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Effects of Reciprocal Imitation Training on Social Communication Skills of Young Children with Autism Spectrum Disorder *

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Abstract

The aim of the current study was firstly to examine the effectiveness of Reciprocal Imitation Training (RIT) on a) imitation of object actions and gestures and b) maintenance of these skills in children with Autism Spectrum Disorder (ASD). Secondly, the purpose was to explore the effectiveness of object and gesture imitation teaching with RIT on motor imitation skills, initiating and responding to initiations of joint attention, play and verbal imitation skills, communicative behaviors and vocabulary, and contextually appropriate use of language. The design of this study was Modified Multiple Baseline Design Across Subjects. The study group consisted of three children with ASD. The results of this study showed that for all subjects there was an increase in the object and gesture imitation. Also, the findings showed that RIT increased motor imitation, verbal imitation, and play skills as well as the frequency of initiating and responding to initiations of joint attention, communicative behaviors, and vocabulary. The results are discussed in line with the literature related to teaching imitation in early childhood period.

Keywords

Autism spectrum disorder
Reciprocal Imitation Training
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Introduction

Because of the role that the imitation skills play in the development of social communication skills in children with ASD (Ingersoll, 2008a; Ledford & Wolery, 2011), they should be supported during early childhood period. In this context, in planning early intervention teaching imitation skills has a vital role. The literature discusses a number of methods which have been implemented in the last five decades to teach imitation skills to children with ASD. These methods include interventions that are evidence based or have been recently developed and are on the way to be regarded as evidence based. One of these intervention methods is the Reciprocal Imitation Training (RIT) (Ingersoll, 2008b), which is a method of teaching imitation skills that in which eclectic intervention techniques based on naturalistic and behavioral approaches, such as Milieu Teaching (Hancock, Ledbetter-Cho, Howell, & Lang, 2016), Incidental Teaching (Neely el al., 2018), an Pivotal Response Treatment (Ventola, Friedman, & Oosting, 2015) are organized in terms of social and communicative reciprocity (Ingersoll &

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Schreibman, 2006). Basically, RIT was developed to teach the spontaneous imitation in the play settings (Ingersoll, 2008b). The common features of the techniques used in RIT are: following the child's lead, responding to the child, and natural reinforcement. It has adopted these characteristics from naturalistic and behavioral approaches. RIT includes the following: contingent imitation that includes imitating the child's actions, vocalizations, or words (e.g., Klinger & Dawson, 1992), linguistic mapping which involves describing child's actions simultaneously (e.g., Yoder, Warren, Gazdag, & Kim, 1993), modeling in which the target imitation actions are modeled, reinforcing that includes presenting natural reinforces when the child exhibits the target action, and prompting that involves error correction when the child cannot exhibit the target imitation action (Ingersoll, 2008b).

For young children with ASD in clinical settings by an implementer RIT's effectiveness on imitating action with object (Cardon & Wilcox, 2011; Ingersoll & Schreibman, 2006), gesture (Ingersoll, Lewis, & Kroman, 2007) and both action with object and gesture (Ingersoll & Lalonde, 2010; Ingersoll & Schreibman, 2006) was examined. research is examined, it is seen that it has been implemented in clinical settings by a practitioner with young children with ASD, RIT's effects on imitation of object (Cardon & Wilcox, 2011; Ingersoll & Schreibman, 2006). In all these studies, RIT techniques were used altogether. In relevant studies (Ingersoll & Lalonde, 2010; Ingersoll & Schreibman, 2006), it was reported that the findings related to the RIT effectiveness might be due to the use of RIT techniques with children to increase the likelihood of the child's responding by increasing the joint attention with the adult and imitative language use. As supportive, each technique of RIT does not play a more active role in terms of effect size on improving children's imitation skills (Ingersoll, 2008b). However, in the literature of teaching imitation skills to children with ASD it was seen that there was a low improvement on spontaneous use of imitation skills in studies in that contingent imitation which is one of the RIT techniques (Ingersoll & Schreibman, 2006) was used solely (Stephens, 2008) or the intervention involved prompting (Ingersoll & Schreibman, 2006) without being placed among RIT techniques (Walton & Ingersoll, 2012). Since in the literature it is seen that imitation supports reciprocal interaction and joint attention (Escalona, Field, Nadel, & Lundy, 2002; Hwang & Hughes, 2000; Lewy & Dawson, 1992), this has contributed to the notion that this imitation technique is a central intervention component in terms of effectiveness in RIT (Schreibman et al., 2015). However, among these discussions about the role of each RIT technique, there is a need for strengthening the findings that support the fact that use of RIT teachniques altogether has sensitive systematic. When this need is met it is expected that the RIT has the quality of being a unique teaching protocol in the direction of becoming an effective evidence based technique in teaching imitation skills to young children with ASD. There are studies which show the relationship of imitation skills with social interaction and communication skills in young children with ASD (Stone, Ousley, & Littleford, 1997; Toth, Munson, Meltzoff, & Dawson, 2006). This relationship has reflections in the literature of teaching imitation skills to children with ASD. Especially in RIT research studies, before and after RIT session, teaching object imitation (Cardon & Wilcox, 2011; Ingersoll & Schreibman, 2006), gesture imitation (Ingersoll et al., 2007), objects imitation and gesture imitation (Ingersoll, 2010, 2012; Ingersoll & Lalonde, 2010) provided with RIT have effects on improving other imitation skills such as motor imitation (Cardon & Wilcox, 2011; Ingersoll, 2010; Ingersoll & Schreibman, 2006), and verbal imitation (Ingersoll & Lalonde, 2010), as well as joint attention (Ingersoll & Schreibman, 2006; Ingersoll, 2012), communication behaviors and vocabulary (Ingersoll & Schreibman, 2006), play (Ingersoll & Schreibman, 2006; Ingersoll, 2010), and contextually appropriate communication and language (Ingersoll & Lalonde, 2010; Ingersoll et al., 2007). However, it is indicated that there is a need for further research to strengthen the findings of RIT showing its effectiveness on imitation skills as well as language and communication, and other social interactive skills while

planning for early intervention for children with ASD since RIT has the potential in being an evidence based method in early intervention (e.g., Ingersoll & Lalonde, 2010).

