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Research Article

Effectiveness of Video Modeling Provided by Mothers in Teaching Play Skills to Children with Autism*

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Abstract

Video modeling is an evidence-based practice that can be used to provide instruction to individuals with autism. Studies show that this instructional practice is effective in teaching many types of skills such as self-help skills, social skills, and academic skills. However, in previous studies, videos used in the video modeling process were prepared and implemented by researchers and teachers. However, it is important to train family members on how to prepare video recordings and how to implement video modeling with treatment integrity. This study examines whether mothers of children with autism can learn to prepare video recordings and implement video modeling with treatment integrity, and whether such video modeling is effective in teaching a play skill to the children. The play skill to be taught was building a model train using Lego bricks. The study was conducted with the participation of three boys with autism, ages 4–6 years, and their mothers, and a multiple probe design across participants was used. Results of the study showed that mothers were able to implement video modeling with high treatment integrity. All the children who participated in the study were able to learn the target skill, maintain their learning, and generalize to non-teaching conditions. Results also showed that the intervention had an acceptable level of social validity.

Keywords

Video modeling • Autism • Parent training • Play skills • Treatment integrity

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Autism spectrum disorder (ASD) is a complex neuro-developmental disorder that causes social communication and interaction impairments. Individuals diagnosed with ASD also display limited/repeated interests and behaviors. Symptoms begin in early childhood, and ASD causes various developmental problems, and significantly hinders daily living functions (American Psychiatric Association, 2013). Although there is still no medical treatment for this complex developmental disability, early and intensive behavioral intervention programs using methods based on applied behavior analysis have shown to effect significant changes in the lives of individuals diagnosed with ASD (Eikeseth & Klintwall, 2014; Eldevik, Eikeseth, Jahr, & Smith, 2006; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Sallows & Graupner, 2005).

In early and intensive behavioral intervention programs and other comprehensive practices that make use of methods based on applied behavior analysis, parents' participation in the instruction process alongside experts create positive results both for the individuals with autism as well as for the parents. Studies show that children attending intensive programs based on the principles of applied behavior analysis derive more benefits compared to children who attend less intensive programs (Eldevik et al., 2006; Lovaas, 1987). Parents' participation in the instruction process can increase the intensity of the instruction provided to children with ASD. Parents can also help children generalize the acquired skills at home and social settings, and thus, improving the quality of the process. Some studies have shown that parents' participation in the education of children with ASD has benefits other than facilitating acquisition of skills and minimizing behavioral problems; for example, more positive parent–child interaction, improvement in the self-perception of parental competence, reduced stress, the ability to spend more time on social and leisure activities, and consequent improvement in the quality of life of both parents and their children. (Brookman-Frazee, Vismara, Drahota, Stahmer, & Openden, 2009; Koegel, Bimbela, & Schreibman, 1996; Machalicek et al., 2014; Najdowski & Goud, 2014).

However, participation of parents in the education of their children with ASD may vary in intensity. In some cases, parents assume the entire responsibility for an intensive instruction program, whereas in other cases they assume only partial responsibility, for example, by learning and implementing methods used to teach certain skills and/or minimize behavioral problems (Najdowski & Goud, 2014; Wong et al., 2013). In a research review conducted to identify effective interventions in children with ASD (National Autism Center, 2015), 48 experimental studies in which parents were trained as trainers or to use certain strategies were examined. Results of this examination showed that parents' training and participation in the education of their children improved the interaction and play skills of children with ASD and mitigated symptoms of autism, problem behaviors, and limited/repeated interests and behaviors. Previous studies show that parents are able to teach many skills

to their children, including self-help skills (Cavkaytar & Pollard, 2009; Ozcan & Cavkaytar, 2009), communication skills (Charlop-Christy & Carpenter, 2000; Park, Alber-Morgan, & Canella-Malone, 2011), imitation skills (Cardon, 2012; Ingersoll & Gergans, 2007), social skills (Olçay-Gül 2012), and joint attention skills (Rocha, Schreibman, & Stahmer, 2007; Schertz & Odom, 2007). Studies also show that parents are able to learn methods based on applied behavior analysis, including discrete trial teaching (Lafasakis & Sturmey, 2007), pivotal response training (Koegel, Symon, & Koegel, 2002), incidental teaching (Charlop-Christy & Carpenter, 2000), PECS (Park et al., 2011), activity schedules (Krantz, MacDuff, & McClannahan, 1993), script fading (Reagon & Higbee, 2009), and social stories (Olçay-Gül 2012). Various studies show that children whose both parents participate in parent training programs and who trained by these parents are able to acquire and maintain target skills and generalize their skills to different settings, persons, and objects (Ingersoll & Gergans, 2007; Park et al., 2011; Olçay-Gül, 2012). Studies on the effects of interventions made by family members establish their positive outcomes both on parents and their children with developmental disabilities. Given these findings, it is important that parents and other family members actively participate in teaching various skills to their children with ASD and learn how to implement evidence-based methods supported by experimental studies.

One of the most effective ways of teaching a skill is to demonstrate how the skill is performed. Modeling, shown to be highly effective in many experimental studies, consists of a peer or an adult performing the target behavior followed by the learner performing the target behavior (National Autism Center, 2015). Modeling can be either live or video. In live modeling, the target behavior is demonstrated in person by a model who then encourages the viewer to repeat the particular behavior, while in video modeling, the learner watches a video of the target behavior performed by a model and is then given an opportunity to perform the same behavior on their own (Bellini & Akullian, 2007; Corbett, 2003; Nicopoulos & Keenan, 2006).

