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A Comparison of Discrete Trial Teaching with and without Gestures/Signs in Teaching Receptive Language Skills to Children with Autism

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Abstract

The present study was designed to compare the effectiveness and efficiency of two discrete trial teaching procedures for teaching receptive language skills to children with autism. While verbal instructions were delivered alone during the first procedure, all verbal instructions were combined with simple gestures and/or signs during the second procedure when teaching receptive language skills by using discrete trial teaching. A parallel treatments design was used to compare the differential effects of the two procedures on the acquisition of the receptive language skills. Two students with autism participated in the study. The results of the study showed that the discrete trial teaching procedure in which verbal instructions were combined with simple gestures and/or signs was slightly more effective and efficient on promoting the acquisition of receptive language skills for both students. Discrete trial teaching procedure in which verbal instructions were delivered alone was not effective for any of the training sets across students.

Key Words

Discrete Trial Teaching, Autism, Language and Communication, and Receptive Language Skills.

One of the most distinctive features of children with autism is their limited language and communication skills. For this reason, the problems observed in language and communication development are among the basic elements taken into consideration in diagnosing autism (Paul & Wilson, 2009). The *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)* published by American Psychiatric Association (2000) is one of the most frequently applied sources in diagnosing children with autism (Kırcaali-İftar, 2003). According to diagnostic criteria presented in this source, some problems observed in language and communication fields are classified as late speaking or never speaking, difficulty in starting or continuing communication, extraordinary or repetitive use of language, disability in games skills appropriate for their developmental levels. It is determined that social interaction problems and restricted/repetitive interests and behaviors, which are the other basic factors taken into consideration when diagnosing children affected by autism spectrum disorder, are closely related to the problems observed in language and communication fields (American Psychiatric Association; Landa, 2007; Sturmey & Fitzer, 2009). The difficulties in language and communication skills in autism affect cognitive and social development; in addition, it can cause behavior problems. Therefore, the applications for developing language and communication skills constitutes one of the most important interests for researchers and practitioners working in the field of autism spectrum disorder (Sigafoos, O'Reilly, Schlosser, & Lancioni, 2007; Webber & Scheuermann, 2008).

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Children with autism live through difficulties related to receptive language skills as well as verbal expressive language skills (Goldstein, 2002; Peterson, Bondy, Vincent, & Finnegan, 1995; Preis, 2006). However, in spite of the difficulties encountered both in expressive and receptive language skills, a great number of publications on language and communication issues in autism evaluate issues related to expressive language skills. There is limited number of studies related to receptive language in autism spectrum disorder (Light, Roberts, Dimarco, & Greiner, 1998; Preis; Schlosser & Wendt, 2008; Tager-Flusberg, Paul, & Lord, 2005). In these studies, receptive language was generally examined in terms of the developmental aspect in autism spectrum disorder (Attwood, Frith, & Hermelin, 1988; Lord, 1995; Smith & Bryson, 2007); however, it is clear that there is limited research for guiding practitioners on teaching receptive language skills to children with autism effectively and efficiently.

One of the most commonly used methods in teaching language and communication skills to children with autism is Discrete Trial Teaching (DTT). In DTT interventions, skills are separated into simple steps and each step is taught by means of repetitive trials (Hall, 2009; Loavaas, 2003; Tarbox & Najdowski, 2008). DTT, which is generally carried out by means of errorless teaching format, has five basic elements: (*i*) discriminative stimulus, (*ii*) prompt, (*iii*) response, (*iv*) consequence, and (*v*) inter-trial interval (Kırcaali-İftar, 2007; Smith, 2001; Tarbox & Najdowski; Webber & Scheuermann, 2008). In DTT application, graduated guidance is one of the errorless teaching methods commonly used for presenting and fading prompts systematically. While providing training with graduated guidance, the instructor carries out training trials by providing prompts at a level on which a student will not demonstrate erroneous response, especially in the beginning of the training process. Then, he/she demonstrates the correct response to the student without providing the child with any prompts by gradually fading the kind or intensity of the prompt. The distinctive feature of graduated guidance is that the instructor spontaneously decides the level and intensity of the prompts in this teaching method (Alberto & Troutman, 2009; Duker, Didden, & Sigafoos, 2004; Tekin-İftar & Kırcaali-İftar, 2006). There are many study findings indicating that the programs based on applied behavior analysis and in which DTT is used are effective for developing language and communication skills in children with autism; besides, many language and communication skills can be taught by means of this training application (Buffington, Krantz, McClannahan, & Poulson, 1998; Eikeseth, Smith, Jahr, & Eldevik, 2002; Mudford, Ford, & Arnold-Saritepe, 2009; Sallows & Graupner, 2005). However, although its effectiveness has been determined by a lot of scientific research findings, an important number of children with autism are unable to acquire communication with verbal language even if they continue to the intensive programs based on DTT (Carr & Dores, 1981; Sigafoos et al., 2007). For this reason, augmentative and alternative communication skills are taught to children who cannot acquire verbal communication skills which they can use instead of verbal communication.

