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Video Modeling Interventions for Students With Learning Disabilities: A Systematic Review

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This paper provides a current and thorough review of the literature on the use of video modeling for students with learning disabilities published over the last four and a half decades. Eight video modeling intervention studies were retrieved and grouped into four areas: (a) mathematics, (b) reading, (c) social studies, and (d) social behavior. Effect sizes were computed to estimate the effectiveness of the video modeling interventions included in this review. Overall, the findings showed moderate to very large effects on students' academic skills and social behaviors for seven of the eight studies.

Keywords: **Video Modeling, Learning Disabilities, K-12, Review**

Introduction

Students with learning disabilities (LD) constitute, by far, the highest prevalence disability category in the United States (National Center for Education Statistics, 2018, 2019). Although these students are a heterogeneous and unique group of learners, they characteristically have academic problems (Pullen, Lane, Ashworth, & Lovelace, 2017), most notably in reading and mathematics (Pullen, 2016), that result in poor academic achievement (Horowitz, Rawe, & Whittaker, 2017). In addition to academic difficulties, students with LD are likely to struggle with social skills (White, Caniglia, Mclaughlin, & Bianco, 2018), are prone to emotional issues (Gallegos, Langley, & Villegas, 2012), and may display problem behaviors (Heward, Alber-Morgan, & Konrad, 2017). These social, emotional, and behavioral problems further impact, and in turn, might be impacted by their academic performance (Al-Yagon & Mikulincer, 2004; Moilanen, Shaw, & Maxwell, 2010; O'Neill, Cumming, Grima-Farrell, & Strnadová, 2020; Walker & Nabuzoka, 2007). Hence, helping students with LD to overcome their learning difficulties and often co-occurring social, emotional, and behavioral challenges is crucial for their success in school.

With more and more students with LD receiving instruction in general education classrooms (Cortiella & Horowitz, 2014), the need to offer individualized instruction becomes increasingly acute. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) provides the legal basis for ensuring that all

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"persons with disabilities receive the support required, within the general education system, to facilitate their effective education" (see Article 24(2)(d); Della Fina, 2017, p. 443). To put this proposition into practice, teaching approaches are required that consider each student's individual characteristics (World Health Organization, 2011). However, factoring in the enormous heterogeneity of the learning needs of students in most inclusive classrooms, finding options that live up to this standard can be extremely challenging (McLeskey & Waldron, 2011; Weiss, 2018).

Video-based instruction is, in this respect, one suitable learning tool that can offer teachers a means to differentiate instruction to support students with LD in the classroom. An option within the scope of video-based instruction is video modeling. According to Cihak, Smith, McMahon, and Ramsey (2015), video modeling "is the general term to classify interventions in which students view a video clip of a task or skill being performed followed by an opportunity to perform the task or skill" (p. 223). The strategy rests on Bandura's social cognitive theory (1986, 1997) wherein he presumed that the effectiveness of observational learning can be increased through the use of video clips as opposed to mere verbal instruction. Bandura argued that watching a person performing a task and successfully completing it would have a positive impact on the observer's self-efficacy. This may lead to an increased probability that the observer will demonstrate the respective behavior more often in the future.

Various video modeling methods such as *video modeling with other as model*, *video self-modeling*, *video prompting*, and *point-of-view video modeling*, to name a few, have been used for students with disabilities. *Video modeling with other as model* (VMO) is the most basal form of video modeling, where the target skill or behavior is modeled by an adult (VMO-A) or a peer (VMO-P), in its entirety on a video to subsequently be imitated by the learner (Bellini & Akullian, 2007). In *video self-modeling* (VSM), the learner serves as the model in the video, and later emulates the target skill by watching themselves perform it correctly (Dowrick, 1999). However, when presenting a rather complex task or behavior altogether, a learner can easily become overwhelmed while attempting to imitate it. This is especially the case for learners with low working memory capacities or short attention spans. Here, *video prompting* (VP) is the method of choice because the task is deconstructed into a sequence of simpler sub-tasks that are modeled step-by-step. The learner watches one of the sub-tasks, and immediately after is prompted to perform it before moving to the next in the sequence (Sigafoos et al., 2007). In *point-of-view video modeling* (POV), the actions to complete a task are recorded from the learner's visual perspective so the learner can see the exact movements, as they perceive them while carrying out the actions on their own without having to perform a mental rotation (Tetreault & Lerman, 2010).

Video modeling has been around for decades and has proven to be an effective learning strategy for students with disabilities, especially for those with autism (Wong et al., 2015). However, its potential in helping students with LD has not been the focus of extensive research activities, even though the benefits of video modeling interventions are so robust for other disability categories. Therefore, the aim of this paper was to provide a systematic review of the literature on the use of video modeling for students with LD. This summary of published research studies provides a comprehensive overview of: (a) the target skill or behavior that researchers taught in the studies, (b) the various types of video modeling interventions used with this population, and (c) the overall effectiveness of the video modeling interventions.

Method

Inclusion & Exclusion Criteria

For inclusion in this review, the studies had to: (a) focus on video modeling as the sole intervention, (b) include at least one participant identified with LD, (c) be conducted in a K-12 public or private school in the United States, (d) use either a single-case, experimental or quasi-experimental group research design, (e) include disaggregated data for the student(s) with LD, (f) be published between 1975 and 2019 in peer-reviewed journals, and (g) be written in English.

