The number of children with autism spectrum disorder (ASD) is gradually increasing around the world. According to the U.S. Centers for Disease Control and Prevention (CDC, 2015), approximately one child in every 68 in the United States is diagnosed with ASD. Prevalence of ASD in Asia, Europe and North America average about 1% (CDC, 2015). ASD is a neurodevelopmental disorder that impacts many aspects of social and communicative functioning, with associated impact on cognitive and adaptive functioning (Klin, 2011). In addition to deficits in social and communicative functioning, restricted, repetitive, stereotyped patterns of behavior negatively affect the learning of adaptive behaviors in children with ASD (American Psychiatric Association, 2013; Bodfish, 2011). Adaptive functioning describes the degree to which individuals are able to function independently in their daily lives. The acquisition of independent living skills, such as self-care (e.g. dressing), adaptive skills (e.g. food preparation) should be a priority for children with ASD (Klin et al., 2007; Taylor, DeQuinzio, & Stine, 2014). Independence in daily life improves quality of life, not only for the individual with ASD, but also for his or her family (Taylor et al., 2014).

Some effective instructional procedures have been developed to teach adaptive skills to children with ASD. Nowadays, a variety of interventions and procedures have been developed to meet the requirements associated with the deficits of these children. Using an effective procedure, and selecting an efficient and socially valid approach, is important for the education of children with ASD (Kurt & Tekin-Iftar, 2008; Schuster, Griffen, & Wolery, 1992; Tekin-Iftar & Kircaali-Iftar, 2006).

Increasing the number of children diagnosed, the variety of services and seeking of effective instructions are required to identify and describe the evidence-based practices for children with ASD (Odom et al., 2003). The National Professional Development Center (NPDC, 2015) and National Autism Center (NAC, 2015), which are organizations dedicated to developing evidence-based practices, report various practices for teaching children with ASD. According to their reports, discrete
trial teaching and video modeling are two of the evidence-based practices for teaching various skills to children with ASD.

Simultaneous prompting (SP), also referred to as errorless learning, is a response-prompting procedure that has been successfully implemented within discrete trial training sessions. SP is a procedure designed to minimize errors. Consequently, SP trials are presented at a zero-second delay; that is, the implementer provides the prompt immediately after providing the direction (Gibson & Schuster, 1992). Since the implementer does not provide an opportunity for the participant to complete the task independently during the intervention sessions, separate probe sessions are conducted to examine the acquisition of the skill. Therefore, the implementer can make a decision regarding whether or not skill acquisition has occurred. During probe sessions, after the attention of the participant is secured, the teacher can present a direction or discriminative stimulus and wait 3–5 seconds for a response. Correct responses may result in praise and incorrect responses, may result in error correction, or the instructor may ignore them altogether (Gibson & Schuster, 1992). Probe sessions can either be conducted prior to every intervention session, or spread throughout the week (Morse & Schuster, 2004).

Studies have shown that SP is an effective instructional procedure for teaching discrete skills, such as object naming (MacFarland-Smith, Schuster, & Stevens, 1993), identifying community signs (Singleton, Schuster, & Ault, 1995), identifying first-aid materials (Tekin-Iftar, Acar, & Kurt, 2003), identifying occupations (Dogan & Tekin-Iftar, 2002), naming features on a map (Gursel, Tekin-Iftar, & Bozkurt, 2006), and identifying transportation vehicles (Reichow & Wolery, 2009). SP is also effective for teaching chained skills, such as opening a keyed lock on a locker (Fetko, Schuster, Harley, & Collins, 1999), assembling shipping boxes (Maciag, Schuster, Collins, & Cooper, 2000), playing with a baby doll (Colozzi, Ward, & Crotty, 2008), and hand washing (Parrott, Schuster, Collins, & Gassaway, 2000) from preschool age to adults diagnosed with ASD and intellectual disabilities, as well as with typically developing children. Furthermore, professionals, nonprofessionals, teachers, family member, and peers have been shown how to implement SP correctly (Gibson & Schuster, 1992; Leaf, Sheldon, & Sherman, 2010; Morse & Schuster, 2004; Parker & Schuster, 2002; Tekin & Kircaali-Iftar, 2002). However, further research is still needed to increase the instructional efficiency of SP, in terms of reducing the number of trials to meet the criteria, the number of errors, and total training time (Akmanoglu, Kurt, & Kapan, 2015; Kurt & Tekin-Iftar, 2008; Morse & Schuster, 2004; Reichow & Wolery, 2009; Waugh, Alberto, & Fredrick, 2011).