In previous research, RIT's effectiveness on object imitation (Cardon & Wilcox, 2011; Ingersoll & Schreibman, 2006), or gesture imitation (Ingersoll et al., 2007) was shown. However, there is a limited number of studies examining the effects of RIT which is offered by an implementer (Ingersoll, 2010, 2012; Ingersoll & Lalonde, 2010). This leads to the need for further research that will provide more findings to make RIT an evidence based practice that is proven to be an effective method as well as to generalize the effects of it to young children with ASD. Indeed, it is frequently emphasized that there is a need to strengthen the research findings that prove efficacy of teaching methods based on naturalistic behavioral approach which in turn will make them methods to be preferred as efficient intervention methods supporting social interaction skills in young children with ASD with a broad range of language abilities as well as chronological and developmental age (Schreibman et al., 2015). In this regard, in this research, the effect of object and gesture imitation, which is presented with KTE in terms of imitation skill types, directly on both object and gesture imitation levels were aimed to be tested.

RIT, which is an imitation based intervention package, is very important to contribute to the previous knowledge to become a preferred teaching method in teaching all social communication skills. In this study, unlike other RIT studies, the effect of RIT on language, communication, and social interaction skills of children with ASD was examined. In the study, before and after RIT sessions, the effect of the intervention was examined that involved actions with objects and gesture imitation provided with RIT to children with ASD on acquisition of motor imitation skills, initiating joint attention and responding to initiations of joint attention, communication skills and vocabulary, verbal imitation, play skills as well as contextually appropriate communication skills altogether. In this regard, the aim is to provide a holistic interpretation regarding RIT's effects on language and social communication skills of young children with ASD. In this study firstly it was aimed to examine the effectiveness of using all RIT techniques together on a) objects and gesture imitation skills and b) maintenance of these skills in children with ASD and secondly it was aimed to examine the effectiveness of teaching imitation of actions with objects and gesture imitation using RIT provided to children with ASD on a) motor imitation skills, b) initiating joint attention, c) responding to initiations of joint attention, d) communication behaviors and vocabulary, e) verbal imitation, f) play kills, and g) contextually appropriate language and communication skills.

Method

Participants

The participant child group consisted of children with ASD with a chronological age of 26 to 42 months old. The inclusion criteria for the participants were as follows: the participants a) had a diagnosis of ASD from the related public or university hospitals, b) had chronological age of 24 to 48 months old, c) had a decision according to Gilliam Autism Rating Scale-2-Turkish Version (GARS-2-TV; Diken, Ardıç, Diken, & Gilliam, 2012) as *a high probability of showing autism*, d) a developmental age of 12 to 36 months old (Ingersoll & Schreibman, 2006) that was according to the Gazi Early Childhood Assessment Tool (GECAT; Baykan, Temel, Ersoy, Avcı, & Turla, 2002), which was administered by the researcher, e) did not have any additional disabilities such as visual, hearing, or physical impairments, f) did not have any impairments in motor skills on head or in trunk that would limit hand, arm, shoulder, or head movements which are needed for imitation skills (Ingersoll, 2008b), g) had a language age of minimum 8 months old (Ingersoll & Schreibman, 2006) according to the MacArthur-Bates Communicative Development Inventory (Fenson et al., 1993) which was adapted into Turkish (Aksu-

Koç et al., 2008), h) had impairments in at least eight of the 16 imitation skills in the Motor Imitation Scale (MIT; Stone, 1999) of which scoring sheet that was adapted into Turkish (Zaghlawan & Ostrosky, 2016), i) had impairments in at least five of the imitation of the modeled 10 actions with objects and 10 object and gesture imitation in Unstructured Imitaion Assesment (Ingersoll, 2010). GECDA is a standardized assessment tool to assess children's development 1 to 72 months old (Baykan et al., 2002). GARS-2-TV is an autistic disorder rating scale based on parental report that is reliable and valid (Diken et al., 2012). TCDI is a standardized tool that examines children's language competence during early childhood period based on parental reports that is adapted to Turkish by Aksu-Koç et al. (2008) from Fenson et al.'s (1993) tool. MacArthur-Bates Communicative Development Inventory/MB-CDI, is a standardized tool which examines the language competence of the child based on parental report (Fenson et al., 1993).

Three children ouf of 7 who met all the inclusion criteria were selected as subjects. After giving written and verbal information to parents of all subjects their written consent was obtained. All three children had a diagnosis of ASD from a public hospital, and they had never received training in imitation skills provided with RIT before. In the research, as the participants the first child was named Cem, the second child was named Ufuk, and the third child was named Ali. The characteristics of the subjects are shown in Table 1.

Table 1. Demographical Characteristics of the Subjects

Subject	Gender	Diagnosis	C.Age	D.Age	L.Age	GARS-2-TV	MIS (score)	ISO (score)
Cem	M	ASD	42 months	27 months	24 months	85	12	14
Ufuk	M	ASD	38 months	17 months	11 months	85	4	4
Ali	M	ASD	26 months	12 months	12 months	90	2	2

C. Age: Chronological Age; D. Age: Developmental Age; L. Age: Language Age; GARS: Gilliam Autism Rating Scale-Turkish Second Version; MIS: Motor Imitation Skills; UIA: Unstructured Imitation Assessment

Implementer

The first researcher implemented RIT. The researcher participated in the 14-hour theoretical and applied training related to the RIT which was offered in the scope of "Infant and Early Childhood" conference which was held at the University of Washington in the United States of America, and he obtained RIT Certificate for implementation.

Setting

All the phases of the study (pre-test, baseline, RIT implementation, assessment during and after the intervention, post-test, and follow-up) were carried out in an individualized education room at Gazi University Learning Development Education Research Center. This room is an individualized education room measuring 4 x 5 square meters. The room has a child sized table, chairs, and toys. The cushions were placed at one corner of the room to sit face to face with the child. Also, a camera system was installed at a corner to record the procedures conducted in each phase.