Studies were excluded if: (a) video modeling was paired with another strategy and was not the sole intervention (adult tutoring; Hitchcock, Prater, & Peter, 2004; self-regulated strategy development; Miller & Little, 2018) or embedded within an instructional program (Lasater & Brady, 1995; Lonnecker, Brady, McPherson, & Hawkins, 1994), (b) students were struggling readers (Bray, Kehle, Spackman, & Hintze, 1998) or identified as at-risk (Ayala & O'Connor, 2013; Dowrick, Kim-Rupnow, & Power, 2006; Montgomerie, Little, & Akin-Little, 2014), but were not formally identified with LD, and (c) individual data for the student(s) with LD was not available (Clare, Jenson, Kehle, & Bray, 2000). Doctoral dissertations, master's theses, and unpublished manuscripts or student papers were also excluded.

Search Procedures

A primary and two secondary electronic searches, an ancestral search, and a search of previous reviews were completed to ensure a thorough review of the literature. To begin the search, six electronic education and technology databases (Academic Search Ultimate [EBSCO], Education Full Text [H.W. Wilson], Education Source, ERIC [EBSCO], LearnTechLib, and PsycINFO [EBSCO]) were searched using groupings of the following subject terms ("*video modeling*", "*video self-modeling*", "*video instruction*", "*video interventions*", "*video technology*", "*video feedback*", "*video prompting*", and "*learning dis**") in kindergarten through the secondary grade levels to locate potential peer-reviewed articles from the university library system from 1975 to 2019.

The results of the initial search were downloaded and transferred into Rayyan, an online application to assist with conducting systematic reviews (rayyan.qcri.org). Duplicates were removed, leaving 68 unique documents. Two of the co-authors independently screened the title and abstract of the documents for eligibility. The documents were sorted into three folders: met ($n = 4$), possibly met ($n = 6$), and did not meet the inclusion criteria ($n = 58$). Initial reliability on the title and abstract screening was 97%. Disagreements were noted, jointly discussed, and fully resolved. After a full-text review of the articles in the possibly met folder, no other studies were found that complied with the inclusion criteria.

A second electronic search was performed with Google Scholar using the following terms: "video modeling" and "learning disabilities." This search yielded three more studies that met the inclusion criteria. A third electronic search was completed looking at all of the issues for 2019 and OnlineFirst (or Early View) in relevant LD journals and in the journals of the previously identified studies. These included: *Contemporary School Psychology*, *Insights on Learning Disabilities: From Prevailing Theories to Validated Practices*, *International Journal for Research in Learning Disabilities*, *Journal of Learning Disabilities*, *Journal of Special Education Technology*, *Learning Disabilities: A Contemporary Journal*, *Learning Disabilities: A Multidisciplinary Journal*, *Learning Disabilities Research & Practice*, *Learning Disability Quarterly*, and *Remedial and Special Education*. No additional studies were found through this search.

An ancestral search was conducted next by reviewing the reference list of the previously identified studies, which identified another study. Finally, a search of previous reviews on video modeling interventions for students with disabilities was performed that resulted in no further studies that fulfilled the inclusion criteria. Upon completion of this comprehensive review of the literature, eight studies were identified as meeting the inclusion criteria.

Coding Procedures

The included studies were coded to extract pertinent information using a coding sheet developed for this purpose. Each study was coded according to: citation of the article, participant characteristics (total number of students, number of students with LD and other disability categories, grade, age), research design, video modeling intervention, model in video, dependent variables, intervention agent, setting, format, number of sessions, maintenance, generalization, treatment fidelity, inter-observer agreement, and social validity. The first author coded the information in all the studies. To ensure the accuracy of the coding, one of the co-authors conducted inter-coder reliability on a point-to-point basis for 100% of the studies. Inter-coder reliability was very high at 99% (range = 87.50% – 100%). Both authors discussed the few discrepancies until reaching full agreement.

Data Analysis

Effect sizes for studies using experimental and quasi-experimental group designs were calculated as the difference between the posttest means of the treatment and control groups divided by the pooled standard deviation when posttest means and standard deviations were reported. If only means and standard deviations of score gains were available, effect sizes were obtained as the mean score gain of the treatment group minus the mean score gain of the control group divided by the pooled standard deviation of the gain scores, and then multiplied by $\sqrt{2(1\text{-}r)}$, with the pretest-posttest correlation *r* set to 0.80 when not provided (Glass, McGaw, & Smith, 1981; Swanson & Lussier, 2001). Effect sizes were adjusted for potential small sample bias (Hedges & Olkin, 1985). A positive effect size value indicates an effect favoring the treatment group. Effect sizes were interpreted with the following criteria (Cohen, 1988): an effect size of 0.80 or greater was considered large, moderate if in the range from 0.50 to 0.79, small if between 0.20 and 0.49, and negligible from 0.01 to 0.19.

Baseline Corrected Tau (BC-Tau; Tarlow, 2017), a non-parametric index based on Kendall's Tau rank correlation, was chosen to estimate effect sizes for single-case research design studies. The BC-Tau method yields a Tau_b coefficient that reflects the extent to which better scores are associated to the intervention, after first controlling for statistical significant monotonic baseline trend using robust Theil-Sen regression (Tarlow, 2017). BC-Tau effect sizes were obtained for each participant and dependent variable within a study, if graphed data were provided. Data were extracted from time series graphs using the GetData Graph Digitizer software®. For multiple baseline or multiple probe design studies, BC-Tau effect sizes were calculated for baseline-intervention contrasts. In the case of studies using alternating treatments designs, BC-Tau effect sizes were computed for baseline-no video modeling, baseline-video modeling, and no video modeling-video modeling contrasts. BC-Tau computations were performed using a web-based calculator (Tarlow, 2016). Baseline correction was applied if the baseline trend was significant at the 0.05 level. Conventions by Vannest and Ninci (2015) were used to interpret BC-Tau effect sizes as follows: if greater than 0.80 – very large, in the range from 0.61 to 0.80 – large, from 0.21 to 0.60 – moderate, and between 0.01 and 0.20 – small.