Video modeling (VM) is an evidence-based practice that has been developed, based on Bandura’s social learning theory (as cited in Bellini & Akullian, 2007). VM incorporates making a video recording of adults, peers, or him or herself completing a behavior or task correctly. The child watches video of the behavior and then imitates the behavior independently (Bellini & Akullian, 2007; Coy & Hermansen, 2007; Nikopoulos & Kenan, 2006). Research has shown that VM is an effective instructional strategy for teaching social-communication, play, and independent life skills in children and adolescents with ASD and developmental disability (Bellini & Akullian, 2007; Mason, Ganz, Parker, Burke, & Camargo, 2012). Although VM is a very effective intervention for the acquisition of these target behaviors, some studies have reported mixed results (Apple, Billingsley, & Schwartz, 2005; D’Atono, Mangiapanello, & Taylor, 2003; Taylor, Levin, & Jasper, 1999). Researchers describe mixed results with the sole use of VM, which on certain occasions may not offer positive gains for all participants. (Delano, 2007; Mason et al., 2012). Therefore, in order to obtain a higher level of achievement VM may need to be combined with other interventions or components.

VM is an intervention that is frequently combined with other interventions or components (Bellini & Akullian, 2007; Genc-Tosun & Kurt, 2014). In the literature, there are many studies that investigate the combined effects of VM with activity schedules (Blum-Dimaya, Reeve, Reeve, & Hoch, 2010), social stories (Sansosti & Powell-Smith, 2008), prompting (Akmanoglu & Tekin-Iftar, 2011; Graves, Collins, & Schuster, 2005), and reinforcement (Charlop-Christy & Daneshvar, 2003). In addition to effectiveness studies,
there are some studies that have compared the instructional efficiency of different types of interventions while using with VM. For example, two studies have demonstrated that implementing VM before PECS and least-to-most prompting strategies, have resulted in the faster acquisition of behavior. Future studies need to examine the effects of VM on instructional efficiency of other intervention procedures (Cihak, Smith, Cornett, & Coleman, 2012; Murzynski & Bourret, 2007).

Although VM and SP are often effective when implemented individually, it may be that participants could learn skills more rapidly and with less instructor time when the two interventions are combined. Therefore, in this study, we investigated the effects of VM on the instructional efficiency of SP. The purpose of the present study was to compare the effectiveness and efficiency on the acquisition of chained adaptive skills in children with ASD and of implementing SP alone versus implementing VM and SP together. The following research questions were asked: Which intervention(s) are more effective in teaching adaptive skills to children with autism spectrum disorder? Which intervention(s) are more efficient in reaching the criterion, regarding (a) the number of training sessions, (b) the number of training trials, (c) the percentage of errors, and (d) total training time? Furthermore, the social validity of this study was investigated via a questionnaire to the parents and teachers.

Method

Participants

Four male preschool-aged children diagnosed with ASD participated in the study. All participants attended individual or group training programs at a developmental support unit of a research institute in Turkey. All the participants had been diagnosed with ASD by child psychiatrist at a university hospital. Additional confirmatory support for diagnosis was obtained by having the teachers complete the Turkish version of the Gilliam Autism Rating Scale (GARS-2-TR), adapted and standardized by Diken, Ardic, and Diken (2011). Adaptive scores were not available for these participants; however, our observations determined that all of the participants had age-appropriate fine and gross motor skills, that they exhibited motor imitation, and that they did not demonstrate any challenging behaviors. None of the participants had a history of systematic instruction with VM but each had experience with SP. Prerequisite skills for the participants were as follows: (a) follow one step verbal instructions, (b) have fine and gross motor skills sufficient for learning target food-preparation skills (described below), (c) able to concentrate on watching television for 2 minutes, (d) able to attend to visual and aural stimuli for 5 minutes.

