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Efficacy of Point-of-View Video Modeling: A Meta-Analysis

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Abstract

Point-of-view video modeling (POV), a variation of video-based modeling interventions, involves creating a video exemplar from a first-person perspective. The advantage is a significant reduction in extraneous stimuli, as well as increased efficiency in production. However, the lack of systematic analysis to evaluate differential impact on targeted outcomes for individuals with disabilities limits the identification of the population for whom POV is most appropriate, as well as the most efficacious implementation procedure. Through meta-analysis of single-subject studies using POV to improve targeted outcomes, this study identifies differential effects of participant characteristics, implementation procedures, and targeted outcomes. Results of the systematic search reveal that POV has only been implemented with individuals with developmental disabilities or an autism spectrum disorder. Analysis yielded an overall improvement rate difference (IRD) effect size of .78 (83.4% confidence interval [CI] = [.76, .80]). Furthermore, age, disability, and implementation variables moderate outcomes. Areas of future research and implications for practice are discussed.

Keywords

autism, exceptionalities, meta-analysis, research methodology, video modeling, point-of-view modeling, developmental disabilities

Video-based modeling (VBM), a category of video-based instruction (VBI), is the process of recording a model engaged in a behavior with the intended goal that the video will be viewed and the desired behavior imitated (Delano, 2007; Hitchcock, Dowrick, & Prater, 2003). VBM has proven to be effective for teaching and improving a variety of skills for individuals with autism spectrum disorder (ASD) and developmental disabilities (DD; Bellini & Akullian, 2007; Mason et al., 2013; Rai, 2008; Van Laarhoven, Zurita, Johnson, Grider, & Grider, 2009). This highly advantageous educational tool allows for the implementation of modeling to teach a new skill by providing the learner with the opportunity to view as many observations of the skill video as necessary. Using VBM procedures requires fewer resources than would be necessary with traditional in vivo modeling (Ayres & Langone, 2005).

VBM is noted to be an evidence-based practice for individuals with ASD (Bellini & Akullian, 2007; Mason, Ganz, Parker, Burke, & Camargo, 2012; Shukla-Mehta, Miller, & Callahan, 2010; Van Laarhoven et al., 2009) and offers a variety of presentation formats. The type of model utilized is the predominant variable, as one has the option of having another individual (video modeling other [VMO]) or the target individual (video self-modeling [VSM]) model the skill or behavior. VMO and VSM provide further options for the creation of the video model. For example, the video model can be implemented by showing the entire task before the target participant is asked to engage in imitation, referred to as priming (McCoy & Hermansen, 2007), or the video can be viewed one step at a time with task completion occurring between each clip, referred to as video prompting (Mechling, Pridgen, & Cronin, 2005). In addition, video modeling has been delivered alone or as a component of a treatment package that includes other interventions such as reinforcement, least-to-most prompting, and performance feedback (Shukla-Mehta et al., 2010).

Whether the video is created from a first- or third-person (Van Laarhoven et al., 2009) perspective is another intervention option to consider. Third-person perspective, currently the most common modality for recording, allows the viewer to see the video as if he/she is an onlooker. Point-of-view video modeling (POV), however, involves recording

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the video from the vantage point of the one carrying out the task (Rai, 2008; Shukla-Mehta et al., 2010).

POV modeling has been implemented to increase independent living (Alberto, Cihak, & Gama, 2005; Hammond, Whatley, Ayres, & Gast, 2010; Le Grice & Blampied, 1994), play (Hine & Wolery, 2006), and social skills (Tetreault & Lerman, 2010), as well as to decrease challenging behavior (Cihak, 2011; Cihak, Fahrenkrog, Ayres, & Smith, 2010; Schreibman, Whalen, & Stahmer, 2000), and offers advantages over the typical third-person perspective. From a production standpoint, POV requires limited preparation and editing (Rai, 2008). As the video is recorded from the visual perspective of the model, the video depicts what the model would see (Rayner, Denholm, & Sigafoos, 2009), thus minimal time is allocated to preparing the scene or the model. In addition, given the nature of the visual perspective, extraneous stimuli is not included in the video, naturally directing attention to the steps necessary to complete the desired task or demonstrate the appropriate behavior (Shukla-Mehta et al., 2010).

Despite the increased efficiency and focus on task, POV modeling has received less empirical attention than the traditional third-person option. For instance, Bellini and Akullian (2007) conducted a meta-analysis to determine the efficacy of utilizing VBM interventions for individuals with ASD. Although the analysis segregated studies based on whether the VMO or VSM was implemented, POV modeling was not considered separately. As such, the study concluded no differences between VMO and VSM—however, information regarding the efficacy of POV was not addressed. Likewise, a more recent meta-analysis of VBM interventions determining whether variations in treatment protocol moderated the overall effectiveness on targeted outcomes was conducted (Mason et al., 2013). Results indicated VMO with adult as model yielded statistically significant higher outcomes than VBM that included reinforcement as part of the intervention. However, VBM with reinforcement was found to be more efficacious than only VBM or VBM as part of a package intervention. Although this provides valuable information for future research and practical implications, the meta-analysis did not include studies utilizing POV. Given the advantages of POV, a similar analysis evaluating potential moderators related to participant characteristics as well as production and protocol variables will assist in developing more efficacious implementation procedures.

Effect Size Calculation for Single-Case Research (SCR)

Calculating effect sizes for research involving interventions such as POV for participants with disabilities can be challenging to accomplish. Heterogeneity of the population is often better suited to SCR. Data from SCR studies often contain few data points with short data series resulting in idiosyncratic patterns (Faith, Allison, & Gorman, 1997; Kratochwill et al., 2010; Parker & Vannest, 2009), which can make aggregating and computing effect sizes of intervention effects different from group meta-analytical research.