Results

Overall Findings

Eight video modeling intervention studies including students with LD were located that met the inclusion criteria. Four of these studies focused on mathematics (Cihak & Bowlin, 2009; Hughes, 2019; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), two on reading (Decker & Buggey, 2014; Edwards & Lambros, 2018), one study in the area of cooperative learning strategies in social studies (O'Brien & Dieker, 2008), and one study on cooperative group discussion behaviors (O'Brien & Wood, 2011).

Participants. A total of 182 students participated in the studies. Sixty-four students had LD, sixty-one of which were identified solely with LD, and three had a diagnosis of LD as their primary disability and other health impairment (OHI) as a secondary disability. Of the other participants with disabilities, one student was diagnosed with mild intellectual disability, one student with OHI and attention-deficit/hyperactivity disorder (ADHD), and another student with autism and ADHD. Three students were classified as English language learners and another three as dual language learners. Participants were enrolled in grades 3 to 12, with ages ranging from 8.7 to 18 years old.

Research Design. One study employed a quasi-experimental group design (O'Brien & Dieker, 2008). Seven studies used single-case research designs, of these, three studies utilized a multiple baseline across participants design (Decker & Buggey, 2014; Edwards & Lambros, 2018; O'Brien & Wood, 2011), two implemented a multiple probe across participants design (Hughes, 2019; Satsangi, Hammer, & Bouck, 2019), one used a multiple probe across behaviors design replicated across participants (Cihak & Bowlin, 2009), and one study employed an alternating treatments design with baseline and best treatment phases (Satsangi, Hammer, & Hogan, 2019).

Intervention. In four studies, the intervention consisted of VMO-A (Cihak & Bowlin, 2009; O'Brien & Wood, 2011; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019). In the other four studies, one study implemented VMO-P (O'Brien & Dieker, 2008), another used VSM (Edwards & Lambros, 2018), one

Table 1. ***Characteristics of the Studies***

Citation	Participants	Grade Age (y.m)	Research Design Intervention (Model) Intervention Agent	Setting Format	Number of Sessions	M/G	Treatment Fidelity (M, S, TF)	Inter-observer Agreement (M, S, IOA)	Social Validity
Mathematics									
Cihak & Bowlin, 2009	N = 3 n = 3 LD	NR 15 - 18	MPBP T: VMO-A (Teacher) Teacher	Pull-out (Home & Special Education Office) Individual	T: 3 - 6	Y/N	DO, 25%, 100%	PP, 25%, 100%	Student Interview
Hughes, 2019	N = 3 n = 1 LD n = 1 OHI, ADHD n = 1 ASD, ADHD	5 & 8 NR	MPP T: POV (Adult) Researcher	Pull-out (After School Program) 1:1	T: 7 - 8	Y/Y	NR	PP, 30%, >99%	Student Semi-structured Interview
Satsangi, Hammer, & Bouck, 2019	N = 3 n = 1 LD n = 2 LD, OHI	9 & 10 14 - 17	MPP T: VMO-A (Researcher) Researchers	Pull-out (Separate Room) 1:1	T: 5 - 6	Y/N	DO, 40%, 100%	PP, 40%, 95 - 100%	Open-ended Student Questionnaire
Satsangi, Hammer, & Hogan, 2019	N = 3 n = 2 LD, ELL n = 1 LD, OHI, ELL	9 14 - 16	ATD T_1: Explicit Instruction T_2: VMO-A (Researcher) Researchers	Pull-out (Separate Room) 1:1	T_1, T_2: 5	N/N	DO, 40%, 100%	PP, 40%, 98 - 100%	Open-ended Student Questionnaire

Table 1. *Continued*

Citation	Participants	Grade Age (y.m)	Research Design Intervention (Model) Intervention Agent	Setting Format	Number of Sessions	M/G	Treatment Fidelity (M, S, TF)	Inter-observer Agreement (M, S, IOA)	Social Validity
Reading									
Decker & Buggey, 2014	*N* = 6 *n* = 6 LD	3 - 5 8.7 - 12.1	MBP T_1: VSM (Self) T_2: VMO-P (Peer) Teacher	Pull-out (Resource Room) 1:1	T_1, T_2: 10	Y/N	NR	AT, 33.33%, 96%	Teacher Journal Log
Edwards & Lambros, 2018	*N* = 3 *n* = 2 LD, DLL *n* = 1 MID, DLL	7 12 - 13	MBP T: VSM (Self) Researchers	Pull-out (Separate Room) 1:1	T: 8 - 12	N/Y	SR, 100%, 100%	DO, 29%, 92%	Student Semi-structured Interview

