

# Effectiveness of Siblings-Delivered iPad Game Activities in Teaching Social Interaction Skills to Children with Autism Spectrum Disorders

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## Abstract

In this study, the effectiveness of a sibling training package offered for teaching social interaction skills that are used by typically developing children while playing iPad game activities with their siblings who have autism spectrum disorders (ASD) is investigated. Three children with ASD and their typically developing siblings participated in the study. Multiple probe design across participants was used in the study. Multiple probe design across participants is a model in which the effectiveness of an independent variable is examined on three different participants. Generalization sessions were conducted in the Unit for Children with Developmental Disabilities at the Research Institute for Individuals with Disabilities, Anadolu University. During these sessions, typically developing siblings implemented the same process with different children with ASD in the unit. Maintenance probe sessions were conducted in the first and second week after the intervention. Data revealed that they were able to learn how to use the social interaction skills necessary for the iPad game activities. All mothers reported their satisfaction about involving their typically developing children in the sibling training program as well as their children's performances during the study.

**Keywords:** Sibling training • Social interaction • iPad games • Video modeling • Autism spectrum disorders

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In recent years, the inclusion policy has been one of the most preferred education arrangements for children with developmental disabilities. Because of this reason it has been seen that the children with ASD who are among the children with developmental disabilities have been placed in general education environments more frequently (Allen & Cowdery, 2005). However, it has been observed that children with ASD have less social competence in peer relationships compared to other groups with disabilities (Barton & Pavlianiis, 2012).

Social communication skills are one of the prerequisite skills for individuals to be able to communicate with others around them. Typically developing children learn social interaction skills during infancy and early childhood. They learn these skills from events that happen naturally at school, home, and in social environments. Typically developing children take the opportunity to develop these skills during these events by responding to the adults and peers around them, making attempts at communication, and getting feedback based on these attempts (Tent, Kasier, & Wolery, 2005). However, as children with ASD have limited abilities for initiating communication, responding, or continuing communication started by other people, they may not evaluate these opportunities as properly as typically developing children. Therefore, it is critically important to increase the quality and quantity of interaction opportunities that children with ASD can practice with the adults and peers around them. Interventions have focused on the natural environments where generalization and maintenance of the social interactions a child with ASD has can best be observed, also focusing on the family and peers with whom the child with ASD spends more time (Rogers, 2000). Studies have shown that families (Drew et al., 2002) and peers (Pierce & Schreibman, 1995) have learned how to successfully deliver these intervention strategies which, after practice, have developed the social interaction skills of children with ASD. Peer-mediated intervention has many benefits for children with ASD. In the literature, there have been a number of studies about peer-mediated interventions both for children with ASD and their typically developing peers that have resulted with positive outcomes (Chan et al., 2009; Kohler, Greteman, Rascke, & Highnam, 2007).

In enabling children with ASD to have peer-mediated social skills, a special type of peer intervention, the training of siblings, is among the practices suggested. However, siblings have been

intervention agents in only a few studies (Walton & Ingersoll, 2012). One of the main findings of many studies examining the quality of life for families of children with ASD has revealed that the social bonds between children with ASD and their siblings are inadequate (Ferraioli, & Harris, 2011; Walton, & Ingersoll, 2012). Children with ASD communicate less with their typically developing siblings. One of the main reasons for this is because of the fact that children with ASD prefer to spend the vast majority of their time alone. Concordantly, the responsibilities of typically developing siblings of children with ASD are twice as great compared to their peers. These responsibilities can be listed as helping their siblings with ASD, planning and managing their life, and assuming the role of caretaker when necessary (Stoneman, Brody, Davis, & Crapps, 1989). Typically developing children who assume the role of caretaker and act in an overprotective manner towards their siblings with ASD bring some limitations on the development of children with ASD. However, children with ASD experience the first rehearsal of peer interactions with their siblings. Moreover, siblings are the most appropriate peer models for children with ASD. When siblings of children with ASD are offered appropriate educational support, not only will children with ASD benefit significantly from this process, but also the responsibility of parents will decline considerably (Oppenheim-Leaf, Leaf, Dozier, Sheldon, & Sherman, 2012).

Even though there have been many research findings in the literature in which peer-mediated intervention has been presented (Odom & Strain, 1986; Strain & Fox, 1981), there are a few research findings where siblings have been used as peers. When the topics of studies carried out with siblings are examined, the very first studies in particular have focused topics such as using behavior modification techniques for teaching academic skills to siblings with ASD (Schreibman, O'Neill, & Koegel, 1983), teaching independent living and academic skills (Swenson-Pierce, Kohl, & Egel, 1987; Tekin & Kircaali-Iftar, 2002) and providing them with leisure activities (Cash & Evans, 1975). When Celiberti and Harris (1993) evaluated the studies carried out with siblings, they emphasized the importance of practices regarding the education of social interaction behavior as well as play activities in these practices, especially when the sibling with ASD is younger. These researchers taught techniques to three typically developing siblings between the ages of seven and ten. During the play sessions, the siblings

delivered behavior modification techniques such as offering appropriate reinforcements, appropriate hints for play skills, and offering instructions on how to play. These techniques were successfully learned by all three siblings. Moreover, every one of the siblings with ASD willingly followed their sibling's intervention. In line with the subject, Tsao and Odom (2006) aimed to teach four typically developing children with siblings with ASD, how to use certain social interaction behaviors such as presenting play activities, making eye contact, and starting as well as continuing a conversation with their siblings with ASD while they are playing with them. After the intervention, positive changes were observed in the social interaction behaviors of typically developing children. A different study was also planned for improving the quality and increasing the time of socially interactive behaviors that three typically developing children between the ages of four and six would use while playing with their siblings with ASD. A social interaction training package was developed to include certain behaviors, such as providing clear instructions, prompting with appropriate hints, reinforcement for appropriate behaviors, getting their attention for a play activity, and sharing toys, that they would use while playing with their siblings with ASD. This intervention has positively contributed to the communication of typically developing children with siblings who have ASD (Oppenheim-Leaf et al., 2012). A further study was carried out by Walton and Ingersoll (2012) on six pairs of siblings. In their study, the effectiveness of the program implementation was assessed regarding the teaching of reciprocal imitation skills to typically developing children with siblings with ASD. In the study, all of the typically developing siblings learned and used the imitation skills related to the premise in the appropriate cases. Also, it was observed that there had been an increase in focusing attention and learning imitation skills in three of the four children with ASD who had participated in the study. A recent study on this subject has been carried out by Ferraioli and Harris (2011). It was training for an intervention program developed in regards to four typically developing children on how to teach their siblings with ASD how to respond to joint attention. Their responses to joint bids for attention bids were evaluated during the pre-post intervention during play and a structured session. At the end of the intervention that was delivered by the typically developing children, it was seen that the siblings with ASD gained the ability to respond to joint bids for attention bids,

and moreover, three participants started to be able to initiate joint attention skills as well. At the same time, it was observed that there had been an increase in imitation and behavioral requests for both structured and natural environments. One of the important findings of this study is it supports the adequacy of siblings as intervention agents for teaching complex social skills in natural environments. Even though there are studies in the literature, the need for planning new studies has been stated. When the suggestions of studies carried out with peers and siblings are considered, targeting more social interaction activities in the practices made with typically developing children who have siblings with ASD is among one of the primary suggestions. Zhang and Wheeler (2011) suggested that researchers need to put emphasis on facilitating and promoting the generalization and maintenance of acquired social interaction skills as well as including parents and siblings in the intervention process within natural settings.