SCR historically relies on visual analysis to evaluate participant outcomes. To quantify the degree of change that occurs for each participant and to compare results across studies, a standard effect size calculation is required. Within SCR, many effect size calculations have been proposed, but the field has yet to agree upon a standard effect size measure. To consider visual analysis and effect size calculations in SCR, a "bottom-up" approach can be applied by allowing researchers to use visual analysis and the use of indices based on simple nonparametric measures yielding meaningful effect sizes (Parker & Vannest, 2012). Calculating effects sizes in SCR can be accomplished using nonparametric indices, which consider odd patterns in data. Effect size results based on a distribution-free index allow for further inferential testing to report not only effect sizes but also confidence intervals (CIs) and significant test results (Parker & Vannest, 2011).

Nonoverlap methods are distribution free and do not require data to meet parametric assumptions often needed in regression model analyses (Parker & Vannest, 2011). Selecting calculations that fit short data series is an advantage of nonoverlap methods to allow for inferential testing of the obtained effect size supported by CIs and *p* values (Parker & Vannest, 2011). Several nonoverlap effect size calculations have been used in SCR: percentage of nonoverlapping data (PND; Scruggs, Mastropieri, & Casto, 1987), percentage of all nonoverlapping pairs (PAND; Parker, Hagan-Burke, & Vannest, 2007), nonoverlap of all pairs (NAP; Parker & Vannest, 2009), percentage of data points exceeding the median (PEM; Ma, 2006), and improvement rate difference (IRD; Parker, Vannest, & Brown, 2009). However, each calculation has its own strengths and weaknesses when considering SCR data.

While PND (Scruggs et al., 1987) is most often used in SCR, PND lacks a known sampling distribution further preventing inference testing of calculated outcomes (Kratochwill et al., 2010; Parker & Vannest, 2011). Furthermore, PND as well as the other previously mentioned statistical measures can vary in statistical power resulting in large CIs (Parker & Vannest, 2011). Other methods such as regression models have been proposed; however, the resulting effect sizes do not correlate well with the more common group measures (Kratochwill et al., 2010; Shadish, Rindskopf, & Hedges, 2008).

IRD is a nonoverlap effect size measure that is well established in the field of medical research (Altman, 1999; Lewis & Clarke, 2001; Petrosino, Boruch, Rounding, McDonald, & Chalmers, 2000; Wolf, 1986) and is recognized as an accepted measure of change (Parker & Vannest, 2011; Petrosino et al., 2000). More recently, IRD has been used for meta-analytic research in the field of special education (e.g., Ganz et al., 2011; Maggin, Chafouleas, Goddard, & Johnson, 2011; Mason et al., 2012; Vannest, Davis, Davis, Mason, & Burke, 2010; Vannest, Harrison, Parker, Harvey, & Ramsey, 2010). IRD quantitatively measures the difference between the improved to not improved ratios of the control group (baseline) and treatment group (intervention; Parker & Vannest, 2011; Sackett, Richardson, Rosenberg, & Haynes, 1997). IRD is an advantageous SCR effect size as it has a "known sampling error," thus CIs are easily obtained, it is consistent with visual analysis, and can be computed rather effortlessly (Parker & Vannest, 2011; Parker et al., 2009). Furthermore, the interpretation of IRD is straightforward, making it more user friendly for those without a statistical background.

Although useful for quantifying the magnitude of change in SCR, IRD does have some limitations that must be considered when using this statistical measure. As is true of all nonoverlap techniques, IRD does have a maximum effect of 100% and does not account for the degree of mean shift between phases (Parker et al., 2009). In addition, IRD does not account for improving trends in the baseline, thus IRD does not accurately reflect the effect size when a pronounced positive trend is present in the baseline (Parker & Vannest, 2011). Finally, IRD only quantifies the magnitude of change between the contrasted phases and does not indicate that the change was caused by the independent variable (Parker et al., 2009). Thus, demonstration of a causal effect, through an evaluation of the methodological quality of the design, must first occur before the degree of change is measured.

Purpose and Research Questions

The purpose of this meta-analysis is to synthesize the evidence base of POV as an intervention for enhancing the skills of individuals with ASD and DD and to measure the effectiveness of this intervention when potential moderators are considered. This meta-analytic study of SCR utilizing POV proposes to answer the following research questions:

Research Question 1: Does POV result in substantial changes in targeted outcomes?

Research Question 2: Does the type of POV, prompting and/or priming, affect the magnitude of change on targeted outcomes?

Research Question 3: Are differential effects noted when participant characteristics such as disability and age are considered?

Research Question 4: Is POV more or less effective for different outcome variables?

Method

Study Identification

Search method. To isolate studies for inclusion in the review, a literature search was conducted utilizing the ERIC, Psychinfo, and Education Full Text databases. Limited to journals published in English, the following Boolean string searches were completed: *modeling* or *observational learning* or *video modeling* or *point-of-view modeling* and *disability* or *autism*, or *autism spectrum disorder*, or *Asperger syndrome*, or *pervasive developmental disorder*, or *PDD* or *ADHD* or *attention deficit hyperactivity disorder* or *behavior disorder** or *developmental delay* or *mental retardation* and *video* or *videotape*. The search, conducted on October 29, 2012, was not limited by date and produced 264 studies, including peer-reviewed journal articles and dissertations. Following the electronic search, prior research syntheses (Ayres & Langone, 2005; Baker, Lang, & O'Reilly, 2009; Bellini & Akullian, 2007; Delano, 2007; Hitchcock et al., 2003; Shukla-Mehta et al., 2010) were reviewed to identify additional studies that were not detected through the electronic search. This did not yield any additional studies.

