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Comparison of Video and Live Modeling in Teaching Response Chains to Children with Autism

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Abstract: Research has shown that video and live modeling are both effective in teaching new skills to children with autism. An adapted alternating treatments design was used to compare the effectiveness and efficiency of video and live modeling in teaching response chains to three children with autism. Each child was taught two chained skills; one skill was planned to be taught by video modeling and the other was planned to be taught by live modeling. Results showed that two children were able to acquire the response chains assigned to them successfully with both procedures. For the third child, live modeling was found to be more effective than video modeling. When the efficiency of two procedures is considered, no dramatic differences were observed in favor of either modeling across participants.

Autism is a developmental disability that significantly affects communication and social interaction. As a result it has negative impacts on a child's development and educational performance. Children with autism generally have problems in interacting and communicating with their peers, in social development, play, daily life, and academic skills. These problems may also cause behavioral problems. Therefore, it is well documented that their programs should be focusing on teaching communication, play, social, daily life, and academic skills (Webber & Scheuermann, 2002). In addition to that, due to their characteristics children with autism present a unique set of challenges to their parents/care givers and educators (Delano, 2007). As a result, a search for finding evidence-based practices has gained greater attention from educators and researchers.

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Although social deficits are evident for children with autistic spectrum disorders, visual processing, interest in technology, and response to modeling can be argued as relative strengths (Kuder & Lord, 2010). Children with autism frequently used visual support systems for making sense of their environment (Van Laarhowen, Kraus, Karpman, Nizzi, & Valentino, 2010). Text, line drawings, photographs, social stories, activity schedules, video-based interventions such as video prompting, video modeling are the main visual support systems for children with autism (Dettmer, Simpson, Smith-Myles, & Ganz, 2000; Rao & Gagie, 2006). A great number of studies have shown the effectiveness of visual support systems on teaching a variety of skills to children with autism.

Video modeling has its roots in Bandura's Social Learning Theory (1977). According to this theory, human behavior is primarily learned by observing and/or modeling others. Modeling is defined as process by which a model—live, recorded, and/or imagined—demonstrates behavior that can be imitated by the learner (Corbett & Abdullah, 2005; Delano, 2007).

Video modeling combines modeling and video demonstration as visual cues (Bellini & Akullian, 2007). During video modeling intervention, the student observes a video of a peer, adult, or herself/himself engaging in the behavior which is planned to teach. It has a successful history in teaching a variety of skills to individuals with autism. Communication skills (Apple, Billingsley, & Schwartz, 2005), social and play skills (Charlop-Christy, Lee, & Freeman, 2000; D'Ateno, Mangiapanello, & Taylor, 2003; Hine & Wolery, 2006; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Nikopoulos & Keenan, 2007; Paterson & Arco, 2007; Reagon, Higbee, & Endicott, 2006), safety skills (Akmanoglu & Tekin-Iftar, 2011), emotion processing (Corbett, 2003), perspective taking (Charlop-Christy & Daneshvar, 2003; LeBlanc et al., 2003), academic skills (Kinney, Vedora, & Stromer, 2003), adaptive and daily life skills (Keen, Brannigan., & Cuskelly, 2007; Norman, Collins, & Schuster, 2001; Shipley-Benamou, Lutzker, & Taubman, 2002) can be taught successfully by video modeling to children with autism.

Delano (2007) conducted a comprehensive review of 19 empirical studies about video modeling interventions for individuals with autism published between 1985 and 2005. The findings show that video modeling interventions are effective in teaching individuals with autism. Delano proposed several suggestions for the future research. Some of them can be summarized as follows: (a) future research should involve treatment integrity measures, (b) social validty of the studies about video modeling should be investigated, (c) the effects of video modeling should be investigated in wider variety of target skills, (d) differential effects of different modeling technique such as video modeling and live modeling should be examined.

Live modeling is another instrument that has been successfully used in teaching behavior chains to children with autism. Learning through observation and imitation of others promote or facilitate to acquire new behaviors. Research has shown that live modeling is effective in teaching various skills to children with autism including developmental skills such as labeling (Charlop, Schreibman, & Tryon, 1983), following one-step commands (Egel, Richman, & Koegel, 1981), and play skills (Goldstein & Cisar, 1992; Jahr, Eldevik, & Eikeseth, 2000).

Video modeling has several advantages as compared to live modeling. (a) The models in the videos are more controllable in live modeling. (b) They are reusable therefore once it is recorded, it can be used as many times as needed. (c) It is time and cost efficient. (d) It is more appropriate for teaching various skills such as pedestrian skills as the natural circumstances are not convenient.

A growing body of literature supports the effectiveness of both video and live modeling in teaching new behaviors to children with autism. However, there is very limited research on examining the differential effects of these two popular interventions. Charlop-Christy et al. (2000) compared video modeling and live modeling in teaching various developmental skills (e.g., independent and cooperative play, conversation speech, expressive labeling, oral comprehension etc.) to five children with autism. A multiple baseline design across students and within a child across two modeling interventions was used. Results show that video modeling is an effective and efficient intervention for teaching various developmental skills. In four of the five children, video modeling resulted in faster acquisition than live modeling. Both interventions were seemed to be equally effective for the fifth children. Furthermore, video modeling was more effective in promoting generalization of the acquired skills. Maintenance effects of the interventions were not assessed in the study.