Table 1. *Continued*

Citation	Participants	Grade Age (y.m)	Research Design Intervention (Model) Intervention Agent	Setting Format	Number of Sessions	M/G	Treatment Fidelity (M, S, TF)	Inter-observer Agreement (M, S, IOA)	Social Validity
Social Studies									
O'Brien & Dieker, 2008	*N* = 158 *n* = 43 LD	6 - 8 NR	Quasi-Experimental Treatment-Control C: Teacher Instruction of Cooperative Learning Strategy T: VMO-P Instruction of Cooperative Learning Strategy (Peers) Teachers	In-class (General Education Classrooms) Large Group	C, T: 1	N/N	NR	DO, 20.40%[cfd], 80 - 100%	Field Notes
Social Behavior									
O'Brien & Wood, 2011	*N* = 3 *n* = 3 LD	12 NR	MBP T: VMO-A (University Students) Project Assistant	Pull-out (Computer Lab) Small Group	T: 4 - 8	Y/N	DO, 30%, 91.60%	DO, 20%, 84 - 86.20%	Student Questionnaire & Teacher Summary

Note. Participants: ADHD = Attention-Deficit/Hyperactivity Disorder, ASD = Autism Spectrum Disorder, LD = Learning Disability, MID = Mild Intellectual Disability, OHI = Other Health Impairment, DLL = Dual Language Learner, ELL = English Language Learner. Research Design: ATD = Alternating Treatments Design, MBP = Multiple Baseline across Participants, MPBP = Multiple Probe across Behaviors Replicated across Participants, MPP = Multiple Probe across Participants. Intervention: C = Control, T = Treatment, POV = Point-of-View Video Modeling, VMO-A = Video Modeling with Other (Adult) as Model, VMO-P = Video Modeling with Other (Peer) as Model, VSM = Video Self-Modeling. M/G: M = Maintenance, G = Generalization. Treatment Fidelity: M = Method, S = % of Sessions, TF = % of Treatment Fidelity, DO = Direct Observation, SR = Self-Reporting. Inter-observer Agreement: M = Method, S = % of Sessions, IOA = % of Inter-observer Agreement, AT = Audio-Tape, DO = Direct Observation, PP = Permanent Product. Other: cfd = Computed from Data, NR = Not Reported, y.m = Year.Month.

included both VSM and VMO-P (Decker & Buggey, 2014), and one administered POV (Hughes, 2019). Among the VMO-A studies, a teacher served as the model in one study (Cihak & Bowlin, 2009), researchers in two studies (Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), and university students in another study (O'Brien & Wood, 2011).

Intervention Agent. In one study (Cihak & Bowlin, 2009), a teacher administered the procedures conducted in school, whereas the students implemented the video modeling part of the intervention at home. In the remaining seven studies, the video modeling intervention was implemented and monitored by teachers (Decker & Buggey, 2014; O'Brien & Dieker, 2008), researchers (Edwards & Lambros, 2018; Hughes, 2019; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), and a project assistant (O'Brien & Wood, 2011).

Setting. The intervention was implemented by the student at home, but training and assessment probes were administered in a special education office in one study (Cihak & Bowlin, 2009). Another study took place in several general education classrooms (O'Brien & Dieker, 2008). Six studies were conducted in a pull-out setting, where the intervention was delivered in a computer lab (O'Brien & Wood, 2011), an after school program (Hughes, 2019), a resource room (Decker & Buggey, 2014), or in a separate room (Edwards & Lambros, 2018; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019).

Format. In one study (Cihak & Bowlin, 2009), students watched the videos individually at home, while receiving training and assessments in a one-to-one format at school. Five studies used a one-to-one format (Decker & Buggey, 2014; Edwards & Lambros, 2018; Hughes, 2019; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), one study employed a three-student group format (O'Brien & Wood, 2011), and another study utilized a large group format (O'Brien & Dieker, 2008).

Number of Sessions. The number of sessions in the video modeling interventions varied widely across the eight studies. Instructional sessions per study ranged from one (O'Brien & Dieker, 2008), three to six (Cihak & Bowlin, 2009), four to eight (O'Brien & Wood, 2011), five (Satsangi, Hammer, & Hogan, 2019), five to six (Satsangi, Hammer, & Bouck, 2019), seven to eight (Hughes, 2019), eight to twelve (Edwards & Lambros, 2018), and ten (Decker & Buggey, 2014).

Maintenance & Generalization. Five studies administered follow-up measures upon completion of the intervention (Cihak & Bowlin, 2009; Decker & Buggey, 2014; Hughes, 2019; O'Brien & Wood, 2011; Satsangi, Hammer, & Bouck, 2019), and two studies performed generalization measures (Edwards & Lambros, 2018; Hughes, 2019).

Treatment Fidelity. Five studies reported treatment fidelity data (Cihak & Bowlin, 2009; Edwards & Lambros, 2018; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019; O'Brien & Wood, 2011), however, in one of the studies (Cihak & Bowlin, 2009), treatment fidelity was assessed on procedures conducted in the school, but not at the participants' home. Treatment fidelity was conducted by direct observation in four studies (Cihak & Bowlin, 2009; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019; O'Brien & Wood, 2011), and with self-reporting in another study (Edwards & Lambros, 2018). Two studies implemented treatment fidelity procedures, but did not report any data (Decker & Buggey, 2014; O'Brien & Dieker, 2008). Overall, of those studies reporting data, treatment fidelity was evaluated in 25% to 100% of the sessions, with treatment fidelity in the range of 91.60% to 100%.