Variables and Measurement Tools

The independent variable of this study was the RIT in which Imitation, Linguistic Mapping, Modeling, Prompting, and Natural Reinforcement were used together (Ingersoll, 2008b). The study had two groups of dependent variables. The first group had the following dependent variables: a) objects and gesture imitation skills, and b) maintenance of the spontaneous use of these skills in children with ASD after two and four weeks following the intervention. The objects and gesture imitation require the child to spontaneous imitate the actions or gestures modeled by the adult within 10 seconds. The object

imitation were measured for object imitation skill included imitating the play actions with the objects (e.g., feeding the teddy bear) which were modeled by the adult (Ingersoll & Schreibman, 2006; Stone et al., 1997), while for gesture imitation skills involved spontaneous imitating descriptive, conversational, or emotional gestures (e.g., opening up hands towards each side showing palms to indicate as "where has it gone?") which were modeled by the adult (Ingersoll et al., 2007). To assess the first group of dependent variables, Imitation Skills Observation Form (ISOF) was used. ISOF, is an imitation assessment tool which identifies child's competence of spontaneous imitation in the context of social interaction. This form was developed based on the Unstructured Imitation Assessment (UIA) Tool of Ingersoll (2010). Unstructured Imittaion Assessment Tool is a reliable and valid tool which measures spontaneous imitation skills of the child in the context of social interaction (Ingersoll, 2010). Moreover it is widely used in RIT research (e.g., Ingersoll & Schreibman, 2006). The ISOF which was developed based on the original UIA includes assessment process of 10 objects and 10 gesture imitation skills. During implementation of ISOF, regarding the imitation tasks correct responses of the child are scored as 2 points "correct response," 1 point is given to "partially correct response," and 0 is given to the "incorrect response."

The second group of dependent variables in the study was as follows: a) *motor imitation scale score,* b) frequency of initiating joint attention, c) frequency of responding to initiation of joint attention, d) number of words uttered, e) verbal imitation score, f) play skills score, and g) frequency of using contextually appropriate language and communication skills. These dependent variables were measured before and after the RIT instruction session. Among these dependent variables, motor imitation skills were assessed by the Motor Imitation Scale (MIS) (Stone et al., 1997). MIS is a reliable and valid tool to measure motor imitation skills (Stone et al., 1997). MIS consists of 16 items. In MIS, there are eight imitation tasks which involve actions with objects and eight tasks which involve actions without objects. Four of the imitation tasks consist of non-meaningful object actions and other four consist meaningful object actions (Stone, 1999). During the implementation of MIS, three trials are conducted for each item. Each trial is scored as 2, 1, or 0 meaning "correct response," "partially correct response," and "incorrect response", respectively. The highest score that can be obtained from MIS is 32. To assess joint attention skills, Joint Attention Skills Observation Form was used. This form is a semi structured form since it involves structured contexts (e.g., putting an object away) as well as unstructured contexts as free-play interactions that were included to reveal joint attention behaviors during the implementation as well as unstructured free-play interactions. In identifying contexts to assess the joint attention skills which are included in this form and to select materials to be used in these contexts, relevant research were utilized that aimed to examine joint attention skills of children with ASD (Clifford, Young, & Williamson, 2007; Charman et al., 1997; Roos, Mcduffie, Weismer ve Gerhsbacher, 2008). There are five contexts in the joint attention skills observation form that measure initiations of joint attention and responding to the initiations of joint attention. Uttered number of *words* were identified depending on parental reports using words and action sections of the Turkish Communicative Development Inventory (TCDI) and TCDI-II. In the study, for children who uttered more than 30 words in the TCDI-I parents also filled TCDI-II. *Verbal imitation skills* score was obtained by the Oral Motor Imitation section of the Imitation Battery, which is a reliable and valid tool to measure verbal imitation skills (Rogers, Hepburn, & Stackhouse, 2003). This battery consists of 16 imitation skills. Of all these imitation skills 8 were object/movement imitation, eight were oral/motor imitation. Of the oral motor imitation actions, 4 were vocalization imitation whereas four included word imitation. *Play skills score* was obtained by Test of Pretend Play which was developed by Lewis and Boucher (1997) and adapted into Turkish by Aydın (2012). In the current study, the third part of the scale which assesses the representational use of one toy was used. If the child plays by an instruction or by modeling it is

scores as 1, if she or he plays by herself or himself by the questions such as "What can be done more?," "What can else be?", the score is 2. The highest score that can be obtained from the third part is 12 (Aydın, 2012). *Contextually appropriate language,* is the frequency of use of gesture, vocalizations, or words to request objects, information, or to give information that are utilized in the correct context with a purpose without imitating gestures, vocalizations, or words uttered by the adult in the context of free play context (Ingersoll, 2010). To measure this variable *Naturalistic Language and Communication Skills Observation Form* was used. This form was developed by the first researcher from the observation form which was used in Ingersoll and Lalonde (2010) study to assess the level of appropriate language use.

Research Model

In this study, multiple-baseline design across subjects which is one of the single subject research models was used by making some adaptations (Ingersoll & Lalonde, 2010). These adaptations were conducted in the same way likewise in similar previous research studies (e.g., Ingersoll & Lalonde, 2010) in the data collection for a baseline. In the baseline level, data were successively collected from each child at the same time, as in the multiple baseline design across subjects model, and when the intervention with the first child was initiated, the baseline data were simultaneously collected from other children *intermittently*. During the experimental process, the implementation was conducted three days a week for three sessions. Three sessions were conducted three times a week during the trial phase of the study. In this direction, while the intervention with the first child continued, baseline data for the other two children were collected every other week.

Experimental Process

The experimental process of this study consisted of a) implementing pre-test, b) baseline level, c) RIT implementation, d) post-intervention assessment, e) implementing post-test, and f) follow-up. The experimental control was achieved by the fact that performance increased after the initiation of the intervention compared to the baseline level, and there was not any increase in the baseline levels of the subjects with whom the intervention was not yet initiated. In this study, RIT was implemented three sessions a week for three days. The first researcher executed the experimental process in the following stages.

