Teaching Pointing to Numerals to Individuals with Autism Using Simultaneous Prompting

Nurgul Akmanoglu and Sema Batu
Anadolu Universitesi

Abstract: The purpose of this study was to examine effectiveness of simultaneous prompting in teaching pointing to numerals to individuals with autism. Three individuals with autism were taught pointing to numerals, which were orally named by the teacher using simultaneous prompting. A multiple probe design was used across three behaviors and replicated across three subjects. Results revealed that simultaneous prompting was effective in teaching pointing to numerals, which were named by the teacher. Subjects managed to learn the numerals and generalize this skill to ‘pointing to the numerals on a calendar page’.

Functional academic skills are one of the pre-requisites for individuals with autism to be a part of regular classes and community. Functional academic skills are perhaps the most useful skills for individuals with handicaps (Snell & Brown, 2000). Of course usefulness is dependent on the individuals’ needs and performance in different skill areas. Learning functional academic skills facilitate students to count, read, write, shop, and perform many other skills independently.

Individuals with autism have many different characteristics. During early months of their lives, babies with autism may fail to keep eye contact with parents and other people. Also, they may fail to respond to their parents’ attempts to start vocalization and play interactions. When the child with autism learns to use vocabulary and language, usually this is for requests, not for socialization. Even after language acquisition is managed, behaviors such as initiating conversations, and responding to other people’s conversations are less frequent than other children (Koegel & Koegel, 1999). Therefore effective procedures to teach different skills are needed for individuals with autism.

In many studies errorless teaching strategies were used to teach different skills to individuals with autism (Farmer, Gast, Wolery, & Wintemberg, 1991; McCurdy, Cundari, & Lentz, 1990; McDonnell, 1987; McDonnell, & Ferguson, 1989; Schoen, Lentz, Jr., & Suppa, 1988; Wolery, Doyle, Ault, Gast, & Meyer, 1991). In these studies, most frequently used procedures are progressive time delay, decreasing prompt hierarchy, increasing prompt hierarchy and time delay. Simultaneous prompting is one of the most effective methods for teaching discrete skills (Fickel, Schuster, & Collins, 1998; Gibson, & Schuster, 1992; MacFarland-Smith, Schuster, & Stevens, 1993; Singleton, Schuster, Morse, & Collins, 1999; Wolery, Holcombe, Werts, & Cipolloni, 1993) and chained skills (Fetko, Schuster, Harley, & Collins, 1999; Parrott, Schuster, Collins, & Gassaway, 2000; Schuster, Griffen, & Ann, 1993) to individuals with moderate and severe mental retardation. However, the literature revealed no study on use of simultaneous...
prompting for teaching skills to individuals with autism.

When using simultaneous prompting, the teacher presents a controlling prompt (i.e., a prompt that ensures a correct response) simultaneously with the stimulus being taught. For example, the teacher shows a picture of a car and says, “What is this on the picture?” and immediately responds “A car.” During the procedure, an independent response is not allowed by the student because the controlling prompt is always given along with the task direction. Therefore, probe sessions play a very important role for determining the transfer of stimulus control (Parrott et al., 2000).

Simultaneous prompting can be suggested for teachers and other practitioners based on several advantages. One advantage is the student does not need to be taught a waiting response. Individuals with autism usually do not have this skill (Koegel & Koegel, 1999). Another advantage is there is no need to change the teaching procedure because all trials are conducted similar to each other. The teacher does not change the time for responding, all trials are conducted with 0 s between task direction and controlling prompt. Also there is only one type of correct response for the learner; therefore, there is no need to differentiate the reinforcement procedure as in other errorless teaching strategies (Parrott et al., 2000; Tekin & Kircaali-Iftar, 2001).