DTT is commonly used in teaching augmentative and alternative communication skills as in teaching verbal communication skills (Buffington et al., 1998; Goldstein, 2002; Webber & Scheuermann, 2008). When examining research related to teaching augmentative and alternative communication skills to children with autism, it is seen that mostly teaching expressive language skills were aimed, and there are limited published study findings related to teaching receptive language skills (Mirenda, 2001; Schlosser & Wendt, 2008). For this reason, there is a need for data that will guide researchers and practitioners using DTT in teaching receptive language skills which are generally hard for children with autism to learn.

Many studies indicate that augmentative and alternative communication skills can be taught to children with autism by visual means such as graphic symbols, sign language and/or communication with gestures (Mirenda, 2001; Wendt, 2009). Presenting stimuli that establish the ground for demonstrating communication behavior with the help of visual stimuli creates positive effects because children with autism have a strong ability to perceive visual stimuli (Dettmer, Simpson, Smith Myles, & Ganz, 2000; Goldstein, 2002; Peterson et al., 1995; Quill, 1997; West, 2008). In the 1970s, the first forms of augmentative and alternative communication in which visual stimuli came into existence with the use of sign language and communication with gestures as a means of augmentative and alternative communication (Schlosser & Wendt, 2008). In the following decade, sign language was used along with speaking. Studies that compared this application and/or sign language usage by itself with using verbal language exclusively were carried out. Some of these studies focused on teaching expressive language skills (Barrera & Sulzer-Azarof, 1983; Yo-

der & Layton, 1988). Some other studies, however, targeted teaching receptive language skills (Brady & Smouse, 1978; Carr, Pridal, & Dores, 1984). The findings of comparison studies indicated that using sign language exclusively or along with speaking was more effective in teaching expressive and receptive language skills to children with autism than using speech only. Presenting speaking by itself, however, was less effective in teaching communication skills to children who demonstrated difficulty especially in verbal imitation skills (Goldstein). In spite of the findings obtained in comparison studies, it is seen that studies aimed at using sign language and gestures as a means of augmentative and alternative communication for children with autism were suspended because of some reasons such as: the difficulties encountered by some children with autism in demonstrating the motor movements required when producing sign language; the limited number of people capable of using sign language; and the difficulties faced by children with autism in generalizing the sign language to different people (Bondy & Frost, 2003; Schlosser & Wendt). In the 2000s, research findings do not give a clear idea as to which augmentative and alternative communication type is more effective for children with autism. Furthermore, depending on the findings of the effectiveness and comparison studies mostly carried out in 1980s, it is repeated and suggested once again that sign language and communication based on gestures can be used as a means of augmentative and alternative communication (Goldstein; Mirenda, 2003; Webber & Scheuerrmann, 2008; Wendt). However, it is observed that studies focusing on using sign language and/or gestures in teaching communication skills to children with autism have some limitations. These limitations, which constitute the reasons behind the present study, are explained in the subsequent sentences.

Firstly, procedural reliability data were not collected in most of the studies in which sign language and/or gestures were used as an alternative means of communication in teaching communication skills to children with autism (Schlosser & Wendt, 2008). Secondly, in most of the studies in which sign language and/or gestures were used to teach communication skills, expressive language skills were the focus (Barrera & Sulzer-Azarof, 1983; Buffington et al., 1998; Carr, Binkoff, Kologinsky, & Eddy, 1978; Yoder & Layton, 1988). Besides, the number of studies related to determining the effectiveness of sign language and/or gestures in teaching receptive language skills to children with autism is considerably limited (Wendt, 2009). It is clear that the target behavior to be taught approximately in all of these studies is receptive labelling (Carr & Dores, 1981; Goldstein, 2002; Mirenda, 2003; Remington & Clarke, 1993). Therefore, it could be considered that studies other than those focusing on receptive labelling might be important. An example is evaluating the effects of sign language usage and/or gestures in teaching other receptive language skills such as giving correct response to basic instructions. Mostly American Sign Language was used in the investigations of sign language and/or gestures used to teach communication skills. However, previous research does not sufficiently examine the effects of gestures and simple signs which can be used without being obliged to use linguistic rules and symbols of any sign language consisting of simple body movements for teaching communication skills (Wendt). As a matter of fact, there is a need for studies that can determine the effects of using gestures in order to support communication processes of children with autism. Considering all these reasons mentioned above, this study attempts to determine whether there are differences in the effectiveness and efficiency of the DDT presented with visual support based on gestures and signs along with verbal instruction and the DDT carried out with only verbal instruction on teaching receptive language skills to children with autism or not. With this purpose, answers were sought for the following questions: (*i*) is there any difference between the DTT presented with visual support based on gestures and signs along with verbal instruction and the DTT carried out with only verbal instruction at the stages of acquisition, maintenance, and generalization? (*ii*) Is there a difference between the two training procedures in terms of the number of sessions to criterion, the number of trials to criterion, total training time to criterion, and the percentage of errors to criterion?