Ersin was a 5-year old boy with ASD who was diagnosed at a university hospital when he was 2.5 years old and his GARS score was 93. According to his teacher report and the authors’ observations, he did not use any spontaneous language, did not imitate verbalizations, and did not make any vocalizations. However, he did follow one or two-step verbal instructions and attend to an activity for 10 minutes. He could perform basic self-help skills, such as eating, washing, dressing and toileting independently. On weekdays, he attended group training at the unit for three hours a day. Cem was 6-year old and had been diagnosed with ASD at a university hospital when he was 3 years old and his GARS score was 90. According to his teacher report and the authors’ observations, he could independently use two or three-word sentences, respond to simple questions (e.g., “What is this?” “Who is she?”), follow verbal instructions, and attend to an activity for 15 minutes. He had difficulty with social and communication skills (e.g., he had limited eye contact, he had difficulty responding to greetings and interaction with peers). He could perform basic self-help skills, such as eating, washing, dressing and toileting independently. He attended individual training sessions at the unit for two hours per week. Burak was a 5-year old boy with ASD. He was diagnosed with ASD at a university hospital when he was 3 years old and his GARS score was 93. According to the teacher report and the authors’ observations, he could imitate one- to two-word sentences, respond to simple questions (e.g., “How are you?” “What is your name?”), follow one or two-step verbal instructions, and attend to an activity for 15 minutes. He had difficulty with social and communica-
tion skills (e.g., he had limited eye contact; he had difficulty interacting with his peers). He was able to perform basic self-help skills such as eating, dressing, toileting independently. He attended group training at the unit on weekdays for three hours each day. Melih was a 6-year-old boy, diagnosed with ASD at the age of 2.5 and his GARS score was 91. Observation indicated he did not speak, imitate others, or make any vocalizations. He was able to follow simple instructions (e.g., “Give me red ball!”) and attend to an activity for 10 minutes. He had difficulty initiating social interactions and used some gestures and signs. He could perform basic self-help skills such as eating, washing, dressing, and toileting with help verbal prompting. He attended group training at the unit on weekdays for three hours each day.

*Trainer and observer.* The researcher (i.e., first author) conducted all experimental sessions. She is a Master’s student in special education and has a minimum of 2 years experience with systematic instruction. The reliability observer was also a graduate student in a Master’s program in special education.

*Setting and Materials*

All probe, intervention and maintenance sessions were conducted in the developmental support unit of the research institute in a one-to-one teaching arrangement. All sessions were video-recorded. SP treatment was conducted in the unit’s cafeteria. The cafeteria had three cabinets, one refrigerator, two long tables, and twenty chairs. The VM sessions were conducted in one of the one-on-one study rooms (4m × 3m). The study rooms had a television, filing cabinets and a DVD player. The participant and researcher sat on the same side of the table to watch the video. The same settings were used both for the video clips and training sessions. Generalization sessions were undertaken by their parents at home in the kitchen. The same materials were used during all sessions.

Materials used during the study included a video camera, and data collection forms. The same setting were used both video clips and training sessions.

*Modeling videos.* Peer video modeling was used in this study. Peer modeling is a type of VM which target behaviors are performed by a familiar peer, such as siblings, classmates or unknown individuals (Coy & Hermansen, 2007). The first author created video clips, which depicted the scenario from the third-person perspective. In other words, the viewpoint is similar to that of an observer. A typically developing peer modeled the appropriate responses for one of the target skills, until the participant accomplished the task correctly. The peer attended second grade at an elementary school and was unknown to the participants. The length of each clip was between 30 and 70 seconds. Six professionals who had experience with special education and VM procedures watched the clips to ensure that the model fully and comprehensively demonstrated the target skills.