In recent years, when the content of intervention programs in the literature carried out through siblings and peers is examined, it can be seen that these programs have been prepared as a training package that contain education strategies in them. Another strikingly critical point in these studies is that common strategies have been used in most of the peer-mediated programs. These strategies are: (i) the preparation of printed documents such as manuals and posters regarding the content of education; (ii) personally informing participants about the content of the education, creating an environment of discussion, and giving participants the opportunity to ask questions; (iii) modeling or playing a role to make practice for appropriate and inappropriate examples of usage strategies; (iv) explaining how to use prompting and reinforcement strategies as well as role playing; and (v) presenting feedback regarding the behaviors of the participants. In teaching these strategies, the importance of preparing video clips that will be models of appropriate behavior for peers has been emphasized along with visual supports such as posters or illustrated communication cards (Ayles & Langone, 2005; Nikopoulos & Keenan, 2006). Therefore unlike other studies, video clips have been prepared in this study consisting of appropriate examples of the skills which will be taught to the typically developing siblings.

Another important point for planning this study from previous studies in the literature is the suggestion that play activities should be preferred

for training peers the social interaction skills that will be gained if the child with ASD is at a younger age. In this study, in order to expand the learning opportunities for children with ASD, an iPad social-game story was chosen as an electronic device. A number of functional skills can be taught to children with ASD by using an iPad (Goldsmith & LeBlanc 2004; Murdock, Ganz, & Crittendon, 2013). The use of iPads and tablets in educational environments brings a number of advantages compared to conventional materials. These advantages can be summarized as follows: (i) with a wide, colorful, and bright screen, the iPad provides attractive usage, grabbing the attention of both typically developing children and children with ASD; (ii) as it can be used with just a hand or a finger, it provides convenience in terms of usage; (iii) as it can open instantly with the press of a single button, it ensures efficient use of training time; (iv) it is useful for making programs because of its relative portability; and (v) it enables individuals to discover and remember cues on their own without the help of adults (Mechling, 2007).

Even though iPads and tablets are commonly used in education and clinical environments, studies which can reveal their effectiveness and help make them widespread are currently lacking. Only three studies stand out in the literature (Flores et al., 2012; Jowett, Moore, & Anderson, 2012; Murdock et al., 2013). In the study carried out by Murdock et al. (2013), it was emphasized that the use of iPad social-play stories especially is a step in the transition to real natural environments for children with ASD, and it is a model for playing games and setting up simple play dialogues. They state that the iPad social-play stories in particular can visually portray domestic life, transportation, and social settings for children with ASD. Therefore, iPad game activities were determined as a play activity to be performed by typically developing children with their siblings with ASD for this study. Taking into account the findings and limitations of the studies mentioned above, this study has two dimensions: (i) to examine whether typically developing children will use the social interaction skills required in the sibling training package

during the iPad game activities with their siblings who have autism successfully and (ii) to examine the effectiveness of sibling-delivered iPad game activities in teaching social interaction skills to children with ASD. Moreover, the use of social interaction skills during iPad game activities for typically developing children was tested on other children with ASD as a generalization. Last but not least, the opinions of the children's mothers were examined as a social validity for this study.

## Method

### Sibling Dyads

Three children with ASD and their typically developing sibling participated in the study. Below are the demographic characteristics of participants. Before the study was started, parents of the participant dyads were provided with information about the study and the skills to be taught in the study, and their written consent was obtained.

### Children with ASD

The following pre-requisite skills were determined for children with ASD: (i) having a diagnosis of autism, (ii) being able to follow directions, (iii) being able to pay attention to visual or verbal stimulus for at least 5 minutes, (iv) being able to keep eye contact, (v) being able to watch a scene on the computer or iPad for at least 2 minutes, (vi) not having any experience of systematical training with the iPad, and (vii) being able to slide their index finger on the iPad screen and press with their finger. The researcher made observations in the schools and homes to determine whether they had these prerequisite skills. The researcher determined three days to make observations individually and in groups during the course hours in the schools where the experiment subjects received education in order to find out whether the subjects had the pre-requisite skills related to the research. When required, the researcher modified the setting to observe the aforementioned behaviors, informing the classroom teachers about the children and planning activities during which these behaviors

Table 1  
Demographic Characteristics of Participants

Name	Children with ASD			Typically Developing Siblings		
	Age	Gender	Diagnosis	Name	Age	Grade level
Pelin	6	Female	ASD	Berke	9	3 <sup>rd</sup>
Ata	5	Male	ASD	Can	11	5 <sup>th</sup>
Hatice	5	Female	ASD	Metem	9	3 <sup>rd</sup>

could be observed. Moreover, the researcher obtained information about their pre-requisite skills by sharing her notes related to the subjects with the subjects' families, the inclusive classrooms, and the special education teachers.

Pelin is a 6-year-old girl with ASD. She was diagnosed by a child psychologist in a university hospital when she was three years old. Pelin has been attending a unit for children with developmental disabilities in a university for 20 months in group sessions. Additionally, she has been attending a rehabilitation center for two hours a week in one-on-one sessions as well as a full inclusion public school five days a week during the study. She can pay attention to an activity for at least ten minutes. She has the conceptual ability of a preschooler (she know colors, opposites, place, and shapes). She can respond to communication initiated by others and can initiate communication. Pelin can express her needs and thoughts with at most three-word sentences. Playing with an iPad is her favorite choice of play. She has problems playing games with others, continuing play with others, taking turns, and playing for the length of time requested by others.

Ata is a boy with ASD. He was diagnosed by a child psychologist in a university hospital when he was three years old. He has been attending a public preschool five days a week as a full inclusion student during the study. In addition, he has been getting support from a rehabilitation center twice a week, one hour per visit. His twin sister is also attending the same class with him. Ata has a similar development level as his peers as far as motor skills. He can use simple sentences. He can pronounce words with similar sounds. He may show aggressive behavior or throw things when people do not do what he wants. He does not want to share his belongings and cannot take turns during play activities. Playing with an iPad is one of his favorite play activities.

Hatice is a five-year-old girl with ASD. She is attending a public kindergarten and getting support for speech and language from a rehabilitation center twice a week. She can pronounce most words with similar sounds to the original. She has echolalia in that she repeats what she hears. She does not speak relative to context. She asks for what she wants by shouting at home. She is independent in her self-help skills. She does not know basic pre-school level concepts. She has a receptive identification of objects. Playing with an iPad is one of her favorite play activities.