Inclusion criteria. Following the search, each of the 264 studies was carefully reviewed to determine which of the studies were appropriate for inclusion in the analysis. Inclusion required that the studies meet the following criteria: (a) independent variable was POV modeling, (b) the study was an English publication, (c) the outcome variable was an observable and measurable skill (i.e., communication, social, academic, behavior, or self-help), (d) at least one of the participants had to have been identified with a disability, (e) the study utilized a SCR design establishing experimental control as evidenced by three or more phases (i.e., multiple baseline, reversal, changing criterion), and (f) raw data were included in a manner that indicated the time sequence in which the scores were obtained (i.e., line graph, table). Of the 264 articles identified through the initial database search, 18 met the initial criteria for inclusion in the study. Another was later excluded as the graphs were not clear enough to accurately count data points. The majority of the articles were excluded as the type of video modeling utilized in the study was not POV. Others were excluded because they were not SCR studies or did not include participants with disabilities. Two studies were excluded because the intervention was a combination of VSM from both a first- and third-person perspective (Cihak, 2011; Cihak et al., 2010).

The reference sections for each of the 17 studies were then manually searched as a final measure to ensure all potential studies were included in the synthesis. Any reference whose title indicated it was either an evaluation of an intervention or included video modeling in the title that had not previously been reviewed was downloaded via an electronic search engine and then reviewed to ensure that it did not meet the inclusion criteria. No additional studies were identified through the manual search.

Evaluation of Quality

An evaluation of the quality of research being reviewed is necessary to determine the internal reliability, and thus a causal effect, of a study prior to calculation of effect size and aggregation of studies (Jitendra, Burgess, & Gajria, 2011; Kratochwill et al., 2010; Lane, Kalberg, & Shepcaro, 2009). The quality, as it relates to internal validity, is established through the quality of the design and replication of effect (Kazdin, 1982). Methodical introduction of the independent variable that results in change across multiple phases and subjects is required to demonstrate internal reliability of a SCR study (Horner et al., 2005; Kratochwill et al., 2010). As a means for evaluating the evidence of SCR, What Works Clearinghouse (WWC; Kratochwill et al., 2010) established evidence standards. Prior to aggregation of studies, each individual study must at least "meet evidence standards with reservation" (Kratochwill et al., 2010).

For the purpose of this study, each of the 17 studies that met the initial inclusion criteria was evaluated by an advanced doctoral student trained in SCR and evidence standards, according to a two-part checklist based on the criteria established by WWC (Kratochwill et al., 2010). The study was first evaluated to determine whether it met the quality standards for methodological soundness study based on the following criteria from Kratochwill et al. (2010): (a) independent variable systematically manipulated when data demonstrated stability and no positive trend; (b) minimum of three demonstrations of effect at different times; (c) adequate number of phases to demonstrate effect (i.e., multiple baseline design with six phases, alternating treatment design with four repetitions of the alternating sequence, or withdrawal design with four phases); (c) minimum of three data points per phase (five for withdrawal design); (d) methodical measurement of each dependent variable; and (e) interobserver agreement (IOA) measured for 20% of data across each phase with at least 80% agreement or a minimum Cohen's kappa of .6. If the study did not meet all criteria, then it was not included in the meta-analysis. Although a component included under "demonstration of effect" for Kratochwill et al. (2010), the baselines for a minimum of three cases also had to be stable, without an increasing slope for the study to be included in the meta-analysis, as positive baseline trend precludes accurate effect size calculation in SCR (Parker et al., 2009)

Kratochwill et al. (2010) also suggested an evaluation of the study to determine a visual demonstration of effect. Excluding positive baseline trend, this includes the following criteria: (a) demonstrates consistency of level, trend, and variability across all cases; (b) uniform responding across all cases; and (c) no more than one non-effect. As the purpose of this meta-analysis was to determine the magnitude of change that occurs as a result of the implementation of POV and to identify potential factors that moderate the effectiveness, studies that met criteria as a quality study were not evaluated according to the additional criteria for demonstration of effect as established by Kratochwill et al. (2010). The justification for this is exclusion of cases in which POV was less effective or non-effective would result in a biased sample size (i.e., only those cases in which POV was effective), potentially yielding an inflated omnibus effect size and decreasing the ability to detect factors for which POV is less effective.

Isolation of Descriptive Information

Each study that met the quality evaluation criteria was further reviewed to obtain the necessary information for meta-analytical consideration of the current POV research and statistical analysis of related data. The process included summary data, coding moderator variables, and calculating effect sizes.

Specific features in each study were isolated and compiled to facilitate comprehensive assimilation of the literature base on POV. Information regarding each participant's age and disability were ascertained for each study. In addition, type of POV implemented as well as independent variable information such as use of reinforcement as well as supplementary components were identified. This information was compiled into a summary table and also utilized for coding of potential moderators.

Potential Moderators Coding

In an effort to identify variables that influence the effectiveness of POV, several potential moderators were identified. Statistical analyses of significant differences based on variations of the moderator requires nominal data, thus the relevant summary data obtained from each study was coded based on the identified moderators for the analysis. Type of POV variable, implementation variables, participant characteristics, and targeted skills were coded for each study.

Type of POV. The type of POV variable included two levels, *priming* or *prompting*. The *priming* level included any intervention in which the entire skill was viewed prior to the target participant implementing the task. The *prompting* level included any intervention in which the participant viewed the video one step at a time, completing each step in between video segments.

Implementation variables. The studies were disaggregated based on whether particular components were included as part of the POV intervention, *included* or *excluded.* A coding of *included* indicated that the particular component was a part of the POV intervention in the study and did not indicate whether other components were also included. For example, the studies including or excluding prompt did not take into account whether error correction was or was not included in the studies. Instruction included any POV intervention that included verbal and/or written instructions as part of the video. Prompt referred to any verbal or written indication to engage in the demonstrated task (e.g., "Do what you saw in the video"). Prompts to watch the video were not included. These components were considered as additional steps to the video-modeling intervention and not as component of an intervention package that also included POV.

