

Volume 4, Issue 1 March 2009

EBP *briefs*

A scholarly forum for guiding evidence-based
practices in speech-language pathology

VIDEO MODELING TO IMPROVE PLAY SKILLS
IN A CHILD WITH AUTISM: A PROCEDURE TO EXAMINE
SINGLE-SUBJECT EXPERIMENTAL RESEARCH

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EBP Briefs

A publication of Pearson

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Cite this document as:

Smith, V., Jelen, M., & Patterson, S. (2009)

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EBP Briefs 4(1), 1-13

Video Modeling to Improve Play Skills in a Child with Autism: A Procedure to Examine Single-Subject Experimental Research

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Case Example

It was recess time at Craigflower Elementary School and Maryanne, the school speech-language pathologist (SLP), was on supervision duty. Maryanne noticed a six-year-old child (DP) on her caseload who was playing by himself in the corner of the sandpit. DP was in a regular morning kindergarten classroom and has been diagnosed with autism. Components of DP's language abilities are strong and he does well at communicating his wants and needs to others. DP, however, has a difficult time communicating in a social capacity, especially when with peers. DP has received intensive behavioural home-based programming. For three years, he engaged in eight hours a day of programming upon receiving his diagnosis. DP's home-based program has been reduced to four hours a day and he currently spends three-and-a-half hours a day in an inclusive school setting. DP's language is rote, static, and lacks the intonation and fluency expected of a typical six-year-old. Additionally, his play skills are very poor and he rarely engages in social interactions with other children. DP's play skills are limited to scripted routines with static sentences and movements that are linked to specific toys and activities that he has learned in other environments.

After a discussion with DP's teacher and parents, the school-based team agreed that improving DP's play skills is a critical element of his Individualized Education Plan (IEP). Maryanne spoke with several colleagues about enhancing play skills for children. One SLP said she had success teaching play skills with an intervention called "video modeling." Maryanne briefly looked into the intervention and felt that it would be a positive strategy for DP. Maryanne mentioned the idea to DP's team who agreed it would be useful to explore. Maryanne agreed to research video modeling to determine if the approach has an evidence base and if it would be appropriate for DP.

Searching For and Retrieving the Evidence

Maryanne was familiar with the National Research Council (2002) review of the state of the science in psychosocial interventions for autism and knew that

many of the interventions used for children within the autism spectrum either had insufficient evidence or the supporting research was in a very preliminary phase. Like many other SLPs, Maryanne did not have access to a university library or a collection of journals that would help her determine if video modeling was effective at teaching children with autism play skills. She decided to strategically search Google Scholar (<http://scholar.google.com/>) utilizing methods outlined by Schwartz, Hahs-Vaugh, Zadroga and Rivera (2008). She wanted to know if there had been any research examining the effects of video modeling on the play skills of children with ASD and began her search by inputting the terms *autism, experimental research, video modeling and play skills*. She also limited her search to the years 1994 to 2009 because she was aware that the *Diagnostic and Statistical Manual of Mental Disorders-IV* (DSM-IV; American Psychiatric Association, 1994), the manual commonly used to diagnose autism, was slightly revised in 1994 and she wanted to include children who were diagnosed using the same criteria.

Maryanne's search led to an impressive but not overwhelming number of citations, 72 in total. She quickly examined the titles and removed the duplicates and irrelevant citations (44), studies that used the video-modeling intervention but did not focus on play skills (6), and citations that were descriptions of how to conduct video modeling, not potential sources of evidence (11). What remained were 11 studies that her employer agreed she could purchase from an online provider. When she received the articles electronically, she noticed an interesting phenomenon: all of the studies had utilized single-subject research designs. She knew that single-subject research was frequently used to evaluate interventions for children with developmental disabilities, especially children with autism, but before she could proceed further to evaluate the quality of these studies, Maryanne knew that she had to find out more about single-subject experimental research.

...research examining
the effects of video
modeling on the
play skills of children
with ASD

Understanding Single-Subject Experimental Research

Four phases of research typically occur in the process of establishing an evidence base for a new intervention (see Table 1). In the first phase¹, single-subject experimental designs (also referred to as single-case or N of 1 research) are a useful starting point for establishing efficacy of an intervention because they use a method that is relatively simple to execute and that provides a clear, replicable effect on a specific or a small set of behaviours. Multiple single-subject studies are often necessary to confirm if an intervention is useful for a particular population, especially in autism where the level and range of behaviours vary widely. Maryanne knew that she needed a model for examining the quality and interpreting the results of the earliest phase of research—single-case experimental designs.