### Typically Developing Siblings

Pre-requisite skills that siblings should have are: (i) volunteering for participation in the study, (ii) being a student in primary school, (iii) being independent in using an iPad, (iv) being able to play the selected iPad game after one or two rehearsals, (v) being able to understand the visual material and verbal presentation regarding the sibling training session, (vi) being able to interact socially with peers and adults, and (vii) being available to participate in the study at least twice a week. Playing with the iPad should be one of the favorite leisure activities of the siblings as well.

### Trainer

The implementation process of the study was conducted by the researcher. The researcher has a Bachelor's degree, Master's degree, and PhD in the field of special education. The researcher has 23 years of work experience with children who have autism and their families. Reliability data of the study was collected by an expert who has a PhD in the field of special education.

### Setting

All experimental sessions were conducted in the guest rooms of the houses of the sibling dyads. Guest rooms of the participants were selected as settings because the researcher did not want to conduct sessions in a setting where all the family members would be present, such as the kitchen or living room. The researcher and mothers of the participants agreed on just using the guest room of the house. One of the reasons for choosing the guest room for the sessions is because there is a big table and a rack for the children to work on during the sessions. During the study, the typically developing siblings watched the video clips on the laptop at the table. Playing the game on the iPad was realized on the rack by the participant dyads. The sibling dyads sat on the carpet and played the game on the floor. In all of the sibling dyads' guest rooms there was similar furniture: a table, chairs around the table, armchairs, a rack, carpet on the floor, and some accessories around the room. Since the guest rooms were in the participant dyads' own houses and the participant dyads were familiar with the setting, the author did not make any changes to the settings for the study. Only decorative items on the table and were taken away during the study. A handy-cam on a tripod was placed in the room for recording data. Generalization data was collected at the Unit

for Children with Developmental Disabilities in the Research Institute for Individuals with Disabilities, Anadolu University.

### Materials

The following materials were used in the study: A laptop, iPad, handy-cam and tripod, two game scenarios which were purchased and loaded on the iPad, check lists regarding the target skills, a pen, data collection forms for the probe and training sessions, stickers, tangible reinforcers (pen, book, hair clips, toy animals), example video clips for teaching social interaction skills to the typically developing siblings for use while playing the iPad game with their siblings who have autism, and a reward list.

### Determining the iPad Game Activity

Game choices for the children with ASD and their typically developing siblings were examined before determining the iPad game activity. Informal interviews were realized with the parents and teachers of both groups of participants regarding this purpose. Going along with both groups of participants' interests, preparations for choosing an activity with the iPad game began. iPad games purchased commercially which were designed for preschool children were examined by the researcher. Among these games, games which could contribute to children with ASD for their independent lives were listed. The listed games were examined once more regarding the following criteria: (i) functionality of the objects being used in the game and level of use in daily life, (ii) the number of natural learning opportunities provided in the game, (iii) provides the opportunity for learning the skill of taking turns, and (iv) provides an opportunity for natural sound effects. Regarding these criteria, eight games were decreased to six games. These games were shown to three special education professors who work on using technology in special education, and their opinions were asked about the games. As a result of their ideas, a game consisting of consecutive and chained behaviors (washing the baby in the bathroom, feeding the baby, and putting it to sleep) was selected. Washing the baby in the bathroom has eight steps while feeding and putting it to sleep has four.

### Determination of Social Interaction Behaviors

Studies in the literature related to the topic were reviewed while determining the social interaction

behaviors in this study. In those studies, behaviors that make social interaction easy were put in the following order: suggesting play activities to the sibling, making eye contact, drawing attention to the play activity, initiating and expanding the conversation, providing clear instructions for the game, presenting clues for appropriate behaviors and enhancements, and sharing toys (Oppenheim-Leaf et al., 2012; Tsao & Odom, 2006; Walton & Ingersoll, 2012). Aside from these studies, the same behaviors also appear in a study by Ozaydin, Tekin-Iftar, and Kaner (2008) in Turkey in which the peers of children with ASD helped them gain friendship skills. In addition to this study, similar behaviors were also seen to appear in "Teaching Typical Children to Enhance the Play and Social Skills of their Friends with Autism and Other PDD's: A Manual" (Pierce and Schreibman, 2007) when examining the behaviors which make social interaction easy during the play activities of typically developing peers with the ASD children. Therefore, similar social interaction behaviors were also targeted in this study. These behaviors are explained under the title of dependent variables.

### Independent Variable

The independent variable of this study is the sibling training package, which includes strategies that will make social interaction skills easy for typically developing siblings while playing iPad game activities with their siblings with ASD.

### Dependent Variables

This study has two dependent variables aimed for the typically developing siblings and siblings with ASD.

**Dependent Variables for the Typically Developing Siblings:** These are the skill levels of the typically developing siblings for performing the social interaction behaviors included in the peer training package. These behaviors are defined under the title "Defining Social Interaction Skills Targeted to be Taught to Typically Developing Siblings."

**Dependent Variables for the Siblings with ASD:** These are the skill levels of the child with ASD for performing the targeted behaviors after being taught by their typically developing sibling. These behaviors are stated under the title "Target Behaviors Intended to be Taught to Siblings with Autism by Their Typically Developing Siblings."



### **Defining the Social Interaction Skills Targeted to be Taught to Typically Developing Siblings**

**Appropriately Inviting their Sibling with ASD to Play:** This skill consists of the following four steps: (i) approaching near their sibling, (ii) making eye contact with their sibling, (iii) providing the direction “Shall we play together?” by pointing to the iPad, (iv) taking their sibling’s hand and moving them to the play area if necessary.

**Providing Simple Directions to their Sibling with ASD for Participating in the Play:** It was decided that twelve directions would be used by the typically developing siblings while playing with the iPad. For example, touch the shampoo, feed the baby with the bottle, touch the book, what should we say when the baby sleeps, and so forth.

**Appropriately Taking Turns during the Game:** The typically developing siblings were asked to take into account the naturally occurring opportunities for taking turns during the iPad games. The following four opportunities were provided to typically developing siblings for turn taking: (i) after the sibling with ASD washed the baby with soap, the typically developing sibling should wash the baby’s body with a sponge, (ii) while washing the baby in the bathroom, blow bubbles by taking turns, (for example, “I am blowing bubbles, now it’s your turn.”), (iii) after the child with ASD dries the baby’s body with a towel, the typically developing sibling should dry the baby’s hair using the towel, and (iv) reading a book to the baby by taking turns. During turn taking, the typically developing sibling provides the direction “now it’s my turn, you wait” and kindly takes control of the iPad. The next action is performed and verbal reinforcement is provided, such as “Well done, you waited for me so nicely,” to the sibling with ASD for waiting. After that, the direction “Now it’s your turn” is provided to the sibling with ASD by giving them the opportunity to play again.