The studies were also disaggregated based on whether the POV was part of a treatment package. The treatment package variable included three levels: *alone, with reinforcement*, and *package*; these were similar to those used in previous video-modeling meta-analysis (Mason et al., 2012; Mason et al., 2013). Studies that only included POV without any other component, including planned reinforcement, were coded as *alone*. If the study included prompting and/or instructions as described above without any other interventions, it was coded as alone as those variables are considered variations in the delivery of POV. Studies that implemented planned reinforcement, such as a preferred tangible or verbal praise for performance of the behavior without any other intervention, were coded as *reinforcement. Package* was used for those studies that included POV as part of an intervention package, with additional interventions such as least-to-most prompt, error correction, or role-play. If the study included reinforcement plus another intervention (e.g., least-to-most prompts), then the study was given the code of *package*. Prompt and Instruction, as defined above, were considered part of the POV intervention and not additional components to a treatment package.

Participant characteristics. The participant characteristics identified as being potential moderators included age and disability. The participant age variable had four levels which included *preschool* (2–5 years), *elementary* (6–10 years), *secondary* (11–17 years), and *postsecondary* (18 and older). For the participant disability category, the original plan was to include four levels: ASD, DD, learning disability (LD), and emotional-behavior disorder (EBD). However, results of the systematic search revealed the POV evidence base is limited to participants with ASD and DD. ASD was coded for any participant identified as having an ASD. DD included any participant identified as having an intellectual disability or other disability such as Tourette's syndrome or Down syndrome.

Targeted outcomes. The targeted outcomes variable addressed in the analysis was categorized according to four levels which included independent living, behavior, play, and social-communicative. *Independent living skills* included day-to-day tasks and related safety issues such as grocery shopping, cooking, and extinguishing fires. The *behavior* level encompassed decreasing maladaptive behaviors such as tantruming and off-task behaviors. The studies for which *play* was coded as the targeted skill moderator included dependent variables such as scripted play exchanges and appropriate engagement with toys. The *social-communication* level included such skills as scripted exchanges, question answering, and eye contact.

Effect Size Calculation and Replication Analysis

Effect size calculation. Given the previously mentioned advantages of IRD as well as its history of application within the medical field (Parker et al., 2009; Petrosino et al., 2000; Sackett et al., 1997), IRD was the measure chosen for the current SCR meta-analysis. The measure is further strengthened in that all included studies did not have prominent baseline trend and met quality standards criteria, indicating methodologically sound studies that demonstrated a causal relationship between POV and the targeted outcome. The included studies were conducted using a variety of SCR designs including multiple baseline, reversal, and alternating treatment. IRD was calculated for each participant and level of the included studies.

IRD contrasts were calculated based on contiguous phases only (i.e., AB, or CD). IRDs were calculated based on adjacent phases only (e.g., AB, BC) and only for those phases in which POV was implemented. When comparing multiple treatments (e.g., POV and another VBM), such as in an alternating treatment design, only the data for the POV treatment was utilized for the IRD calculation. IRD was calculated by comparing the proportions of two phases (e.g., A and B) through splitting the frequency of the overlap to remove all overlap between the phases (Parker et al., 2009).

Overlap was defined as any data point in the baseline phase that was equal to or greater than a data point in the intervention phase or, conversely, any data point in the intervention phase that was equal to or less than any data point in the baseline phase. Following identification of the overlapping data points, the graphs were evaluated to determine the fewest number of data points that would require removal to eliminate overlap. Removed data points were then divided evenly between the improved portion of the baseline ratio and the not improved portion of the intervention ratio, creating the improved to not improved ratio for each of the contrasted phases (Parker & Vannest, 2011).

The data for each IRD matrix was then analyzed utilizing the "meta-analysis of proportions" module of the Number Cruncher Statistical Software (NCSS; Hintze, 2002). In addition to providing each individual IRD effect size, the module calculates omnibus IRDs for each level of the specified moderators. The omnibus IRD effect sizes are averages obtained from individual IRDs that have been weighted based on the "inverse of the standard error." In addition to providing individual and omnibus IRD effect sizes, the statistical output provides CIs around the effect size and relevant forest plots, allowing for visual analysis.

Statistical significance. An evaluation of statistical significance was also performed, utilizing 83.4% CIs, with the goal of identifying factors that moderate the impact of POV. Although CIs of 90% have been identified as appropriate for clinical and publication purposes (Parker et al., 2009), 83.4% CIs can be utilized to identify statistically significant differences ($p = .05$) between any two compared intervals (Payton, Greenstone, & Schenker, 2003). When the upper and lower limits of two contrasted CIs for the same measure (i.e., IRD), visually analyzed in a forest plot do not overlap, a statistically significant difference ($p = .05$) equivalent to the student test of statistical significance ($p = .05$) is indicated (Payton et al., 2003; Payton, Miller, & Raun, 2000; Schenker & Gentleman, 2001).

Reliability

Inclusion/exclusion. In an effort to ensure the process resulted in a reliable review of the published literature on POV modeling, each study found in the initial search was reviewed by two raters to determine whether the inclusion criteria were met. Percentage of agreement was calculated, yielding 98% agreement.