A more recent study comparing the effects of video modeling and live modeling in teaching contextually appropriate affective responses to three preschoolers with autism in home settings and in the context of play activities was conducted by Gena, Couloura, and Kymissis (2005). A multiple baseline design across subjects with a return to baseline condition was used in the study. Training was given in three categories of affective behaviors. Findings illustrate that both interventions systematically increased appropriate affective responding for the three preschoolers. Moreover, positive outcomes were obtained for the generalization and maintenance. Children were able to generalize the acquired skills across untrained scenarios, persons, and time with two interventions and maintained the acquired skills one and three months after training to a certain extent.

To date only two studies have directly and experimentally compared these two interventions. Maintenance effects were tested only in Gena et al.'s study (2005). In both comparison studies the number of steps to be taught in response chains was relatively short. Apparently more research is needed to refine the earlier findings and extend the literature by examining the differential effects of video and live modeling in teaching more complex (long chained) response chains, and assessing the maintenance effects of both interventions. Therefore the purpose of this study is to investigate the effects of video modeling and live modeling in teaching relatively more complex behavior chains (more complex in terms of number of steps in the task analysis) and maintenance effects of these interventions. Consequently the following research questions were addressed in the study: (a) Are there any differences between video modeling and live modeling intervention in terms of acquisition, maintenance, and generalization effects? (b) Are there any differences between video modeling and live modeling in terms of the efficiency of intervention? (c) What do parents think about social validity of the study?

Method

Participants

Students. Three children with autism participated in this study. All children were diagnosed at hospitals in Turkey by child psychiatrists through behavioral observations and parental interview. They were also diagnosed with intellectual disability. All of them were attending the Developmental Disability Unit for the Children with Developmental Disabilities at the Research Institute for the Handicapped at Anadolu University, Eskisehir, Turkey. Several objectives from various developmental areas were identified to teach the children. All children were verbal. No adaptive scores were available for the children. All children had an instructional history with both video and live modeling. Prior to the study, parental consent was obtained. Pseudonyms were used for the children.

Bora was 9 years old during the study and identified as having autism and intellectual disability. He took one on one instruction for three semesters in the unit and continued his education in a group arrangement. In addition to that, he received one on one instruction from a private rehabilitation center. He had age appropriate gross motor skills. He was able to perform motor imitation skills. He could perform various fine motor skills such as cutting and pasting simple shapes, making puzzles, building blocks. He could classify the objects from three different classes, match up to 30 objects, and show the different object among others. He was able to attend for an activity for 10 minutes and watch a cartoon on the TV for 15 minutes. He had difficulties in social and communications skills. He was able to follow two words directions and to answer simple question with one word. He often failed to answer questions in correct context.

Can was a 10 year old boy and identified as having autism and intellectual disability. He took one on one instruction for three semesters in the same unit and continued his education in group instruction for four years. In addition, he received one on one instruction from a private rehabilitation center. He had age appropriate gross motor skills. He was able to perform motor imitation skills just like Bora. He could perform various fine motor skills such as cutting and pasting simple shapes, making puzzles with 20 items, building blocks. He could classify the objects from four different classes, match up to 30 objects. He was able to attend for an activity for 10 minutes and watch a cartoon on the TV for 15 minutes. He had difficulties in social and communications skills. He was able to follow two words directions and to answer simple questions with one word. He often failed to answer questions in correct context. He could perform age appropriate self care skills.

Efe was 5 years old during study and like other children he was identified as having autism and intellectual disability. He took one on one instruction for one semester in the institute and continued his education in group instruction. In addition to that, he has received one on one instruction from a private rehabilitation center for three years. He had age appropriate gross motor skills. He was given training on performing motor imitation skills as an IEP objective prior to study. He could perform various fine motor skills such as cutting and pasting simple shapes, making puzzles with nine items, building blocks. He

TABLE 1

Participants, Instructional Procedures, Response Chains, and Durations

Participants	*Instructional Procedures*	*Bevaior Chains*	*Durations of Videoclips and Live Modeling*
	Video Modeling	Fixing a table (9 steps)	1 min
Bora	Live Modeling	Folding a shirt (9 steps)	37 s
	Video Modeling	Fixing orange juice (22 steps)	1 min 25 s
Can	Live Modeling	Making a toasted cheese sandwich (21 steps)	2 min
	Video Modeling	Pushing a toy car down the ramps of toy garage (9 step)	29 s
Efe	Live Modeling	Building a Mr. Potato Head (9 steps)	26 s

could classify the objects from three different classes, match up at least 12 objects, match colors up to 8 and classify three different categories. He was able to attend for an activity for 10 minutes and watch the TV for 15 minutes. He had difficulties in social and communications skills. He could follow one word directions and was able to communicate with one-two words sentences with regard to his needs. He could perform fine motor skills with assistance.