**Using Naturally Occurring Learning Opportunities during the Game related to Objects and Actions:** The target related to this skill is the use of some pre-determined sound effects and words. Along with this purpose, a total of three sound effects and two words were targeted. The sound effects were imitating the sounds of flowing water (fosh fosh), blowing bubbles (pop pop), and drinking bottle formula (asking “How does the baby drink milk?” glug, glug, glug, and so on). The targeted words were to approximately or exactly say “good night” and “good morning.” For example, the typically developing sibling provides the target stimulus “Look, the baby sleeps, what should we say to her?” and waits for 3 seconds. If the child with autism does not respond, the sibling provides the

appropriate prompt (“What do we say before going to sleep? Good night,” for example).

**Using Effective Prompts on the Sibling with ASD to Play Independently:** At this point, systematic teaching using effective prompts on the typically developing sibling was targeted. iPad games provide visual prompts while playing. For this reason, the transition from least-controlling prompt to most-controlling prompt was taught to the typically developing siblings. During this transition, how to decide and implement *when to wait* were also taught to the typically developing siblings. The prompting hierarchy was determined as providing direction, using gestural prompts (pointing), and using physical prompts. For example, in order to provide direction related to an object, touch the bottle for example. If the child does not touch the bottle within 3 seconds, then point at the bottle with a finger. If the child still does not touch the bottle within 3 seconds after pointing, then touch the hand of the sibling with autism and provide a physical prompt for touching the bottle.

**Reinforcing the Appropriate Play Behaviors of the Sibling with Autism:** This skill consists of reinforcing the appropriate behaviors of the child with ASD during play by using verbal reinforcers such as “well done,” “you are excellent,” “very good,” and so forth. Appropriate behaviors to be performed during play ( $n = 22$ ) were determined for the child with autism. Out of these, the typically developing sibling should provide verbal reinforcers to the sibling with autism for eight behaviors. The reason being that since the behavior sequence is very quick during the iPad game, providing verbal reinforcers after every behavior might not be possible.

### **Target Behaviors Intended to be Taught to Siblings with ASD by Their Typically Developing Siblings**

The following are the target skills which were targeted for children with ASD to be taught by their typically developing siblings. (i) Touch the target object after the sibling has named the object, such as “touch the shampoo,” optimally within 5 seconds. (ii) Perform the behavior independently within five seconds after the sibling has named the behavior, for example “wash the baby’s hair with shampoo.” (iii) Take their finger off the iPad and wait for them to finish their turn within five seconds after the sibling has provided the direction for taking turns, saying “Now it’s my turn, you wait,” for example. (iv) Independently perform the sound effect within five seconds after the trainer has

provided the target stimulus regarding the target object or behavior, such as the sound of flowing water, blowing bubbles, or drinking from the bottle; or saying the appropriate phrase or a similar sound, like “good night” or “good morning.”

### Preparing the Training Videos

Appropriate example videos were prepared for teaching social interaction skills to the typically developing siblings. Along with this purpose, two typically developing children of similar age to the participants demonstrated the social interaction behaviors which were targeted for the participants. The demonstration was recorded as the training video for the typically developing siblings. For training the model siblings, the author modeled the target behaviors herself to the model siblings. At the end of six training sessions, which lasted for 40 minutes, the training video was complete. A total of four video clips were prepared for the siblings. These clips consisted of appropriately inviting the sibling to the play; two scenes for washing the baby in the bathroom, feeding the baby, and putting the baby to sleep, which consisted of the embedded social interaction behaviors; and providing effective prompts while playing the predetermined iPad games.

### Experimental Design

Multiple probe design across participants was used in the study. Multiple probe design across participants is a model in which the effectiveness of an independent variable is examined on three different participants. Baseline data is collected from all participants until consistent data is maintained from all participants. After consistent data is maintained from the first participant, the independent variable begins being conducted on the first participant. The same process is followed for the rest of the sibling dyads in a time-stepped manner.

### General Procedures

This study consists of baseline and intermittent probes, training, generalization, and maintenance sessions. One-on-one instruction was used during these sessions. Probe sessions were conducted by the researcher and the rest of them were conducted by the siblings.

**Probe sessions.** Baseline probe sessions and intermittent probe sessions were conducted in the study.

### *Baseline Sessions Conducted for Typically*

***Developing Siblings:*** Baseline probe sessions were conducted before the training sessions started until three consistent data sessions were recorded. Probe sessions were conducted in the guestrooms of the participants' houses. The iPad was placed on the rack in the room. Baseline probe sessions were conducted as follows. The researcher provided a controlling prompt for securing their attention. For example, “Berke, are you ready to work with your sister?” If the typically developing sibling gave an affirmative verbal or gesticulated response, they were reinforced by the researcher and provided the task direction, such as “Play the iPad game with your sister.” The researcher would then observe their behaviors. Appropriate behaviors were praised verbally and inappropriate behaviors were ignored during play. Seven minutes of play opportunity was provided during this session. Correct and incorrect responses from the typically developing siblings were recorded on the probe sessions data collection form.

### *Baseline Sessions Conducted for Children with*

***ASD:*** During these sessions only the researcher and children with ASD were present in the room. These sessions were conducted as follows. The researcher provided the attentional cue to the child with ASD, such as “Pelin, shall we play a game on the iPad?” When an affirmative response was given, the researcher provided reinforcement for this behavior and provided task direction, saying “Let’s play the game on iPad,” for example. The researcher turned on the game and provided task directions for each step of the game. Correct responses of the children resulted in verbal reinforcement and incorrect responses were ignored during these sessions.

Intermittent probe sessions were conducted after every two training sessions. Intermittent probe sessions were conducted the same way as the baseline probe sessions. Only one trial was conducted in each session. Intermittent probe sessions were conducted until the typically developing siblings performed 82% correct responses or better for the 33 target behaviors in three consecutive probe sessions. The reason behind the determination for this criterion with the typically developing children is the formation of the targeted skills from complicated successive skills.

Different criteria for the children with ASD were determined for each target skill in the dependent variable. These criteria were (i) 75% accuracy with following the twelve directions, (ii) 75% accuracy with taking turns four times, and (iii) 80% accuracy with acting upon the five learning opportunities



provided to them. Sibling dyads were expected to perform the mentioned criteria in at least three consecutive sessions. The reason behind the determination for these criteria with the children having ASD can be explained as follows. It was revealed as a result of the pilot implementation that some behaviors could be skipped because the iPad game flow was quick; the child with autism directed his attention mostly to the game flow so as not to miss the next behavior. Therefore, these criteria weren't set at 100%.

**Training Sessions Conducted for Typically Developing Siblings:** Training sessions were conducted once a day with one trial in every session for each participating dyad. Before presenting the sibling training package to the typically developing siblings, they were given the opportunity to spend free time with the iPad games. The steps of the program are shown below.

**Watching the Sample Video Clips:** In this step, sample video clips were shown to the typically developing sibling for training. In the first step, the researcher provided an attentional cue, such as "Berke, shall we watch a video together?" to get the participant to pay attention to the study. The researcher and the typically developing sibling sat in front of the laptop and watched the video clip consisting of scenes in which other typically developing siblings demonstrated the target skill. The researcher praised the participation behavior of the sibling and pasted a sticker on the reward list of the participant.