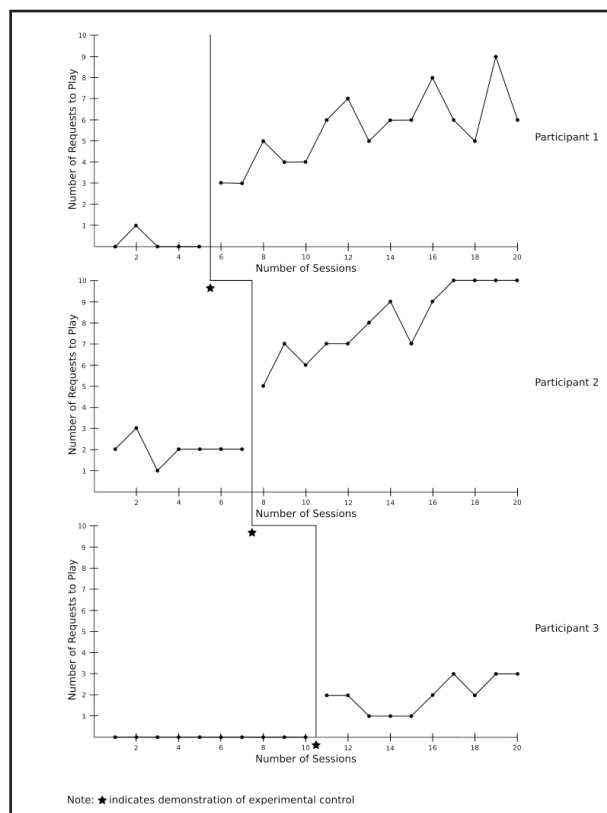
Single-subject design is experimental rather than correlational or descriptive...

To understand more about single-subject experimental research, Maryanne consulted an article by Robert Horner and his colleagues (2005) that described the features of single-case research. According to Horner et al., “Single-subject design is experimental rather than correlational or descriptive, and its purpose is to document a functional relationship between independent and dependent variables” (p. 166). After reading this statement, Maryanne looked back at the 11 articles in her retrieved pile, and realized that while it appeared Kimball, Kinney, Taylor and Stromer (2004) provided an excellent description of the outcome of a video-modeling intervention, their study was a descriptive case study. The authors did not provide numeric data that would establish an empirical, or scientific, relationship between the intervention and the targeted behaviour. Based on this assessment, she put the Kimball et al. (2004) article aside, reducing her included studies to 10.

Maryanne knew that there are a variety of single-subject experimental designs². One design, *multiple baseline*, involves the staggered introduction of the treatment across participants, behaviours, or settings. For example, after baseline data is collected for each participant in the study, a treatment is applied to one student to see if it influences

his/her behaviour in the predicted manner (e.g., social initiations increase after video-modeling intervention is implemented). If the predicted effect occurs while the next student’s baseline behaviour remains unchanged, then the treatment is applied to the next student to determine if the effect can be replicated. This systematic introduction of the treatment continues until all participants receive the intervention (see Figure 1 for an illustration of a sample graph produced in multiple baseline designs). Multiple baseline studies might also be designed to test the effect of the intervention with the one participant across different activities (e.g., play with one or more toys, play with gym equipment, etc.) or across different settings (e.g., play in three different locations) and some more complex studies might include combinations of these manipulations (e.g., three participants across three different play behaviours in three different locations).