*Experimental Design*

An adapted alternating-treatments design was used to investigate the relationship between the dependent variables and independent variables and the efficiency of VM+SP procedure, and SP alone, on teaching target skills for participants with ASD (Holcombe, Wolery, & Gast, 1994). Using an adapted alternating-treatments design, each of two similar but functionally different dependent variables, receive a different independent variable (Holcombe et al., 1994). The dependent variable of the study was the percentage of correct responses on the steps of the task analyses of the target skills. Two similarly complex food-preparation tasks were implemented with each participant for each independent variable. The independent variables of the study were VM+SP and SP alone. The implementation of VM+SP and SP alone with the target skills was counterbalanced across four participants. Rapid alternation of the interventions was administered by allowing at least one hour between the sessions. For example, SP alone was implemented with one target skill, and at least one hour later VM+SP was implemented with other target skill to the same participant.
Selection of Target Skills

The researchers initially selected adaptive skills (preparing a food or drink) for each participant by asking the participants’ teachers what food-preparation sequences were needed (and not mastered) for each participant. The food-preparation sequences were similar but functionally different and consisted of the same number of steps and similar levels of complexity. The pool of skills was divided into three sets. Each set contained two chained skills. Later, parents choose two target skills for each of their children from the pool. The lack of prior mastery of each food-preparation sequence was confirmed via the collection of baseline data, as described below.

Dependent Measures

Two dependent measures were evaluated in this study. The first was the percentage of correct responses during baseline and intermittent probe sessions. Correct responses were defined as correctly performing a step of the task analyses within 4 seconds, and incorrect responses were defined as incorrectly performing a step of the task analyses, not completing it in 4 seconds, or performing a step differently from the task analyses. The task analysis for one chained skill is shown in Table 1. A single opportunity to perform each food-preparation sequence was provided during each baseline and intermittent probe session. The second dependent measure was the parameters of the efficiency. The parameters were, the number of trials to criterion, incorrect responses to criterion and total amount of time to reach the criterion. Response definitions for participants’ responses were the same in baseline and intermittent probe sessions.

Data Collection Probe Sessions (Baseline and Intermittent Probe Sessions)

There were baseline and intermittent probe sessions in the study. Baseline sessions were conducted prior to teaching chained skills and continued until stable data and a minimum of three data points were obtained for each food-preparation sequence and for each participant. A baseline session was performed as follows: The implementer delivered a specific attention cue to secure the participants’ attention (e.g., “Melih would you like to eat some cereal?”), and after receiving an affirmative response from the participant through either eye contact or a gesture, the implementer praised the participant (e.g., “Good!”). The implementer than delivered the task direction (e.g., “Let’s prepare some cereal for you.”), waited 4 seconds for the participant’s response and delivered verbal praise for every step of the task analysis (e.g., “Good job!”). The trial ended when the participant made an error and all remaining steps were scored as incorrect. Intermittent probe sessions were conducted every other day immediately before implementing training sessions in each food-preparation sequence in order to test acquisition.

Training Sessions

A total task format was used to teach the chained skills. Physical prompting was used for each participant and the implementer stood behind or next to the participant. Correct responses resulted in verbal reinforcement. Participants’ cooperation skills were reinforced verbally at the end of each session. The instructional procedures, SP with/without VM, were randomly assigned to the chained skills. Training was provided until a 100% correct response was obtained on at least three consecutive intermittent probe sessions.