**Describing Each Social Interaction Behavior on the iPad:** After watching the training scenes, the second step of the training was conducted. The researcher shut down the laptop and put it on the other side of the table. The researcher turned on the iPad and set up the game scenario that the siblings would play together. The researcher told the sibling when and how to perform certain behaviors during the study in this step. The researcher described behaviors such as turn taking, using naturally occurring learning opportunities, reinforcing appropriate behaviors, and using appropriate prompts that the typically developing sibling should perform while playing with their sibling who has ASD and watching the iPad game scenario. The sibling's questions were also answered. The researcher praised the participant sibling once more and pasted another sticker on their reward table. During this step, the sibling with autism was not with them.

**Playing with the Sibling with ASD:** During this third step, the typically developing sibling was

asked to play the iPad game with their sibling who has ASD by paying attention to the video scenes they had watched and verbal explanations with which they had been provided. The sibling with ASD was included in the training setting. The iPad was placed on the rack in the guest room. The trainer provided the task direction, "Play the iPad game with your sister," for example, to the typically developing sibling. The participants were asked to play the iPad game together. After the game was completed, the sibling with autism was praised verbally and taken out of the room.

**Providing Feedback and Reinforcers:** During this step, video recordings of the children playing the iPad game together were shown to the typically developing sibling. Additionally, the siblings were asked if their behaviors could be recorded. The researcher provided feedback for inappropriate as well as appropriate behaviors. At the end of the implementation, the researcher pasted two more stickers on the participant's reward list for the last two steps of the implementation. Verbal reinforcers such as "Well done!", "You're excellent!" and so on, were provided to the typically developing sibling after completing each step mentioned above. In addition, a sticker was pasted on the reward list of the sibling after completing each step. After each training session, if the typically developing sibling had collected four stickers, one of the pre-determined tangible reinforcers such as a book, pencil box, or sports journal was given to him.

**Training Sessions Conducted for Children with ASD**

Participant dyads sat together on the floor in front of the rack for the training sessions. The typically developing sibling provided the attentional cue to the sibling with ASD. When this sibling mentioned that they were ready, the typically developing sibling immediately provided the task direction related to each target behavior as well as the controlling prompt. The time between trials was determined at three seconds. The typically developing sibling reinforced their sibling's correct responses and provided the controlling prompt for their incorrect responses. Two types of correct responses (before and after the controlling prompt) and three types of incorrect responses (before and after the controlling prompt, or no response) were recorded during the training sessions. The typically developing sibling provided verbal praise for both types of correct responses from their sibling with ASD. For incorrect responses, the typically developing

siblings provided the controlling prompt for each target behavior, such as jests, verbal prompts, or physical prompts. Correct responses before the prompt were counted toward meeting the criteria.

### Maintenance and Generalization

Maintenance sessions were conducted one and two weeks after the criteria were met. Generalization sessions were conducted at the Unit for Children with Developmental Disabilities at the Research Institute for Individuals with Disabilities, Anadolu University. During these sessions, the typically developing siblings implemented the same process with different children with ASD in the unit. Maintenance probe sessions were conducted in the first and second week after the intervention.

### Reliability Data

Dependent and independent reliability data were collected from 30% of the sessions in the study. Dependent variability data was calculated using the point-by-point method. Dependent variable data for children with ASD was obtained across 100% of the baseline sessions, 90% of the intervention sessions, 100% of the maintenance sessions, and 100% from the generalization sessions. Independent variable data showed that the researcher implemented the intervention with 100% accuracy in the baseline sessions and with 95% accuracy in the intervention sessions.

### Social Validation Data

The mothers of the participants provided the social validity data through a subjective evaluation approach. The Social Validity Form for Mothers was used in order to determine the importance of the target behaviors, appropriateness of the implementation used for teaching the target behaviors, and the meaning of the results of the study both for the typically developing child and the child with ASD. Three close-ended and four open-ended questions were asked in the form.

## Results

### Effectiveness Findings for Typically Developing Children: Acquisition, Maintenance, and Generalization

Figure 1 displays the data for acquisition of the social interaction skills of typically developing

children (Berke, Can, and Mete) while delivering iPad game activities to their siblings with ASD. The data reveals that they were able to learn to use the social interaction skills needed during the iPad game activities. The percentage of correct responses is plotted in the figures. As seen in Figure 1, Berke performed the necessary social interaction skills for the iPad game activities with a mean accuracy of 12% (range = 12%-12%) during the baseline sessions. He met the criterion in the sixth intervention session and showed 85% accuracy across three sessions. The data also shows that Berke was able to maintain the acquired social interaction skills with a mean accuracy of 84% (range = 82%-85%) in the first and second week after the intervention. Moreover, the generalization data shows that prior to the intervention he had performed social interaction skills with 21% accuracy and after the intervention he performed the same skills with an accuracy of 91%. As shown in Figure 1, Can performed the necessary social interaction skills for the iPad game activities with a mean accuracy of 16% (range = 12%-16%) during the baseline sessions. He met the criterion in the sixth intervention session and showed a 91% accuracy (range = 91% - 91%) across three sessions. Data also showed that Can was able to maintain the acquired social interaction skills with a mean accuracy of 90% (range = 88%-91%) in the first and second week after the intervention. Moreover, his generalization data showed that prior to the intervention he had performed social interaction skills with 25% accuracy and after the intervention he performed the same skills with 88% accuracy. As shown in Figure 1, Mete performed the necessary social interaction skills during the iPad game activities with a mean accuracy of 10% (range = 6%-12%) during the baseline sessions. He met the criterion in the fifth intervention session and showed an 88% accuracy (range = 88% - 88%) across three sessions. Data also showed that Mete was able to maintain the acquired social interaction skills with a mean accuracy of 84% (range = 84% - 84%) during the first and second week after the intervention. Moreover, his generalization data revealed that prior to the intervention he had performed social interaction skills with a 12% accuracy and after the intervention he performed the same skills with an 85% accuracy. All these findings showed that the sibling training program used in this study was effective in teaching, maintaining, and generalizing the necessary social interaction skills for the iPad game activities. Visual analysis of this data also verifies these findings with a therapeutic change in trend across the baseline