Dogan and Tekin-Iftar (2002) assessed percentage of correct responses on receptively identifying occupations from picture cards. A multiple probe across subjects design study was conducted and maintenance and generalization effects were also assessed. Five occupations (e.g. teacher, butcher, grocer, etc.) were taught to each of three subjects with developmental disabilities. Simultaneous prompting procedure was found to be effective for teaching the skill and maintenance and generalization effects were positive. Griffen, Schuster, and Morse (1998) also examined effectiveness of simultaneous prompting on teaching some words that participants would encounter in their daily lives. An alternating treatments design was used. Participants were five children with moderate mental retardation between the ages of six and eleven. Results revealed that simultaneous prompting was effective on teaching target behaviors. Singleton, Schuster, and Ault (1995) also assessed effectiveness of simultaneous prompting on teaching sight words to two children with moderate mental retardation. In this study, learning by observing in the group and acquisition of nontarget behaviors were examined. Target behaviors were determined by conducting a survey of parents of the participants. Results indicated that simultaneous prompting was effective on teaching sight words to children with mental retardation, and those participants learned to read sight words via observing their friends in the group.

In another study, Wolery et al. (1993) assessed effectiveness of both simultaneous prompting and teaching feedback together for teaching naming the playing cards verbally to children with developmental disabilities. Participants were five children aged between 36 and 42 months. Results were (a) simultaneous prompting was effective for teaching naming the playing cards, (b) all five participants learned to name all playing cards in their sets, (c) after learning the first set, participants learned the second and third sets more quickly than the first set, and (d) generalization effects were positive for all materials used.

The studies summarized above were concerned with teaching discrete behaviors as in the present study. As mentioned before, there are many other studies in the literature assessing effectiveness of simultaneous prompting on chained behaviors with individuals with moderate and severe mental retardation (Fetko et al., 1999; Parrott et al., 2000; Schuster et al., 1993; Swell, Collins, Hemmeter, & Schuster, 1998).

Pointing to numerals is a prerequisite skill for students with autism for several reasons. A child who learns to point to numerals when orally named by the teacher will be more likely to use the telephone, tell time, choose the bus to take independently and so on. Furthermore, when pointing to numerals is learned, one can more efficiently learn to use money and other extended skills using numbers. Of course these are the skills to be performed in the community during daily living, on the other hand individuals who learn pointing to numerals can also use numerals while matching subjects with appropriate numerals, solv-
ing problems in math classes, etc. before using them in more comprehensive skills.

Although simultaneous prompting has been used frequently for teaching many different skills, studies on teaching individuals with autism could not be found. Therefore the purpose of this study is to assess effectiveness of simultaneous prompting for individuals with autism for teaching pointing to numerals named by the teacher. Research questions addressed are: (a) Is simultaneous prompting an effective procedure for teaching pointing to numerals (1, 2, 3, 4, 5, 6, 7, 8, 9) when named by the teacher? (b) Will students maintain acquired skills one, two, and four weeks after intervention? (c) Will students be able to generalize skills to other materials (calendar pages)? and (d) What are mothers’ opinions about the importance of the study?

Method

Participants

Participants were three students with autism, two male and one female, ranging in age from 6 to 17 years old. Male students were also identified as having mental retardation. No student had any experience with systematic instruction of any skills with any of the response prompting techniques. All participants were attending special education schools. Male participants attended a private special education school, and the female participant attended a university center for children with developmental disabilities. Names of students are pseudonyms.

Participants were identified by the first author based on the following prerequisite skills: (a) keep attention on an activity for at least 10 min (during the pilot study, it was determined that sessions would last a maximum of 10 min), (b) successfully follow simple verbal instructions (i.e., show me the... give me the...), and (c) choose the named picture from three given pictures. In addition, naming numerals was a new skill not yet learned by participants.

Omer was a 17-year old boy with autism and mental retardation. He attended a private school for children with developmental disabilities for four years. He could perform basic self-help skills such as toileting, dressing and undressing independently. He had limited verbal language. He used one word sentences for requests and had ecolalia.

Baris was a 12-year old boy with autism and mental retardation. He attended the same private special education school for two years. He could manage several fine motor skills (hold a pencil, color a given shape, etc.) when told to do so and gross motor skills (kick a ball, play with group during PE classes, etc.) independently as well as self-help (toileting, eating, dressing, etc.) skills when told to do so. He could imitate mouth movements when he was told to do so. He used mimics and gestures as requests.

Serap was a six-year old girl with autism. She attended a small classroom in a university center for children with developmental disabilities for a year. She could perform all the fine and gross motor skills independently. She was also able to understand simple instructions such as “come here,” “give the pencil, close the door” etc. She could use two word sentences and had ecolalia while speaking. None of the participants had experience in a mainstreamed setting.