Method

Participants

Subjects: Two male students with autism, Efe (age=5) and Tan (age=12), participated in the study. They were diagnosed in health institutions. The participants are not testable. Neither of the participants could have been taught receptive language skills (following simple directions) by using traditional DTT. The participants could not have been taught expressive language skills by using PECS (Picture Exchange Communication System) (Bondy & Frost, 1994) as an alternative way of com-

munication. The participants were receiving an intensive behavioral intervention program based on DTT (OCIDEP: Intensive Behavioral Intervention Program for Children with ASD) (Kırcaali-İftar, Kurt, Güleç-Aslan, & Ülke-Kürkçüoğlu, 2009) when the study began.

Staff: All sessions were conducted by two trainers working as instructors in the DTT program attended by the participants.

Settings and Materials

The sessions carried out with Efe were conducted in a one-to-one study room in the Anadolu University Research Institute for the Handicapped, Unit of Developmental Disabilities. The sessions with Tan were conducted in Tan's house. A handy cam was used to record all sessions.

Dependent and Independent Variables

The dependent variable of the study is learning receptive language skill. Six training sets consisting of receptive language skills for both participants were prepared. There were two target stimuli in each training set.

The independent variables of the study are DTT procedures which were carried out by presenting only verbal instructions and in which visual support based on gestures and signs along with verbal instruction were provided.

Experimental Design

A parallel treatments design was used to examine the differential effects, if any, of using two different DTT procedures on teaching receptive language skills. The parallel treatments design is a single subject research design in which the effectiveness of two or more independent variables on two or more dependent variables is compared (Holcombe, Wolery, & Gast, 1994; Tekin, 2000; Wolery, Bailey, & Sugai, 1988).

Procedure

Before the experimental process, a pilot study was carried out. The experimental sessions were consisted of full probe, training, maintenance and generalization sessions. In the study, all the sessions were conducted in one on one teaching format.

Probe Sessions

Full probe sessions and intermittent probe sessions were carried out. In full probe sessions, the subjects' performance levels related to dependent variables were determined before the training. The data obtained from intermittent probe sessions were used when the two DTT procedures were compared in terms of effectiveness.

Training Sessions

After obtaining stable data in the baseline sessions, training sessions were conducted to teach the target behaviors. In both procedures, the training was continued until the subjects demonstrated 100% correct performance in the skills taught, respectively for three sessions. A total of 20 trials were carried out in each training session. Graduated guidance was used in training sessions. Physical prompt was used as a controlling prompt. In the first stages of the process, the instructor presented the controlling prompt as physical prompt without letting the subject demonstrate an independent response and ensured that the subject would give the correct response. Physical prompt was faded gradually during training sessions. In compliance with graduated guidance procedure, the instructor make spontaneous decisions on the level and intensity of the physical prompt to be used. When the instructor was sure that the subject was going to show the correct response with less intrusive prompt, the instructor provided the subject with less intense physical prompts. While the subject's correct responses were reinforced, error correction was made for their incorrect responses. The participation and cooperation of the subject were reinforced in the beginning and at the end of the sessions.

DTT Sessions in Which Visual Support Based on Gestures and Signs is Provided Along with Verbal Instruction: In each trial conducted in DTT sessions in which visual support based on gestures and signs are provided along with verbal instruction, task direction was simultaneously presented with simple gestures and/or sign matched with this instruction.

DTT Sessions Carried Out by Presenting Only Verbal Instruction: In DTT sessions carried out by presenting only verbal instruction, no visual stimulus was used while task direction was presented. Except for visual stimulus based on gestures and signs added to task direction, these sessions were carried out in the same way with DTT sessions in which visual support based on gestures and signs are provided together with verbal instruction.

