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A Comparison of Constant Time Delay Instruction with High and Low Treatment Integrity

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Abstract

Time delay (TD) procedure is an effective procedure in teaching various skills to children with developmental disabilities. Moreover, research has shown that it is used with high treatment integrity (HTI). However, there are several barriers which may prevent to deliver instruction with HTI. Therefore, this study was designed to compare the effectiveness and efficiency of TD instruction with HTI and low treatment integrity (LTI) in teaching object naming to children with autism. LTI was defined as not delivering prompt 30% of all teaching trials. An adapted alternating treatments design was used in the study. Three 5 to 6 year old male students participated in the study. Results showed that all three children learned their target behaviors on the criterion level with both conditions. Mixed findings were obtained for the efficiency of instruction. Based upon evaluation of the findings, recommendations for practitioners are provided and future research needs are discussed.

Key Words

Time Delay Procedure, Treatment Integrity, Autism.

Time delay instruction was first used by Touchette (1971) to teach discrimination skills to adolescents with mental retardation. In time delay instruction, prompt is provided followed by task direction so students are expected to respond to the task direction correctly. It is one of the errorless learning procedures. The rationale of "individuals do not learn from their errors but from positive practices" is basically important while developing errorless learning procedures (Wolery, Bailey, & Sugai, 1988, p. 220). Response prompting procedure and stimulus modifications are the two main types of errorless learning procedures (Tekin-Iftar & Kircaali-Iftar, 2006). In response prompting procedures, the prompt is provided prior to students' response and they are expected to respond correctly whereas in stimulus modification procedures, prompt is provided to the stimuli and the students are expected to recognize the stimuli and give correct response. There are many different procedures in both response prompting and stimulus modification approaches.

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Constant and progressive time delay procedures are two types of time delay procedures. Fixed amount of time such as 4 or 5 s is inserted between task direction and prompt in constant time delay. The duration between task direction and prompt is called delay interval. The interval is used for giving the student a chance to respond independently. In progressive time delay procedure, the delay interval is progressively increased. Both procedures have been developed by using one of the main principles of applied behavior analysis which is known as ABC principle.

The procedural characteristics of constant time delay procedure (CTD) can be explained as follows: (a) same prompt is used throughout the instruction, (b) task direction is used in its final form, (c) it requires two types of teacher behaviors known as "0 s delay interval trials" and "constant time delay intervals", (d) five types of student responses are possible during instruction.

After the first published study mentioned above, in the following four decades many research studies have been conducted to examine the effectiveness of CTD, to compare CTD with other procedures in terms of effectiveness and efficiency, to investigate

the use of CTD by paraprofessionals, peers, and siblings. These published studies have shown that CTD is an effective procedure in teaching discrete as well as chained skills to individuals with various disabilities and ages.

CTD is successfully used for teaching discrete skills such as sight words (Gast, Ault, Wolery, Doyle, & Belanger, 1988), mathematical skills (Kırcaali-Iftar, Ergenekon, & Uysal, 2008; Koscinski & Gast, 1993), community signs (Yıldırım & Tekin-Iftar, 2002) and chained skills such as food and drink preparation (Bozkurt & Gursel, 2005; Fiscus, Schuster, Morse, & Collins, 2002; Graves, Collins, Schuster, & Kleinhert, 2005; Hall, Schuster, Wolery, Gast, & Doyle, 1992; Schuster, Gast, Wolery, & Gultinan, 1988; Schuster & Griffen, 1991); responding to the lures of strangers (Collins, Schuster, & Nelson, 1992; Gast, Collins, Wolery, & Jones, 1993), first-aid skills (Gast, Winterling, Wolery, & Farmer, 1992), shopping skills (Dippi-Hoy & Jitendra, 2004; Morse & Schuster, 2000), and leisure skills (Tekin-Iftar et al., 2001; Wall, Gast, & Royston, 1999).