Settings

For Omer and Baris, all sessions were conducted in a classroom in their own school. For Serap, all sessions were conducted in a classroom at the university center. All settings were segregated. In both classes there was a table and two chairs, one for the student and one for the trainer. Another table was used for the study materials. A handycam video camera was used for recording the sessions. The student and the trainer sat at the table facing each other and all the sessions were conducted in a 1:1 environment.

Materials

The controlling prompts were written on 10 cm × 15 cm cards. Cards were white and numerals were black. For generalization, daily calendar pages were used. On each calendar page, there was only one numeral. Also a 30 cm × 40 cm paste board was prepared for the numeral cards to be put on. All cards and the paste board were covered with clear stretch
A stopwatch was used to time session duration. The video camera was set up in the classroom before each session.

**Trainer and Observer**

The trainer (i.e., first author) was a research assistant in a masters program in special education. She conducted all sessions. She had three years experience teaching children with autism. The reliability observer was also a research assistant and a master’s student in a special education program. She had a background in using errorless teaching procedures with individuals with developmental disabilities. The reliability observer was trained by the first author on procedures for data collection.

**Procedure**

Phases consisted of full probe, daily probe, training, maintenance, and generalization sessions. All sessions were conducted between 9 and 12 a.m. in participants’ classes each school day. Reinforcers were placed in the classes and the trainer used them for each correct response. Also, every attempt to participate in the activities and the correct responses were rewarded verbally (i.e., “good job”, “well done”, etc.) by the trainer.

**Full probe sessions.** These were conducted before training sessions started and after criterion was met by participants in training sessions. The first full probe session was conducted in order to collect baseline data from participants. In each full probe session six trials were conducted in order to check each target stimulus (i.e., the numerals). Each teaching set contained three randomly selected numerals. Hence, in each full probe session each target stimulus was asked twice randomly. After meeting criterion with the first set, the second full probe session was conducted. Similarly, after meeting criterion with the second set, the third full probe session was conducted. Lastly, after meeting criterion with the third set, the last full probe session was conducted.

Full probe sessions were conducted in the following order: (1) Materials were placed (sets of three numerals as indicated before) on the material table in the experimental setting, (2) Numeral cards for the first teaching set were placed either on the table or on the paste board, (3) Attentional cue (i.e., “Baris, are you ready to work?”) was given to the participant, (4) Task direction (i.e., “Baris, show me three”) was given, (5) Participant had to respond within 4 s, (6) Correct responses were rewarded verbally and incorrect responses were ignored, and (7) The next trial was conducted after 4 s.

During full probe sessions, correct responses of participants were rewarded verbally. Correct responses were either pointing to or naming the numeral. Incorrect responses were ignored. Incorrect responses were pointing to a wrong numeral within 4 s, pointing to more than one numeral within 4 s, or not showing any of the numerals within 4 s. At the end of the full probe conditions, participants were given tangible reinforcers in order to reinforce their attention and cooperation during sessions.

**Daily probe sessions.** The only difference between the full probe sessions and daily probe sessions was that, during full probe sessions all target behaviors were asked, whereas during daily probe sessions only the target behavior currently taught was asked. The reason for daily probe sessions was that while using simultaneous prompting, controlling prompts were being given in each trial. Therefore, participants did not have a chance to respond independently (Tekin & Kircaali-Iftar, 2001). Hence, daily probe sessions were conducted prior to each training session in order to collect the study data. The task directions were given to participants in an unpredictable order. Daily probe sessions were conducted with two participants until they performed 100% correct responses for at least three consecutive days, and with the other participant until he performed 80% correct responses for at least three consecutive days. As in the full probe sessions, participants were rewarded verbally for each correct response during daily probe sessions and all incorrect responses were ignored. Participants’ attention and cooperation were reinforced at the end of each session.

**Training sessions.** During training sessions, task direction and controlling prompt were delivered at the same time (0 s), which means the trainer delivered the controlling prompt just after the task direction. In each training
session, each of the target numerals was asked twice. Since there were three target numerals in each material set, six trials were conducted during the sessions. Response interval and inter-trial interval were 4 s. Controlling prompts were modeling plus verbal prompting during training sessions. Correct response was defined as to point to/give the correct numeral card after the task direction and controlling prompt were delivered. Training sessions continued until three consecutive 90-100% correct responses were given during daily probe sessions.