Many studies demonstrate effective use of video modeling to teach different skills to individuals of varying ages with ASD: initiating social communication (Nikopoulas & Keenan, 2003, 2004); making requests (Wert & Neisworth, 2003); using verbal expressions, intonation, gestures, and facial expression during social interactions (Charlop, Dennis, Carpenter, & Greenberg, 2010); naming emotional facial expressions (Akmanoğlu, 2015); imitation skills (Cardon, 2012; Tereshko, McDonald, & Ahearn, 2010); play skills (D'Ateno, Mangipanello, & Taylor, 2003; MacDonald, Clark, Garrigan, & Vangala, 2005); toilet skills (Keen, Brannigan, & Cuskelley, 2007), dental and facial hygiene (Charlop-Christy, Le, & Freeman, 2000); posting letters, setting up the table, caring for pets, squeezing oranges (Shipley-Benamou, Lutzker, & Taubman, 2002); and shopping at the supermarket (Alcantara, 1994; Haring, Kennedy,

Adams, & Pitts-Conway, 1987). In addition, several literature reviews have been published, systematically examining the results of numerous experimental studies, and demonstrate that video modeling can be used to teach communication skills, social skills, play skills, joint attention, cognitive skills, school preparation skills, academic skills, motor skills, adaptation skills, and professional skills to individuals with ASD (Acar & Diken, 2012; Bellini & Akullian, 2007; McCoy & Hermansen, 2007; Shukla-Mehta, Miller, & Callahan, 2010; Wong et al., 2013, 2015).

Video modeling is preferable for training individuals with ASD for the following reasons: individuals with ASD are visual learners (they are usually better at processing visual information compared to verbal information); and video modeling does not require social interaction and face-to-face communication; and video modeling allows demonstrating the target behavior multiple times with minimal effort (Buggey, 2012; Delano, 2007; Keenan & Nikopoulos, 2006). Given that parents are able to use various methods based on applied behavior analysis with treatment integrity to teach their children with ASD, they should be able to use video modeling, which is an effective teaching intervention and has certain advantages for individuals with ASD. However, to the best of our knowledge, there has been only a single study on the effectiveness of video modeling provided by family members. In this study, Cardon (2012) used a single-subject research design to examine the effects of a video modeling-based teaching intervention provided by mothers. This teaching intervention, developed for teaching imitation skills to individuals with autism, included video modeling shown on an iPad as well as physical prompts and reinforcements (Cardon, 2012). Results showed that mothers were able to implement video modeling with treatment integrity, and there was a significant improvement in the imitation skills of children with ASD who were able to retain and generalize their skills to different models. In single-subject research, repetition is very important to establish external validity or the generalizability of findings to non-research conditions (Gast, 2010; Tekin-İftar, 2012). For findings from such studies to be validated as scientific evidence in support of any practice, similar results should be obtained in different studies by different researchers with different participants (Horner et al., 2005; Kırcaali-İftar, 2012; Odom, Collet-Klingerberg, Rogers, & Hatton, 2010). Within this framework, a parent training program was created for the present study, designed to equip mothers with the ability to teach skills to their children with ASD using video modeling, and after the training, its effectiveness was examined. This study thus examines whether mothers are able to implement video modeling with treatment integrity after completing the parent training program, tests the effectiveness of video modeling provided by mothers in teaching a play skill to children with ASD, and explores the mothers' views on the study.

Method

Participants

Subjects. Three boys with ASD and their mothers participated in this study. Interviews conducted with the families showed that the subjects were diagnosed in Turkish health facilities. In the first stage of the study, the Turkish version of the Gilliam Autism Rating Scale-2 (GARS-2-TR), developed by Gilliam in 1995 and adapted and standardized for use in Turkey by Diken, Ardıç, and Diken (2011), was administered on the basis of information given by mothers, and autism scores of the subjects were calculated. All of the subjects attended a group education program between 09:00 am and 12:30 pm on weekdays, offered by a developmental disability intervention unit attached to a university, and attended a preschool for the rest of the day, together with neurotypical children.

In order to participate in the study, subjects were required to display the following competencies: visual perception, the ability to follow verbal instructions, the ability to pay attention to visual and auditory stimuli for at least 5 min and to images on a computer screen for at least 2 min, and the ability to imitate gross and fine motor skills. To test whether the subjects had visual perception, they were asked to point out the named object among three objects shown on a computer screen. To test whether they had the ability to follow verbal instructions, the subjects were given instructions such as "hold the baby," "drive the car," "pick up the ball," and "color the picture" and were expected to follow each instruction. To see whether the subjects were able to focus their attention on visual and auditory stimuli for at least 5 min, the subjects were offered "jigsaw puzzles" and "coloring" activities and were observed. To see whether they were able to pay attention to images on a computer screen for at least 2 min, the subjects were shown an animated movie on the computer and were observed. To test whether they had the ability to imitate gross and fine motor skills, tasks such as "attaching a clothespin," "stringing beads," "throwing cubes into a bucket," "pounding a drum," "giving water to the baby," "clapping hands," and "jumping" were demonstrated; subjects were instructed to "do like this," and were expected to follow the instructions. In these tests conducted to ascertain whether they possessed the prerequisite competencies, subjects were expected to respond correctly for at least 80% of the time.

Alp is 6 years old. A GARS-2-TR test showed that his autism score was 94. Alp is able to form two or three word sentences, can count from 1 to 20 independently, and is at par with his peers in terms of gross and fine motor skills. Alp responds to his name, makes eye contact, and is able to follow two-step verbal instructions. Alp experiences difficulties with social communication and play skills. He is able to focus his attention on an activity for 15 min.

Deha is 5 years old. A GARS-2-TR test showed that his autism score is 83. Deha makes eye contact, responds to his name, follows two-step verbal instructions, and is able to play games with a limited number of rules with a playmate, such as dominoes and throwing balls. He is able to count rhythmically from 1 to 10, and has gross and fine motor skills similar to his peers. He experiences problems with social communication and play skills, and is able to focus his attention on an activity for 15 min.