Prerequisite skills for the children were as follows: (a) attending to an activity for 5–6 minutes, (b) following verbal instructions, (c) watching TV for at least 5 minutes.

Staff. The third author conducted all experimental sessions in the study. He has 15 years of experience educating children with autism and intellectual disability. He holds bachelor degree from a special education teacher training program. He is the teacher of the participants and has experience using video modeling in his class.

Settings and Materials

The study was conducted at the classroom reserved for one on one instruction and breakfast room at the Unit. The classroom was about 4 × 6 meters and there were tables and chairs for the students and teacher, cupboards, writing board, boxes for saving the materials used during the study. The breakfast room was about 8 × 8 meters. There were a refrigerator, mini oven, water fountain, toaster, citrus maker, coffee machine, popcorn machine, an electrical stove, a box containing the materials used during the study, chairs in different sizes, and a writing board.

Also, CDs including video clips for teaching target behaviors via video modeling, a lap top computer for watching the clips, a handycam, data collection forms, and pencils were used in the study. Besides these materials, materials which were specific to teach the target behaviors in the study were used. For example for teaching fixing a table skill, a table cloth, place mat, cutlery set, glass, salt and pepper set, and pitcher were used.

Dependent Measures, Response Definitions, and Behavioral Consequences

Two dependent measures were considered for each child to compare the effectiveness and efficiency of video modeling and live modeling on teaching response chains. Information about children, interventions, and response chains including the number of steps are presented in Table 1. These response chains were selected based on parents' interviews and curriculum of each child. In order to make sound comparison, independent and functionally similar response chains were identified. Task analyses for the response chains were developed by the first and third author by performing the behaviors and validated by the remaining authors. The task analyses for the behaviors can be obtained from corresponding author.

There were three possible child responses in each experimental session in the study. These are correct response, incorrect response, and no response. Correct responses were defined as initiating the steps of the task analysis in 4 s and completing it in a specific duration that was defined for that particular step correctly. Incorrect responses were defined as not initiating the step of the task analysis in 4 s, initiating a different step in the analysis, or not completing the correct step in a duration which was defined for that particular step. No responses were defined as not initiating a response at all. It was also counted as incorrect response in the study. Correct responses resulted in verbal and social reinforcement and incorrect responses resulted in error correction.

Experimental Design

An adapted alternating treatments design (AATD) was used to compare the effectiveness and efficiency of video modeling and live modeling in teaching various response chains to children with autism (Holcombe, Wolery, & Gast, 1994). The dependent variable was the percentage of correct responses of the steps of the task analyses of the response chains, and the independent variables of the study were video modeling and live modeling interventions. Dependent variables in AATD should be in equal difficulty. These particular response chains were selected by conducting logical analysis of the behaviors to ensure equality. Logical analysis was performed by considering the number of steps to be completed for the response chains and difficulty level of each step in the chains. Also, for difficulty level analysis, task analyses were given to a group of experts (teachers, researchers) and their judgements about whether the chains are in same difficulty. All of them reported that these response chains were in equal difficulty. Experimental control is established when the dependent variable assigned to one independent variable is acquired more rapidly than others regardless of the sequence of intervention in this design (Holcombe et al.). The sequence of independent variables was alternated across the sessions and at least one hour passed between the intervention sessions to control for threats of multiple interference effects (sequence and carry over effects).

General Procedure

Various response chains from different domains such as fixing a sandwich, fixing a table, folding a shirt etc. were taught to three children with autism. One on one instructional arrangement was used during all experimental sessions. Four second response interval and intertrial interval was used in the study. A training trial was conducted for each response chain and two sessions were conducted alternately for five days a week. There were baseline and intermittent probe sessions, training sessions, maintenance, and generalization probe sessions in the study.

Probe Sessions

Two types of probe sessions were held in the study. These are baseline and intermittent probe sessions. Baseline sessions were conducted prior to training sessions and continued until obtaining three stable data points consecutively. Single opportunity method was used to collect data in these sessions. Although multiple opportunity method is much more sensitive to measure the performance, single opportunity method was used due to experimental control.

Intermittent probe sessions were conducted after the training sessions for testing the acquisition of response chains. These sessions were conducted after every other two training sessions. Intermittent probe sessions were conducted instead of daily probe session to decrease the number of incorrect responses and time devoted to probe sessions in the study. Besides these advantages, for creating a more natural training circumstances intermittent probe sessions were preferred.

Correct responses resulted in verbal and social praise and incorrect responses were resulted in error correction during all sessions. Cooperation and attentive behaviors of the children were reinforced in the beginning and at the end of the sessions.

A baseline or intermittent probe trial was conducted as follows: The teacher delivered a specific attentional cue to secure the child's attention (e.g., "Bora would you like to make a toasted cheese sandwich with me?") and after having an affirmative response from him, the teacher praised the child socially (e.g., "Very good!"). Then the teacher delivered the task direction (e.g., "Bora, please make a toasted cheese sandwich.") and waited 4 s for the child's response, and delivered appropriate behavioral consequences (e.g., "Great, that is right!" or "No, that is not right you should do it by this way!"). Intermittent probe sessions were conducted after every two training sessions. Correct responses were counted towards criterion and the criterion was 100% correct responding for three consecutive intermittent probe sessions.