Pre-test Level. In this study, before the RIT training sessions, the second group of dependent variables was measured.

Baseline Level. The baseline level data were collected until a consistency was reached at the objects and gesture imitation. Assessment of objects and gesture imitation levels were conducted in the first session of the three sessions of daily assessments. In objects and gesture imitation skills for Cem, Ufuk, and Ali 3, 6, and 9 baseline level data were collected, respectively. Target imitation skills were assessed in the baseline level with the purpose of training were imitation skills of actions with objects and gesture which were involved in the Unstructrued Imitation Assessment Form (Ingersoll, 2010).

Reciprocal Imitation Training: Having achieved consistency in the baseline level, RIT was implemented with the children in the study group. In the implementation phase, different materials than the baseline level were used. RIT was carried out until the level of objects and gesture imitation skills were 80% more than the baseline level, and data in successive three sessions were stable. For the first and second subjects, Cem and Ufuk, a total of 48 sessions and with the third subject, Ali, a total of 45 sessions were conducted. In the study, each target imitation skill was aimed for 1.5 minutes on average in the intervention sessions (Ingersoll & Schreibman, 2006). Three intervention sessions were held in one day, each lasting about 10 to 15 minutes.

In the baseline level, because of the assessment of imitation skills, the imitation skills which the children were independently exhibiting were eliminated, and the ones that children were not independently exhibiting were chosen for instruction. Thus, in the intervention phase, a total of 15, 10, and 13 imitation skills instructions was conducted with the first, second, and third subjects, respectively. During the process of implementing the RIT techniques (Ingersoll, 2008b), actions with objects and gesture imitation skills were instructed in the same session together. The implementer, modeled the actions with objects and gesture behaviors beginning from the ones that the child was familiar with to the novel behaviors taking into consideration the developmental stage of the child (Ingersoll & Schreibman, 2006). In this regard, in the intervention sessions which were conducted in the context of the play, for each of the imitation skills following RIT techniques, which were presented in a tiered manner, were implemented. Following are the instructional steps of the RIT:

In the first step, *contingent imitation* and *linguistic mapping* techniques were applied. The implementer imitated all the verbal and nonverbal behaviors of the child (gesture, play behaviors which involve actions with objects, vocalizations, and words) by using *imitating* to increase the social interactional reciprocity with the child. While the implementer was imitating these behaviors, he also implemented *linguistic mapping stage* simultaneously. In this process, while the implementer imitated all the behaviors of the child he also described the child's behaviors by using a simple language, and he also elaborated verbal utterances (sounds, syllables, words, and word combinations). In the second step, the implementer modeled actions with objects and gestures by using verbal prompts or markers describing these actions or gestures. The implementer waited for 10 seconds for the child to imitate the actions or gestures having modeled these three times. In the third step, *prompts* or *natural reinforcement/praise* techniques were used. At this step, when the child did not imitate the action the implementer modeled, the implementer used physical prompts *(prompting stage)* for the child to complete the imitation action. The physical prompts varied according to the physical movements that the action required to be displayed in the upper body (e.g., imitation actions which require head or trunk movements or imitation actions which require hand or arm movement) as physical directions by holding hands, wrists, elbows, arms, or shoulders (Ingersoll, 2008b). If the child had exhibited the imitation action, the implementer would have let the child play with a toy for 3 to 5 seconds, or he had used verbal or physical praises (well done, pat on the back, and so forth) to reinforce the imitation action. The same procedure was repeated for all the imitation actions. Throughout the instructional sessions, for the language use, play actions, joint attention behaviors, motor or verbal imitation actions to occur, the stimuli were offered unsystematically, and these behaviors were randomly reinforced (Ingersoll, 2008b).

Post-intervention assessment stage. At the end of the intervention, likewise in the baseline, an assessment was conducted. Three times a week, in different days, probes were conducted. For Cem and Ufuk a total of 16 probes, for Ali 15 probes were conducted.

Post-test Stage. Data related to the second dependent variables that were collected during the pre-test was collected likewise at the end of RIT.

Follow-up Stage. To determine the maintenance of objects and gesture imitation skills, follow-up data were collected likewise they were gathered at the baseline, two and four weeks after the intervention was terminated.

Implementation and Scoring of Data Collection Tools

Implementation and Scoring of ISOF. ISOF was used to assess the objects and gesture imitation skills of children. This assessment tool was conducted during play interaction of the researcher and the child together. For the assessment of the imitation following the first stage in which imitation and language mapping techniques were used, i.e., in the second stage in which modeling was used, after the implementer modeled an action for three times the use of the modeled action by the child in 10 seconds were coded in the ISOF. In the assessment of imitation during these times of waiting, the implementer focused on the child's face and only smiled. The implementer did not respond to the

child's imitation or non-imitation. Physical prompts were provided when only the child was unable to lift or switch on the toys (holding or lifting the fishing rod). Intermittently the child was rewarded for making him keep playing or reinforcing his participation in assessment. During the assessment of imitation skills, the skills were modeled in order of appearance in the observation forms. The tone of voice was differentiated to keep the interaction as much as possible (Ingersoll & Lalonde, 2010; Ingersoll, 2012).

In the study, objects and gesture imitation skills that the children displayed were video recorded, and by watching these video records their skills were coded as "2, 1, or 0" on ISOF (Ingersoll, 2010).

Implementation and Scoring of Pre-test and Post-test Data Collection Tools. During pre-test and post-test data collection, for motor imitation skills MIS; for initiating and responding to joint attention *joint attention skills observation form;* for communicative behaviors and vocabulary *TİGE*; for play skills *Symbolic Play Test (SPT);* for verbal imitation skills *Imitation Skills (IS),* for contextually appropriate language use *naturalistic language and communication skills observation form* was used. All tests and observations were conducted in individualized education room one-to-one with the child. MIS was carried out in line with the manual of the scale (Stone, 1999), while the researcher and the child were in play interaction reciprocally. While administering the scale, three trials are conducted for each item. Each trial is scored as 2, 1, and 0 meaning "correct response," "partially correct response," and "incorrect response," respectively. The highest score that can be obtained from MIS is 32. During the implementation of Joint Attention Skills Observation Form, the researcher presented contexts that allowed the child to use different communicative behaviors regarding joint attention function during the researcher and child interaction. The behaviors that occurred during the presentation of these contexts were video recorded for 45 minutes and initiations of joint attention and responding to joint attention bids were coded on the observation form. By identifying the type of the joint attention behavior and calculating its frequency, total frequency data were obtained.