Ege is 6 years old. A GARS-2-TR test showed that his autism score was 94. Ege is able to form one or two word sentences, makes eye contact, responds to his name, is able to follow two-step verbal instructions but is not sufficiently able to communicate or respond to questions. Ege experiences difficulties with social communication and play skills. He is able to count from 1 to 20 independently, and has gross and fine motor skills comparable to his peers, and is able to focus his attention on an activity for 10 min.

Mothers. In order to participate in the study, the mothers had to possess the ability to read the written material prepared for the study, to use a camera and a computer to record and present videos, and be available for a minimum of three days per week. The three mothers who met the prerequisite and volunteered to participate in the study were aged between 30 and 40 years. One of the mothers is an elementary school graduate, one graduated from a junior college, and one holds a bachelor's degree. One of the mothers is a police officer, one works as a civil servant, and one is a housewife.

Settings and Materials

At the first stage of the study, the first author conducted one-on-one training sessions on video modeling with the mothers in a seminar room in the university unit. In the second stage of the study, mothers held video modeling training and probe sessions with their children at a setting of their choice in their homes (Alp's mother chose to conduct the sessions in their kitchen, Deha's mother in Deha's room, and Ege's mother in their living room). Before the training sessions, the mothers set out a table and two chairs next to one another, allowing both the mother and the child to watch the videos comfortably. In addition, pieces of the toy selected for the "building a Lego train" task were kept on the table, ready to be assembled, in a way that would not distract subjects' attention. For the target skill of building a Lego train to be taught in the experimental part of the study, the 17-piece Lego model of Thomas the Train Engine, the lead character of the animated series "Thomas and Friends" was used.

Training Mothers on the Implementation of Video Modeling with Treatment Integrity

A goal prior to the experiment in the study was training mothers on the implementation of video modeling with treatment integrity. A pilot study was conducted to identify potential problems. In addition to the primary participants, three other children diagnosed

with ASD and their mothers who met the prerequisite criteria participated in the pilot study. Following the pilot study, a pre-test session was held to assess the mothers' levels of video modeling intervention performance; mothers were asked to prepare videos on making chocolate milk and to present the videos to their children. The mothers were assessed at the following stages: (a) preparing task analysis, (b) preparing materials, (c) choosing the model to be used in the film, (d) deciding on the shoot location, (e) deciding on the camera angle, (f) telling the model about the target behavior, (g) shooting the video, (h) checking video footage (repeating if necessary), and (i) transferring the video to the computer. In pre-test and post-test sessions, a skill that would not interfere with the dependent variable of the study was used. After training sessions teaching the mothers how to provide instruction using video modeling, the post-test session was conducted, and the mothers were asked to prepare videos on making chocolate milk and to train their children using the videos they prepared once again. In the pre-test session, the mothers followed, on average, 26% of the video preparation steps correctly (range: 22–33%), and 11% of the steps for video modeling intervention (range: 0–32%), whereas in the post-test session, they correctly followed 100% of the steps for both skills.

Two 3-hour training sessions were held with the mothers over two consecutive days, on a one-on-one basis, teaching them about video modeling intervention. On the first day the following topics were covered: introduction to video modeling, preparing a task analysis, learning about and practicing to prepare videos, learning about and practicing to conduct video modeling intervention, and planning and keeping records of video modeling intervention. On the second day, practice sessions were held at the participants' homes where the mothers used the videos on making chocolate milk to instruct their children in order to gain first-hand experience of providing video modeling instruction. These sessions were video-recorded by the researcher, and at the end of the session, both the researcher and the mothers assessed the mothers' performance using a video preparation assessment form and a video modeling treatment integrity assessment form. The researcher collected data both on whether the mothers kept accurate records of their children's performance and on whether they provided video modeling with treatment integrity. In the training, verbal, visual, and written materials were used together with examples, questions, and practice activities, and timely feedback was given at each step. During the practical training part of the sessions on the first day, the first author assumed the role of a child learner. On the second day, the mothers worked with their own children.

Dependent and Independent Variables

The dependent variable in this study is the ratio of correct responses by participating children regarding the skill of building a Lego train. The first author prepared a task analysis prior to the study by performing the skill. The task analysis was examined

by two graduate students working towards their master's degree in special education and was revised and given its final form incorporating the recommendations. Mothers prepared videos in line with this task analysis. Because the skill in question is a play skill involving a toy consisting of 17 pieces, the subjects' performance of the target skill was assessed on the basis of whether they were able to assemble the pieces correctly and whether they followed the sequence of steps in the task analysis. Making the "chug chug" sound part of the original game was not included among the necessary steps for displaying the skill. Table 1 presents the task analysis of building a Lego train.

Table 1
Task Analysis of Building a Lego Train

1. Take the Lego part with blue wheels.
2. Attach the face of the locomotive so that it faces the hole in front of the Lego part.
3. Attach the part numbered 1 behind the face of the train.
4. Attach the blue Lego part with four holes behind the part numbered 1.
5. Attach the Lego with coal on top of the Lego with four holes, with its windows facing the sides.
6. Pick up the Lego with orange wheels.
7. Attach one of the log-shaped Legos.
8. Attach the second log-shaped Lego on top of the first log-shaped Lego.
9. Attach the third log-shaped Lego on top of the other log-shaped Legos already attached.
10. Attach the log car behind the blue locomotive.
11. Pick up the Lego part with brown wheels.
12. Attach one of the rock-shaped parts to the first four holes.
13. Attach the second rock-shaped part next to the other log-shaped part already installed.
14. Attach the rock car to the log car.
15. Attach two yellow parts on top of one another.
16. Attach the other two yellow parts on top of one another.
17. Attach the green part with the yellow parts to form a bridge.
18. Place the bridge in front of the train.
19. Move the train towards the bridge (saying "chug chug").
20. Drive the train under the bridge.