Maintenance and Generalization

Maintenance sessions were carried out approximately three and ten weeks after the criterion was reached in target behaviors. Generalization across people was measured in the study with pre-test and post-test designs.

Reliability

In at least 30 % of all of the sessions inter-observer and procedural reliability data were collected. Reliability data were collected by a graduate student continuing her education in special education. For the analysis of inter- observer agreement data, [(Agreement/Agreement + Disagrement) x 100] formula was used (Tawney & Gast, 1984; Tekin-İftar & Kırcaali-İftar, 2006). To analyze the data of procedural reliability, the number of the observed instructor behavior was divided into the number of the planned instructor behavior. The result was multiplied by 100 to determine procedural reliability percentage (Billingsley, White, & Munson, 1980; Tekin-İftar & Kırcaali-İftar). In the study, reliability coefficients were calculated as 100% inter-observers for both subjects. Procedural reliability coefficient was calculated as 100% compliance in the sessions carried out with Tan, while it was calculated as 99.93% (range = 99.67% - 100%) compliance in Efe's sessions.

Results

Effectiveness and Efficiency

Figures 1 and 2 present, consecutively, data related to the effects of DTT procedures carried out by providing visual support based on gestures and signs along with verbal instructions, and by providing only verbal instruction on teaching receptive language skills to Efe and Tan.

Efe and Tan met the criterion and showed 100% correct response in the first training sets in the intervention stage where DTT in which visual support based on gestures and signs along with verbal instruction was used; 100% correct response in the second training sets after the training where DTT in which visual support based on gestures and signs along with verbal instruction was used; and 100% correct response in the third training sets in the intervention stage where DDT in which visual support based on gestures and signs along with verbal instruction was used after the training. It was observed that subjects did not show correct response in criterion level in any training sets following DTT application carried out only with verbal instruction.

Since DTT provided with visual support based on gestures and signs was more effective on Efe and Tan, and the criterion was not realized in the other procedure, it was seen in the efficiency comparison that the DTT procedure provided by visual support based on gestures and signs was more efficient.

Maintenance and Generalization

Maintenance: Efe maintained receptive language skills taught with DTT presented with visual support based on gestures and signs for 3 or 10 weeks after the training at a success rate of 96% on average (range = 90% - 100%), while at a success rate of 31% on average in the other training procedure (range = 0% - 50%). Tan maintained receptive language skills taught with DTT presented with visual support based on gestures and signs for 3 or 10 weeks after the training at 100% accuracy, while at 30% (range = 0% - 60%) accuracy in the other training application.

Generalization: Both subjects generalized receptive language skills taught by means of DTT presented with visual support based on gestures and signs to another person at a level that was close to the criterion. In pre-test generalization sessions, Efe and Tan demonstrated no correct response related to the skill developed by means of the two training procedures. In post-test generalization sessions related to the skills taught by means of DTT presented with visual support based on gestures and signs, Efe made correct responses at an average rate of 96.6% (range = 90% - 100%); he gave correct responses at an average rate of 46. 6% (range = 20% - 80%) in the post-test generalization session carried out for the skills trained by means of DTT presented only with verbal instruction. Tan made correct responses at an average rate of 96.6% (range = 90% - 100%) in the post-test generalization sessions related to the skills taught by means of DTT presented with visual support based on gestures and signs. He gave correct responses at an average rate of 33.3% (range = 20% - 50%) in the post-test generalization session carried out for the skills developed by means of DTT presented only with verbal instruction.

Discussion

This study compared the effectiveness and efficiency of DTT procedure presented with visual sup-

port based on gestures and signs along with verbal instruction and of DTT procedure presented only with verbal instruction on teaching receptive language skills to children with autism.

Findings indicate that the DTT, in which verbal instructions were presented as integrated with gestures and signs in teaching receptive language skills, was more effective. The findings obtained in this study show a resemblance to findings in the studies that compare sign language usage by itself or as integrated with speaking and exclusive usage of verbal language (Brady & Smouse, 1978; Carr et al., 1984). In addition, the study findings are in compliance with the findings of the study examining the effectiveness of presenting sign language with speech (Carr & Dores, 1981). However, the behavior targeted to teach in these studies is receptive labelling. The present study, however, examines the receptive discriminations for the instructions provided by the trainer. As a result, this paper supports and broadens the findings of previous research.