Considerable changes have been observed for the past 25 years in effective teaching practices provided to children with developmental disabilities. These changes can be summarized as follows: (a) Not only effectiveness but also the efficiency of instruction have received attention. (b) The tendency of conducting research in real classroom settings has increased. (c) There is an increase in using single subject research methodology in the classroom settings. (d) The easiness of instructional procedure has received attention from both researchers and practitioners. (e) The treatment integrity of instruction has received much attention from researchers.

Treatment integrity is defined as implementing the intervention/instruction as it is planned (Billingsley, White, & Munson, 1980; Peterson, Horner, & Wonderlich, 1982). In order to conduct treatment integrity analysis, the intervention/instruction steps which are expected to be performed by the trainer is specified and [(observed teacher behaviors/planned teacher behaviors) X 100] formula is used. By conducting treatment integrity, researchers have the confidence to say that independent variable is responsible for the observed changes in the dependent variable. Also, the accuracy of generalizing findings of a study will increase.

As mentioned before, there are many published studies showing the effectiveness of CTD after its first use. There are two review studies (Dogoe & Banda, 2009; Schuster et al., 1988) evaluating the use of CTD by using various parameters. Schuster et al. did not mention treatment integrity findings of the studies they reviewed since this review includes the studies published during the 1980s and it was not common to focus on treatment integrity in those days. Dogoe and Banda examined treatment integrity findings of 10 studies that they reviewed and explained that CTD was implemented with a mean of 97% accuracy (range= 90% to 100%) across the studies.

As it is seen above, CTD has been used by researchers with almost perfect implementation. However, it should be kept in mind that these studies are experimentally controlled studies. As stated by Holcombe, Wolery, and Synder (1994) in all these studies researchers had to provide perfect implementation to establish functional relations between the dependent and independent variable. However, as one may easily guess, it is neither necessary nor possible to establish a control for the environment in real classroom settings in terms of providing perfect implementation due to following reasons. First, classrooms are crowded and there are various variables which may distract teachers and students. Second, teachers may not have enough information about the concept and importance of treatment integrity during instruction. Third, teachers may have less training about the instructional procedures. Lastly, in a classroom setting not having an observer to evaluate the correct implementation may cause a relaxation in the teacher.

Holcombe et al. (1994) conducted a study examining the differential effects of CTD instruction with high and low treatment integrity in teaching object recognition receptively and expressively to six children (48 to 53 months old) with mental retardation. Adapted alternating treatments design was used in the study. Two training sets were formed for each child and one was taught by CTD instruction with high treatment integrity and the other was taught by CTD instruction with low treatment integrity. Low treatment integrity condition was defined as not providing prompt 44% of all the teaching trials. Results showed that in 4 out of 6 children both conditions were equally effective. The criterion was met in one child with high treatment integrity condition, learning did not occur in the other condition. Neither condition was found to be effective in the sixth child. Efficiency findings showed that high treatment integrity condition seemed to be more efficient than the other in 3 children out of 4.

The purpose of the present study, by considering the findings of Holcombe et al.'s (1994), study was to

compare CTD instruction with high and low treatment integrity in teaching receptive and expressive object naming to children with developmental disabilities. Low treatment integrity was defined as not delivering prompt at most 30% of instruction during all teaching trials. The following research questions were addressed in this study: (a) Is there any difference between CTD instruction with high and low treatment integrity conditions in teaching, maintaining, and generalizing object naming to children with autism? (2) Is there any difference of efficiency between CTD instructions with high and low treatment integrity conditions when teaching object naming to children with autism?

Method

Participants

Subject: Three students with autism who were enrolled at the Developmental Disability Unit of the Research Institute for Handicapped at Anadolu University participated in this study. All students received their diagnoses in hospitals. No adaptive scores were available for the students. Parental consents were obtained prior to study. The following prerequisite skills were required for the students for attending this study: (a) visual discrimination, (b) following verbal direction, (c) attending audio and visual stimuli for 5 minutes.

Instructor: All experimental sessions were conducted by the third author of the study. She has 7 years of experience in teaching children with developmental disabilities and of providing instruction with CTD.

Settings and Materials

All sessions were conducted at the Research Institute in one on one teaching format. Trainer and student sat facing each other. Picture cards for the objects, handy cam to record sessions, and data collection forms were used.