The independent variable of this study is the video modeling intervention provided by mothers. Video modeling intervention was provided by mothers on a one-on-one basis to their children at least three days a week, one session a day.

Experimental Design

Multiple probe design across participants was used in the study—a research design that allows examination of the effectiveness of an independent variable using three different subjects. Experimental control is achieved when changes in the performance of the first participant is due to the application of the independent variable, no change is observed in the performances of the other participants to whom the independent variable was not applied, and the same effect is subsequently repeated in the other participants (Gast, 2010; Tekin-İftar, 2012). A number of measures were taken to control factors that affect internal validity and to achieve experimental control. An effort was made to

control external factors by asking people interacting with the subjects not to provide any additional training related to the target skill other than the video modeling. Efforts were also made to control maturity effects by completing the interventions as soon as possible, to control measurement effects by collecting data throughout the study on inter-observer reliability and treatment integrity, and to control participant loss by working with voluntary participants who were willing to commit their time.

Experimental Procedure

The experiment of the study began after the mothers were trained on preparing videos and had acquired the skills to provide video modeling intervention. All stages of the experiment were run by the mothers in settings of their homes set apart for this purpose.

Probe sessions. Two types of probe data were collected: daily probes and full probes. During the experiment, all probe sessions were held using the single opportunity method—the mother assigned a "+" to the child every time a step was correctly completed, recording the behavior as a correct response, and assigned a "–" every time the child made a mistake in one of the steps, recording the behavior as an incorrect response. The session was ended by the mother upon the first incorrect response.

Full probe sessions. The first full probe session was held to collect baseline data. The other full probe sessions were held prior to starting instruction with a participant. After the first participant responded in line with the criteria by engaging in target behavior, the full probe sessions were held simultaneously with all other participants. In full probe sessions, data were collected from one session per day, until a minimum of three consecutive sessions and stable data were collected. In full probe sessions, the mother first prepared the setting by preparing play materials before bringing the child into the room, and prompted to draw the attention of the child (such as "come here, darling, why don't we look at these toys now," or "would you like to make a train out of these Legos?") If the child expressed that he was ready to work, either verbally or by a sign (e.g., by nodding or saying "yes") the mother reinforced the child verbally (e.g., by saying "very well" or "alright") and gave the instruction on the skill ("make a train out of the Legos"). The mother waited 5 s for the child to respond and then waited for the child to complete each of the steps identified in the task analysis, giving 5 s for each step. She also verbally reinforced correct responses (e.g., by saying "well done" or "you are doing very well") following a continuous reinforcement schedule. When the child gave an incorrect response at any of the steps, the mother stopped the activity ("alright, this is enough for now, we will pick it up later") and ended the session. After the mother verbally reinforced the child ("thank you for working with me"), data were recorded by the mother and by the researcher in baseline, probe, maintenance, and generalization session data collection forms.

Daily probe sessions. Daily probe sessions were held in the same format as the full probe sessions, prior to video modeling intervention every day. In daily probe sessions, instruction continued until a 100% correct response rate was achieved in three consecutive sessions. Data obtained from the daily probe sessions were recorded by the mother and the researcher in baseline, probe, maintenance and generalization session data collection forms.

Training sessions. Prior to training sessions, the mother prepared the video on the computer, readied it for watching, and brought her child into the room. After giving a prompt to secure the child's attention (e.g., "We are going to watch a video now. Are you ready?") and receiving a verbal or visual sign from the child that he is (e.g., nodding or by saying "yes" or "I am ready"), the mother reinforced the child verbally (e.g., by saying "Attaboy," or "Great"). After starting the video, the mother checked if the child was paying attention to the screen. If his attention was not on the screen, the mother verbally reminded the child (e.g., by saying "Look at the screen" or "Watch the film"), or gave a partially physical prompt (e.g., pointing to the screen, or kindly turning his head towards it) and made sure that the child was watching. Once the video was over, the mother verbally reinforced the child for watching the video properly (e.g., by saying, "Well done, you did very well") and directed the child to the area where the Legos were placed so that he could perform the task. Then, the mother gave a prompt to draw the child's attention ("Are you ready to do what you watched?") and gave the instruction for the task ("Make a train out of the Legos.") The mother waited for the child to complete each of the steps identified in the task analysis giving 5 s for each step and verbally reinforced correct responses (e.g., by saying "well done" or "you are doing very well") following a continuous reinforcement schedule. The mother stopped the activity ("alright, this is enough for now, we will pick it up tomorrow") when the child gave an incorrect response at any of the steps and ended the session. At the end of the session, the mother verbally reinforced the child for his participation and cooperation ("Thank you for working with me.") Training sessions were continued until a 100% correct response rate was obtained for the target skill in three consecutive probe sessions.

Maintenance and generalization. Maintenance and generalization sessions had the same general format as the probe sessions. However, these sessions involved reinforcement fading, which was different from the previous sessions. With Alp and Ege, probe sessions were held 7, 14, and 28 days after the criteria were met for the target behavior. Deha's mother dropped out of the study after the first probe session, saying they would not be able to spend the required amount of time for the study, and it was not possible to hold the second and third probe sessions with him.

Pre-test and post-test measurements were used to see whether the subjects were able to generalize the acquired skill. Data were collected on the generalization of

target behavior to other settings and to other people. The first author held pre-test and post-test generalization sessions with the children at their homes: with Alp in the living room of his house, with Ege in his own room, and with Deha in the living room of his house.