Quality evaluation. Two raters, the first author and an advanced-level doctoral student, independently rated 67% of the initial 17 articles according to the quality standards previously described. Simple percent agreement (disagreements divided by agreements plus disagreements and then multiplied by 100) was calculated for each individual criterion and overall. Percent agreement for the quality standards was 100%. Percent agreement for the *demonstration of effect* criterion ranged from 94% to 100%. Overall percent agreement across all criteria was 99%. Criteria for which disagreements occurred were rated by a third rater, a doctoral-level researcher trained in SCR. The study was rated according to the third rater's decision.

Moderator coding. The identified moderators were independently coded by two raters for 22% of the 17 studies. Again, simple percent agreement was calculated. The percent agreement for participant characteristics, including age, gender, and disability, and targeted outcomes was 100%. The percent of agreement for type of POV was initially 75%; however, upon discussion, it was discovered that the raters were considering different treatment phases. Following this clarification, 100% agreement was obtained. Agreement for the POV components (instruction and prompting) and package (alone, with reinforcement, and package) variable codes was 87%. Again, disagreements occurred when studies included a combination of any of the variables. The studies for which disagreements occurred were discussed and recoded by each rater. Following this, 100% agreement occurred.

Data analysis. The IRDs from each study were independently calculated by two authors. IOA was again calculated using simple percent agreement. The result was 98% agreement. Disagreements, which were all due to human error, were discussed and recoded. One recoding was all that was required to obtain 100% agreement and the resulting new IRD was used in the analyses.

Results

Evaluation of Quality

Each of the 17 studies that met the initial inclusion criteria were evaluated to determine whether the methodological rigor of the study met quality standards based on WWC (Kratochwill et al., 2010) criteria. Of the 17 studies, 82% (14 studies) met the quality standards. Three of the studies failed to meet quality standards due to failure to include at least a minimum number of phases (e.g., 6 for multiple baseline design) and/or less than 3 data points in one or more phases. These three studies were not included in the meta-analysis.

Descriptive Summary

The 14 studies that met the evaluation of quality standards were evaluated for characteristics identified in the POV literature. Table 1 summarizes each study by number of participants, participant characteristics including age and disability, type of POV, components, package variable, and targeted outcomes.

Type of POV. Of the studies reviewed, two types of POV were implemented: priming and prompting. Priming was implemented in 10 (71%) of the included studies and prompting was implemented in 4 (28%) of the studies. Two studies (14%) included a POV video that contained priming and prompting. The total percentage exceeds 100% as 2 studies (Cannella-Malone et al., 2006; Cannella-Malone et al., 2011) compared the effects of prompting and priming.

Implementation variables. Instruction and prompts were coded as components of the POV intervention. Instruction was implemented in four (28%) of the studies, whereas

Table 1. Summary Data for Each POV Study Included in the Meta-Analysis.

Author	Design	Disability	Age	Target skills	Type of POV	Package
Alberto, Cihak, and Gama (2005)	ATD	DD	Secondary	Independent living	Priming	++
Bereznak, Ayres, Mechling, and Alexander (2012)	MBD	ASD	Post	Independent living	Prompting	+
Cannella-Malone et al. (2006)	MBD with ATD	ASD	Post	Independent living	Priming and prompting	a, ++
Cannella-Malone et al. (2011)	MBD with ATD	ASD, DD	Secondary	Independent living	Priming and prompting	a, ++
Hammond, Whatley, Ayres, and Gast (2010)	MBD	DD	Secondary	Independent living	Priming	+
Hine and Wolery (2006)	MBD	ASD	Preschool	Play skills	Priming	a, ++
Mechling, Gast, and Barthold (2003)	MBD	DD	Secondary, post	Independent living	Combined	++
Mechling, Gast, and Gustafson (2009)	MBD with replication	DD	Post	Independent living	Priming	+
Mechling and Collins (2012)	AATD	DD	Post	Independent living	Priming	+
Norman, Collins, and Schuster (2001)	MBD	ASD, DD	Elementary, secondary	Independent living	Combined	++
Shipley-Benamou, Lutzker, and Taubman (2002)	MBD	ASD	Preschool	Independent living	Priming	+
Sigafoos et al. (2005)	MBD	ASD, DD	Post	Independent living	Prompting	++
Tetreault and Lerman (2010)	MBD	ASD	Preschool, elementary	Social	Priming	+
Van Laarhoven, Zurita, Johnson, Grider, and Grider (2009)	AATD	DD	Secondary	Independent living	Priming	++

Note. POV = point-of-view video modeling; ATD = alternating treatment design; DD = developmental disability; MBD = multiple baseline design; ASD= autism spectrum disorder; AATD = adapted alternating treatment design; preschool = ages 2–5; elementary = ages 6–10; secondary = ages 11–17; post = ages 18 and older; a = alone; + = reinforcement; ++ = package.

prompts occurred in three (21%) of the studies. Instruction and prompts occurred in seven (50%) of the studies and neither instruction or prompts occurred in only one (7%) of the studies. The total exceeds 100% as one study (Mechling & Collins, 2012) included prompts only and instruction and prompts.

The studies were examined to determine whether POV was implemented alone, with reinforcement, or as part of a package. Three studies (21%) implemented POV alone. Six studies (43%) implemented POV with reinforcement only, whereas 8 studies (57%) implemented POV as part of a package. Again the total number exceeds 14, as 3 studies (Cannella-Malone et al., 2006; Cannella-Malone et al., 2011; Mechling & Collins, 2012) were initially implementing POV alone and then added an error correction procedure for one or more of the participants.

Participant characteristics. A total of 54 participants were included in the 14 studies. The participants were parceled into four *age* categories as defined in the method section. The preschool category included a total of 7 participants (13%) while elementary included 4 (7%). For the secondary and postsecondary categories, there were 26 (48%) and 17 (32%) students, respectively. As previously noted, the systematic search indicated POV research is limited to participants with ASD or DD. Of the 54 participants, 25 (46%) were diagnosed with ASD and 29 (53%) were diagnosed with a DD.

