behavior of middle school students with emotional or behavioral disorders. *Journal of Emotional and Behavioral Disorders*, *15*, 103-118. doi: 10.1177/10634266070150020101

Tan, A., Tan, S., & Wettasinghe, M. (2011). Learning to be a science teacher: Reflections and lessons from video-based instruction. *Australasian Journal of Educational Technology*, *27*, 446-462. doi: 10.1007/978-3-642-13166-0_28

Turner, A. (2010). Is peer-mediated video-modeling an effective social skills intervention for children with autism spectrum disorder? Retrieved from http://uwo.ca/fhs/csd/ebp/reviews/2010-11/Turner.pdf

Understanding the No Child Left Behind Act of 2001: Technology integration: Quick key No.3. (2012). Retrieved from http://www.learningpt.org/pdfs/qkey3.pdf

Utley, C. A., & Mortweet, S. L. (1997). Peer-mediated instruction and interventions. *Focus on Exceptional Children*, *29*, 1. doi: 10.1177/074193250102200101

Van Dam, D. (2012). The use of video based instruction in physical education class: Mountain biking. Retrieved from http://www.usma.edu/cfe/Literature/VanDam_12.pdf

Walsh, M. (1995). Study links television viewing, school readiness. *Education Week*, *14*, 5. Retrieved from http://www.edweek.org/ew/articles/1995/06/07/37tv.h14.html

Wang SY, Cui Y, Parrila R. (2011). Examining the effectiveness of peer-mediated and video-modeling social skills interventions for children with autism spectrum disorders: a meta-analysis in single-case research using HLM. *Research in Autism Spectrum Disorders, 5*, 562-569. doi: 10.1016/j.rasd.2010.06.023

Wedding, D. (2009). Video self-modeling: Another useful strategy for helping children with autism?. *Psyccritiques Blog*, Sep 8, 2009; np. doi:10.1037/e671812011-001.

What Works Clearinghouse, (2013). Peer-assisted learning strategies. What Works Clearinghouse Intervention Report. What Works Clearinghouse. doi: 10.1037/e596872011-001

Wilcox, F., Jacobs, G., & National Center for Postsecondary Research, (2010). Video-based supplemental instruction as an alternative to traditional developmental courses. An NCPR Working Paper. National Center for Postsecondary Research.

Wolf, M. M. (1978). Social validity: The case for subjective measurement how Applied behavior analysis is finding its heart. *Journal of Applied behavior Analysis*, 11, 203-214. doi: 10.1901/jaba.1978.11-203

Woltersdorf, M. A. (1992). Videotape self-modeling in the treatment of attention-deficit hyperactivity disorder. *Child and Behavior Family Therapy, 14*, 53-73.doi: 10.1300/j019v14n02_04

Woolfolk, A. (2007). Educational psychology (10th ed.). New York: Pearson Education, Inc.

Wright, J. C., & Hutson, A. C. (1995). *Effects of educational TV viewing of lower income preschoolers on academic skills, school readiness, and school adjustment one to three years later: A report to the Children's Television Workhop.* Lawrence, KS:

Center for Research on the Influences of Television on Children, The University of Kansas.

Zill, N., Davies, E., & Daly, M. (1994). *Viewing of Sesame Street by preschool children and its relationship to school readiness: Report prepared for the Children's Television Workshop.* Rockville, MD: Westat, Inc.

Zimmerman, B. J., & Schunk, D. H. (2003). Albert Bandura: The scholar and his contributions to educational psychology. In B. J. Zimmerman & D. H. Schunk (Eds.), Educational psychology: A century of contributions (pp. 431-457). Mahwah, NJ: Lawrence Erlbaum Associates.

Appendix A

Behavior Intervention Rating Scale

Please evaluate the intervention by circling the number which best describes agreement or disagreement with each statement. Please circle only one item for each statement.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. Video modeling would be an acceptable intervention to teach academic skills.	1	2	3	4	5	6
2. Most teachers would find video modeling an appropriate way to address skill deficits.	1	2	3	4	5	6
3. This intervention should prove to be effective for increasing academic achievement.	1	2	3	4	5	6
4. I would suggest the use of video modeling to other teachers.	1	2	3	4	5	6
5. My student's skill deficits are problematic enough to warrant the use of video modeling.	1	2	3	4	5	6
6. Most teachers would find video modeling to be a suitable intervention to increase academic achievement.	1	2	3	4	5	6
7. Most teachers would be willing to use video modeling within the classroom setting.	1	2	3	4	5	6
8. Video modeling would not result in negative side effects for my students.	1	2	3	4	5	6
9. Video modeling would be an appropriate intervention for a variety of students.	1	2	3	4	5	6
10. Video modeling is consistent with other interventions I have used in my classroom.	1	2	3	4	5	6
11. This intervention was a fair way to address my student's skill deficits.	1	2	3	4	5	6
12. Video modeling is a reasonable intervention to use with my students who struggle academically.	1	2	3	4	5	6
13. I like the procedures used in video modeling.	1	2	3	4	5	6
14. Video modeling is a good intervention to use with my student's skill deficits.	1	2	3	4	5	6
15. Overall, video modeling would be beneficial for my students.	1	2	3	4	5	6
16. Video modeling would quickly improve my student's skill deficits.	1	2	3	4	5	6
17. Video modeling would provide a quick improvement to my student's skill deficits.	1	2	3	4	5	6
18. Video modeling would improve student's	1	2	3	4	5	6