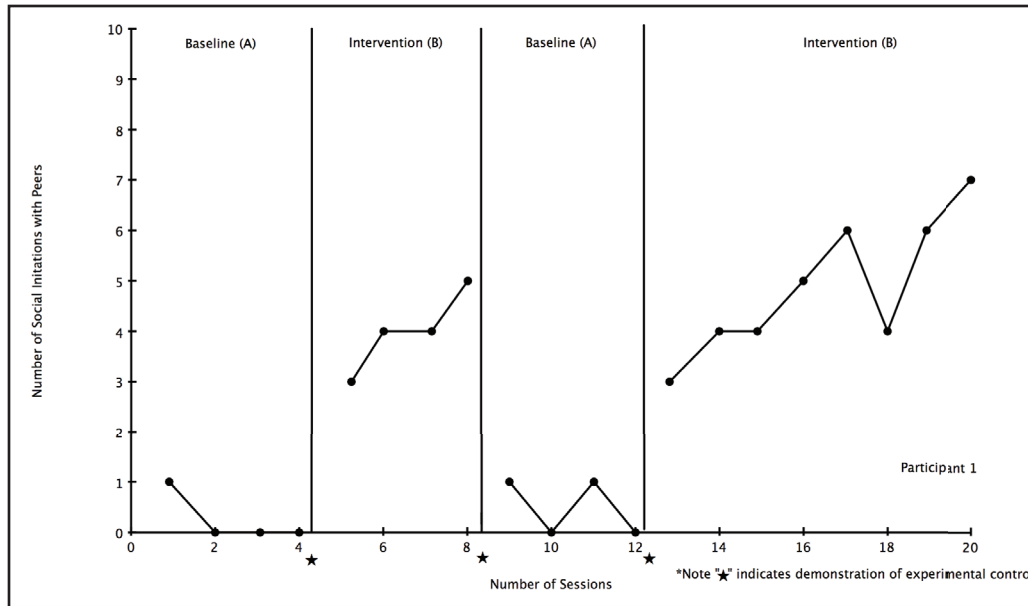
Figure 1. Multiple baseline design graph



1 Only the use of single-subject designs, a method used in the first phase of research, is addressed in this Brief. The remaining three phases of research consolidate the intervention techniques in a manual to ensure replicable implementation in the subsequent phases of efficacy and effectiveness trials. To learn more about these phases, the reader is invited to read an article written by Smith et al (2007) that describes the use of these designs in regard to interventions for children with autism.

2 Described are two single-subject research designs. We recognize that there are other methods, such as alternating treatment and changing criterion; however, the intent of this section was to describe two of the more commonly utilized designs. For more information on single-subject designs, the reader is encouraged to read Richards, Taylor, Ramasamy and Richards (1999), *Single-subject research: Applications for educational and clinical settings*.

Figure 2. ABAB design graph



ABAB (also referred to as withdrawal, or reversal design) is another single-subject experimental design. Like multiple baseline, this procedure starts by measuring the target behaviour repeatedly to establish a stable baseline of performance (A phase). Next, the treatment is introduced until it is clear that an effect has been achieved (B phase). Then, the treatment is removed to determine if the performance returns to the baseline level (A phase). This is followed by the reintroduction of the treatment to determine if the performance is again influenced (B phase). (See Figure 2 for an illustration of a sample graph produced in ABAB designs.) The reintroduction of the treatment allows the researcher to rule out that some outside influence caused the child's changed performance.

Maryanne looked over the abstracts of her remaining 10 articles and noted that all of them utilized either a multiple baseline design or withdrawal design. However, she noticed that one of the studies (Reagon, Higbee & Endicott, 2006) utilized a design that did not include a reintroduction of the treatment (this is often referred to as an AB design). Convinced that this omission diminished the study's quality because it failed to rule out that some outside influence was responsible for the child's changed behaviour, she decided to exclude this study. With the remaining nine studies, she knew that her next step was to evaluate the quality of the articles to determine if the use of video modeling to increase play skills in a child with autism is supported with scientific evidence.

Assessing the Quality of the Evidence

Maryanne decided to use the first study on her pile (D'Ateno, Mangiapanello & Taylor, 2003) to examine the components of the single-subject experimental quality rating scale developed by the American Academy of Cerebral Palsy and Developmental Medicine (AACPD) (2008). She began by briefly reading the introduction of the study. She found that the purpose of this study was to examine whether video models of adults modeling appropriate play in three play vignettes helped a preschool girl with autism use more verbal statements during play and demonstrate appropriate play with toy objects. Next, Maryanne reviewed the methods section to clearly understand how the study was conducted.

Description of Participants and Setting. Guided by the quality rating scale (see Table 2), Maryanne first examined the participants. She looked for a clear description of the participant, knowing that a clear description helps the reader determine who the intervention is appropriate for and allows others to replicate the sampled population. For example, knowing that a child has a diagnosis of autism is only part of the information needed for a study evaluating an intervention geared at play skill acquisition. Knowing how much language the child has prior to commencing

...determine if the use of video modeling to increase play skills in a child with autism is supported with scientific evidence.

the intervention, the child's behavioural challenges, and/or the child's cognitive ability are all important factors to consider as they may affect play skill acquisition. D'Ateno et al. (2003) provided a concise description of the participant and Maryanne felt satisfied that she understood the child's strengths and challenges. She knew the age of the single female participant, her standardized scores on tests measuring variables related to the dependent variable, and had a description of the participant's verbal and play behaviours. Thus, she

checked "yes" for question #1 on her rating scale.