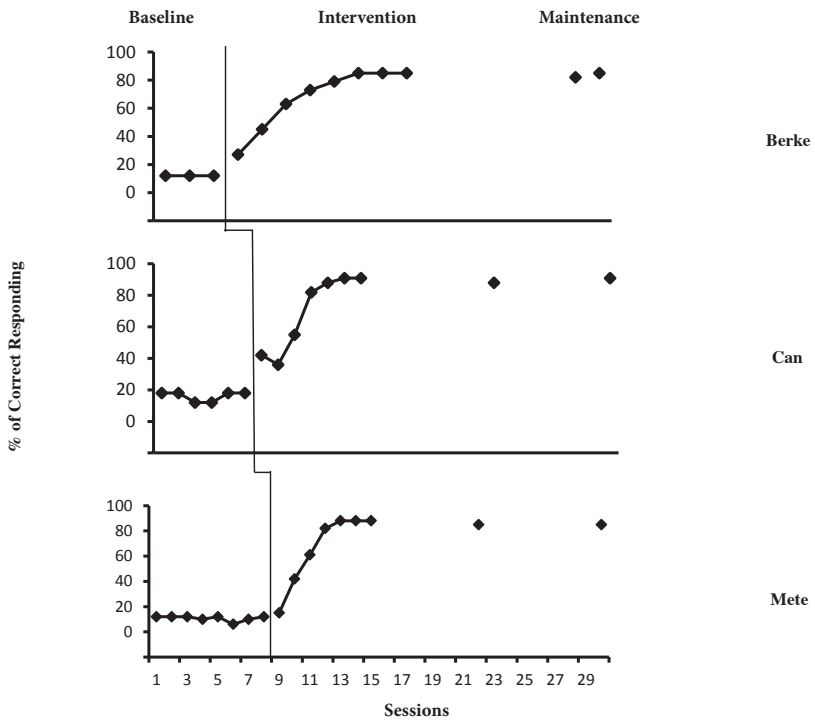


Figure 1: Data for acquisition of targeted social interaction for typically developing siblings.

and intervention sessions for all of the participants. Due to the criterion, seven intervention sessions were conducted with Can and Mete, while eight intervention sessions were conducted with Berke. There was one intervention trial per session.

**Effectiveness Findings for Siblings with ASD: Acquisition and Maintenance**

Figures 2, 3 and 4 display the data for the children with ASD on the acquisition and maintenance for the social interaction skills of following directions, taking turns, and giving appropriate responses to teaching opportunities for the iPad game activities delivered by their typically developing siblings.

Figure 2 shows that Pelin performed the skill of following directions with a mean accuracy of 50%, Ata performed the same skill with a mean accuracy of 27% (range = 15%-31%), and Hatice did not respond correctly at all for this skill during the baseline sessions. As soon as intervention was applied, Pelin performed the target skill with 100% accuracy. Moreover, she maintained this skill at 100% accuracy in the first and second week after the intervention. Ata performed the skill of following directions with a mean accuracy of 85%.

He maintained this skill with a mean accuracy of 89% (range = 85%-92%). Hatice performed the skill of following directions at 100% accuracy. Moreover, she maintained this skill at 100% accuracy during the first and second week after the intervention.

Figure 3 reveals that none of the participants performed any correct responses during the baseline sessions for the turn-taking skill. After the intervention was initiated, Pelin performed turn taking with 100% accuracy during the intervention sessions. Moreover, she maintained this skill at 100% accuracy during the first and second week after the intervention. Ata performed turn taking with 75% accuracy during the intervention sessions and at 63% accuracy (range = 50%-75%) in the first and second week after the intervention. Hatice performed the turn-taking skill with a mean accuracy of 75% accuracy during the intervention. She improved her turn-taking skill with a mean accuracy of 88% accuracy (range = 75%-100%) in the first and second week after the intervention.

Figure 4 shows that Pelin, Ata, and Hatice had no correct responses for the skill of giving appropriate responses to teaching opportunities during the baseline sessions. After the intervention, Pelin performed all three target behaviors with 100% accuracy. Moreover,

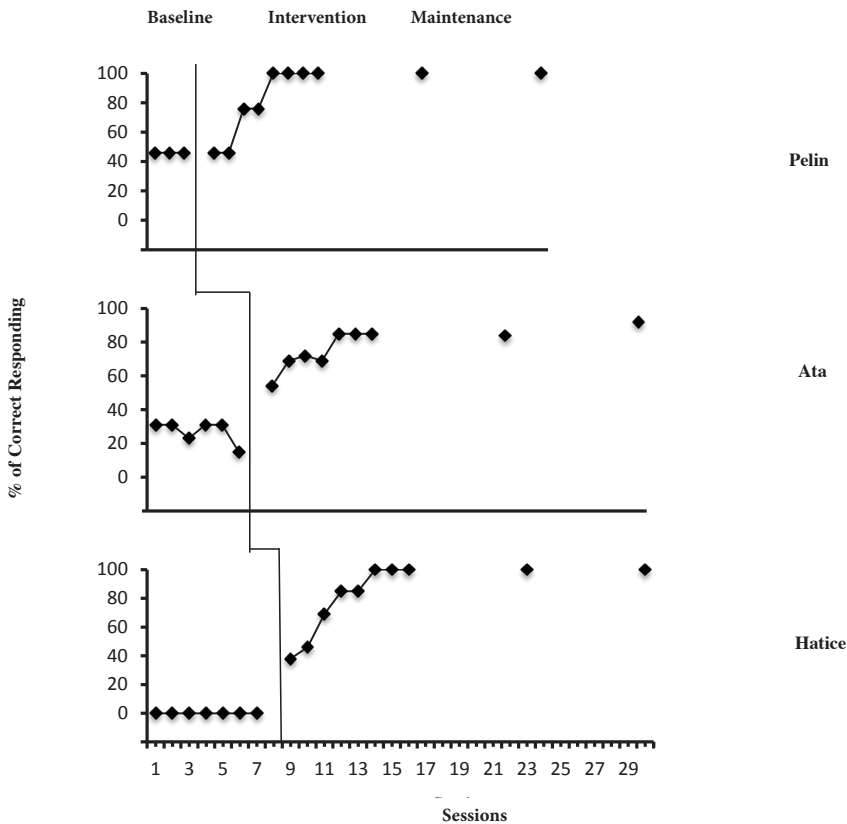


Figure 2: Data for acquisition level for the skill of following directions for the children with ASD.

she maintained these skills at 100% accuracy during the first and second week after intervention. Ata performed the skill of giving appropriate responses to teaching opportunities with 80% accuracy during the intervention sessions. Moreover, he maintained giving appropriate responses to teaching opportunities with a mean accuracy of 80% (range = 80%-80%) during the first and second week after the intervention. Hatice performed the skill of giving appropriate responses to teaching opportunities with 100% accuracy during the intervention. Lastly, it is seen that she maintained this skill with 100% accuracy during the first and second week after the intervention. When all the data is examined, there are considerable differences in the trends and data levels for the baseline and intervention sessions regarding the children with ASD.

In general, these findings show that the sibling training package was effective in teaching the above skills to the participant children with ASD. As per the criteria, eight intervention sessions were conducted with Pelin and Hatice while seven intervention sessions were conducted with Ata.

**Social Validity Findings**

Social validity data collected from the mothers of the siblings was analyzed descriptively as a subjective evaluation. All mothers reported being satisfied with the involvement of their typically developing children in the sibling training program as well as with their children’s performance during the study. They also stated liking the performance of their children with ASD during the study. In addition, they said that their children would use the skills taught in the present study within their daily lives and they would generalize these skills across different skill sets. Two of the mothers shared their doubts about whether their typically developing children would use and maintain these social interaction skills after the study. The ages of their children could be the reason for this opinion. They stated that since their children are so young, they might forget the skills they acquired during the study. However, they also reported that their children would perform these skills in their daily lives if they, the parents, helped.