Maintenance and generalization data were also collected for the mothers. To ascertain whether the mothers retained their skills in video preparation, maintenance data were collected 5 weeks after the intervention sessions, and generalization data were collected on preparing videos for another task. In generalization sessions, Alp's mother prepared a video on cleaning the table, and Ege's mother prepared a video on drawing a stick man. Deha's mother did not participate in maintenance and generalization sessions because she had dropped out of the study by then.

Reliability

Data were collected on inter-observer reliability and to check whether video modeling intervention was being provided with treatment integrity. Reliability data were collected by a teacher who has six years of experience, holds a bachelor's degree in special education, and is working towards a master's degree in Applied Behavior Analysis in Autism. Reliability data were collected from at least 30% of all sessions randomly. To examine inter-observer reliability, the following formula was used: [(Agreement / Agreement + Disagreement) × 100] (Alberto & Troutman, 2009; Tekin-İftar, 2012).

In the collection of treatment integrity data, the following behaviors by mothers were taken into consideration: (a) arranging the educational setting; (b) preparing the materials; (c) directing the child to the area where he would watch the video; (d) giving a prompt to draw his attention; (e) drawing his attention to the screen; (f) responding correctly to the child's responses as he watches the video; (g) reinforcing the child once the video is over; (h) directing the child to the area where the task is to be performed; (i) giving the instruction to perform the task; (j) waiting for 5 s for the child to respond; (k) responding correctly to the child's responses during the performance of the task (reinforcing correct responses, ignoring incorrect responses); and (l) ending the session. To examine treatment integrity, the following formula was used: [Observed trainer behavior / Planned trainer behavior × 100] (Erbaş, 2012; Tekin-İftar, 2012).

Social Validity

Social validity analysis was conducted to examine the appropriateness of the parent training provided to mothers, the target skill of building a train out of Lego bricks, and the intervention carried out to teach the skill and to examine the significance of the behavioral change that resulted. Data were collected using the method of subjective evaluations: a social validity questionnaire, prepared by the researchers

and consisting of 15 questions [13 closed (yes-no-neutral) and two open-ended], was answered by the mothers. The questionnaire was designed to examine the importance of the target behavior, the appropriateness of the intervention used to teach the target behavior, and the significance of the results for the children and their mothers. It included items on whether the mothers approved of the parent training program, whether they enjoyed being able to teach a play skill to their children, whether they were planning to use video modeling to teach other skills, and whether they would recommend this teaching method to other parents. Social validity data were analyzed using descriptive analysis.

Results

Findings on Whether Mothers were able to Prepare Appropriate Videos

In pre-test and post-test sessions conducted to assess participant mothers' performance in preparing videos, the task was making chocolate milk. In these sessions, Alp's mother and Ege's mother received a 22% performance rating because they missed the steps of conducting task analysis, preparing materials, choosing the model to be used in the film, deciding on the shoot location, deciding on the camera angle, telling the model about the target behavior, and checking video footage (repeating if necessary). Deha's mother received a 33% performance rating because she missed the steps of conducting task analysis, preparing materials, choosing the model to be used in the film, deciding on the shoot location, telling the model about the target behavior, and checking video footage (repeating if necessary). In the post-test session on preparing videos, all mothers received a 100% performance rating. Table 2 reports the pre-test and post-test performance ratings of the mothers in video preparation

Table 2
Pre-test and Post-test Performance Ratings of the Mothers in Video Preparation

	Percentage of Correct Responses		
Sessions	Alp's Mother	Deha's Mother	Ege's Mother
Pre-test	22%	33%	22%
Post-test	100%	100%	100%

Five weeks after the experiment in the study was over, a session was conducted by the researchers to verify whether the mothers maintained the skill of preparing videos and whether they generalized the skill to preparing videos on other tasks. Alp's mother prepared a video on "cleaning the table," and Ege's mother prepared a video on "drawing a stick man." An examination of these videos showed that both mothers had maintained 100% of their skill and were able to generalize to other tasks. It was not possible to conduct a similar assessment regarding Deha's mother because Deha and his mother dropped out of the study following the first maintenance session.

Findings on Reliability

Treatment integrity. Treatment integrity data from the sessions held by the mothers during the experimental part of the study are reported in Table 3. Alp's mother provided eight sessions of video modeling instruction, and Ege's mother provided seven sessions. In these sessions, both mothers displayed behaviors expected from them with 100% accuracy. Deha's mother provided 12 sessions of video modeling instruction, and had an average of 95.75% (range: 91.5–100%) treatment integrity in these sessions.

The mothers' behaviors in the probe sessions were also examined. Alp's mother held three baseline, nine full probe, and eight daily probe sessions, making a total of 20 probe sessions with an average of 95.5% (range: 85.5–100%) treatment integrity. Deha's mother held three baseline, nine full probe, and 12 daily probe sessions, making a total of 24 probe sessions with an average of 96.47% (range: 90.3–100%) treatment integrity. Ege's mother held three baseline, nine full probe, and seven daily probe sessions, making a total of 19 probe sessions with average of 97.1% (range: 85.5–100%) treatment integrity.

In maintenance sessions, all the mothers displayed the expected behaviors with 100% accuracy. To collect generalization data, the first author conducted the sessions instead of the mothers. Reliability analysis showed that the researcher conducted the generalization sessions with 100% procedural reliability.