Training sessions were conducted as follows: (1) Three target stimuli cards were placed on the table where teaching would take place, (2) An introduction took place (i.e., “Now we are going to learn numerals with you. First I will say and you will listen. Then, when I ask you, you point to or give the numerals that I ask.”), (3) An attentional cue was delivered to the student (i.e., “Baris, are you ready to work with me?”), (4) Task direction was delivered (i.e., “Serap, which one is five?” or “Serap give me/point to card three.”), (5) Controlling prompt and modeling were delivered (i.e., “Look this is five. Now you show me which one is five.”), (6) Subject’s response within 4 s, and (7) Correct responses within 4 s were verbally praised (i.e., “Well done”, “Good job”, etc.) and incorrect responses were ignored. Students’ attention and cooperation behaviors were reinforced with tangible reinforcers at the end of each session.

Maintenance and generalization probe sessions. Maintenance probe sessions were conducted one, two and four weeks after training sessions were completed. Maintenance sessions were conducted the same as full probe sessions. During these sessions correct responses were praised verbally continuously and attention and cooperation behaviors of participants were reinforced with tangible reinforcers.

Generalization probe sessions were conducted after the last full probe session took place the same as full probe sessions. Generalization was assessed across materials and calendar pages with target numerals on them were used. Pre- and post-test design was used for the generalization assessment. Pre-test was conducted just after the first full probe session and the post-test was conducted after criterion was met by each student. In each generalization session, each of the target numerals was asked twice since there were three target numerals in each material set. Six trials were conducted during the sessions. As in other probe sessions, correct responses of participants were praised verbally continuously and incorrect responses were ignored. Also, at the end of generalization sessions, attention and cooperation behaviors of participants were reinforced with tangible reinforcers.

Experimental Design

A multiple probe design across behaviors was used to examine effectiveness of simultaneous prompting in teaching pointing to numerals and replicated with three subjects with autism. Multiple probe design across behaviors is a single-subject design in which effectiveness of an independent variable is tested on three or more dependent variables (Kircaali-Iftar & Tekin, 1997; Tawney & Gast, 1984).

The dependent measure was percent of correctly pointing to the numerals named by the trainer. The numerals in each teaching set are presented in Table 1. The independent variable was the simultaneous prompting procedure. Experimental control was obtained through sequential introduction of the teaching set (Tekin & Kircaali-Iftar, 2001).

Reliability

Inter observer and procedural reliability data were collected. Sessions of reliability data collection were random video records of selected sessions were examined by the trainer and the observer independently. Reliability data were collected from 20% of all the probe, training, maintenance and generalization sessions.

Inter observer reliability was calculated by the formula of number of agreements divided

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by number of agreements plus disagreements multiplied by 100 (Kircaali-Iftar & Tekin, 1997). Inter observer reliability data indicated 100% agreement for all participants during all sessions.

Procedural reliability data were collected for assessing implementation of the teaching plan. Data were calculated with the formula of number of trainer behaviors observed divided by number of behaviors planned multiplied by 100 (Tekin & Kircaali-Iftar, 2001). Steps assessed were as follows: (1) controlling the materials, (2) attention securing, (3) delivering the task direction, (4) delivering the controlling prompt, (5) waiting for the response interval, (6) giving appropriate responses for the students’ responses, and (7) waiting for the intertrial interval. Reliability data indicated 99% accuracy during full probe sessions, 99% accuracy during daily probe sessions, 100% accuracy during training session, 99% accuracy during maintenance sessions and 99% accuracy during generalization sessions.

Social Validity

A social validity scale was developed to collect the opinions of the participant’s mother. Random sessions were chosen from video records of the sessions for mothers to watch. After watching the videos, questions in the scale were asked one by one individually by the trainer and answers were reported on the scale verbatim. The five questions were as follows: (1) Do you think it is important to teach numerals to your child? (2) What do you think are the important parts of the study I conducted with your child? (3) Are there any parts of the study that you did not like? If yes, please specify, (4) Are you satisfied with the method used to teach numerals to your child? and (5) When the study was completed, were there any positive changes in your child? If yes, please specify.

Results

Instructional Data

Results revealed that all participants met the criterion. Data indicated that simultaneous prompting was found to be effective for teaching pointing to numerals to individuals with developmental disabilities.