| TABLE 1 |
| Task Analysis for Chocolate Milk |

<table>
<thead>
<tr>
<th>Steps in the Task Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Open milk bottle</td>
</tr>
<tr>
<td>2. Hold milk bottle</td>
</tr>
<tr>
<td>3. Pour milk in glass</td>
</tr>
<tr>
<td>4. Put milk bottle on table</td>
</tr>
<tr>
<td>5. Close milk bottle</td>
</tr>
<tr>
<td>6. Open chocolate powder box</td>
</tr>
<tr>
<td>7. Put the cover of chocolate box on table</td>
</tr>
<tr>
<td>8. Get table spoon</td>
</tr>
<tr>
<td>9. Fill table spoon with chocolate powder</td>
</tr>
<tr>
<td>10. Pour chocolate in glass</td>
</tr>
<tr>
<td>11. Stir the milk with spoon</td>
</tr>
<tr>
<td>12. Put table spoon on tray</td>
</tr>
<tr>
<td>13. Get the cover of chocolate powder</td>
</tr>
<tr>
<td>14. Close chocolate box</td>
</tr>
</tbody>
</table>

Errorless Teaching / 295
Simultaneous prompting alone. After the baseline sessions, the implementer started to teach chained skill, as SP sessions. The instructional trial with SP was delivered as follows: the implementer secured the participant’s attention (e.g., “Ersin, would you like to make a chocolate milk?”). After receiving an affirmative response to the question, the implementer verbally reinforced the participant (e.g., “Good!”) and delivered the task direction (e.g., “Ersin, make a chocolate milk please!”). The implementer immediately delivered full physical prompt to the participant. The implementer held the participant’s hand and completed the task analyses together. So, the participant did not have a chance to make any incorrect responses. Correct responses by the participant were reinforced verbally (e.g., “Perfect!”). At the end of the session, as natural reinforcement, the implementer was given a hazelnut-spread sandwich to eat.

Video modeling with simultaneous prompting. After consistent data had been obtained during baseline sessions, the implementer initiated instruction with VM+SP. The intervention sessions were conducted as follows: The implementer and the participant watched the video together. If the participant did not watch, the implementer delivered verbally direction (e.g., “Ersin, please watch the television!”), after watching the video; the participant was given verbal reinforcements (e.g., “You are watching television very well!”). The implementer and the participant went to the cafeteria together, then the implementer secured the participant’s attention (e.g., “Ersin, would you like to make a sandwich?”). After receiving an affirmative response to the question, the implementer verbally reinforced the participant (e.g., “Good!”) and delivered the task direction (e.g., “Ersin please make a sandwich.”). The implementer immediately delivered a physical prompt and kept providing the prompt to the participant until the task completed. A correct response by the participant was reinforced verbally (e.g., “Good job, Ersin!”). At the end of the session the implementer said the participant could eat the food.

Maintenance Sessions

Maintenance probe sessions conducted 1, 2 and 4 weeks following the criterion were met by all participants, apart from Ersin. The third maintenance session for Ersin was conducted 90 days later after first maintenance session, because of his family’s summer vacation. Maintenance sessions were conducted just like the probe session, apart from the reinforcement schedule. The verbal reinforcements were delivered on solely the basis of the correct completion of the tasks.

Generalization Sessions

Generalization sessions were conducted in the participants’ homes with their parents. Generalization sessions were performed in a pre-test and post-test format. A pre-test generalization session was carried out immediately after baseline sessions and post-test generalization sessions were carried out directly after last intermittent probe session.

Post-test generalization sessions conducted once every 2 weeks. Generalization probe trials were conducted in the same manner as the maintenance trials and the same response definitions were used.

Reliability

Dependent variable reliability and procedural reliability data were collected during at least 30% of the sessions. A graduate student in special education served as an independent observer and collected the reliability data. Inter-observer agreement was calculated by dividing the total number of agreements between the experimenter and the observer by the total number of agreements plus disagreements and multiplying by 100% (Tawney & Gast, 1984; Tekin-Iftar & Kircaali-Iftar, 2006). The mean percentage of agreement was 99% (range = 94%–100%) for all participants. Inter-observer agreement data for all participants during all sessions and conditions are shown in Table 2.