Inter-observer Agreement. All eight studies collected inter-observer agreement (IOA). IOA was gathered via permanent products in four studies (Cihak & Bowlin, 2009; Hughes, 2019; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), by direct observations in three studies (Edwards & Lambros, 2018; O'Brien & Dieker, 2008; O'Brien & Wood, 2011), and through audio-tapes in another study (Decker & Buggey, 2014). IOA was assessed in 20% to 40% of the sessions, with percentages of IOA ranging from 80% to 100%.

Social Validity. Five studies conducted social validity measures. Of these, student interviews were used in three studies (Cihak & Bowlin, 2009; Edwards & Lambros, 2018; Hughes, 2019), student questionnaires in two studies (Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), and a student questionnaire and comments from a teacher summary in another study (O'Brien & Wood, 2011). Two other studies included anecdotal reports, one from teachers' comments (Decker & Buggey, 2014), and the other from field notes taken during intervention (O'Brien & Dieker, 2008).

Summary of the Video Modeling Intervention Studies

Mathematics

Three studies (Cihak & Bowlin, 2009; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019) employed a video modeling intervention to teach students to solve geometry problems, and one study (Hughes, 2019) taught students to simplify fractions.

Cihak and Bowlin (2009) used a multiple probe across behaviors design replicated across participants to evaluate the effects of VMO-A, using a handheld computer, to teach three high school students with LD to compute the perimeter of several geometry shapes (i.e., squares, rectangles, triangles, trapezoids, and polygons). Video clips were made showing the steps needed to solve the geometry problems. During intervention, the students were told to view the video clips at home while working on their geometry homework. On the following day, the students took an assessment probe, if they had no errors on the homework problems. Otherwise, they were asked to watch the videos at home again and redo the incorrect problems. Results indicated that the VMO-A intervention was highly effective to assist the students with LD to learn the steps to find the perimeter of different geometric shapes. Students demonstrated mean gains of at least 83% on the percentage of problems solved correctly across geometry skills with BC-Taus ranging from 0.72 to 0.93. Effects were maintained for six weeks after the completion of the intervention.

Employing a multiple probe across participants design, Hughes (2019) studied the effectiveness of POV instruction to teach three elementary and middle school students with disabilities, including a fifth grader with LD, to simplify fractions using concrete manipulatives (i.e., pom-poms). During the POV intervention, the students watched the video, and then completed five fraction problems. Overall, the POV intervention was very effective to teach the student with LD the use of manipulatives to simplify fractions, with a mean of 90% more problems solved correctly during intervention than in baseline, and a BC-Tau of 0.87. For this student, effects of the POV instruction were maintained several weeks after the end of the intervention; however, the student was not able to generalize the acquired skill to solve word problems that required simplification of fractions.

A multiple probe across participants design was used by Satsangi, Hammer, and Bouck (2019) to investigate the effects of VMO-A to teach students to solve area and perimeter word problems of rectangles and squares. The study included two ninth graders with LD and OHI, and one tenth grader with LD. In the VMO-A phase, the students watched a video that modeled the procedures to solve a geometry problem, and afterwards, were instructed to solve five problems on a worksheet. While working on the problems, the students could watch either part or the entire video again, if they chose. In addition, if students struggled to perform one of the steps in a problem, the interventionist instructed them to watch the corresponding part of the video. The interventionist provided further instruction if afterwards the students continued having trouble with the step. Results revealed that VMO-A was effective to improve students' accuracy to solve the geometry word problems, with mean gains from baseline to intervention ranging from 90% to 92%. BC-Taus for the percentage of problems solved correctly across participants ranged from 0.88 to 0.93. In addition, during intervention, all of the students completed independently a large percentage of steps needed to solve the problems (*M* range = 96.70% – 98.00%). Furthermore, students spent between 2.6 and 4.9 more minutes on average to solve the worksheet problems during intervention than in baseline. Effects on students' accuracy and independence of the video modeling intervention were sustained or increased over time in the maintenance phase.

Satsangi, Hammer, and Hogan (2019) utilized an alternating treatments design with baseline and best treatment phases to contrast teacher-directed explicit instruction versus VMO-A to solve area and perimeter word problems of rectangles and squares. Three high school English language learners with LD, one of which was also diagnosed with OHI, participated in the study. In the explicit instruction condition, the interventionist provided instruction and modeled the steps to solve a geometry word problem on a whiteboard. After completion of the instructional lesson, the students were required to solve five word problems on a worksheet. Students could view the whiteboard while solving the problems. During this time, if they had difficulty applying one of the steps to solve a problem, the interventionist instructed them to review the specific step on the whiteboard. Additional instruction was given if the students continued to fail to execute the step correctly. The video modeling condition followed similar procedures as those outlined in Satsangi, Hammer, and Bouck (2019). Results indicated students performed marginally better during the explicit instruction condition than in the VMO-A condition to solve geometry word problems. The students solved 100% of the problems correctly during the explicit instruction condition and between 92% to 100% on average in the VMO-A condition compared to 0% in baseline. BC-Taus across all the students were 1.00 for explicit instruction and from 0.90 to 1.00 for video modeling. BC-Taus for video modeling relative to explicit instruction ranged from -0.50 to 0.00. Moreover, students demonstrated a large degree of autonomy to apply the steps needed to solve the word problems in both explicit instruction and VMO-A (*M* range = 98.70% – 100%, 98.60% – 100%, respectively), with two of the three students performing on average a few more steps on their own during the explicit instruction condition. Overall, students solved problems faster in the explicit instruction condition (*M* range = 6.8 – 8.6 min) compared to the VMO-A condition (*M* range = 8.6 – 10.4 min).