...the description of the independent variable should explain exactly what was done during the intervention phase...

Independent Variable. Maryanne next looked at the information in the procedure section of the study to examine the *independent variable*. The *independent variable*

refers to the intervention used to change, increase, or alter the behaviour of the participants. In intervention studies, the goal of the study is to evaluate the effect of the independent variable (i.e., the intervention). It is important that the independent variable is well described to ensure that other researchers can replicate the study and that practitioners can use the intervention in a similar manner. Ideally, the description of the independent variable should explain exactly what was done during the intervention phase of a study. For example, if a study used video modeling to increase play initiations, it is not enough to say that videos were created for the participants to watch. Information about who was in the videos, what was said in the videos, which materials were used in the videos, and how long the videos lasted is important to allow for accurate replication. Additionally, understanding the research setting informs the reader of *where* the intervention can be implemented and in which environments the intervention has been examined (for example, the intervention may have been conducted only in home environments and thus, the efficacy of the intervention in the school environment may still be unknown). In considering the setting of the study, knowing if the child is in an inclusive or segregated environment or reviewing possible distracters present in the environment are examples of setting variables that can affect the results of a study. These detailed descriptions allow the reader and other researchers to have a solid understanding of the participants and setting.

The study provides a good description of the video intervention. For example, the authors describe the toys/activities in the video, who was in the video, and

clear descriptions of what was said in the video. Given this clarity, she decided that question #2 in her rating scale warranted a "yes." Maryanne also noted that the procedure used to share the video with the study participant was well described. She knew where the child watched the video, how frequently and for how long, and who shared the video with the child. She concluded that the intervention could be replicated with a different participant and scored question #3 a "yes." Next, she looked to see if the authors collected and reported data on whether the treatment was delivered as intended, in other words, implementation fidelity. In single-subject experimental research, interventions are delivered over time and it is important to maintain accurate and replicable delivery throughout. There was no report of monitoring the delivery of the videos, so Maryanne marked question #4 with a "no."

Dependent Variable. Next, Maryanne read through the *dependent variable* section of the D'Ateno et al. (2003) study. The dependent variable is the observable and measurable participant behaviour that is the focus of change. High quality descriptions of dependent variables make it clear to the reader what the behaviour of concern specifically is and what exactly it looks and/or sounds like. For example, if a

In single-subject experimental research, interventions are delivered over time...

study is evaluating how an intervention affects a child's social initiations, examples of social initiations should be provided. If the child is non-verbal, a social initiation might be described as the number of times a child taps a play partner on the shoulder, or it might be described as the number of times a child obtains eye contact from a play partner. If the child is verbal, social initiations might be described as the number of times a child says a peer's name or the number of times a child asks a peer a question. Maryanne noted that there were four dependent variables in the D'Ateno et al. (2003) study. She felt satisfied that the dependent variables were well described and she could actually picture working on some of these behavioural goals with DP and other children on her caseload; consequently, she marked question #5 "yes."

Next, Maryanne looked through the article to find the section entitled interobserver agreement. Researcher bias is removed in high-quality research by using more than one rater to evaluate a participant's behaviours. The independent ratings of each observer can then be compared to examine if any inconsistencies are present.

This is called *interrater reliability*. The higher the score on interrater reliability (0-100%) the better, because this indicates that observers are all interpreting the observable behaviours in the same way. Clinicians are advised to look for interrater data collected on at least 20% of the sessions with a minimum of 80% agreement between at least two raters (Reichow, Volkmer, & Cicchetti, 2007). Ideally, the dependent variables should be assessed with more than one rater during every phase of the study: the baseline, the intervention, and follow-up/generalization. Additionally, high-quality research eliminates bias by ensuring that the raters are unaware, or blind, to the phase of the study. Maryanne was pleased to see that

The higher the score on interrater reliability (0-100%) the better...

interobserver agreement was calculated for both the baseline and intervention phases of the study and marked question #6 “yes.” However, she did not read anything about either of the raters

being blind to the treatment conditions, an important consideration to reduce rater bias. Therefore, question #7 in her rating scale was checked “no.”