Procedural reliability data were collected for 30% of training sessions to determine whether the independent variable was being used as initially planned. Procedural reliability was calculated, by dividing the number of steps accurately completed, by the total number of training steps and multiplying by 100 (Billingsley, White, & Munson, 1980). The procedural reliability was average 98% (range = 80%–100%) across four
participants. Procedural reliability data for all participants are shown in Table 3.

**Results**

**Effectiveness Data**

Figures 1 through 4 show the percentages of correct responses during baseline, intervention, generalization, and maintenance sessions for all participants across instructional procedures. The findings of this study indicated that both independent variables were effective. As can be seen from the figures, both SP alone and VM+SP were equally effective on promoting acquisition of the food-preparation sequence for three participants.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Target Skills</th>
<th>Intermittent</th>
<th>Baseline</th>
<th>Probe</th>
<th>Intervention</th>
<th>Generalization</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ersin</td>
<td>Preparing chocolate milk</td>
<td>100%</td>
<td>98%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Making a cheese sandwich</td>
<td>100%</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Cem</td>
<td>Making popcorn</td>
<td>94%</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Preparing hot chocolate</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Burak</td>
<td>Making a fruit drink</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Making a hazelnut-spread sandwich</td>
<td>98%</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Melih</td>
<td>Making a hazelnut-spread sandwich</td>
<td>100%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Preparing cereal</td>
<td>100%</td>
<td>95%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TABLE 3**

Procedural Reliability Data for All Participants during All Sessions and Conditions

<table>
<thead>
<tr>
<th>Participants</th>
<th>Target Skills</th>
<th>Intermittent</th>
<th>Baseline</th>
<th>Probe</th>
<th>Intervention</th>
<th>Generalization</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ersin</td>
<td>Preparing chocolate milk</td>
<td>100%</td>
<td>98%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Making a cheese sandwich</td>
<td>100%</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Cem</td>
<td>Making popcorn</td>
<td>94%</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Preparing hot chocolate</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Burak</td>
<td>Making a fruit drink</td>
<td>100%</td>
<td>97%</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Making a hazelnut-spread sandwich</td>
<td>97%</td>
<td>98%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Melih</td>
<td>Making a hazelnut-spread sandwich</td>
<td>99%</td>
<td>100%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Preparing cereal</td>
<td>100%</td>
<td>99%</td>
<td>99%</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Note.** R = range.
However, these results were not replicated with the fourth participant, Melih.

Ersin did not perform any steps of either food-preparation sequence during baseline. When intervention sessions started with both procedures, the trend and level of each chained skill immediately improved. Ersin mastered the preparation of chocolate milk with SP alone over 16 trials and making sandwich VM+SP over 14 trials.

Cem provided between 0% and 10% correct responses for making popcorn and did not perform any correct responses for preparing hot chocolate during the baseline. When in-
tervention sessions were initiated with both procedures, the trend and level of each chained skill immediately improved. During intervention, he acquired 100% accuracy for preparing hot chocolate with VM+SP over 12 trials and making popcorn with SP alone over 14 trials.

Burak did not provide correct responses for either chained skill during the baseline. When intervention sessions were initiated with both procedures, the trend and level of chained skill immediately improved. During intervention, he mastered the preparation of a fruit drink with SP alone over 16 trials and preparing a hazelnut-spread sandwich with VM+SP over 22 trials.

Melih provided between 0% and 25% correct responses for cereal making skills with VM+SP alone, and between 0% and 8% correct responses for preparing hazelnut-spread sand-

![Figure 3. Percent of correct responses during baseline, intermittent probe, generalization maintenance sessions for Burak.](image1)

![Figure 4. Percent of correct responses during baseline, intermittent probe, generalization maintenance sessions for Melih.](image2)
with SP alone, during the baseline. During intervention, he acquired 100% accuracy for preparing cereal with VM + SP over 12 trials but he did not meet the criteria for making a hazelnut-spread sandwich taught by SP alone. Unfortunately, the study was discontinued at that point due to summer vacation.