Targeted Skills

Although it was anticipated that the research base for POV would include a variety of targeted outcomes, the included studies covered only three areas of targeted skills. Of these, the majority, 12 studies (86%), targeted independent living skills (e.g., using an ATM machine, making popcorn, making purchases, using an iPod, putting out a fire, making food, setting the table, cleaning, and zipping a jacket). One study each (7%) evaluated the effects of POV on individualized play (e.g., engaging in play with toys) and social skills (e.g., making appropriate eye contact and scripted verbal exchanges).

IRD Calculations

Effect sizes were calculated for each data series from the 14 studies that met criteria of the quality evaluation. In addition, 83.4% CIs were calculated to allow for comparisons of differences among the dependent variable (IRD effect size) when the specified moderators are considered. From the 14 studies, a total of 129 individual IRD effect sizes were calculated. The mean IRD across effect sizes was .78 (83.4% CI = [.76, .80]). The range across the effect sizes ranged from 0 to .93, indicating other variables likely affected the effectiveness of the intervention. Thus, moderator variables were analyzed to ascertain whether implementation variables and/or participant characteristics had differential effects on the outcome variable. Additional outcome variables were analyzed to determine for which skills POV was most effective. Results are discussed below including mean IRDs and CIs, all of which were calculated at the 83.4% level for each level of the independent variables evaluated.

Type of POV. Analysis of type of POV as variable only included three levels: priming, prompting, and combined. Eleven individual IRDs were aggregated for the level of *combined* yielding an IRD effect size of .23<<.32>>.40. Given the small number of IRDs available for this calculation, the minimal effect size must be viewed with caution. Large effects sizes for both levels, priming (.72, CI = [.69, .75]) and prompting (.88, CI = [.85, .91]), were obtained. The lack of overlap between the two CIs indicates a statistically significant difference exists between priming and prompting, with prompting yielding a greater magnitude of change.

Implementation variables. Separate analyses were performed for each of the component variables, prompt and instruction, to determine whether the *inclusion* or *exclusion* of each of these yielded differential effects on targeted outcomes. The studies including prompt as part of the POV yielded a total of 80 IRDs (IRD = .79 <<.81>>.84), whereas those that excluded prompt yielded 49 IRDs (IRD = .64<<.68>>.72). The studies that included instruction yielded a total of 91 IRDs (IRD = .79<<.81>>.83) and those that excluded instruction yielded 38 IRDs (.63<<.67>>.72). Lack of overlap of the resulting CIs around the IRD effect sizes indicates the *inclusion* of each yielded a statistically significant larger effect size than the *exclusion*.

As a result of this analysis, the studies were further analyzed to determine whether differential effects occurred based on whether the POV included prompt, instruction, or both. The levels for this analysis included the following: *no instruction or prompt, prompt only, instruction only*, and *instruction and prompt*. Large effect sizes were obtained for *prompt only* (.77), *instruction only* (.75), and *instruction and prompt* (.82). As can be seen from the overlapping CIs (Figure 1), there are no statistically significant differences when either or both *instruction and prompt* are included as part of POV. A moderate effect size was obtained for *no instruction or prompt* (.55). Visual analysis of the CIs in Figure 1 indicate smaller, statistically significant differences when *no instruction or prompt* is compared with *instruction only, prompt only*, and *instruction and prompt*.

The results for the package variable analysis are also displayed in Figure 1. The large omnibus effect sizes for the levels of *alone and package*, and the moderate effect size for *reinforcement* comprised 39, 29, and 61 IRDs, respectively. As can be seen from visual analysis, the effect size obtained for *alone* (.86) is a statistically significant larger effect size than the ones obtained for *package* (.74) and *reinforcement* (.72).

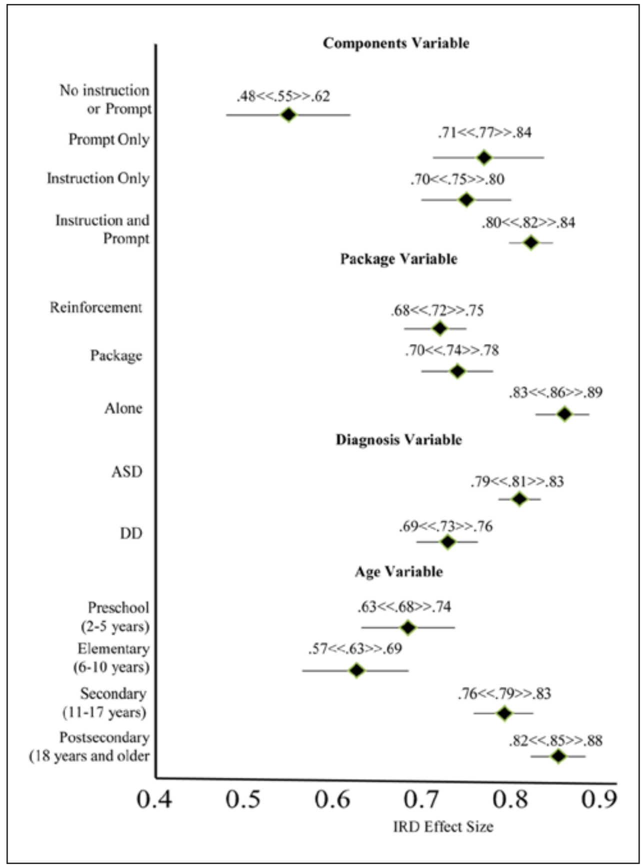

Figure 1. Forest plot of IRD effect size and 83.4% CIs for each level of the components, package, diagnosis, and age variables.
Note. IRD = improvement rate difference.