For question #8, Maryanne examined the *baseline* section of the graphs. It is important that the repeated measures taken before the intervention is applied are stable, in other words, the “typical” pattern of that behaviour is clear. Also, it is important that it is clear that the participant’s behaviour of interest is not changing in the manner expected after application of the intervention. For example, if a video-modeling intervention is expected to increase sharing, then the child should not show a steady increase in sharing prior to the start of the intervention. This is important because single-subject experimental research applies a “within subject” comparison in that the performance during the baseline condition is contrasted with the performance during or after the intervention period. Without stability, it is impossible to attribute the change in behaviour to the intervention. Maryanne noted that all baselines were stable with limited variability. She also noted that none of the baselines showed *trends* in the direction expected by intervention and therefore marked question #8 “yes.”

Design. Next, Maryanne reviewed the section in her article entitled *experimental design*. As noted previously, there are several different kinds of single-subject experimental research designs. In order to effectively demonstrate the effect of the independent variable on the dependent variable, it is imperative that the researchers clearly and accurately describe the type of single-subject experimental research that they are using. Maryanne

made a note that the researchers stated they were using a multiple-baseline design. This was apparent to Maryanne from the description in the procedure section and the graphical data. She was satisfied and indicated a “yes” for question #9.

Maryanne then looked back at the graphs to count the number of data points in each phase of the study for each graph. The number of data points counted in each phase of the study should be five or more to ensure consistency in the results in all phases of the study and to allow comparisons across phases of the study. Maryanne carefully counted to ensure each dependent variable had at least five data points in each phase. She checked “yes” for question #10. Next, Maryanne realized that because there was only one participant in the study, question #11 received an automatic “no.” Having three or more participants allows adequate replication of the effects of the intervention across more than one participant. With only one participant, there is simply not enough data to allow the reader to assume that the intervention will work with other participants. However, it is important to note that not all studies which include three or more participants will meet this criterion. The data for all three participants must demonstrate that the change in the behaviour due to the intervention must be similar for all three participants. In other words, the treatment was effective for all three participants. Another important single-subject research design feature is the measurement of generalization (i.e., whether the target behaviour was measured in other settings) and maintenance (i.e., whether the behavioural response to the intervention was maintained in follow-up measures). Maryanne noted that neither of these factors were measured in the D’Ateno et al. (2003) study and marked question #12 “no.”

The number of data points counted in each phase of the study should be five or more...

Analysis. The ability to interpret the single-subject experimental graphs gives the reader a strong advantage in accurately understanding the effect of the intervention on the target behaviour. Maryanne examined the graphs again and then read the results section. Maryanne first looked at the graphs to see if she could determine a trend (an upward or downward slope in the data) in any of the phases. Specifically, she looked to see if there was a trend in the baseline that was in the direction of the anticipated results. She also looked at variability in all of the baselines. Were each of the data points measured similar? Or were there large changes or variation among these measures? She noted that the author accurately

described stability in several of the baselines in the *results* section of the study. Furthermore, in reading through the *discussion* section, Maryanne discovered that the authors were accurate in their interpretation that the intervention had an effect on some dependent variables in some but not all of the intervention conditions. Maryanne decided that the author accurately interpreted the graphs and felt satisfied to mark “yes” in #13 of the quality rating scale.

The next question on the quality rating scale brought Maryanne back to her days in public school where she learned about simple graphs.

Social validity refers to whether the intervention and behavioural results were of value...

She realized that her 11th grade teacher Mr. Wachuznuk was right when he told her that one day she would need the information she learned in his class, and she was delighted to discover that this

was the day! Creating clear graphs is important to ensure that the graphed data is properly interpreted. Looking at items such as consistency of scales on axes of all the graphs, ensuring the lines clearly delineate phases of the study, and making sure that there are legends to explain different types of dependent variables is very important. Upon inspecting all six graphs carefully, Maryanne was pleased that she learned something valuable in Mr. Wachuznuk’s class after all, and confidently marked #14 a “yes.”

The final question, #15, asks whether social validity of the study was reported. *Social validity* refers to whether the intervention and behavioural results were of value, were practical, or, simply, were worth the effort. Often, in single-subject experimental research, caregiver or support personnel are asked to provide this information. To meet this criterion, the authors can report numeric results of scales or questionnaires or anecdotal parent/teacher reports. Maryanne noted that D’Ateno et al. (2003) did not include this information and mark the final question “no.”