Another finding of the present study was that the participants’ maintained the chained skills, with the exception of the sequence Melih had not mastered, after the intervention phase had ended. Furthermore, participants’ high levels of performance were also observed in the generalization sessions, which they performed at home with their parents.

**Efficiency Data**

Three primary variables were measured: the number of trials to reach criterion, number of incorrect responses to reach criterion, and the total amount of time taken to reach the criterion. The efficiency data shows that, SP with VM was more efficient than SP alone with regard to the number of training sessions and trials to reach the criterion for Ersin, Cem and Melih. However, SP alone was more efficient than VM + SP with regard to the number of training sessions and trials to reach the criterion for Burak. On the other hand, for two participants (Burak and Ersin), SP alone seemed to be more efficient in terms of the percentage of incorrect responses. For Cem, no differences were found between the two dependent variables, in terms of the percentage of incorrect responses. The SP alone procedure seemed to be more efficient than VM + SP for all participants, in terms of the total amount time taken to reach the criterion. Efficiency results for each participant are presented in Table 4.

**Social Validation**

The parents \((n = 6)\) and teachers \((n = 3)\) of the participants individually completed a social validity questionnaire at the end of the intervention to share their opinions regarding the purpose of the study, the appropriateness of the procedures, and the significance of the changes observed in the chained skills. The researchers developed a different Social Validity Form for teachers and parents, which included yes/no and open-ended questions. The teachers and parents found the intervention to be effective and acceptable. The parents reported that they would let their children prepare food that they learned as a result of this study. In addition, the parents said that participating in the generalization sessions of the study and implementing them with their children made them happy. The teachers reported that they had experience with SP procedure, but they had no experience of teaching with VM. Consequently, some of them stated that they would prefer to use both SP and VM separately. On the other hand, others reported if they had proper material and environment, they would use VM both alone and with SP in their class.

**Discussion**

The purpose of this study was to compare the effectiveness and efficiency of SP with VM and
SP alone, in the teaching of adaptive skills to children with ASD. The outcomes of this study revealed that both SP with VM and SP alone were effective in the teaching of adaptive skills to children with ASD. The effectiveness findings from this study are consistent with those of other studies, which separately examined the effectiveness of SP and VM in teaching chained skills (Akmanoglu & Batu, 2004; Alcantara, 1994; Bidwell & Rehfeldt, 2004; Colozzi et al., 2008; Dogan & Tekin-Iftar, 2002; Gibson & Schuster, 1992). Although the effectiveness data had positive findings, some significant points need to be discussed.

In this study, the criteria for both chained skills were met by three of the four participants. However, only Melih met 100% of the criteria in the preparation of cereal with VM and SP intervention procedures. Although Melih learned to make a hazelnut-spread sandwich with SP alone with 60% accuracy, the study had to be terminated because of summer vacation. When an adapted alternated treatments design is used to compare two independent variables in a study, using the more effective independent variable as a final phase is recommended (Holcombe et al., 1994). Therefore, to teach the making of a hazelnut-spread sandwich to Melih, by using more effective teaching strategy, VM and SP in this study, instructional sessions were planned. However, Melih left the institute and instruction could not be completed. The following points could explain his failure to learn this skill. First, the difficulty level of target behaviors may not have been equal for Melih, even though both target behaviors had the same number of steps in the task analysis. Second, during intervention sessions, the implementer observed that Melih was inclined to put the hazelnut-spread in his mouth directly, rather than spreading it on the bread first. As a result of this, he became stuck on the spreading step of the sandwich making, occasioning the failure of his performance.