Participant characteristics. The IRD effect sizes for participants with ASD (.81) and DD (.73) demonstrated large effect sizes. Review of the forest plot (see Figure 1) indicates a statistically significant (p = .05) difference between the levels as evidenced by no overlap between plotted CIs. The level of ASD, comprised of a total of 81 IRDs, demonstrated a larger effect than the level of DD, comprised of 52 IRDs.

When considering the effect sizes based on participant ages, both *secondary* (ages 11–17) and *postsecondary* (ages 18 and older) yielded large effect sizes, .79 and .85, respectively, whereas *preschool* (ages 2–5) and *elementary* (ages 6–10) yielded moderate effect sizes, .68 and .63, respectively. Review of the forest plot in Figure 1 indicates the effect sizes obtained for preschool and elementary aged participants, an aggregation of 25 and 17 IRDs, respectively, are statistically significant (p = .05) smaller effect sizes than those obtained for *secondary* and *postsecondary* participants. In addition, the lack of overlap between *preschool* and *elementary* (see Figure 1) indicates the larger effect size obtained for *preschool* is a statistically significant (p = .05) difference when compared with *elementary*. A statistical difference between the magnitude of change for *secondary* (46 aggregated IRDs) and *postsecondary* (41 aggregated IRDs) is not indicated.

Targeted outcomes. The targeted outcomes variable included the levels of *independent living, play*, and *social-communicative* skills. *Play* was not included in the analysis as there were not enough IRDs (5) to yield reliable results. The analysis indicated large effect sizes for *independent living* skills (IRD = .79<<.81>>.83) and a moderate effect size for *social-communicative skills* (IRD = .49<<.56>>.63). The difference in effect size obtained for *social-communicative* skills compared with independent living skills is statistically significant ($p = .05$).

Discussion

VBM is a practical and portable intervention that has demonstrated high efficacy across diverse populations and skills. Video modeling with other as model and VSM have received significant attention in research, providing further guidance regarding the practical implementation of these interventions. The efficacy of POV modeling, however, has not been explored particularly in terms of moderating factors. The purpose of this meta-analysis of POV SCR was to determine whether methodologically sound POV research yielded substantial changes in targeted interventions. In addition, moderating effects of type of POV, implementation variables, participant characteristics, and targeted outcomes were explored.

Overall results indicated a large omnibus effect size across the 14 studies that met quality standards. Considering differences in type of POV implemented, moderating effects were noted between priming and prompting with prompting yielding a greater magnitude of change on targeted outcomes. This is likely due to the capitalization on the benefits of forward chaining (Cooper, Heron, & Heward, 2007), which allows for step-by-step demonstration and completion of each component of the skill sequence. POV priming, which is more of a total-task chaining (Cooper et al., 2007) technique, is likely more challenging as it requires the participant to view the entire chain of steps prior to performing the complete chain. In addition, POV with prompting necessitates some type of error correction, whether overt (i.e., participant saw the completion by the implementer or prompted to accurately complete the step; Norman, Collins, & Schuster, 2001; Sigafoos et al., 2005; Van Laarhoven et al., 2009) or covert (the implementer blocks the participants view while the step is completed; Bereznak, Ayres, Mechling, & Alexander, 2012; Cannella-Malone et al., 2006; Cannella-Malone et al., 2011).

In response to previous recommendations to identify variations in video-modeling implementation that yield differential effects (Rayner et al., 2009; Shukla-Mehta et al., 2010), another question addressed by this meta-analysis was whether levels of implementation variables moderate outcomes. The initial analysis exploring differential effects due to the inclusion or exclusion of instruction and prompts as part of the POV intervention indicated that inclusion of either or both did yield greater changes in targeted outcomes than the exclusion. This difference is likely attributable to the increased clarity in behavioral expectation that occurs due to the inclusion of instruction and/or prompts.

This study also addressed another area that has been identified as an unanswered question in regard to VBM research. As many of the VBM studies deliver VBM as part of a package, it is conceivable that the large changes in targeted outcomes are attributable to other components of the package rather than the VBM intervention (Mason et al., 2013; Rayner et al., 2009). This meta-analysis addresses this issue specifically as it relates to POV, in an effort to ascertain the efficacy of POV delivered alone compared with when it is delivered with planned reinforcement or as a component of a package. Results indicated strong changes in behavior across levels; however, POV delivered alone was stronger than the results for POV with planned reinforcement and POV as part of a package. This is a promising discovery as it indicates that POV, without other components, is an effective change agent for targeted outcomes. Inclusion of other intervention components with POV is likely unnecessary to obtain changes in targeted outcomes. In regard to the omission of reinforcement, it is likely that the completion of the targeted skills was reinforcing enough for the participants to result in change. Furthermore, as most of the participants were older in the studies that implemented POV alone, it is reasonable to assume that the targeted outcome itself was intrinsically reinforcing, perhaps due to the level of increased independence.

In regard to participant characteristics, this study revealed that unlike other types of VBM research (Mason et al., 2013), the evidence base is limited to participants with DD and ASD. Results of the analysis indicated POV to be highly effective for participants with ASD and DD, although results indicate stronger effects for those with ASD. As has previously been noted, the participants with ASD are typically more responsive to visual stimuli and VBM interventions capitalize on this preference (Bellini & Akullian, 2007; Mason et al., 2013). POV modeling takes this a step farther as extraneous stimuli is significantly reduced due to the nature of filming, allowing the viewer to focus on the relevant stimuli.