Training Sessions

Training sessions were conducted either in classroom or in breakfast room in one on one instructional arrangement. Total task training format was used to teach response chains in these sessions. Two instructional procedures were used in the study and they were assigned to response chains randomly. Criterion was 100% correct responding in each response chain for each child. One teaching trial was conducted in each session with each procedure and the procedures were alternated systematically. After obtaining stable data during baseline sessions, training was initiated with both procedures. Based on the severity of the disability and history of participants with video modeling, video modeling (having the participants watch entire chain before attempting the task) was preferred instead of video prompting (having the participant watch a video clip of a single step and then performing that step) in the study.

Video modeling sessions. Video clips for the response chains were developed. An adult (teacher) modeled the behavior in the clip. Children were requested to watch the related video clip one time. In these sessions the teacher and the child sits next to each other in front of the monitor. A teaching trial was conducted as follows: The teacher delivered a specific attentional cue to secure the child's attention and explained the rules (e.g., "Can, would you like to learn preparing orange juice with me? First we will watch the movie then you will prepare an orange juice. Are you ready?"), and after having an affirmative response from him, the teacher praised the child socially (e.g., "Very good! I see you are ready to work."). Both the teacher and the child started to watch the clip. The teacher reinforced watching behavior of the child ("Great I noticed you were very careful while watching. Let's go to prepare orange juice."). After arriving the area, the teacher again delivered attentional cue ("Now, we will prepare orange juice just like we have watched.") and reinforced his affirmative response verbally ("Yes great! I see you are ready to work."). Then the teacher delivered the task direction ("Can, please prepare an orange juice."). Once the child completed the response chain the teacher reinforced him verbally. When an incorrect response was delivered by the participants error correction was provided and the sessions was terminated. The rest of the steps were scored as incorrect. This procedure was preferred to use to reveal the relative effects of both procedures on dependent variables of the study.

Live modeling sessions: Live modeling sessions were conducted same as video modeling except live modeling the teacher himself modeled the response chain to the child and the child was expected to imitate the teacher. In these sessions, the teacher and the child stood next to each other. A teaching trial was conducted as follows: The teacher delivered a specific attentional cue to secure the child's attention and explained the rules (e.g., "Can would you like to learn fixing a toasted cheese sandwich with me? First, I will show you how to prepare it and then ask you to fix one. Are you ready?"), and after having an affirmative response from him, the teacher praised the child socially (e.g., "Very good!"). Then the teacher started to prepare a sandwich. The teacher reinforced watching behavior of the child ("Great I noticed you were very careful while watching me. Now, it is your turn.") then delivered specific attentional cue ("Are you ready?") and reinforced his affirmative response verbally ("Yes great! I see you are ready to work."). Then the teacher delivered the task direction ("Can, please make a toasted cheese sandwich."). Once the child completed the response chain the teacher delivered him verbally. The same procedure was followed for the incorrect response as in video modeling sessions.

Maintenance and Generalization Sessions

Maintenance probe sessions were conducted two, four, and six weeks after the training.

These sessions were conducted like baseline probe sessions. The only difference was about delivery of reinforcement. In these sessions, the teacher faded the reinforcers and delivered only after the completion of the response chain correctly.

Different persons in different settings conducted generalization sessions. Only post test measured were taken for testing generalization. They were conducted after the criterion at acquisition was obtained.

Reliability

Dependent variable reliability and independent variable reliability data were collected during 20% of each experimental session for each child. Three graduate students in special education collected these data. Dependent variable reliability data were analyzed by using point-by-point method with a formula of dividing the number of agreements by the number of agreements and disagreements and multiplying by 100 (Tawney & Gast, 1984).

Dependent variable reliability data for Bora and Can indicated 100% agreement for their both behaviors across the experimental sessions. For Efe, 100% agreements were obtained for their both behaviors during interventions, and 97% (range = 96% to 100%) agreements were obtained during baseline sessions with both behaviors for Efe.

Independent variable reliability was calculated by using the formula of dividing the number of observed teacher behaviors by the number of planned teacher behaviors and multiplying by 100 (Billingsley, White, & Munson, 1980). The teacher showed 100% compliance with the planned steps of both instructional procedures with two children. The teacher delivered the baseline sessions with 97% compliance with the planned steps of both instructional procedures, and delivered other experimental sessions with 100% compliance.

Social Validation

Social validation data were collected from the parents ($N = 3$) of the children. The significance of teaching these target behaviors to their children, the appropriateness of these instructional procedures used to promote learning in their children, and the impacts of the outcomes on the lives of their children were analyzed. First and second authors developed a Social Validity Questionnaire. The questionnaire has nine closed ended and three open-ended questions. A brief direction about how to answer the question was written and the third author delivered these questionnaires to the parents asking them to return it in a closed envelop without writing their names.