To assess *the communication behaviors and vocabulary* for the first subject TCDI-II (16-36 months old), for the second and third child TCDI-I (8-16 months old) form were conducted. After the parents were informed that the list that the inventory has consists of words that the young children frequently use they were requested to mark the words that their children used on the list. The data were scored by the scoring principles indicated on the form of TCDI inventory (Aksu-Koç et al., 2008). SPT's Section III was implemented. In this section, the child was provided with a teddy bear, and in all the sub-sections he was asked questions such as "What can he do more? " "What more can happen?" and he was expected to play by himself. Afterwards, he was modeled and supposed to play by the instructions and modeling the researcher (Aydın, 2012). If the child plays by being modeled or instructions, she or he gets 1 point, however when asked: "What can he do more?" "What more can happen?" if she or he plays by herself or himself, she or he gets 2 points. The highest score that can be obtained from Section III is 12 (Aydın, 2012). IS was conducted in line with the implementation manual of the scale during play interaction (Rogers et al., 2003). The data obtained were scored by the scoring principles that were identified in IS scoring form (Rogers et al., 2003). For the imitation skills, valid responses were scored as 2, partially valid responses were scored as 1, and incorrect responses were scored as 0, and for each item, three trials are conducted (Rogers et al., 2003). Naturalistic Language and Communication Skills Observation Form was carried out in a setting in which the researcher and child were present during free play interactions with various toys. During this interaction, the communicative behaviors which the child exhibited (gestures, sounds, and words) were video recorded and coded on the observation form. The frequency of the children's communicative behaviors was calculated, and frequency data were obtained.

Social Validity

To collect social validity data in this study, firstly after the imitation training which was offered by RIT, the mothers of the children in the study group were given a 10-question form to indicate their thoughts about the effectiveness of imitation training and the development of their children's social

communicative and imitation skills. These answers to these questions included "Totally agree" to "Totally disagree" on a 5-point Liker type questionnaire form. To collect social validity data, mothers of the children in the study group were asked to watch 4 minutes of videos which were taken from the baseline and intervention phases. The beginning of the videos started from the 5th minute of the sessions to provide consistency in all of the videos. The videos were presented randomly without indicating whether the video belonged to the baseline or training sessions. The mothers were then asked to score the social validity questionnaire on a 5-point Likert type scale. Secondly, to collect social validity data semi-structured interviews were conducted with the mothers. For this purpose, a semi structured interview form which consisted 5 open ended questions were prepared. This form was individually carried out with the mothers.

Treatment Fidelity

Treatment fidelity was calculated for both the assessment and intervention sessions.

Assessment Sessions Treatment Fidelity. Imitation Skills Treatment Fidelity Form was prepared to identify treatment fidelity of assessment sessions. The researcher delivered the observer videos that consisted at least 30% of all the assessment sessions that included each child and each assessment session as well as the Imitation Skills Treatment Fidelity Form. Treatment fidelity for assessment sessions were 88%, 93%, and 91% of the first, second, and third subjects, respectively.

Intervention Sessions Treatment Fidelity. To identify the treatment fidelity of RIT implementation, Fidelity of Implementation Rating Form which was developed by Ingersoll and Lalonde (2010) in a Likert type format was used. This form included the level of use of RIT techniques and modeling speed. The form is rated from 1 with low fidelity of implementation to 5 high fidelity of implementation. For every fidelity degree, there is an operational definition. Treatment fidelity was calculated by an observer for at least 30% of the intervention sessions which were randomly selected from each child. Treatment fidelity was calculated by the formula of "observed implementer behaviors / planned implementer behaviors x 100". Treatment fidelity was 90%, 96%, and 95% for the first, second, and third subjects, respectively.

Calculation of Inter-Observer Reliability

Inter-observer reliability was calculated for 30% (36 sessions) of all the data obtained from all the children in the study group that was collected for objects and gesture imitation skills in all the experimental stages. The lowest and highest inter-observer reliability was 91 and 94%, respectively, and the average was 92%.

For the dependent variables of joint attention skills and contextually appropriate use of language and communicative skills regarding pre-test and post-test target behaviors, interrater reliability data were also calculated. Form was 95%, the lowest and highest reliability was 93% and 98%, respectively. The Naturalistic Language and Communication Skills Observation Form had an average of 92% reliability, the lowest score was 90%, and the highest score was 95%.

Data Analysis

Object and gesture imitation skills which were dependent variables of this study were shown on a graphic and visually analyzed. For identifying the direction of data trend or slope and increase split-middle method was used (Tawney & Gast, 1984). In the study, tables were used to show the data related to the second group of dependent variables before and after the RIT implementation sessions. Pre- and post-test scores of MIS, the frequency of initiating and responding to the initiations of joint attention; the number of word utterances according to parental reports, IS oral-word imitation scores, SPT scores, the frequency of use of language and communicative behaviors were compared. Before and after RIT implementation, object imitation and gesture imiataion as well as relationships among other social interaction, languae and communication skills were measured by correlation as a limitation of the research model.

Results

Findings of Effectiveness

Figure 1 shows the findings related to the objects and gesture imitation skills of the children who participated in this study as well as follow-up data regarding these skills. As it can be seen in Figure 1, the three subjects did not perform any of the objects or gesture imitation skills in the baseline level. With the initiation of RIT implementation, there was an increase in the degree of objects and gesture imitation skills of the children. For Cem and Ufuk there was a steady and decrease in trend however in successive sessions this trend increased. For Ali, the steep trend continued the following weeks. The steepest trend among the subjects was for Ali. These findings show that actions with objects and gesture imitation training offered with RIT were effective on the objects and gesture imitation skills.