Reading

Two studies (Decker & Buggey, 2014; Edwards & Lambros, 2018) examined the use of video modeling instruction in reading. Decker and Buggey (2014) assessed the effectiveness of VSM and VMO-P to improve the reading fluency skills of six elementary students with LD using a multiple baseline across participants design. During intervention, three participants received VSM instruction, and the other three participants were administered VMO-P instruction. In the VSM condition, the videos showed the student reading a passage fluently, whereas in the VMO-P condition, the videos presented a peer reading a passage. Students in both conditions watched the videos individually once a day, and were administered curriculum-based measures twice a week. Students in both VSM and VMO-P conditions improved their reading fluency from baseline to intervention. In particular, two of the three students in the VSM more than doubled their reading fluency level during intervention, while for the other student, the level of reading fluency showed a more modest improvement. Mean gains on correct words per minute (CWPM) for students in the VSM condition ranged between 25.00 and 85.25. Participants in the VMO-P condition displayed more moderate mean fluency gains, ranging from 20.70 to 26.50 CWPM. BC-Taus for the students with LD in the VSM and VMO-P condition ranged from 0.69 to 0.74 and 0.67 to 0.76, respectively. Fluency growth achieved by the participants in both conditions persisted or continued to improve during the maintenance phase.

Edwards and Lambros (2018) used a multiple baseline across participants design to evaluate the effects of VSM on the reading fluency of three seventh grade students, of which, two were diagnosed with LD, and one student with mild intellectual disability. The three students who participated in the study were also dual language learners. Two videos of each student were recorded during the last two baseline sessions, and edited to show the student reading a passage fluently. During the VSM sessions, the students watched themselves twice reading a passage fluently in the video. After two viewings of the video, the students read the same passage presented in the video to measure their reading fluency. The reading videos were alternated between sessions. Generalization measures to novel reading passages were conducted once a week. Overall, for the two students with LD, the VSM intervention was moderate to highly effective to improve the number of CWPM (BC-Tau range = 0.42 – 0.66) and to reduce the number of errors per minute (EPM) (BC-Tau range = 0.29 – 0.75) on the passages shown in the videos. On average, the students with LD read 21 to 22 more CWPM and made 2 to 9 fewer EPM during intervention relative to baseline. Gains on CWPM demonstrated on intervention passages did not transfer to novel passages for both students with LD; however, a decrease on EPM was observed for one of the students.

Social Studies

Using a quasi-experimental group design, O'Brien and Dieker (2008) compared the effects of traditional instruction versus VMO-P to teach middle school students a cooperative peer-mediated group learning strategy known as literature circles (Daniels, 2005). The sample consisted of 158 students, including 43 students with LD, in grades six to eight in four schools. In the control condition, the teacher delivered instruction explaining the cooperative learning strategy using traditional classroom materials, and led a student discussion of the strategy. In the VMO-P condition, the students viewed a 10-min video showing peers modeling the strategy. In both conditions, the students implemented the strategy the day after receiving instruction. Findings indicated that students with LD in the VMO-P condition outperformed their peers in the control condition, with larger effects found on the strategy related measures (*ES* range = 0.39 – 0.44) than for the content knowledge measure (*ES* = 0.05). However, no statistical differences were noted between both conditions.

Social Behavior

O'Brien and Wood (2011) analyzed the effects of VMO-A on the cooperative and group discussion behaviors of three twelfth graders with LD employing a multiple baseline across participants design. In the baseline, the students participated in a peer-mediated group learning strategy, known as Numbered Heads Together (NHT; Haydon, Maheady, & Hunter, 2010; Maheady, Michielli-Pendl, Harper, & Mallette, 2006), in social studies instruction. During intervention, the students first attended a video modeling session and then took part in NHT activities in their social studies class. Each session consisted of students watching a series of video clips demonstrating examples and non-examples of cooperative participation and group discussion behaviors. Video clips were followed by a student discussion led by prompting questions embedded in the video. Video instruction was administered to a three-student group, which included two general education students and one student with LD. Results revealed that the VMO-A intervention was moderate to very effective to improve the cooperative behaviors of students with LD from baseline to intervention (BC-Tau range = 0.59 – 0.77), and promoted higher levels of group discussion skills (BC-Tau range = 0.50 – 0.79). Average gains on cooperative behaviors and discussion skills from baseline to intervention for the students with LD ranged from 17.10% to 52.80% and from 32.70% to 58.00%, respectively. Effects of the intervention were sustained during the maintenance phase.

Discussion

The purpose of this review was to present the current state of the literature on video modeling for students with LD. Findings indicated that video modeling instruction improved academic learning and social behaviors for these students. All of the video modeling interventions demonstrated an intervention effect. In seven of the studies, effect sizes were in the moderate to very large range, however, in one of these studies (Satsangi, Hammer, & Hogan, 2019), even though the video modeling intervention was very effective, explicit instruction proved to be a slightly better strategy. The remaining study (O'Brien & Dieker, 2008) showed negligible to small effects favoring video modeling over traditional instruction. Overall, the use of video