Experimental Control. Going back to the Horner et al. (2005) article, Maryanne learned that there was another very important feature that influences the quality of single-subject experimental studies, ensuring that the study is conducted in a way that establishes experimental control. *Experimental control* involves meeting three criteria. First, it is vital that the measurement of the behaviour before treatment is applied is stable. This means that the performance pattern for the behaviour of interest is well established before the intervention is introduced. Second, the last three measures of the behaviour taken during this baseline data collection period should not

vary more than 20%. Finally, there should not be a *trend*, or increase/decrease in scores in the direction predicted by the treatment. If a trend occurs before the intervention is applied, it is impossible to know if the intervention was responsible for the behaviour change or some other factor was responsible for the behaviour change. These three criterion needed to be satisfied at least three times for each dependent variable to provide evidence of experimental control. Maryanne examined the D’Ateno et al. (2003) article again to determine whether experimental control was achieved in this study. She went directly to the graphs that record the behavioural data and examined one of the dependent variables, “motor responses.” During the baseline period, the researchers measured how frequently the child engaged in appropriate motor behaviours with toys. Maryanne looked at the data points taken during the baseline period and noted that the child participated in eight sessions and each time used two appropriate behaviours. The baseline was clearly flat, with no variability, and there was no indication that the child’s motor responses in play were improving over time. After the intervention, the “motor responses” increased, indicating that the intervention had had the intended effect. Maryanne noticed that a stable baseline and the intended effect of the intervention had been achieved across three play settings. According to Horner et al. (2005) a minimum of three replications of experimental control are necessary to prove that the intervention had an effect. (See Figure 2 where stars document the experimental effect at three different points in time for the ABAB design and Figure 1 for multiple baseline design).

...a minimum of three replications of experimental control are necessary...

Now that Maryanne had a good understanding of the features of quality single-subject experimental research, she was ready to review and evaluate the rest of the studies and compile the findings. She used the table of her results as a basis for making an evidence-based decision regarding the use of video modeling to teach DP play skills.

Summarizing the Evidence

Maryanne looked over the evidence table that she created (Table 3). For each study, she summarized the study design, the participant characteristics, the setting of the study, the dependent variables addressed, details of the independent variable, the quality rating, and whether the study had achieved experimental control.

Maryanne knew that participant characteristics are important to consider when making evidence-based decisions. What works for a low-functioning preschool child with autism may not be effective for an older high-functioning child and vice versa. Across all the studies, 18 children participated in research testing the effects of video modeling, including 15 males and three females. These children ranged in age from 2.6–10.0 years, all had autism (with the exception of one male with Asperger's Syndrome (Sansosti et al., 2008), and their functioning ranged from minimal language to high-functioning autism. Interestingly, there were no non-verbal participants in any of these studies. One participant had

Thus, these studies indicate that video modeling has been found to be effective with multiple children...

a comorbid diagnosis of epilepsy (Nikopoulos & Keenan, 2007). Other demographic information such as socioeconomic status, ethnicity, language spoken at home, etc., would also provide important information in order

for Maryanne to accurately compare the participants to DP. However, only two studies (Kleeberger & Mirenda, 2008; Maione & Mirenda, 2006) provided the participant's ethnicity and only one (Kleeberger & Mirenda, 2008) noted the participant's primary language. The intervention had been conducted in a range of settings from home to preschool and school placements. The play skills that were the focus of the intervention fell into two rough categories: play actions and play verbalizations. Several of the studies examined whether the children only learned modeled behaviours from the videos or if they developed new, spontaneous verbalizations and play with objects. All of the studies utilized a multiple baseline design. Interestingly, one study (Paterson & Arco, 2007) included two experiments, one utilizing a multiple-baseline design and one utilizing the ABAB design.

Of great interest to Maryanne was the finding that video modeling can be conducted in a number of ways. The video might depict other-as-model, adults with peers, or two adults modeling targeted behaviours. One study (Hine & Wolery, 2006) used a method that involved point-of-view modeling, where videos were created using the perspective of the person who is the target of the intervention and showing him or her the target behaviour from the viewer's vantage point, but without showing the entire person who is modeling the behaviour. Additionally, three studies (Kleeberger & Mirenda, 2008; Maione & Mirenda, 2006; Sansosti & Powell-Smith, 2008) used more than just video modeling during the intervention phase. Kleeberger and Mirenda (2008)

asked parents who supervised the viewing of the videos to highlight certain target behaviours by commenting on the behaviours. For example, parents would comment, "Look he's choosing the truck" to highlight choice of an appropriate play object. They also, like Maione and Mirenda (2008), provided prompts and reinforcement for targeted behaviours in the toy play sessions. Maione and Mirenda (2008) used video feedback to show their participant his improved play behaviours. Sansosti and Powell-Smith (2008) combined video models with social stories that both emphasized the same play and verbal behaviours.