Furthermore, the majority of the research on POV has been conducted with secondary and postsecondary aged participants with disabilities, which is promising considering the dearth of interventions for this age category (Dillon, 2007; Welkowitz & Baker, 2005). Results indicate a large magnitude of change on targeted outcomes for secondary and postsecondary participants to be more efficacious than the moderate results obtained for elementary and preschool aged participants. Likewise, results indicated POV to be more efficacious for preschool participants than elementary participants. An explanation for this difference is that all of the studies with older participants targeted independent living skills whereas those with younger participants also targeted play and social-communicative skills. Given the abstract nature of the later skills, they are more challenging to learn than the more concrete independent living skills.

Finally, the presence of differential impacts as they relate to targeted outcomes when POV is implemented was evaluated. Unfortunately, results of this meta-analysis revealed that the research base for POV for targeted outcomes other than independent living skills is insufficient for ascertaining effectiveness. However, the results of this meta-analysis indicate POV to be a highly efficacious intervention for targeting independent living skills.

Limitations

A primary limitation of this analysis of the evidence base for POV for participants with disabilities is the relatively small number of included studies, although these studies did yield a substantially large number of individual effect sizes. When the data are disaggregated based on the various levels for each potential moderator, the number of IRDs for each level is further decreased. Despite this, review of the relatively narrow CIs across moderators and levels indicates the results can be viewed with confidence.

Another limitation of this study is the limited information provided in each study as it relates to participant diagnosis. Most of the studies did not provide diagnostic evidence (e.g., Autism Diagnostic Observation System [ADOS]) that the participants did meet the criteria for the identified disability, rather they utilized preexisting diagnoses (e.g., Individuals With Disabilities Education Act [IDEA] eligibility as determined by educational assessments). Given the inconsistency in assessment protocol, particularly for older participants, it is possible that some of the participants were misdiagnosed. Furthermore, given the wide range of symptomology that can occur for those with ASD, results are limited to the diagnosis and not specific participant characteristics that may moderate outcomes.

Implications for Practice

The quantitative information obtained from this meta-analysis provides support for the establishment of POV implementation guidelines. First, the results clearly indicate POV to be a worthwhile option for improving independent living skills for participants with DD and ASD across all ages. Practitioners should keep in mind that the current evidence base for POV does not extend to other skills such as play, sociocommunicative skills, or decreasing challenging behaviors. In addition, there is not sufficient evidence for the use of POV with participants with other disabilities such as LD and EBD. Despite the larger effect size obtained for secondary and postsecondary participants, results indicate POV is also an effective intervention for elementary- and preschool-age participants.

In regard to the creation of the POV video, the results indicated stronger effects when prompting was implemented as compared with priming, although both yielded strong, clinically significant effects. However, each individual will respond differently dependent upon skill level and other traits that impact learning. When choosing which type of POV to use, consideration should be given to the complexity of the targeted skill, the number of steps in the sequence that the participant has already acquired, and the participant's individual learning abilities. For more complex skills with few known steps and/or a participant who struggles with retention and cognitive acquisition, prompting is likely the more viable option. On the other hand, for more simplistic skills with a short chain of steps and/or a participant with strong retention, priming may be more suitable.

As always, another consideration when making intervention protocol decisions is the availability of resources, such as time. Considering prompting is the more time intensive version both in terms of the creation of the video clips and implementation, practitioners may choose to initially implement POV priming. If the participant does not meet expectations within a preestablished time frame, the video can easily be edited utilizing video editing software into individual clips for each step in the sequence and reintroduced utilizing POV prompting procedures.

Regardless of the type of POV chosen, inclusion of instructions within the video is highly recommended based on the results of this meta-analysis. In addition, prompts to watch the video and/or engage in the modeled behavior (i.e., Do what you saw in the video) will likely facilitate acquisition of the targeted skill. Initially presenting POV as part of a treatment package is not recommended, as POV alone had the strongest outcomes. It is recommended that POV initially be implemented alone and other components added only after evidence that POV alone is not sufficient for a given individual. In regard to the inclusion of planned reinforcement, the practitioner must take the individual learner into consideration as well as the targeted skill. Results suggest POV to be more effective without planned reinforcement, although the differences in complexity of skill for those studies with and without reinforcement were not evaluated. Again, it is suggested that consideration be given to the individual participant and the desired outcomes when making decisions regarding the necessity of including planned reinforcement. If the skill is not likely to be intrinsically reinforcing or provide natural reinforcement for a particular individual, then inclusion of planned reinforcement may be warranted.

Future Research

More research is needed to evaluate the efficacy of POV across a broader range of targeted outcomes such as increasing academic, play, and sociocommunicative skills and decreasing challenging behavior. Further research that encompasses a broader range of participants, such as those with LD, ADHD, and EBD, as well as additional studies targeting preschool and elementary participants is suggested. Given the simplicity and portability of this intervention, like all other VBM interventions, exploration of its use across populations is needed to maximize the impact.

In addition, this meta-analysis did not evaluate issues as they relate to dosage and latency. Research that explores how frequently and for what length of time the participant needs to view the video to obtain clinically significant changes is recommended. Further exploration of the optimal time frame between watching the video and engaging in the targeted outcome would assist in establishment of implementation guidelines for practitioners.

In regard to participants, research that provides substantial diagnostic information as well as details regarding the participants' diagnostic topography is important. Given the wide variation in manifestation of symptoms, particularly for participants identified with ASD, evidence that assists in determining efficacy of POV based on individual characteristics (e.g., cognitive level, imitation skills, attention, initial communication skills, etc.) rather than diagnosis is likely more relevant and practical.

In summary, POV is a highly effective intervention for increasing independent living skills for participants with ASD and DD across all ages. The large omnibus effect size was obtained from the aggregation of 129 demonstrations of effect across the 14 quality studies which were conducted by 12 different research groups and included 54 participants. This far exceeds current guidelines for qualification as an evidence-based practice (Horner et al., 2005; Kratochwill et al., 2010).

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