Table 2. ***Overall Study Findings***

Citation	Intervention(s)	Dependent Variable(s)	Results for Students with LD
Mathematics			
Cihak & Bowlin, 2009	T: VMO-A	(a) Percentage of Geometry Problems Solved Correctly	(a) BC-Tau: $P_1 = 0.82^{**}, 0.77^{**}, 0.77^{**}$ $P_2 = 0.93^{**}, 0.72^{**}, 0.74^{**}$ $P_3 = 0.83^{**}, 0.75^{**}, 0.78^{**}$ M_{Gain}: P_1: 89.00%, 94.00%, 95.00% P_2: 98.00%, 93.00%, 83.00% P_3: 89.00%, 91.00%, 94.00%
Hughes, 2019	T: POV	(a) Percentage of Fraction Problems Solved Correctly	(a) BC-Tau: $P_1 = 0.87^{**}$ M_{Gain}: P_1: 90.00%
Satsangi, Hammer, & Bouck, 2019	T: VMO-A	(a) Percentage of Geometry Problems Solved Correctly (b) Percentage of Steps Completed Independently (c) Total Time to Complete Geometry Problems	(a) BC-Tau: $P_1 = 0.88^{**}$, $P_2 = 0.93^{**}$, $P_3 = 0.90^{**}$ M_{Gain}: P_1 = 90.00%, P_2 = 92.00%, P_3 = 92.00% (b) M: P_1 = 97.80%, P_2 = 96.70%, P_3 = 98.00% (c) M_{Gain}: P_1 = 4.9 min, P_2 = 3.4 min, P_3 = 2.6 min
Satsangi, Hammer, & Hogan, 2019	T_1: Explicit Instruction T_2: VMO-A	(a) Percentage of Geometry Problems Solved Correctly (b) Percentage of Steps Completed Independently (c) Total Time to Complete Geometry Problems	(a) T_1 BC-Tau: $P_1 = 1.00^{**}$, $P_2 = 1.00^{**}$, $P_3 = 1.00^{**}$ M_{Gain}: P_1 = 100.00%, P_2 = 100.00%, P_3 = 100.00% T_2 BC-Tau: $P_1 = 0.93^{**}$, $P_2 = 0.90^{**}$, $P_3 = 1.00^{**}$ M_{Gain}: P_1 = 96.00%, P_2 = 92.00%, P_3 = 100.00% T_2 vs T_1 BC-Tau: P_1 = -0.33, P_2 = -0.50, P_3 = 0.00 (b) T_1 M: P_1 = 99.30%, P_2 = 100.00%, P_3 = 98.70% T_2 M: P_1 = 98.60%, P_2 = 98.70%, P_3 = 100.00% (c) T_1 M: P_1 = 8.6 min, P_2 = 6.8 min, P_3 = 8.6 min T_2 M: P_1 = 10.4 min, P_2 = 8.6 min, P_3 = 10.2 min

Table 2. ***Continued***

Citation	Intervention(s)	Dependent Variable(s)	Results for Students with LD
Reading			
Decker & Buggey, 2014	T_1: VSM T_2: VMO-P	(a) Correct Words per Minute	(a) T_1 BC-Tau: $P_1 = 0.73$, $P_2 = 0.74^{**}$, $P_3 = 0.69^{**}$ M_{Gain}: $P_1 = 63.70$, $P_2 = 85.25$, $P_3 = 25.00$ T_2 BC-Tau: $P_4 = 0.76$, $P_5 = 0.75^{**}$, $P_6 = 0.67^{**}$ M_{Gain}: $P_4 = 20.70$, $P_5 = 25.40$, $P_6 = 26.50$
Edwards & Lambros, 2018	T: VSM	(a) Correct Words per Minute (b) Errors per Minute	(a) BC-Tau: $P_2 = 0.42^{*}$, $P_3 = 0.66^{**}$ M_{Gain}: $P_2 = 22.00$, $P_3 = 21.00$ (b) BC-Tau: $P_2 = 0.29$, $P_3 = 0.75^{**}$ $M_{Decrease}$: $P_2 = 2.00$, $P_3 = 9.00$
Social Studies			
O'Brien & Dieker, 2008	C: Teacher Instruction of Cooperative Learning Strategy T: VMO-P Instruction of Cooperative Learning Strategy	(a) Strategy Knowledge (b) Role Implementation (c) Cooperative Behavior (d) Content Knowledge	(a) T vs C $ES = 0.39$ (b) T vs C $ES = 0.39$ (c) T vs C $ES = 0.44$ (d) T vs C $ES = 0.05$
Social Behavior			
O'Brien & Wood, 2011	T: VMO-A	(a) Percentage of Cooperative Participation (b) Percentage of Higher-Level Content-Oriented Group Discussion	(a) BC-Tau: $P_1 = 0.65^{**}$, $P_2 = 0.77^{**}$, $P_3 = 0.59^{**}$ M_{Gain}: $P_1 = 52.80\%$, $P_2 = 48.60\%$, $P_3 = 17.10\%$ (b) BC-Tau: $P_1 = 0.71^{**}$, $P_2 = 0.79^{**}$, $P_3 = 0.50^{**}$ M_{Gain}: $P_1 = 47.10\%$, $P_2 = 58.00\%$, $P_3 = 32.70\%$

Note. BC-Tau = Baseline Corrected Tau, *ES* = Effect Size, $M_{Decrease}$ = Baseline Mean Minus Intervention Mean, M_{Gain} = Intervention Mean Minus Baseline Mean, P_1 = Participant 1, P_2 = Participant 2, P_3 = Participant 3, P_4 = Participant 4, P_5 = Participant 5, P_6 = Participant 6.
$^{*}p < 0.10$, $^{**}p < 0.05$.

modeling boosted the acquisition of the target skill or behavior for the students with LD. However, due to the limited empirical research-base, these results should be considered with caution.