This finding was also confirmed by the fact that there was no increase in the skills of children before RIT implementation in the baseline level. In the follow-up session two and four weeks after the intervention phase it was seen that there was a decrease in all subjects for objects and gesture imitation levels compared to the intervention phase. However, in the follow-up phase, children showed 60% to 93% higher performance compared to the baseline level.

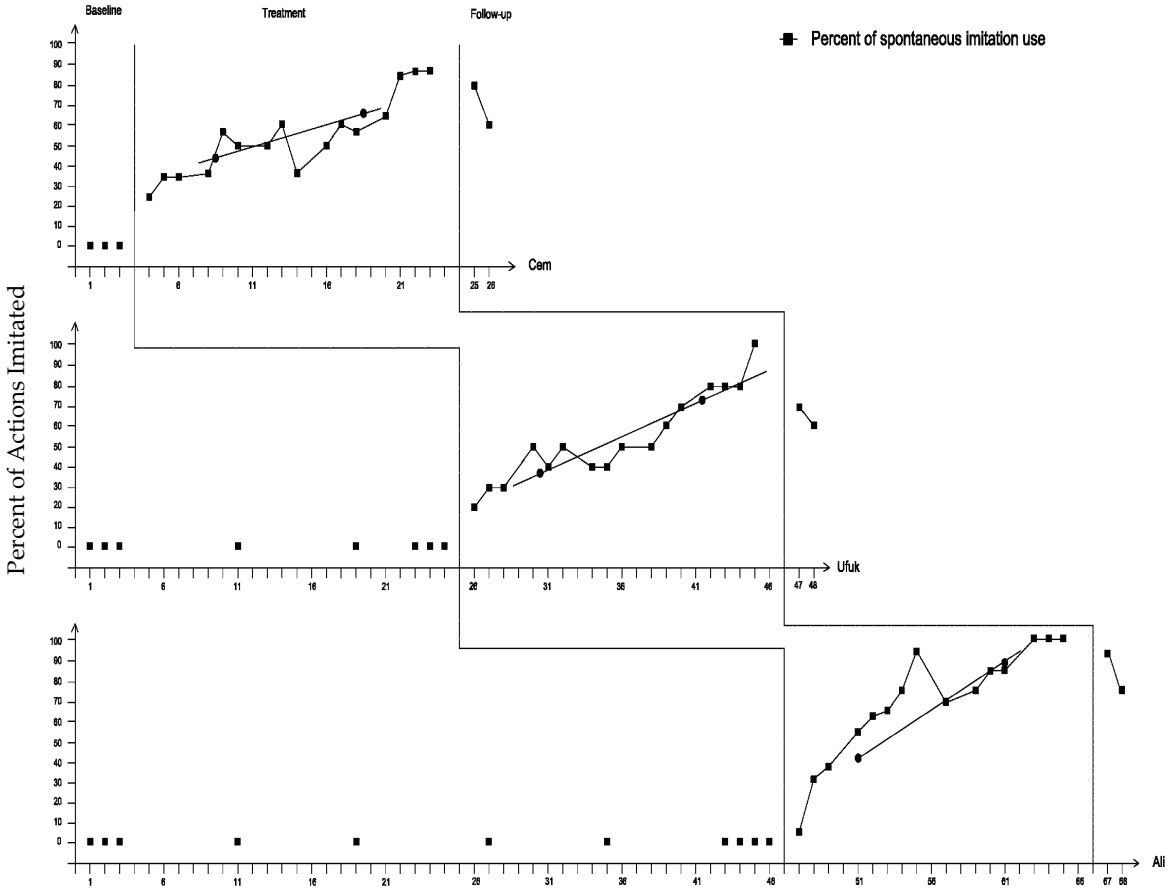

Figure 1. Percent of Imitation Use

Pre-Test and Post-Test Findings

Pre-test and post-test findings for the subjects who participated in this study are shown in Table 2. Because of the object and gesture imitation skills training with RIT the skills that showed significant progress in all subjects differed. Following the imitation skills training with RIT, verbal imitation, motor imitation, play skills, and initiating joint attention skills increased in all subjects, as shown in Table 2. When the findings related to the communicative behaviors and vocabulary was examined, it was seen that there was not a significant increase for Ali and Ufuk but Cem. There was an increase in the IS-oral

imitation scores for all subjects. This increase was lowest for the first subject Cem with 2 points, highest for the third subject Ali with 6 points. Ali showed the highest improvement in play skills (3-6), motor imitation (16-24), and initiating joint attention (3-34) compared to the other subjects. Even though Cem and Ufuk showed improvements in these skills, their improvements were not as high as Ali's. Therefore, Ali was the subject who showed the highest improvement in verbal imitation, motor imitation, play, and initiating joint attention skills.

Table 2. Pre-test and Post-test Findings of the Subjects

Variables	Subjects	Pre-test	Post-test
Motor Imitation	Cem	14	28
	Ufuk	6	8
	Ali	16	24
Initiating Joint Attention	Cem	14	21
	Ufuk	6	7
	Ali	3	34
Responding to Initiations of Joint Attention	Cem	11	16
	Ufuk	8	6
	Ali	13	5
Communicative Behaviors and Vocabulary	Cem	468	611
	Ufuk	27	33
	Ali	3	6
Verbal Imitation	Cem	14	16
	Ufuk	4	8
	Ali	0	6
Play	Cem	3	5
	Ufuk	1	3
	Ali	3	6
Contextually Appropriate Language and Communication	Cem	137	177
	Ufuk	17	15
	Ali	19	55

Motor Imitation Skills: MIS scores; Initiating and Responding to Initiations of Joint Attention: Frequency of behaviors of initiating and responding to the initiations of joint attention; Communicative Behaviors and Vocabulary: The frequency of different communicative behaviors used by the children that was reported by the parents; Verbal Imitation: IS scores; Play Behaviors: SPT scores; Contextually Appropriate Language and Communication Skills: The frequency of contextually appropriate language and communicative behaviors

There was an increase in the IS-oral imitation scores for all subjects. This increase was lowest for the first subject Cem with 2 points, highest for the third subject Ali with 6 points. Ali showed the highest improvement in play skills (3-6), motor imitation (16-24), and initiating joint attention (3-34) compared to the other subjects. Even though Cem and Ufuk showed improvements in these skills, their improvements were not as high as Ali's. Therefore, Ali was the subject who showed the highest improvement in verbal imitation, motor imitation, play, and initiating joint attention skills.