Table 3
Treatment Integrity of the Sessions Conducted by the Mothers in the Experimental Part of the Study

	Alp's Mother	Ege's Mother	Deha's Mother
Baseline Sessions	85.5%	85.5%	100%
Training Sessions	100%	100%	95.75%
Daily Probe Sessions	92.5%	100%	96.3%
Full Probe Sessions	100%	100%	90.3%
Maintenance Sessions	100%	100%	100%

Inter-observer reliability. Apart from the full probe sessions conducted with Deha, an inter-observer reliability coefficient of 100% was achieved in all the baseline, full probe, daily probe, maintenance, and generalization sessions held by the participants. The average inter-observer reliability coefficient was 99.68%. The lowest inter-observer reliability coefficient was 95.2%, and the highest inter-observer reliability coefficient was 100%.

Findings on the Effectiveness of Video Modeling Provided by Mothers

Figure 1 and Figure 2 display the findings on the effectiveness of video modeling provided by the mothers. Figure 1 reports the performance of the subjects in full probe, training, and maintenance sessions, and Figure 2 reports their performance in generalization pre-test and post-test sessions.

As the graph in Figure 1 shows, the ratio of correct responses displayed by Alp in the baseline stage of the skill building a Lego train was 3.33% (range: 0—5%), and reached 100% by the sixth training session although the intervention continued until data were stabilized. In the intervention stage, a total of eight training sessions were held, and eight trials were conducted. Alp was provided, in total, with 18 min and 33 s of instruction on the skill of building a Lego train. Alp displayed a 100% ratio of correct responses in the second and third full probe sessions. In the maintenance sessions conducted 7, 14, and 28 days after the intervention was over, Alp displayed the skill of building a Lego train with 100% accuracy rate. Analysis of the generalization data showed that Alp was not able to perform the skill of "building a Lego train" in the pre-test session, but performed it with 100% accuracy rate in the post-test session.

The ratio of correct responses displayed by Deha in the baseline stage of the skill building a Lego train was 1.66% (range: 0–5%) and reached 100% by the tenth session, although the intervention continued until data were stabilized. In the intervention stage, a total of 12 training sessions were held, and 12 trials were conducted. Deha was provided, in total, with 26 min and 06 s of instruction on the skill of building a Lego train. Deha displayed a 95% ratio of correct responses in the full probe session, and 100% in the third full probe session. In the maintenance session conducted one week after the intervention was over, Deha displayed the skill of building a Lego train with 100% accuracy rate. Analysis of generalization data showed that Deha was not able to perform the skill of "building a Lego train" in the pre-test session, but performed it with 70% accuracy rate in the post-test session.

As the graph in Figure 1 shows, the ratio of correct responses displayed by Ege in the baseline stage of the skill building a Lego train was 13.33% (range: 0–25%), and reached 100% by the fifth session, although the intervention continued until data were stabilized. In the intervention stage, a total of seven training sessions were held, and seven trials were conducted. Ege was provided, in total, with 17 min and 59 s of instruction on the skill of building a Lego train. Ege displayed a 100% ratio of correct responses in the second and third full probe sessions. In maintenance sessions conducted 7, 14, and 28 days after the intervention was over, Ege displayed the skill of building a Lego train with 100% accuracy rate. Analysis of generalization data showed that Ege was able to perform the skill of building a Lego train with a 15% accuracy rate in the pre-test session, but performed it with 100% accuracy rate in the post-test session.

Overall, findings on the performances of Alp, Deha, and Ege in the full probe, training, and maintenance sessions show that the baseline performances of each of the participants changed after the video modeling intervention, with all the subjects subsequently meeting performance criteria. This change shows that video modeling provided by mothers was effective in teaching the subjects the skill of building a Lego train.

Social Validity

Findings of the study showed that all the mothers approved of the training program. The mothers stated that the amount of time they devoted to the training program and the video modeling sessions they conducted with their children did not prevent them from getting on with their daily activities and that the parent training program did not impose