To date, there are no published studies that have compared the effectiveness and efficiency of SP with VM and SP alone. The efficiency data presented above did not result in a strong conclusion as to which procedure was more efficient. That is, there was no apparent difference between SP with VM and SP alone, in terms of the intervention procedure of the efficiency variables. The results indicate that for three participants, SP with VM was more efficient than SP alone with regard to the number of training sessions and attempts to reach the criterion; for one participant, SP alone was more efficient than SP with VM in terms of all the efficiency variables. On the other hand, analysis of the percentage of errors to reach the criterion show that SP alone was more efficient than SP with VM for two participants and SP with VM was more efficient than SP alone for two participants. Meanwhile, SP alone, required less training time in all participants. Although mixed results on the efficiency measures were obtained in the study, it might be said that efficiency results showed only a small difference in favor of the VM + SP procedure. This is in general agreement with previous studies involving the combination of prompting and VM. Murzunski and Bourret (2007) stated that VM/least-to-most prompting was more efficient than least-to-most prompting alone, in teaching adaptive skills in terms of the number of trials and number of prompted steps. Cihak et al. (2012) found out that the VM + PECS intervention procedure required fewer training sessions than PECS procedure alone, for acquisition of independent communicative initiations.

The reason for the mixed results related to efficiency could be explained in this manner. First, SP might be an effective and efficient procedure without combining VM or other interventions. Secondly, the participants’ individual characteristics may have affected the findings. For example, Melih might prefer to eat hazelnut-spread with a spoon, preventing him from completing the analysis task properly. Third, task difficulty of the selected chained skills might not establish an equivalent. Therefore, similar studies for teaching different skills (e.g., play skills, self-care skills) in different settings, by different implementers, could be conducted in the future.

The social validity findings of the study showed that both the participants’ teachers and parents responded positively. The data was in agreement with previous studies that investigated the effects of SP in terms of social validity (Akmanoglu & Batu, 2004; Colozzi et al., 2008, Kurt & Tekin-Iftar, 2008; Waugh, Fredrick & Alberto, 2009). Conversely, limited studies have reported social validity outcomes.
of VM (Bellini & Akullian, 2007); therefore, these findings enhance the existing literature regarding the measurement of the social validity of VM.

Generalization across two conditions (participants’ home and with their parents) was assessed in this study. Generalization is an essential challenge for individuals with ASD. Research indicates that VM facilitate generalization. However, only limited studies have conducted generalization sessions (Bellini & Akullian, 2007). Participants have demonstrated generalization across setting and people. Furthermore, most previous studies have not provided a measure of treatment fidelity for VM. This study was conducted with average of 98% (range: 80%–100%) across all sessions; therefore, these findings contribute to the current literature regarding the generalization outcomes and treatment fidelity.

Although this study contributes to the existing literature in some ways, there were a number of limitations should be mentioned. First of all, a small sample was used in this study. Therefore, to obtain consistent findings and generalizability of results, future researchers should include a larger sample size with different disabilities. Secondly, this study was conducted with a structured setting in the cafeteria of the unit, except for the generalization sessions that were implemented at participants’ homes. In other words, the sessions used in the study were not conducted in natural settings and occasions. Thirdly, to determine the performance levels of the participants during baseline and probe sessions, a single-opportunity method was used. Therefore, the probe data may not be accurate indicators of the participants’ actual performances. Future research may be improved by including multiple opportunities and an extended baseline phase.

Furthermore, future research should be conducted by adding different parameters to increase instructional efficiency. Additional studies should be conducted to investigate whether VM causes an increase on instructional efficiency of other response prompt teaching strategies (e.g., constant time delay, graduated guidance). There is no difference between SP with VM and SP alone intervention procedure, in terms of the effectiveness and efficiency variables. For this reason choosing best practice for their participants, according to participant and behavior features, is recommended to both teachers and implementers.

References
Charlop-Christy, M. H., & Daneshvar, S. (2005). Using video modeling to teach perspective taking...


Odom, S. L., Brown, W. H., Frey, T., Karasu, N.,

Received: 11 April 2016
Initial Acceptance: 8 June 2016
Final Acceptance: 1 September 2016