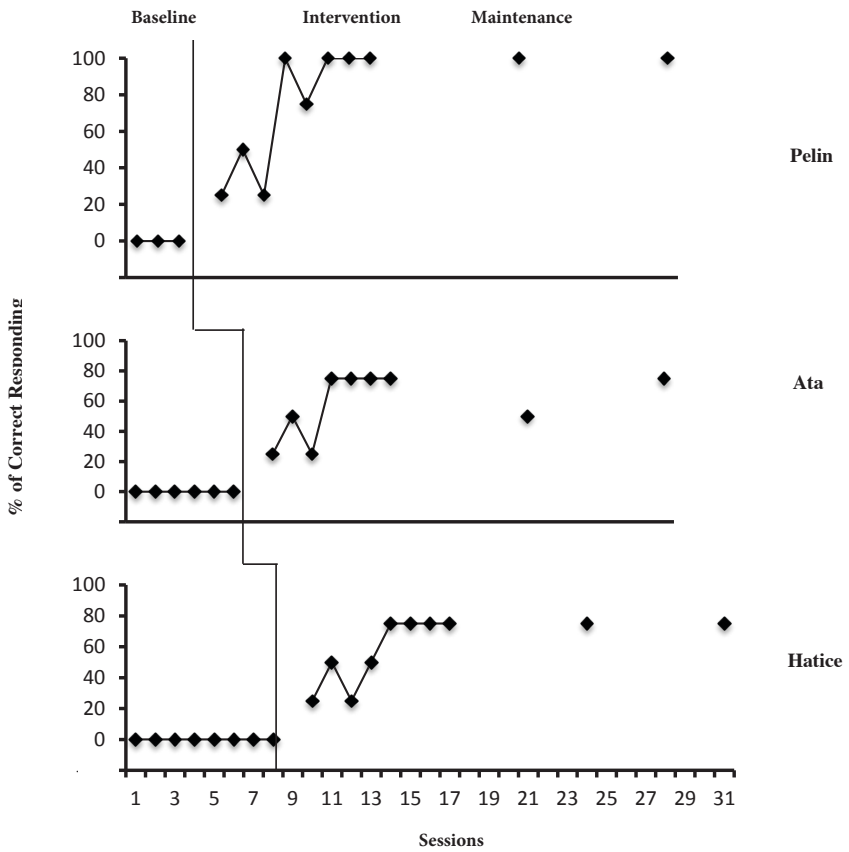


Figure 3: Data for acquisition level of the turn-taking skill for children with ASD.

**Discussion**

In this study, the effectiveness of the sibling training package offered for teaching the social interaction skills that typically developing siblings use while playing iPad games with their siblings with ASD was investigated. Moreover, the effects of teaching the targeted skills by the typically developing children who had completed the program to their siblings with ASD were studied. Another purpose of the study is to examine the effects of this intervention on promoting the generalization of these skills by typically developing siblings towards different children with ASD. The mothers' views regarding the intervention were examined as well as.

The findings of the study show that Berke performed the social interaction skills with 85% accuracy, Can with 91% accuracy, and Mete with 88% accuracy. Moreover, it was found out that they maintained these skills during the first week and second week after the intervention was terminated, and were able to generalize these skills to different children

with ASD as well. Additionally, one of the siblings with ASD, Pelin, acquired the targeted skills of following directions, taking turns, and responding appropriately to learning opportunities at 100% after the teaching was presented by her typically developing sibling. Ata acquired the skill of following directions at 85%, the skill of taking turns at 75%, and the skill of responding appropriately to learning opportunities at 100%. Hatice acquired the skill of following directions at 100%, the skill of taking turns at 75%, and the skill of responding appropriately to learning opportunities at 100%. They maintained these targeted skills during the first and second week after the training. In the study, the social validity findings collected from the mothers for subjective evaluation revealed that their opinions regarding the social interaction skills were positive. The findings of this study show consistency with the findings of the previous studies in which behavior modification techniques (Celiberti & Harris, 1993), social interaction behaviors (Oppenheim-Leaf et al., 2012; Tsao & Odom, 2006), imitation skills (Walton

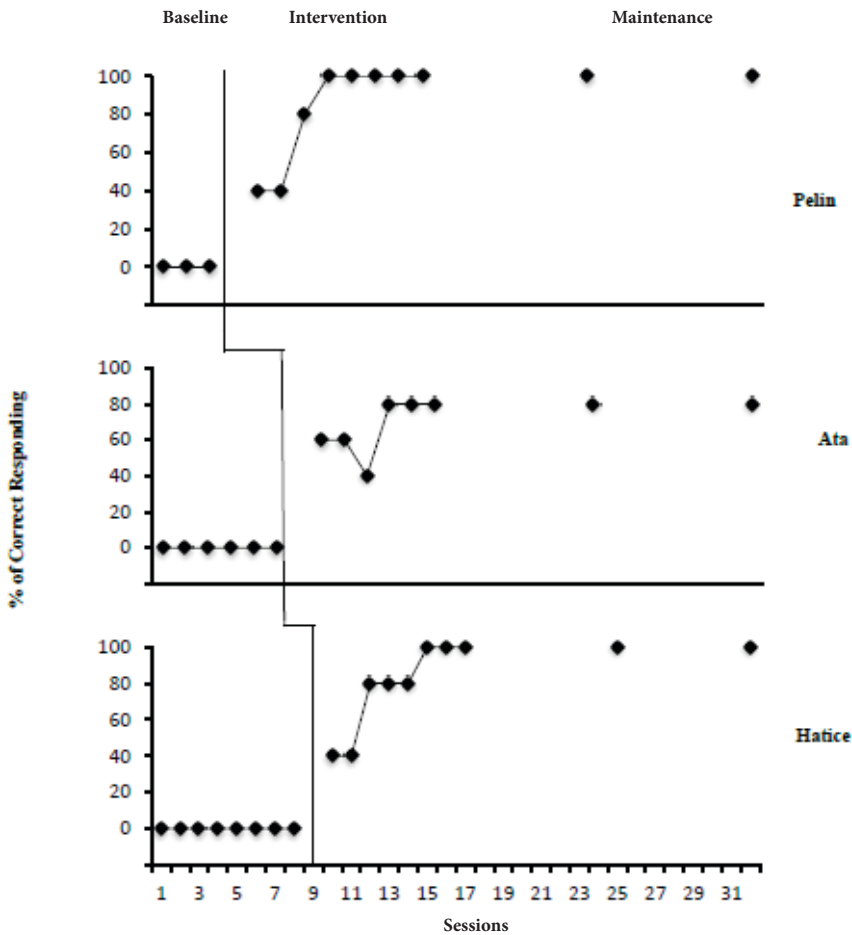


Figure 4: Data for acquisition level of the skill of giving appropriate responses to teaching opportunities for children with ASD.