Different from similar previous investigations (Brady & Smouse, 1978; Carr & Dores, 1981; Carr et al., 1984), the present study uses simple gestures and signs representing the instructions given to the subjects in teaching receptive language skills to children with autism rather than the symbols present in any sign language. Earlier researchers examine the effectiveness of augmentative and alternative communication applications carried out by benefiting from sign language and/or communication with gestures. Considering the fact that communication based on gestures was underrepresented (Wendt, 2009), it might be concluded that findings of this study can contribute to the literature in this respect.

The DTT presented with visual support based on gestures and signs along with verbal instruction clearly caused positive results also in the maintenance and generalization stages. In the studies that compare sign language usage and/or communication with gestures exclusively or as integrated with speaking and using verbal language exclusively in teaching receptive language skills to children with autism, it is seen that systematic data related to maintenance and generalization were not collected. Thus the effects of independent variables on maintenance and generalization were not compared (Brady & Smouse, 1978; Carr et al., 1984; Wherry & Edwards, 1983).

In this study, it was observed in both subjects that the DTT which was presented with visual support based on gestures and signs along with verbal instruction was more effective in terms of all efficiency parameters. Efficiency findings of the study are similar to the findings of the studies comparing sign language with or without speaking and presenting verbal language alone (Brady & Smouse, 1978; Carr et al., 1984). Considering effectiveness and efficiency findings of the study, it can be suggested for the practitioners of using DTT to use DTT presented with visual support based on gestures and signs along with verbal instructions in teaching receptive language skills to children with autism who have difficulty in learning receptive language skills.

There are some strong points in addition to the fact of this study's positive findings related to using gestures and signs as a means of visual support along with verbal instructions in teaching receptive language skills to children with autism. One point is that training sessions were conducted out of the experimental process with the aim of teaching receptive language skills which the subjects could not learn by means of the application determined to be effective, in other words by means of DTT application provided with visual support based on gestures and signs along with verbal instruction. In these sessions conducted out of experimental process, the subjects learned all receptive language skills at the criterion level that they could not learn with DTT carried out by providing only verbal instruction, and they sustained the skills they learned at the criterion level 3 or 10 weeks after the completion of the training. The results obtained with this intervention support and reinforce the findings obtained by establishing experimental control.

Another strength of the study is that the independent variables whose effects were examined in the study were applied with a very high level of procedural reliability. Also in the studies in which sign language and/or gestures were used in teaching communication skills to children with autism, generally, procedural reliability data were not collected (Schlosser & Wendt, 2008). The fact that no data related to procedural reliability were collected poses a threat both to internal validity and external validity of the study (Billingsley et al., 1980; Gersten et al., 2005; Schlosser, 2002).

In spite of the positive findings, it should be kept in mind that the study is limited to two children with autism and teaching basic receptive language skills to these children. A limitation of the study is that there are only two receptive language skills in each training set taught to the subjects as depend-

ent variable. However, it should also be considered while mentioning this limitation that the subjects of the study have severe mental retardation as well as having autism. In addition, another limitation that can be mentioned is that social validity data were not collected.

Considering the study's limitations and findings, ranged suggestions can be made for further research. It can be suggested that similar studies be repeated for teaching different receptive language skills to different students with autism. Social validity data can be collected in the future studies, related to using visual stimuli based on gestures and signs by integrating them with verbal instructions in teaching receptive language skills to children with autism. In this study, gestures and signs were not used as visual prompts aimed at fading gestures and signs, but as a means of visual support in order to provide students with understanding the instructions. New effectiveness and comparative studies could examine the effects of fading or retreating prompts after using them as instructional prompts of gestures and signs while providing training for children who learn receptive language skills with difficulty. The present study carried out DTT procedures in which massed trials were presented for teaching receptive language skills. The effects of the training in which verbal instructions integrated with gestures and signs are presented can be tested especially by applications carried out with a naturalistic teaching method in which distributed trials are presented. The findings of studies published about teaching augmentative and alternative communication skills to children with autism have not yet provided a clear idea about issues such as which augmentative and alternative communication type is more effective and efficient, and which augmentative and alternative communication type is more appropriate and beneficial for children according to the features they have (Goldstein, 2002; Schlosser & Wendt, 2008; Wendt, 2009). For this reason, further research is required to determine to what extent the training interventions using visual support based on gestures and signs are more effective and efficient in children according to the features they have. Furthermore, in future studies, the training interventions that are integrated with verbal instructions in which gestures and signs are used for teaching receptive language skills to children with autism can be compared with training interventions in which verbal instructions are integrated with graphic symbols in terms of effectiveness and efficiency.

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