Dependent and Independent Variables

Receptive and expressive object naming was the dependent variable of the study. Erkan and Gokhan were taught receptively identifying animals and clothes respectively and Mehmet was taught expressively identifying names of clothes. Two training sets were formed for each student including 6 target stimuli. Therefore, there were 12 target stimuli for each student. One training set was planned to teach by CTD instruction with high treatment integrity and the other was planned to teach by low treatment integrity. The sets were randomly assigned to instructional conditions.

The independent variable of the study was CTD instruction with high and low treatment integrity. During instruction with high treatment integrity conditions the trainer was expected to deliver prompt in each teaching trials. The trainer was expected not to deliver prompt 30% of teaching trials during low treatment integrity condition. The efficiency of instruction was measured by collecting data for the number of sessions and trials, total training time, and number and percentage of incorrect responses to criterion.

Experimental Design

An adapted alternating treatments design was used to examine CTD instruction with high and low treatment integrity in teaching object naming to children with autism. This design is used to evaluate the effects of two or more independent variables on two or more dependent variables (Sindelar, Rosenberg, & Wilson, 1985). Experimental control is demonstrated when the dependent variable assigned to one independent variable is acquired more rapidly than others regardless of the sequence of intervention (Holcombe, Wolery, & Gast, 1994; Tekin, 2000).

Procedure

A pilot study was conducted prior to the study for shaping up the procedure in its final form. Experimental sessions were consisted of baseline sessions, instructional sessions, maintenance and generalization probe sessions, and the maintenance of generalization sessions. In order to control the threats of interval validity, significant persons in the lives of the students were informed about the study and sequence effect was planned to control by delivering instruction with high and low treatment conditions with unpredictable order. All experimental sessions were recorded. Students' attending behaviors were reinforced at the end of each experimental session.

Screening Sessions

Two screening sessions were conducted to identify the target stimuli from the pool of prospective target stimuli. There were 24 prospective target stimuli in the pool and each stimulus was asked by

three times. Both correct and incorrect responses were ignored during these sessions. Twelve target stimuli were identified to be taught for each student. Two training sets were formed from these 12 stimuli each having 6.

Baseline Sessions

Baseline sessions were conducted prior to teaching object naming to get stable data for at least three consecutive sessions. Three trials were conducted in each baseline session and one session was conducted per day. Correct responses were reinforced socially. Incorrect responses were ignored during these sessions.

Instructional Sessions

After obtaining stable data during baseline sessions, training sessions were conducted to teach target stimuli in each training set by CTD instruction with high and low treatment integrity. The criterion was determined as at least 80% correct responding before prompting. One session with high treatment condition and one with low treatment condition were conducted per day. There were two phases in CTD instruction. Zero second delay trials were conducted in the first three instructional sessions and the remaining sessions through criterion were conducted as constant time delay trials. Correct responses before or after prompts were reinforced verbally and incorrect responses were resulted in error correction. Reinforcement was thinned after criterion was met.

CTD Instruction with High Treatment Integrity Conditions: In these conditions, prompts were provided with 100% accuracy across all teaching trials. In other words, the instructor was expected to provide prompts after each task direction in instructional sessions.

CTD Instruction with Low Treatment Integrity Conditions: In these conditions, prompts were provided at most with 30% accuracy during all teaching trials in instruction. There were 18 teaching trials in an instructional session. The teacher was expected not to provide prompt for the 6 trials out of 18. The trials that were not going to be prompted were assigned in the data collection form by the researchers in advance. Therefore, the teacher knew in advance in which trials she would and would not going to provide prompt.

Maintenance and Generalization

Maintenance probe sessions were conducted 1, 2, and 5 weeks after the criterion was met. Generalization across people and settings were measured in the study with pre test-post test design. Furthermore, the maintenance of the generalization was also probed in study. All sessions were conducted just like baseline sessions. Reinforcement was thinned during these sessions. FR18 reinforcement schedule was used.