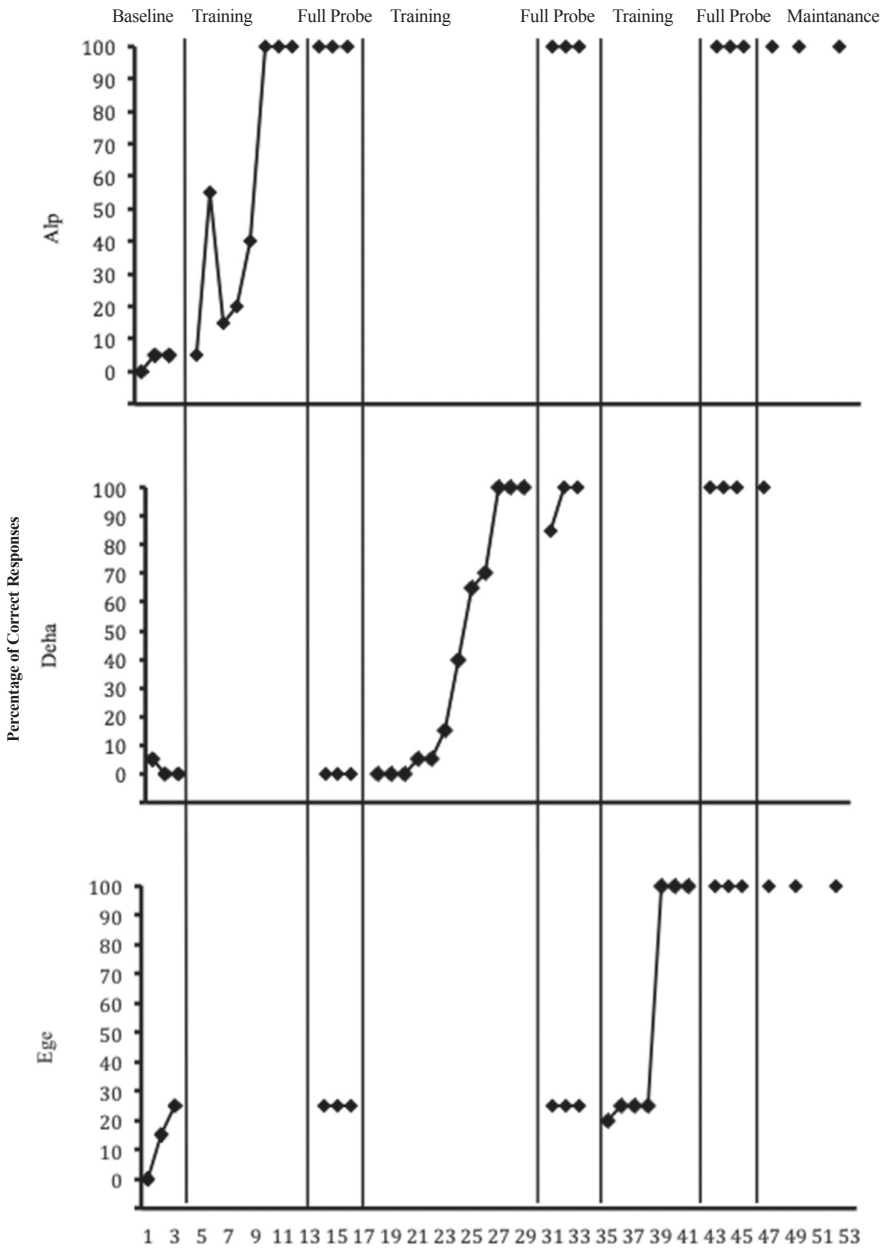

Figure 1. Percentage of correct responses for the target skill by participants during baseline, training, and maintenance sessions.

any extra financial costs on them. All the mothers said that it was important for family members to have the ability to teach certain skills to their children with ASD, that learning a play skill was important for their children, and that they would like to teach other play skills. Mothers said that they enjoyed being in a position of teaching, were planning to use video modeling to teach other skills to their children, and would recommend this teaching method to other parents. In response to the question of what they liked about the study, one of the mothers said that she was happy because she was able to teach a skill to her child using a visual support, and another mother said that she doubted whether her son would be able to learn, simply by watching a video, to play with a toy that had so many parts, and she was pleasantly surprised and happy to see that he could. Another mother said that video modeling saved a lot of time because it eliminated the need to demonstrate a skill many times, that shooting a video of the skill was sufficient, eliminating the need to use a live model all the time, and that video modeling was very economical because the same video could be used multiple times. Finally, mothers who participated in the study said there was nothing they did not like about it.

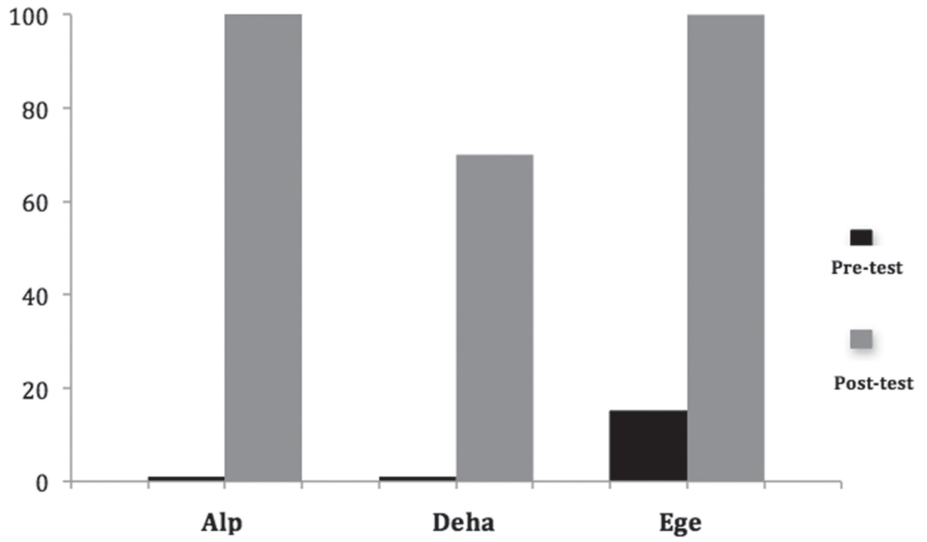

Figure 2. Pre-test and post-test generalization results.

Discussion

This study examined whether mothers could provide video modeling after participating in a training program, and whether video modeling provided by mothers would be effective in teaching the skill of building a Lego train to children with ASD. In addition, social validity data were collected from the participating mothers, using subjective evaluations method. In this section the findings of the study are discussed from various perspectives and a number of recommendations are made regarding future research.

Findings of the study showed that mothers were able to prepare videos with a 100% accuracy rate, and implemented video modeling intervention with an average of 96.39% (range: 85.5–100%) accuracy rate. These findings are consistent with the findings of the only other study in the literature on the effectiveness of video modeling provided by family members. Cardon (2012) found that mothers were able to prepare videos using a tablet computer with over 90% accuracy rate, and implemented video modeling intervention with over 95% accuracy rate. Both studies show that video modeling can be taught to family members, and family members are able to use video modeling with high treatment integrity. Previous studies show that parents are able to make successful use of evidence-based practices in the field of ASD (Charlop-Christy & Carpenter, 2000; Koegel et al., 2002; Lafasakis & Sturmey, 2007). Findings of the present study lend significant support to the idea that parents would be successful in using video modeling to provide instruction to individuals with ASD, as is the case with other evidence-based practices.