& Ingersoll, 2012), and joint-attention skills in home environments (Ferraioli & Harris, 2011) were taught. When the study findings were examined regarding the typically developing siblings, it was found that the first and second participants met the required criteria in the sixth training session, and the third participant in the fifth session. It was observed that the typically developing siblings could not perform the targeted skills with 100% accuracy. They did, however, meet the criteria determined for the study. One of the main reasons for this is because the social interaction skills planned to be taught to the typically developing siblings consist of successive, complex, and lengthy skills. The skill that the typically developing siblings were not able to perform during the study was experienced in the reinforcement of appropriate behaviors exhibited by their siblings with ASD during the course of the iPad game. It was noted that the typically developing

children usually ignored the appropriate behaviors of their siblings with ASD. The typically developing siblings used approval expressions such as “yes” or “okay” instead of verbal reinforcers like “well done” or “very good.” One of the main reasons for this is that the flow was too fast in the course of the iPad game and the typically developing siblings gave more attention to game flow in order not to miss the next behavior of their sibling with ASD. The other reason is thought to result from the culture of the country where the participants live. The use of verbal reinforcers or praise words is not socially prevalent in the participants’ culture. At the same time, every appropriate behavior performed by typically developing children is not reinforced in all societies, and this situation takes place naturally. When the findings regarding the siblings with ADS were studied, it was found that Ata and Hatice performed the skill of taking turns at 75%. The



opportunity for taking a turn was offered four times in the study. Two of the participants responded to only three of these opportunities. This situation may be a result of the iPad game being attractive to the siblings with ASD, as they liked it very much and did not want to share it. When looking into the findings, it can be seen that Ata underperformed compared to the others. Also, Ata demonstrated problem behaviors during the study. The typically developing sibling mostly abstained and did not intervene. As this situation was experienced in the three intervention sessions consecutively, adaptation was made during the study by the researcher. At the beginning of the study, when appropriate behaviors were displayed by three of the siblings with ASD, it was decided not to use any edible reinforcer, as the iPad itself was the reinforcer. Another reason for this is that using edible reinforcers was considered difficult because the social interaction behavior is a chain of successive behaviors following each other at quick intervals. It was planned to use verbal reinforcers instead of edible ones. However, it was determined to be effective to use edible ones for the behavior of Ata. Especially when the time came for the typically developing sibling to take her turn, she would pull the iPad gently towards herself then immediately offer the reinforcer (popcorn) to her sibling with ASD. Celiberti and Harris (1993) stated that it is necessary to study the behavior modification techniques (which are offering appropriate reinforcements, appropriate tips for play skills, and offering instructions) aimed to be taught by using more complex social-interaction behaviors; in these studies, a variety of different arrangements may be necessary as well. One of these arrangements is informing the typically developing siblings about the behavior problems that they may encounter with children ASD prior to the study, as well as preparing visual support in regard to this. In this way, there will be fewer problems during the training sessions, and negative interactions between the sibling with ASD and the typically developing sibling can be prevented. Furthermore, when the typically developing siblings learn about these strategies prior to the practice, they might feel more confident and efficient, thus able to complete the study with fewer mistakes (Oppenheim-Leaf et al., 2012).

In line with these findings, it can be said that there are many strong points in the study. One of these is the use of visual supports in the presentation of appropriate examples offered to the typically developing sibling during the preparation process for the sibling training program. In this study, video clips were used for visual support. The main reason

for this is that it brings many advantages with it. Namely, the video clips which were prepared enable the individual to watch it over and over again; these video clips can be reused for other individuals with similar needs, and the practitioner has more control over the model compared to a live model (Ayres & Langone, 2005; Nikopoulos & Keenan, 2006). In this study, unlike other ones, video clips were prepared consisting of appropriate examples of skills which would be taught to the typically developing siblings. All these advantages listed above facilitated the practice stage of the study.

In the study, while selecting game skills, the game choices of all sibling pairs were taken into consideration. Taking into account the game choices of the participants and using iPad game stories as games made this study different from other studies. Game sets were used as teaching materials in other studies (Ferraioli & Harris, 2011; Oppenheim-Leaf et al., 2012; Walton & Ingersoll, 2012). Moreover, feedback in this study regarding the performance displayed by the participants has been presented differently when compared to other studies. Namely, video records of the participants with their siblings who have ADS were watched by the participants, and feedback from these records was given to the participants by the practitioner.

Along with the strong points of this study, certain limitations can also be expressed. In the study, the iPad game stories which were prepared for preschool education students and sold in the application market were used. The chosen iPad game stories were prepared for typically developing children, even though they consisted of examples of behavior contributing to the independent lives of children with ASD. iPad game stories can be prepared by considering the behavior and learning characteristics of children with ASD. In the study, another limitation experienced during the training sessions stemmed from the technological feature of iPad use. iPads offer the possibility of practical and rapid utilization for individuals. Individuals can perform multiple behaviors quickly in a few seconds with a single touch of a finger. Therefore, the typically developing siblings were sometimes not able to perform the targeted skills such as offering tips or reinforcing appropriate behaviors when they were supposed to. Another limitation was that when touching any point on the iPad screen, the game would close or return to the beginning. This kind of situation was encountered in the teaching and probe sessions, especially during the beginning of the study conducted with Ata, who was displaying

behavior problems. Therefore, when the issue was experienced, the sessions were restarted, causing the intervention or probe session to be extended. In this study, feedback was offered to the typically developing siblings during the last stage of training that was carried out. After the feedback was given in the study, an intervention session could not be made. The next session was carried out after one or two days when the families and children were available. In the study, this can be considered as a limitation since a training session was not performed immediately after the feedback. The main reason for making a single training session was that the training sessions on average took nearly 40 minutes. On the condition that a second session had been carried out, both the typically developing sibling and sibling with ASD would have been distracted. Another limitation of the study is that the daily use of the names of objects in the iPad game that the children with ASD used, the sound effects presented to them, and the behaviors that they displayed during the game were not taken into consideration but were only evaluated during the iPad game. The last limitation regarding the study is that the video clips were presented with only positive examples of behavior, as used

in the training process for the typically developing children. Along with positive examples, preparing video clips including examples of negative behavior would undoubtedly increase the quality of study.

Based on findings of this research, recommendations for further research can be summarized as follows. The effects of conducting a similar study with typically developing children in different environments such as the home and other social contexts, or with different skills such as self-care, daily living, and cognitive skills can be investigated. Similar studies can be planned with typically developing peers in preschool educational environments as well as with typically developing siblings. Moreover, whether siblings with ASD generalize the skills that they learned in the study to different environments, such as at home, in play, or other social environments, can be examined. Lastly, instead of iPad game stories, similar studies can be planned by using imaginary play stories in which game sets and the effectiveness of these games can be studied. Additionally, parents can conduct similar implementations with different target behaviors at home, and regular education teachers as well can embed various target skills into their daily classroom routines.

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