Results

Effectiveness Data

Figures 1 to 3 illustrate the percentages of correct responses during baseline, intervention, maintenance, and generalization probe sessions for Bora, Can, and Efe respectively across instructional procedures. As figures indicate, two instructional procedures, video modeling and live modeling, were equally effective in two children (Bora and Can) to acquire the skills. In other words, two of the three children were able to acquire the skills assigned to them successfully with both procedures. Bora acquired the skill taught by live modeling faster than video modeling. Can acquired the skill taught by video modeling faster than live modeling. In the third child (Efe), live modeling was seemed to be more effective than video modeling. After observing the differential effects of live modeling, the rest of the sessions for the remaining response chain were conducted by live modeling. Few modifications were conducted during training such as changing the sequence of the task analyses and/or adding a new prompts for Bora and Can. For teaching Efe, modifications in the presentation of the teaching materials were planned. For teaching building a Mr. Potato Head, in the beginning all items were provided at the same time during live sessions, the items were provided one by one in the subsequent sessions for facilitating acquisition. The ramp for the toy garage used in video modeling sessions was also changed for the same participant.

As seen in Figure 1, Bora did not perform any correct responses with neither response chains during baseline sessions. After he was exposed to video modeling and live modeling

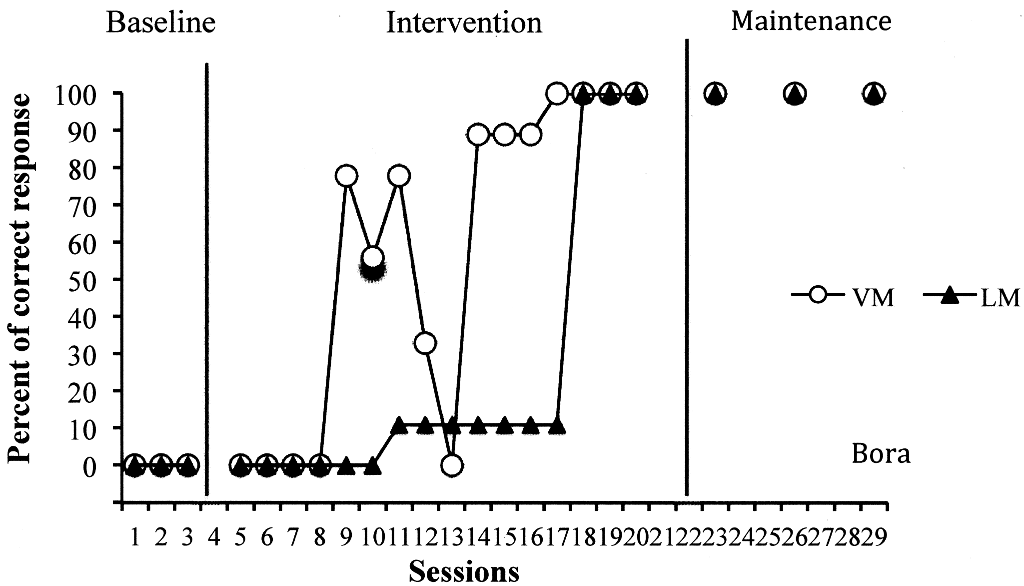

Figure 1. Percent of correct responding for Bora during baseline, intervention, and maintenance probe sessions.

to teach fixing a table and folding a shirt respectively, increase in the trend and level of the data were obtained and he acquired both response chains at 100% accuracy. Morover, it can be seen that he was able to maintained the acquired skills taught by video and live modeling two, four, and six weeks after intervention with 100% accuracy and generalized the acquired skills with 100% accuracy to novel people, materials, and settings.

In Figure 2, Can's baseline data indicated that he performed the skill about preparing

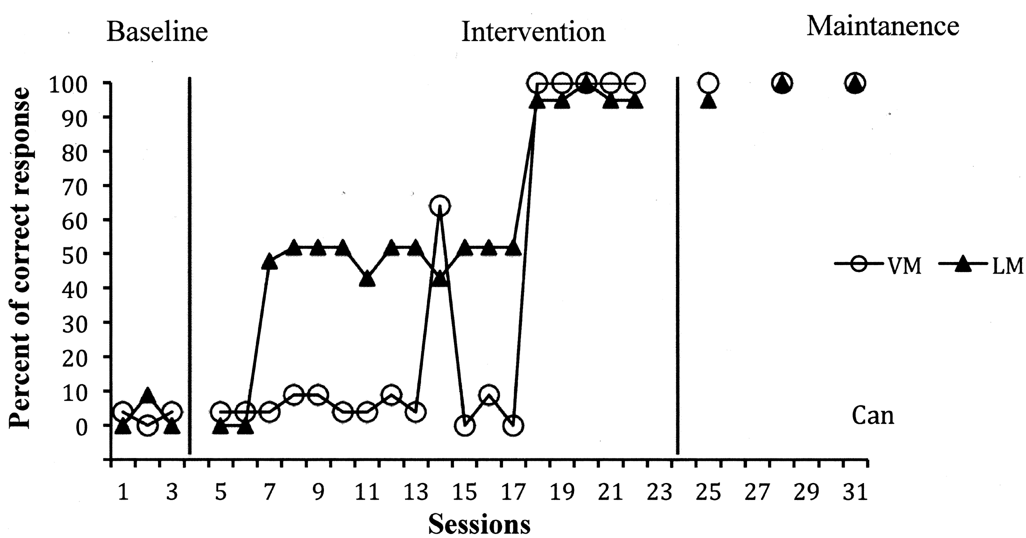

Figure 2. Percent of correct responding for Can during baseline, intervention, and maintenance probe sessions.