There were variables for which there was not any increases but decreases following imitation skills training with RIT. In the frequency of responding to initiations of joint attention, there was a 5-point increase for Cem whereas there were decreases for Ufuk and Ali. These decreases were the lowest for the second subject Ufuk with 2 points and highest for the third subject Ali with 8 points. Thus, Cem was the only subject who showed increases in responding to initiations of joint attention bids. Finally, for contextually appropriate use of language and communication, Cem had an increase in the frequency as 40, and Ali had 36-point increase whereas Ufuk had a decrease of 2.

Social Validity Findings

Social validity results of this study showed that mothers' responses to the questionnaire items were 4 points or higher on average. Mothers indicated that because of RIT implementation, their children's imitation skills increased, object and gesture imitation improved, RIT was an effective method in teaching imitation skills and RIT should be continually provided, and they were satisfied with the RIT implementation.

Secondly, the interviews with the mothers indicated that the mothers thought the actions with objects and gesture imitation skills offered with the RIT supported imitation development, and it had effects on other social interaction, as well as language and communication skills. In summary, social validity findings suggested that RIT was a socially valid method for parents.

Discussion, Conclusion and Suggestions

The results of this study showed that as a result of RIT implementation, objects and gesture imitation skills increased in the post intervention compared to the baseline. The social validity data of the study was supportive of these findings related to the effectiveness. When the results of the research studies related to the RIT's effectiveness on actions with objects and gesture imitation skills for young children with ASD were examined (Cardon & Wilcox, 2011; Ingersoll, 2010, 2012, Ingersoll & Lalonde, 2010; Ingersoll et al., 2007; Ingersoll & Schreibman, 2006; Ingersoll et al., 2013; Taylor, 2014; Zaghlawan & Ostrosky, 2016), it was seen that RIT seemed to be effective in increasing objects and gesture imitation skills. Therefore, the findings of the current study strengthen the view in the literature that RIT is an effective teaching method for imitation skills of young children with ASD. In this study, RIT was implemented with imitation, language mapping, modeling, promoting, and naturalistic reinforcement techniques implemented likewise in the previous studies with RIT (Ingersoll, 2010, 2012, Ingersoll & Lalonde, 2010; Ingersoll et al., 2007; Ingersoll & Schreibman, 2006; Ingersoll et al., 2013). The use of these techniques together was thought to yield increases observed in the imitation skills. The fact that related RIT studies show that there were significant improvements in imitation skills with the use of RIT techniques together also supports this conclusion. Moreover, these findings strengthen the idea that the presentation of RIT techniques has a sensitive systematicity in improving imitation skills. In future research, the effects of the use of RIT techniques when adapted or non-adapted on the imitation skills can be comparatively examined.

In this study, it needs to be discussed that the significant improvements in imitation skills regarding the type of imitation skills which were taught. In the literature, RIT was frequently implemented with object or gesture imitation skills (e.g., Ingersoll & Schreibman, 2006; Ingersoll et al., 2007). In related research studies in which as a result of RIT implementation improvements were observed, it was suggested that object imitation skills led to easier establishment of the direct response-reinforcer relationship and natural reinforcement possible (Ingersoll & Gergans, 2007), it provided intrinsic motivation thus facilitating increases in imitation skills (Ingersoll, 2010). Therefore, in this study especially during the implementation, it is considered that the type of actions with objects and gesture imitation skills chosen as target skills played a role in the fast increases in the imitation skills and in the following sessions in which the significant improvement obtained.

On the other hand finding of this study, namely that in terms of spontaneous imitation there were significant improvements in the objects and gesture imitation skills, is very critical in that improving imitation skills in children with ASD in early childhood period is very important. There is a consensus in the literature that children with ASD in early childhood have difficulties in spontaneous imitation skills (Ingersoll, 2008a; Ingersoll & Gergans, 2007; Ingersoll & Meyer, 2011a). Also, it was emphasized that RIT is specially designed to improve the spontaneous imitation skills in children with ASD (Ingersoll, 2008b), and the results of the studies also confirm this emphasis (Ingersoll, 2010; Ingersoll et al., 2007; Ingersoll & Lalonde, 2010).

In this study, the effects of teaching actions with objects and gesture imitation skills with RIT was examined in pre- and post-tests on motor imitation skills, initiating and responding to the initiations of joint attention skills, communicative behaviors and vocabulary, play skills, and contextually appropriate language and communication skills. There were increases in the MIS scores of all subjects at the end of the training. In all RIT research studies, as well as in this study, motor imitation skills were assessed by MIS. In these studies, as a result of RIT, there were improvements in motor imitation skills of young children with ASD (Cardon & Wilcox, 2011; Ingersoll, 2010; Ingersoll & Schreibman, 2006). Therefore, the findings of this study strengthen the previous research findings that actions with objects and gesture imitation skills teaching with RIT are effective on improving motor imitation skills of young children with ASD. On the other hand, non-meaningful actions with objects and body movements such as "walking around the hair brush on the table, opening and closing the fist" were not able to be taught in this study that was involved in MIS (Stone, 1999). Considering that target imitation skills which were taught in the RIT implementation consisted of actions with objects and gestures which were meaningful (Ingersoll, 2010), increases in the MIS scores on post-test might show that effectiveness of RIT on actions with objects and gesture imitation skills could be interpreted as clues for generalization to the imitation of non-meaningful body movements.