One of the findings of the present study is that video modeling provided by mothers with high treatment integrity is effective. Video modeling provided by the mothers was effective in helping children acquire the skill of building a Lego train, maintain the skill after the intervention was over, and generalize the skill to different settings and different people. These findings regarding the effectiveness of video modeling provided by mothers mirror those by Cardon's (2012). Cardon found that, following video modeling provided by mothers, there was a significant increase in the imitation skills of children with ASD, the skills taught in the study were maintained, and were generalized to different models. The findings of both studies indicate that video modeling provided by mothers can be as effective as video modeling provided by professionals (Akmanoğlu, 2015; Nikopoulas & Keenan, 2003; 2004; Shipley-Benamou et al., 2002), and thus expand the literature on video modeling.

Five weeks after the intervention was over, sessions were conducted with two of the mothers who participated in the study to see whether the skill of preparing videos was maintained and whether this skill could be generalized to prepare videos on other tasks. In these sessions, mothers were asked to pick another task for their children and prepare videos on these tasks. For their videos, Alp's mother chose the skill of cleaning the dinner table, and Ege's mother chose the skill of drawing a stick man. Mothers were observed preparing videos for the new tasks with a 100% accuracy rate. Given that in Cardon's (2012) study, videos prepared by mothers were limited to imitation behaviors such as waving goodbye, pushing a cart, and touching one's nose, it can be argued that findings of the present study expand the literature by showing that mothers are able to generalize their skill of preparing videos.

The main goal of this study was to find out whether mothers were able to implement video modeling with treatment integrity, and to test the effectiveness of

video modeling provided by mothers in teaching a playing skill to children with ASD. It was found that mothers were able to implement video modeling with treatment integrity, and video modeling provided by mothers was effective. In addition to issues of treatment integrity and effectiveness, there are other aspects of the study that are worth considering, which discussed below.

Positive findings regarding the social validity of the study are one of the strengths of the present study. The mothers usually had positive things to say about the study, for example, "In video modeling, I don't have to demonstrate the same activity over and over again. I just need to shoot one video, and we can watch it together. This saves both time and energy. It also eliminates the problem of finding a model every time when I am teaching a new activity." Another mother expressed her positive views about the study as follows: "I didn't think he would be able to learn how to play a game with so many parts just by watching a video. I was really surprised when he learned it such a short time. It made me really happy." The mothers stated that the amount of time they devoted to the video modeling sessions they conducted with their children did not prevent them from getting on with their daily activities, and said that video modeling was a very efficient method in terms of time spent. On average, a video modeling session lasted 2 min and 28 s, with the longest session lasting 3 min and 23 s and the shortest lasting 1 min and 46 s. It took a total of 18 min and 33 s for Alp, 26 min and 06 s for Deha, and 17 min and 59 s for Ege to acquire the skill of "building a Lego train." These findings are consistent with mothers' views on video modeling, and indicate that mothers can use video modeling in a very time-efficient way to teach various skills to their children. In addition to being able to make use of video modeling in an effective manner and with high treatment integrity, social validity data showed that mothers had very positive views about video modeling. Given the findings of this study on treatment integrity and effectiveness and social validity of video modeling, it could be recommended that parent training programs might be developed and offered to help family members learn video modeling and use it to teach various skills to their children with ASD. Trainers working with children with ASD would be well advised to encourage family members to use video modeling when instructing their children.

Although the findings of the study on treatment integrity, effectiveness, and social validity were very positive, there were also a number of limitations. First of all, the effectiveness of the training program on video modeling, offered to the mothers, was not tested using experimental control. This is a limitation of the present study. As part of the study, two three-hour training sessions were held with the mothers over two consecutive days, on a one-on-one basis, to teach them about video modeling intervention. In the only other study published on the effectiveness of video modeling provided by mothers (Cardon, 2012), it is reported that it took about two hours to train mothers on preparing videos and conducting video modeling intervention, that mothers were able to prepare

videos using a tablet computer with an accuracy rate higher than 90%, and that they implemented video modeling intervention with an accuracy rate higher than 95%. When these findings are considered together, it is recommended that future studies should use experimental controls to identify more effective and more efficient ways of teaching video modeling intervention to parents of children with ASD. A second limitation is that data were collected, after the training sessions were over, on whether mothers were able to generalize their skill of preparing videos, but no effort was made to see whether mothers were able to generalize their skill of conducting video modeling intervention. This is another limitation of the study. Therefore, future studies should also look into whether mothers are able to generalize their skill of performing video modeling intervention. Third, although mothers were taught about conducting a task analysis and preparing a data collection form, due to concerns about experimental control, the task analysis and data collection form used in the study were prepared by the researchers and given to the mothers. Thus, it was not possible to learn about the mothers' behaviors regarding conducting a task analysis and preparing a data collection form. Future studies should examine the effectiveness of interventions where all stages of video modeling are planned and run by family members. The skill of building a Lego train—the play skill taught as part of this study—is a chained skill that does not require any social interaction. Future studies should examine the effectiveness of video modeling provided by family members in teaching more complex play skills that also involve social interaction. In addition, future studies can look into the effectiveness of video modeling provided by family members in teaching different skills such as self-help skills, daily living skills, and social skills. Future studies can also examine the effectiveness of video modeling provided by family members other than mothers, or by peers. In addition, future studies can compare the effectiveness and efficiency of video modeling provided by family members and by professionals. Finally, social validity data in this study were collected only from the mothers. Future studies should collect social validity data on video modeling intervention from all family members.

Based on the findings of the present study and previous studies, the following conclusions are made. Mothers are able, after participating in a parent training program, to acquire the skill of conducting video modeling intervention, to maintain the skill of preparing videos for this purpose, and to generalize this skill to the preparation of videos on other tasks. Children are able, after the intervention conducted by their mothers, to acquire the target skill, to maintain the target skill once the intervention is over, and to generalize this skill to other settings and other people.

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