For Maryanne, the data that was synthesized from these nine studies can provide clues as to whether or not video modeling would be appropriate for DP. Video modeling has been examined with some children who are very similar to DP in that they are male, elementary school-age children with autism, all of whom are verbal but have difficulties in social play interactions. The outcomes targeted in these studies including play actions and play verbalizations could be viable target behaviours for DP. Video modeling has been examined in school settings, utilizing parents, teachers, and other team members. This setting and the involvement of all of these critical stakeholders would be very appropriate as these skills will be a part of DP's IEP. Several studies documented positive effects for several children's play behaviours (Maione & Mirenda, 2006; Nikopoulos & Keenan, 2004; Nikopoulos & Keenan, 2007; Paterson & Arco, 2007). Thus, these studies indicate that video modeling has been found to be effective with multiple children who present similarly to DP.

...participant characteristics are important to consider when making evidence-based decisions.

From her evaluation of the evidence, Maryann felt confident that video modeling had a good chance of being successful with DP. Nonetheless, she also felt that she should be realistically cautious in presenting her findings to the rest of the team and knew that she needed to be clear in detailing the quality of the research. Though the evidence that has been published to date is quite good, it is not excellent. As well, she needed to convey that the team should not set their expectations too high because, while there is evidence to support using video modeling with children with autism, there is not overwhelming support that this intervention will lead to new, spontaneous behaviours in play.

Discussion

This case study has served as an example of how to carefully examine single-subject experimental research. Like studies using group designs, single-subject experimental research varies greatly in quality. Careful examination of each individual component of the research is important to draw conclusions about the efficacy of the intervention. When evaluating the potential of an intervention with a population as heterogeneous as individuals with ASD, single-subject experimental

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research can provide important contributions which, when the results of multiple studies are synthesized, can provide a clearer picture of the effects of an intervention when a rigorous group design has yet to be put

forth. In regard to video modeling, based on Maryanne's review of these studies, therapists can feel reasonably confident that they can make use of the technology of moving images and the power of observational learning to assist children in learning modeled play behaviours. However, video modeling is still in a very early phase of formulation, development, and research. Given the variability in the studies and the quality of the research conducted, definitive conclusions about who video modeling works for, under what circumstances, and with which targeted behaviours cannot be made. In looking back to the Smith et al. (2007) article, Maryanne decided that video modeling is likely between phase one and two (see Table 1) and has a way to go before it becomes empirically supported in a community-based environment.

Maryanne was pleased with what she had learned about evaluating single-subject experimental research. Her increased knowledge of research methodology had given her the ability to understand the content of studies and make a well-informed appraisal of the evidence rather than blindly trusting the researchers' interpretations of the results.

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Table 1. Phases of Research

Phase(s)	Goals and Activities	Research Designs
1. Formulation and systematic application of a new intervention	To conduct initial efficacy studies to refine techniques and document clinical significance of effects	Single-subject experimental designs such as multiple baseline and reversal OR between group designs
2. Manualization and protocol development	Assemble efficacious interventions into a manual and assessment protocol Devise treatment fidelity measures Assess acceptability of interventions to clinicians and families Examine sustainability	Small, multisite studies for feasibility testing Surveys and focus groups with clinicians and families at each site Focus groups with consumers and providers in the community
3. Efficacy studies	Evaluate efficacy of an intervention in a large scale trial Demonstrate consistent effects across sites, as a step toward disseminating the intervention	Randomized clinical trials
4. Community effectiveness studies	Assess whether competent clinicians in community can implement treatment	Randomized trials or other between group designs

Adapted from Smith et al. (2007)