A number of key findings emerged from this review. First, very few video modeling intervention studies that included students with LD were identified in the literature over the past 45 years, with all of these studies being published from 2008 to 2019. This was a surprising discovery, given the extensive body of research that has been conducted in the area of video modeling for students with emotional and behavioral disorders (Losinski, Wiseman, White, & Balluch 2016), intellectual disabilities (Park, Bouck, & Duenas, 2019), and autism (Qi, Barton, Collier, & Lin, 2018). The number of participants identified with LD was relatively small across the studies, ranging from one to six students with LD in the seven studies using single-case research designs, while a larger sample of students with LD participated in the only included group research design study (O'Brien & Dieker, 2008). Thus, it is difficult to generalize the results to the larger population of students with LD.

Second, seven of the studies were conducted in a pull-out setting where the students viewed the videos mostly individually. Only one study (O'Brien & Dieker, 2008) was implemented in general education classrooms, in which the students watched the instructional video as an entire class. This was also an interesting finding since most students with LD receive a large part of their instruction in a general education classroom setting (Horowitz, Rawe, & Whittaker, 2017). Therefore, it would be worth researching ways both general and special education teachers can effectively use video modeling to teach or as a supplement to their instruction in the inclusive classroom.

Third, most of the video modeling intervention studies targeted academic skills. Three focused on solving geometry problems (Cihak & Bowlin, 2009; Satsangi, Hammer, & Bouck, 2019; Satsangi, Hammer, & Hogan, 2019), and one on simplifying fractions (Hughes, 2019). Two studies targeted reading fluency (Decker & Buggey, 2014; Edwards & Lambros, 2018). One study taught a cooperative learning strategy in social studies instruction (O'Brien & Dieker, 2008). O'Brien and Wood (2011) was the only study that focused on student social behavior, specifically, cooperative and group discussion behaviors. It is noteworthy to mention that despite the fact that students with LD are inclined to suffer from emotional problems, and may engage in inappropriate classroom behaviors, no studies were found that looked at the use of video modeling in these areas.

Fourth, three types of video modeling interventions were implemented across the eight studies, VMO in two modalities (i.e., VMO-A and VMO-P), VSM, and POV, which all showed positive effects. VMO-A and POV were effective to teach students to solve problems in mathematics, however, in one study, VMO-A was less effective compared to explicit instruction. In reading, VSM appears to help students with LD to increase their reading fluency skills, in particular, VSM worked better than VMO-P to promote reading fluency. Effects of VMO-P were more marked than those of traditional instruction to teach a cooperative learning strategy in a social studies inclusive classroom, while VMO-A improved cooperative behaviors and built group discussion skills in social studies, as well. All in all, in light of these results, the three video modeling approaches seem to be beneficial interventions for students with LD.

However, because of the sparse number of studies, there is not enough empirical evidence to come to a definitive conclusion on the effectiveness of the video modeling methods on the academic and social behavior skills for these students.

Fifth, over half of the studies examined the long-lasting effects of the video modeling interventions. Although the impact of the intervention for students with LD persisted over time in the studies reporting maintenance or follow-up measures, the overall long-term benefits of video modeling instruction cannot be determined due to the limited number of studies. In the two studies that reported generalization measures, the students were unable to transfer the learning of the video modeling instruction to other related skill areas, thus, again, any significant conclusions cannot be made relating to the students' ability to generalize the effects of the video modeling interventions.

Sixth, in terms of treatment fidelity, of the eight studies, three did not report treatment fidelity data, and one study did not conduct treatment fidelity on the part of the intervention that occurred at the participants' home. This is concerning given the critical need for researchers to implement interventions with fidelity, because without knowing whether the intervention procedures were implemented as planned, it makes it difficult to determine the effectiveness of the intervention (Gresham, Gansle, Noell, Cohen, & Rosenblum, 1993).

Seventh, social validity measures and informal comments collected from teachers and students indicated that they both responded favorably towards the use of video modeling instruction. This suggests a higher likelihood that video modeling instruction will be used by teachers in class to support their instruction and by students in class and/or at home as a means to learn or reinforce their learning.

Although the findings are encouraging, more research is needed to investigate the effectiveness of video modeling, either alone or as a component of an instructional package, to teach academic skills and learning strategies in content area instruction for students with LD. For example, in mathematics, even though, the results indicated video modeling was effective to teach procedural knowledge to solve geometry and fraction problems, questions remain on its effects on other basic and higher-level mathematics skills. In reading, it would be worth investigating to what extent video modeling instruction might be useful to improve reading fluency, as in two of the works included in this review, and also on other areas of reading (i.e., phonemic awareness, phonics, vocabulary, and comprehension). Lastly, research is also warranted to determine the effects of video modeling to promote student social-emotional well-being, and to increase positive prosocial classroom behaviors.

Future research should compare different variations of video modeling interventions and their effects for students with LD. Another area of research is the identification of instructional features that can potentially increase the benefits of video modeling instruction for students with LD, such as, among others, perspective (first-person or third-person), type of model (adult, peer, self, or animated character), and viewing format (individual, dyads, small group, or classwide). Additionally, studies should also investigate further the use of portable viewing devices (e.g., smartphones, tablets, iPods) and explore ways to enhance video modeling instruction with augmented or virtual reality.

In conclusion, in view of the scant research on video modeling interventions for students with LD, much research is still required to fully determine its effectiveness for this population.

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