As shown in Figures 1, 2, and 3, all participants learned to point to numerals when asked by the trainer. Percent of correct responses of participants during full probe, training, maintenance, and generalization sessions can be seen on these figures.

Each participant’s number of training sessions and trials, number of correct and incorrect responses during training sessions, and percentage of correct and incorrect responses during training sessions are listed in Table 2.

As can be seen in Table 2, total number of training sessions was 99 and total number of trials was 588. Length of all training sessions with three participants was 125 min and 50 s. Number of correct responses during training sessions was 360 and number of incorrect responses during training sessions was 269.

Maintenance and Generalization Data

Maintenance data were collected one, two and four weeks after completing training with simultaneous prompting. As can be seen in Figures 1, 2, and 3, participants maintained the skills they acquired during training sessions. Baris maintained the behaviors taught 94.6% (range = 89-100%), Omer maintained the behavior taught 85.7% (range = 84-100%) and Serap maintained the behavior taught 100%.

Generalization data were collected across materials. Calendar pages with numerals were used for generalization. During pre-test, Baris responded with 11% accuracy, Omer responded with 17% accuracy, and Serap responded with 0% accuracy. After the training sessions, Baris responded with 100% accuracy, and Omer and Serap responded with 89% accuracy.

Social Validity

Social validity findings were as follows: (a) Mothers of participants indicated that teaching numerals to their children was very important for the future, (b) As a feature of many children with autism, participants used to refuse to work with different teachers, therefore mothers were also happy about their children’s working with the trainer, (c) Two
Figure 1. Percent of correct responses for Baris during full probe, daily probe, and maintenance probe sessions.
Figure 2. Percent of correct responses for Omer during full probe, daily probe, and maintenance probe sessions.
Figure 3. Percent of correct responses for Serap during full probe, daily probe, and maintenance probe sessions.
mothers indicated that attention period of their child increased, and (d) One mother reported that her child developed imitating skills via this study.

Discussion

Results revealed that simultaneous prompting was effective in teaching pointing to numerals by children with autism. Maintenance data showed that participants maintained the skills taught and generalization data showed that participants were able to generalize the skills they learned across another set of materials (calendar pages). According to the effectiveness, maintenance and generalization data, findings were consistent with many other studies examining effectiveness of simultaneous prompting on discrete behaviors (Dogan & Tekin-Iftar, 2002; Gibson & Schuster, 1992; Griffen et al., 1998; MacFarland-Smith et al., 1993; Schuster, Griffen, & Wolery, 1992; Singleton et al., 1995).

Ease of implementation of simultaneous prompting by the trainers is another finding that shares consistency with other studies in the literature (Griffen et al., 1998; Parrott et al., 2000; Schuster & Griffen, 1993; Schuster et al., 1992). As mentioned in previous studies, simultaneous prompting again was an easy method to use by trainers for two reasons. First, the same prompting strategy is used during the whole study. Second, there is no need for the trainer to teach waiting response to participants.

Data for full probe sessions showed an increase in correct responses of participants. The trainer provided reinforcement to participants both during full and daily probe and also during training sessions in order to confirm that learning occurred only as a result of the independent variable.

Results of the present study lead to a number of suggestions for future research. First, simultaneous prompting can be used with individuals with autism to teach both discrete and chained behaviors. Second, types of errors occurring during the study can be examined. Third, effectiveness of various errorless teaching techniques can be compared for individuals with autism.

In the present study generalization data were collected across one set of materials (i.e. calendar pages). The use of other materials such as numerals on a clock, numerals on a book, etc., collecting the data within different settings ideally in less restrictive environments could be suggested and also generalization across implementers could be suggested for the future studies.

Results should also be considered in light of some limitations. The trainer met participants just before the research started. This unfamiliarity might have been a cause of the extended training time. Another limitation was that the types of errors that occurred during the study were not examined. Therefore, an error correction procedure was not conducted during this study. Even with the limitations noted, the experimental design of the study allows attribution of effect of the independent variable. Thus simultaneous prompting was found to be effective in teaching pointing to numerals to individuals with autism, a finding not previously reported in the literature.

References

Dogan, O. S., & Tekin-Iftar, E. (2002). The effects of simultaneous prompting on teaching receptively


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