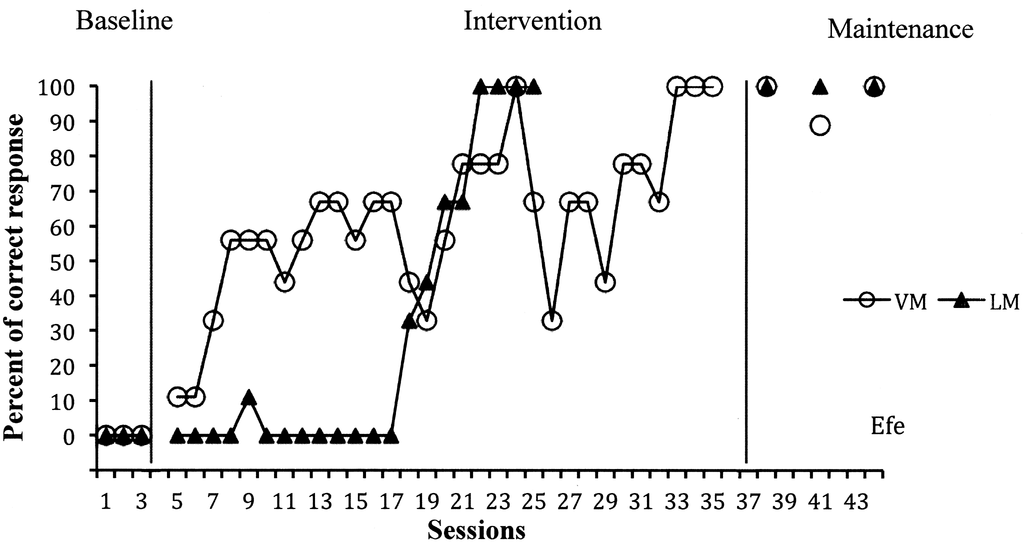

Figure 3. Percent of correct responding for Efe during baseline, intervention, and maintenance probe sessions.

orange juice with 1.4% accuracy (range = 0% to 4%) and making a toasted cheese sandwich with 3,3% accuracy (range = 0% to 9%). After introducing intervention, he performed the skill of preparing orange juice taught by video modeling at 100% accuracy and making toasted cheese sandwich taught by live modeling with a mean of 96.6% accuracy (range = 95%–100%). His maintenance data showed that he maintained the skills of preparing orange juice and making a toasted cheese sandwich two, four, and six weeks after the intervention with 100% and 97.5% (range = 95%–100%) accuracy respectively. A higher rate for generalization was obtained for Can with video modeling intervention. He generalized the skill of preparing orange juice with 100% accuracy and of making toasted cheese sandwich with 90% accuracy across novel persons, materials, and settings.

As seen in Figure 3, Efe did not perform any correct responses with either response chains during baseline sessions. After he was exposed to video modeling and live modeling to teach pushing a toy car down the ramp of toy garage and building a Mr. Potato Head respectively, increase in the trend and level of the data were obtained and he acquired the skill of building a Mr. Potato Head with 100% accuracy and the skill of pushing a toy car with a mean of 33% during intervention. Since live modeling was found to be more effective for Efe, after 39th sessions the rest of sessions were conducted by live modeling instead of video modeling to teach pushing a toy car down the ramp of toy garage due to ethical reasons. Maintenance data showed that he was able to maintain the skill of building a Mr. Potato Head and pushing a toy car down the ramp of toy garage with 100% and 96.3% (range = 95%–100%) accuracy respectively. Regarding generalization, it was found that he generalized both skills with 100% accuracy to novel people, materials, and settings.

Efficiency Data

Efficiency data were collected for number of training trials to criterion, number and percentage of errors to criterion, and total training time to criterion and data for efficiency are presented in Table 2. Data did not allow for making a general conclusion across all children. Bora's efficiency data showed that video modeling and live modeling interventions were equally efficient in terms of number of training trials. He needed 34 training sessions and trials to criterion. Higher error rate (94%) resulted in live modeling, therefore it can be said that regarding this param-

TABLE 2

Measures of Efficiency through Criterion across Response Chains and Instructional Procedures