Table 2. Quality Rating Scale for Single Subject Research

Description of Participants and Setting
1. Was/were the participant(s) sufficiently well described to allow comparison with other studies or with the reader's own patient population? (Descriptors should be relevant to the dependent variables of interest and appropriate to the intervention)
Independent Variables
2. Were the independent variables operationally defined to allow replication?
3. Were intervention conditions operationally defined to allow replication? (Intervention conditions include setting, interventionist, and at least some reference to the duration of sessions or duration of the study as a whole)
4. Was fidelity of intervention implementation monitored through direct observation?
Dependent Variables
5. Were the dependent variables operationally defined as dependent measures?
6. Was interrater or intrarater reliability of the dependent measures assessed before the intervention began (i.e., during baseline) and during each subsequent phase of the study?
7. Was the outcomes assessor unaware of the phase of the study (intervention vs. control) in which the participant was involved?
8. Was stability of the data demonstrated in baseline, namely lack of variability or a trend opposite to the direction one would expect after application of the intervention? (Must be true for 100% of baselines)
Design
9. Was the type of SSRD clearly and correctly stated?
10. Were there an adequate number of data points in each phase (min. of 5) for each participant? (<5 data points okay for training, follow-up, maintenance, and generalization phases)
11. Were the effects of the intervention replicated across three or more subjects? (If multiple DVs, at least one DV must show change for at least three participants)
12. Assessment of generalization of intervention effects for all participants to at least one other setting or maintenance of effects over time
Analysis
13. Did the authors conduct and report appropriate visual analysis, for example, level, trend, and variability?
14. Did the graphs used for visual analysis follow standard conventions, for example x- and y-axes labeled clearly and logically, phases clearly labeled (A, B, etc.) and delineated with vertical lines, data paths separated between phases, consistency of scales?
15. Was the social validity of the study reported either qualitatively or quantitatively?
Adapted from the American Academy for Cerebral Palsy and Developmental Medicine (AACPD), 2008

Table 3. Single-case studies that examine the effectiveness of video modeling to teach play skills to children with autism

Study	Design	N	Participant	Location	Play Skill (Dependent Variable)	Intervention (Independent Variable)	Quality Score	Experimental Control
D'Ateno, Mangiapanello, & Taylor, 2003	MB	1	3.8 yrs, female, autism	Special preschool education program	1. Modeled verbal statements and object use 2. Spontaneous verbal statements and object use (* all needed to be appropriate to play)	Videos of adults talking and modeling appropriate play in 3 play vignettes	10/15	Yes—modeled verbal and object use; No—spontaneous verbal or object use
Hine & Wolery, 2006	MB	2	2.6 and 3.7 yrs, female, autism	Inclusive full day preschool program	Imitation of play actions on objects (gardening and cooking)	“Point of view” video of play actions on objects	10/15	Yes—for DV
Kleeberger & Miranda, 2008	MB	1	4.4 yrs, male, autism	Home	Imitation of 1. “Play” actions 2. Gross motor songs 3. Finger plays	Video of one adult modeling the behaviours and two typical children imitating adult, highlighting, prompting/fading, reinforcement	11/15	Yes—all DVs
Maione & Miranda, 2006	MB	1	5.7 yrs, male, autism, Chinese Canadian, language delay but able to speak in sentences	Home	1. Verbalization 2. Initiations 3. Responses to initiations	Video of two adults modeling play with objects and verbal scripts in nine video vignettes; video feedback; prompting	10/15	Yes—for verbalizations and initiations No—for responses to others' initiations

Table 3. Single-case studies that examine the effectiveness of video modeling to teach play skills to children with autism

Study	Design	N	Participant	Location	Play Skill (Dependent Variable)	Intervention (Independent Variable)	Quality Score	Experimental Control
Nikopoulos & Keenan, 2004	MB	3	7-9 yrs, male, autism, CARS scores 31, 32, and 35.5	"a room" (not clear)	1. Amount of time in reciprocal play 2. Time taken to initiate play	Video of typically developing peer initiating and engaging in reciprocal play with examiner	8/14	Yes—for all DVs
Nikopoulos & Keenan, 2007 (exp 1 only)	MB	3	6.5, 6.5, and 7.0 yrs; male; autism; some speech, echolalia	Special school	1. Social interaction 2. Reciprocal play 3. Object engagement	Video of 10-year-old typical boy interacting with examiner, initiating play, and engaging in a sequence of play activities	12/15	Yes—for all DVs
Paterson & Arco, 2007	MB	2	7.0 and 6.0 yrs, male, autism, described as high functioning	Regular suburban primary school	1. Increases in modeled appropriate motor play and verbalizations 2. Decreases in repetitive motor play and verbalizations	Young male adult modeled appropriate motor and verbal play with toys	7/15	Yes—for both modeled verbal and motor play No—for decrease repetitive verbal and motor
Sansori & Powell-Smith, 2008	MB and ABAB	3	6.6, 9.3, and 8.10 yrs; male; Aspergers; autism; functional communication; included in general education class	Recess and lunch time on playground and courtyard	1. Joining in play (2 children) 2. Maintaining conversation (1 child)	Computer-presented social stories and video models of social communication skills and prompts	13/15	Yes—all DVs