achievement to the point that it would not noticeably deviate from other classmates.						
19. Soon after using the video modeling intervention, a positive change in my students' academic performance was observed.	1	2	3	4	5	6
20. My student's achievement would remain at an improved level even after discontinuing the use of the intervention.	1	2	3	4	5	6
21. Video modeling could not only improve student's achievement in the math classroom, but could also be used for academic concerns in other classes.	1	2	3	4	5	6
22. When comparing my student's achievement before and after use of the intervention, their achievement would be more closely aligned to other students who lack the same skill deficit.	1	2	3	4	5	6
23. Video modeling should produce enough improvement in student's achievement so the skill deficit is no longer a problem.	1	2	3	4	5	6
24. Other skill deficits related to the target skill also are likely to be improved by the intervention.	1	2	3	4	5	6

Appendix B

Children's Intervention Rating Profile

Please evaluate the use of video modeling in your classroom by circling the number which best describes your agreement or disagreement with each statement. Please circle only one item for each statement.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1. The use of video modeling was fair.	1	2	3	4	5	6
2. The use of video modeling helped me to better understand the math.	1	2	3	4	5	6
3. The use of video modeling would help me learn other areas of mathematics better.	1	2	3	4	5	6
4. It would be good for my teacher to use video modeling with other classes.	1	2	3	4	5	6
5. I think that video modeling could help students do better in other subjects.	1	2	3	4	5	6
6. Most students would find video modeling to be an appropriate way to teach math skills.	1	2	3	4	5	6
7. I think that video modeling could help students do better in school.	1	2	3	4	5	6

Appendix C

VM Treatment Calendar

Student: A	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Week: 1 **Treatment:** Baseline	**Probe**: 1	**Probe:** 2	**Probe:** 3	**Probe:** 4	**Probe:** 5
Week: 2 **Treatment:** VM	**Probe**: 16	**Probe:** 17	**Probe:** 18	**Probe:** 19	**Probe:** 20
Week: 3 **Treatment:** None					
Week: 4 **Treatment:** None					
Week: 5 **Treatment:** None					
Week: 6 **Treatment:** None					
Week: 7 **Treatment:** Maintenance	**Probe**: 21	**Probe:** 22	**Probe:** 23	**Probe:** 24	**Probe:** 25
Week: 8 **Treatment:** None					
Week: 9 Treatment: None					

Student: B	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Week: 1 **Treatment:** Baseline	**Probe**: 1	**Probe:** 2	**Probe:** 3	**Probe:** 4	**Probe:** 5
Week: 2 **Treatment:** Baseline	**Probe**: 6	**Probe:** 7	**Probe:** 8	**Probe:** 9	**Probe:** 10
Week: 3 **Treatment:** VM	**Probe**: 16	**Probe:** 17	**Probe:** 18	**Probe:** 19	**Probe:** 20
Week: 4 **Treatment:** None					
Week: 5 **Treatment:** None					
Week: 6 **Treatment:** None					
Week: 7 **Treatment:** None					
Week: 8 **Treatment:** Maintenance	**Probe**: 21	**Probe:** 22	**Probe:** 23	**Probe:** 24	**Probe:** 25
Week: 9 **Treatment:** None					

Student: C	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Week: 1 **Treatment:** Baseline	**Probe**: 1	**Probe:** 2	**Probe:** 3	**Probe:** 4	**Probe:** 5
Week: 2 **Treatment:** Baseline	**Probe**: 6	**Probe:** 7	**Probe:** 8	**Probe:** 9	**Probe:** 10
Week: 3 **Treatment:** Baseline	**Probe**: 11	**Probe:** 12	**Probe:** 13	**Probe:** 14	**Probe:** 15
Week: 4 **Treatment:** VM	**Probe**: 16	**Probe:** 17	**Probe:** 18	**Probe:** 19	**Probe:** 20
Week: 5 Treatment: None					
Week: 6 Treatment: None					
Week: 7 **Treatment:** None					
Week: 8 **Treatment:** None					
Week: 9 **Treatment:** Maintenance	**Probe**: 21	**Probe:** 22	**Probe:** 23	**Probe:** 24	**Probe:** 25

Appendix D

Baseline Probes

Name: ______________________________ **Date:** _____________
Probe: 1 **Skill:** Two-Step Equations

1) $5x + 3 = 8$	Check your answer…
2) $-2x - 6 = 10$	Check your answer…

Name: ______________________________ **Date:** _____________
Probe: 2 **Skill:** Two-Step Equations

1) $7 + 3x = -5$	Check your answer…
2) $4 + 3x = 19$	Check your answer…

Appendix E

Treatment Fidelity Form

Student Number:_________

Week Number:___________

Day	**1**	**2**	**3**	**4**	**5**	**Comments**
Entire video was watched						
Only partial video was watched						
Video not shown						
Student watched with minimal prompting						
Student watched with multiple prompts						