Children	*Instructional Procedures*	*No of Trials*	*No & % of Incorrect Responses*	*Total Training Time*
	Video modeling	34	26–24%	1:16:31
Bora	Live modeling	34	110–94%	57:05
	Video modeling	37	258–90%	3:16:03
Can	Live modeling	37	147–54%	3:33:44
	Video modeling	39	89–45%	1:17:05
Efe	Live modeling	38	133–87%	1:54:49

eter of efficiency video modeling was seemed to be more efficient. As seen Table 2, 26% incorrect response occurred in video modeling. He acquired the skill with live modeling faster (57 min 5 s). He needed 1 hour 16 min and 31 s training time to criterion via video modeling. Efficiency data for Can showed that video modeling and live modeling interventions were equally efficient in terms of number of training sessions and trials. Thirty seven training trials were presented to criterion. A higher error rate (90%) resulted in video modeling than live modeling (54%). Therefore, live modeling seemed to be more efficient for Can. He acquired the skill with video modeling faster (1 h 17 min 5 s). He needed 1 hour 54 min and 49 s training time to criterion via live modeling. As live modeling was significantly more effective than video modeling instruction, video modeling intervention was terminated and the skills initially assigned to video modeling taught by live modeling. Therefore, efficiency analysis could not be conducted for Efe.

Social Validation

Parents (mothers for Bora and Efe and father for Can participated) of the children reported positive opinions regarding the aims, procedures, and results of the study in their children. Regarding the question about significance of the response chains taught in the study, they reported that they found these skills important for their children. They were asked about the contributions of learning these skills to their children in daily life. Bora's mother and Efe's father indicated that learning these skills had positive impacts on independent living of their children. Can's mother shared his positive opinions about the impacts of teaching assigned skills on his son's play skills development. Parents also shared their satisfaction for participating in this study and the impacts of the instruction on their children. All parents answered the question about whether they think that their children acquired the skills taught to them positively. Their observations about whether they saw their children using these skills at home were asked to parents as the fourth question. Efe and Can's parents indicated that they observed their children using these skills at their home and Bora's parent reported no such evidence. Parents were also asked a question about if their answers were no for the above question whether they gave any chances or create any circumstances that elicit these skills. Bora's parent reported that she did not provide any chance to his son for performing these skills. They reported they would use these interventions when teaching their children and shared their desires to learn these interventions. They also reported that they prefer their children to learn new skills with these interventions. Parents were asked about their observation about the changes in their children, Efe's mother told that prior to study her son used to have a stereotypy on spinning the wheels of the toy cars and she observed a decrease on this stereotypy and an increase on the purposeful play behaviors with a toy car. Also Can's parents reported that his son started to drink orange juice and sandwich after the study. Bora's parent did not answer this question. When the parents were asked about stating the best part of the study, Efe's mother shared her positive opinions regarding his son using the objects to their purposes. Can's father shared his positive opinions by stating that his son became more independent and seemed to be happier because of being independent. Bora's mother did not answer this question. When the parents were asked about stating the parts that they did not agree or like, Can's father explained there was no such a thing and the remaning parents did not give an answer to this question.

Discussion

The present study was designed to examine the differential effects of video modeling and live modeling in teaching response chains to children with autism. Also the possible differences of these two procedures were examined during maintenance and generalization of the acquired behaviors. Moreover, social validity of the study was investigated in the study. In the light of the data collected in the study, the following findings, limitations, contributions, and recommendations are discussed.

Findings indicated that both procedures were equally effective in teaching long response chains to two children with autism. However, this finding was not replicated with the third child (Efe). Live modeling was found to be effective in this child. Although an increase was occurred in the trend and level of Efe's data with video modeling intervention, the criterion was not met. These findings are consistent with the findings of the earlier studies (Charlop-Christy et al., 2000; Gena et al., 2005) on this topic. In these studies, it is indicated that the participants learned the skills via both intervention. These findings are supported and enhanced by the findings obtained from two children in the present study.

The findings of the study showed that there was no difference in terms of maintenance and generalization effects of both interventions. Data indicated that two of three children maintained the acquired response chains two, four and six weeks after intervention and generalized those response chains across novel situations. Charlop-Christy et al. (2000) assessed maintenance of the acquired skills with neither intervention. Maintenance effects of both interventions were tested in Gena et al.'s (2005) study. Participants of this study showed criterion level responding with both interventions. The findings of this study contribute the current literature about the effectiveness of video and live modeling in teaching response chains to children with autism. Regarding generalization, Charlop et al. study indicated that participant children who learned their skills through live modeling could not generalize their behaviors. Generalization occurred in Gena et al.'s study. In contrast to Charlop et al.'s study, this study indicated positive outcomes on the generalization effects of both interventions so as did Gena et al. Generalization of the response chains through live modeling can be explained by either characteristic of the participant children or the response chains. The interests of the children towards the behavior chains taught by live modeling or reinforcing effects of the response chain could be the possible sources of these findings.

Inconsistent results were obtained when considering efficiency findings in the study. In two of three children (Bora and Can) both intervention were found to be equally efficient in terms of number of training sessions and trials through criterion. However this finding was not replicated with the findings about the number and percentage of incorrect responses and training time to criterion in these two children. Findings for Bora revealed that video modeling intervention resulted with less error. And more training time needed through video modeling through criterion. In contrast, Can's data was just the opposite of data obtained for Bora. That is to say that learning occurred more efficient through live modeling. Efficiency analysis was not conducted for Efe. In Charlop et al.'s (2000) study efficiency was measured by only considering total training time through criterion and concluded that video modeling was more efficient than live modeling across the participant children. This study extends and enhances the literature by measuring multiple parameters of the efficiency.