As a result of RIT implementation, there were increases in subjects' initiation of joint attention (Ingersoll, 2012). In this study as well the increases observed in the frequency of initiation of joint attention, in particular for the first and the third subjects were high. These promising findings strengthen the view that RIT is a method which supports the increases in initiations of joint attention skills. In RIT research studies, as a result of RIT implementation, the increases in the joint attention skills might have been due to imitation and linguistic mapping strategies (Ingersoll & Schreibman, 2006) and the high level of reciprocal interaction which takes place between the teacher and the child in implementation during the time that the child monitors the imitation action (Ingersoll, 2012). Therefore, the results of this study are critical in that RIT as a teaching method might be preferred to support the development of joint attention skills which are one of the key elements of the intervention programs which support the social interaction of children with ASD in early childhood period. On the other hand, in post-test, there were not any significant increases in the frequency of responding to initiations of joint attention in the second and third subjects but in the first when compared to the pre-test. When the increases in the initiation of joint attention is regarded, the use of RIT techniques, might be suggested to increase the frequency of initiating joint attention more than responding to joint attention initiation bids. Therefore, RIT's use in children with ASD during early childhood period might not be effective in supporting responding to joint attention. However, unlike the findings of this study, related studies (Ingersoll & Schreibman, 2006; Taylor, 2014) showed increases in the frequency of responding to initiations of joint attention. These different results should be examined in future research studies to show the effects of RIT on joint attention skills.

In the literature, the studies in which RIT's effects on verbal imitation -which is another imitation skill- play skills, communicative behaviors and vocabulary, and contextually appropriate use of language and communication skills were examined are scarce. In those studies, as a result of RIT implementation, verbal imitation and play skills (Ingersoll & Lalonde, 2010; Ingersoll & Schreibman, 2006), communicative behaviors and vocabulary (Ingersoll, 2010), contextually appropriate language and communication skills (Ingersoll & Lalonde, 2010) increased. In this study also subjects' verbal imitation, play skills, communicative behaviors, and vocabulary increased, in all children except one (second subject) contextually appropriate use of language and communicative skills also increased. For the increases in the expressive vocabulary and the use of contextually appropriate language and communication skills imitating and language mapping might be effective that are suggested to be

supportive of imitation based language and reciprocal interaction (Ingersoll, 2008b). On the other hand this might be the reflection of the positive relationship among the object imitation, gesture imitation, vocabulary, and the use of contextually appropriate language during early childhood for children with ASD (Ingersoll & Meyer, 2011b). Therefore, this study provides a scientific basis to prefer RIT as an intervention method to teach play, verbal imitation, communicative behaviors, vocabulary and contextually appropriate use of language and communication skills to young children with ASD. However, in this study, the effects of RIT on social communication skills, are limited with the interpretation of the degree of difference on acquisition or development levels exhibited before and after RIT. Therefore, the similarities, increases, or decreases suggested between pre- and post-test results, are interpreted as the indirect developmental achievements rather than direct effects of RIT on these skills.

For future implementations, it may be suggested to target actions with objects and gesture imitation skills which the children lack in the intervention programs that target teaching play skills to young children and using RIT as an alternative method to teach these skills. As a result of teaching actions with objects and gesture imitation skills with RIT, it is remarkable that the third subject, Ali, who showed the highest increase in the objects and gesture imitation skills, after the intervention, had the highest improvement in the frequency of initiating joint attention behaviors among all subjects and he showed critical improvements in motor imitation skills, verbal imitation skills, contextually appropriate language and communicative structures. Ali is different from the other two children in that as language development he was at the pre-linguistic communication period. These findings in favor of Ali might suggest that RIT might highly increase joint attention, motor, and verbal imitation skills in children who are at or close to the developmental period of emergence of these skills than children who can verbally communicate. In addition to this, for the subjects who had significant increases in contextually appropriate language and communication skills, Cem was able to communicate verbally. However, Ali was at the prelinguistic period. In pre-linguistic communication stage, gestures (Bruner, 1981), words and word combinations (Dore, 1974) serve different communication function regarding contextually appropriate language and communication skills (Bates and Dick, 2000). Hence, the impact of imitation skills training with RIT on contextually appropriate use of language and communication skills might be examined regarding different communication functions served by the language and communication.

Limitations and Future Directions

The study has some limitations. First, since the study was conducted in single subject research design, before and after RIT, correlations between object and gesture imitation skills and social interaction and language and communication skills assessed in pre- and post-test were not examined, therefore the generalizability of the effect of RIT on these skills to children with ASD is limited. For this reason, variables considered in pre- and post-test of this study should be strengthened with results of studies conducted as group experimental designs for generalization of the study findings. Secondly, since the study was carried out in adapted multiple baseline model, before the implementation phase with the third subject, due to the fact that he had received baseline sessions more than other subjects might have led the implementer to become a more familiar interaction partner thus leading to an increase in the response speed and accuracy to imitate in the implementation phase. These limitations might be controlled in the future research studies and the data obtained might be interpreted as more power regarding the effectiveness of RIT techniques and their effects on dependent variables. Thirdly, the generalization of imitation levels, acquired at the end of implementation, to other individuals, object imitation or gestures with different types, different toys regarding a similar object imitation were not examined. When it is considered that children with ASD have the difficulties in generalizing the skills they acquire to different individuals, settings, or materials, for future research studies it can be

suggested to examine the effects of RIT on generalization levels of imitation skills mentioned of children with ASD during early childhood period. Fourthly, in this study the effects of RIT on play behavior levels before and after RIT were limited with the use of representational one toy which is one of the symbolic play behaviors due to the limitations of children's play behaviors after the implementation. In future research, the effects of imitation teaching with RIT on play's social dimension as well as a wide range of symbolic play behaviors can be examined.

In the direction of this research's findings, some suggestions can be made for implementation. Firstly, during the process of program planning for supporting social communication development of children with ASD in early childhood period, RIT can be a preferable method. Secondly, in pre-service education of special education teachers during their undergraduate years, RIT can be included both in terms of theoretical knowledge and implementation in courses regarding children with ASD. Thirdly, for dissemination of RIT implementations, national projects can be developed for teachers and parents.

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