Social validity findings were reported positively by the parents of the participants. Only Bora's mother indicated that she had not observed the response chains taught in the study at home yet. However, she also reported that she did not create the suitable environment or circumstances in which the behavior chain likely to occur. Therefore, this particular result can be explained by the lack of environmental arrangement instead of weakness of the interventions. Another mother reported that her son plays pushing a toy car game frequently at home. This mother also reported that before this study her son only used toy car by spinning the wheels of it as a stereotypy for him. In conclusion, parents of the participants indicated that their sons became more independent in the areas in which they received training in this study. As stated earlier, Delano (2007) indicated the need of conducting social validity analysis in video modeling research. This study contributes to the literature in this perspective.

Although findings of this study were promising, it should be kept in mind that several modifications were realized in both interventions. For Bora and Can, modifications were realized both for their target behaviors and teaching procedures. For example, the target behaviors were modified by changing the sequence of the task analyses and/or adding new or extra prompts. Prompts were faded based on the progress during training. For teaching Efe, modifications in the presentation of the teaching materials were planned. For teaching building a Mr. Potato Head, in the beginning all items were provided at the same time during live sessions, the items were provided one by one in the subsequent sessions for facilitating acquisition. The ramp for the toy garage used in video modeling sessions was also changed for the same participant. Acquiring the response chains assigned to children was rather long in this study. The characteristics of the children and the complexity of the response chains could be possible reasons for that. As mentioned earlier, the number of steps in the task analyses was rather high than the number of steps in the previous studies (Charlop-Christy et al., 2000; Gena et al., 2005).

Limitations

Several limitations of the current study bear noting. First, this study was limited with three participants with autism and teaching response chains. Second, an adapted alternating treatments design was used in this study. The design requires two target behaviors, which are equal in terms of difficulty level. When selecting target behaviors, equality of them was assessed by conducting logical analysis. The numbers of steps in the task analyses, the difficulty level of each step, and opinions of experts were considered in logical analysis. There is no objective measurement, therefore the equality of the difficulty level of response chains considered as an assumption. Third, the current study was limited with preschool and elementary school age children. Fourth, single opportunity method was used due to experimental control in the study.

Aside from these limitations, expanding the current literature by planning to teach long chained skills and by investigating the maintenance effects on these skills can be considered the main strengths of the study. In earlier research, the effects of video modeling were assessed in short chained behaviors. In the majority of these studies showed various behaviors can be taught by video modeling (Alberto, Cihak, & Gama, 2005; Bidwell & Rehfeldt, 2004; Charlop-Christy et al., 2000; Charlop et al., 1983; D'Ateno et al., 2003; Norman et al., 2001; Shipley-Benamou et al., 2002; Sigafoos et al., 2005). In this study, contributions to the related literature were made by planning to teach long chained response chains and maintenance effects of the intervention on these skills.

Suggestions for Future Research and Implications for Practice

Future research should involve investigating the differential effects of video modeling and live modeling on children with autism whose functioning levels are different from the participants of the study and on teaching different behavior chains. Researchers need to conduct to investigate the effects of peer and/or sibling delivered video modeling and live modeling in teaching various behavior chains. The differential effects of video modeling and live modeling should be tested in a group of children with autism during small group instruction. Adult models were used in this study and researchers also need to conduct further analysis by using peer models. Different studies can be designed to investigate social validity parameter via using social comparison and/or opinions of the professionals. The effects of backward chaining or total task format can be investigated during video modeling and live modeling in the future research. It is well documented in the literature that children with autism have visual strengths. However, there is no such study assessing their interest towards video modeling and live modeling. Researchers also need to conduct further analyses investigating their interest. Future research is also need to refine the results of this study and to continue to investigate the differential effects of these interventions during acquisition, maintenance, and generalization.

Several implications for practice can be drawn from this study. Data indicated that video modeling was as much as effective in live modeling in two of three children with autism. Thus, teachers, practitioners and/or therapists who work with children with autism, and parents and care-givers of the children with autism are recommended to use video modeling to teach long chained skills to teach their children/students. While generalizing this recommendation, the cost of video modeling is considered. Using video modeling is highly cost effective. Another advantage of video modeling is about the chance of using it many times. Once the video clips are prepared it can be used as many times as it is needed. Another practical implication of video modeling is about personnel preparation. It does not require highly trained teachers/therapists. Last but not least, the portability of tools used during video modeling and generalization effects of it in this study suggest that teachers and parents can use it in collaboration for successful outcomes.

Conclusion

In conclusion this study indicates that video modeling and live modeling were equally effective in two of three children with autism. It may be useful in providing treatment for some of the central deficits of children with autism. Therefore, video modeling interventions can be included as a strong tool for teaching children with autism. The use of video modeling can be recommended since it is cost effective and repeatable until the children acquire the reponse chains. It can be easily used as a supplementary tool in home, school and/or community settings and used by peers/siblings, and other caregivers.

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