Reliability

Reliability (both inter-observer agreement and treatment integrity) data were collected at least 30% of all experimental sessions by a graduate student in special education. The point by point method was used for the analysis of inter-observer reliability (Tawney and Gast, 1984; Tekin-Iftar and Kircaali-Iftar, 2006). The formula of [(observed teacher behaviors/planned teacher behavior) x 100] was used to analyze treatment integrity. Procedural reliability data were collected to determine whether the independent variable was used as it was initially planned. Both inter-observer agreement and treatment integrity were 100% across all students.

Results

Effectiveness Data: Acquisition and Maintenance

Data for the effects of CTD instruction with high and low treatment integrity in teaching object naming to Erkan, Gokhan, and Mehmet are displayed at Figure 1 through 3, respectively.

Prior to intervention Erkan performed with a mean of 17% (range = 17%-33%) accuracy on the training set consisting of animal names which was planned to be taught by CTD instruction with high treatment integrity. He performed on the other training set with a mean of 3% (range = 0%-6%) accuracy. It took 7 training sessions for him to meet criterion on both training sets. He performed 100% on the training sets taught by high treatment integrity condition and 83% accuracy on the other set taught by low treatment integrity condition across instructional sessions. It was seen that he maintained the training sets taught by high and low treatment integrity condition with a mean of 96% (range = 94%-100%) and 87% (range = 78%-94%) accuracy respectively 1, 3, and 5 weeks after criterion.

Gokhan performed with a mean of 7% (range = 0%-22%) accuracy on the training set consisting of names of clothes which was planned to be taught with high treatment integrity condition. He performed on the other training set that was planned to be taught with low treatment integrity condition with a mean of 2% (range = 0%-6%) accuracy. Gokhan acquired 100% accuracy on both training sets after receiving 8 training sessions with both instructional conditions. He also maintained the acquired skills with 100% accuracy 1, 2, and 5 weeks after instruction.

Mehmet did not perform any correct response on the training set consisting of names of clothes which was planned to be taught with high treatment integrity condition. He performed on the other training set which was planned to be taught with low treatment integrity condition with a mean of 6% (range = 0%-17%) accuracy. Mehmet acquired 80% accuracy on the first training sets after receiving 25 training sessions. He met the criterion on the second training set taught by low treatment integrity with a mean of 93% (range = 78%-100%) accuracy. He maintained the acquired skills taught by CTD instruction with high and low treatment integrity with a mean of 81% (range = 78%-83%) and %98 (range = %94-%100) accuracy respectively 1, 2, and 5 weeks after instruction.

Effectiveness Data: Generalization

Generalization data across settings and persons showed that all participants generalized the acquired skills at least on the criterion level. Generalization across settings data for Erkan showed that he performed 33% and 1% accuracy with the training sets taught by CTD instruction with high and low treatment integrity conditions on the pretest respectively, and generalized the acquired skills on the both sets with 100% and 94% accuracy during post test. Generalization across persons' data for Erkan showed that he performed 11% and 6% accuracy with the training sets taught by CTD instruction with high and low treatment integrity condition on the pretest respectively, and generalized the acquired skills with 94% accuracy on the both sets during post test.

Generalization data across settings and persons showed that Gokhan performed 1% accuracy with the training sets taught by both CTD instructions with high and low treatment integrity on the pre test and he generalized the acquired skills on the both sets with 100% accuracy during post tests.

Generalization across settings data for Mehmet showed that he performed 1% and 17% accuracy with the training sets taught by CTD instruction with high and low treatment integrity on the pretest respectively, and generalized the acquired skills on the both sets with 83% and 100% accuracy respectively during post test. Generalization data across persons for Mehmet showed that he performed 1% and 11% accuracy with the training sets taught by CTD instruction with high and low treatment integrity on the pretest respectively, and generalized the acquired skills with 100% and 94% accuracy respectively on both sets during post test.

Efficiency Data

Efficiency data, number of training sessions to criterion, number of training trials to criterion, percentage of errors to criterion, and total training time to criterion for CTD instruction with high and low treatment integrity are presented in Table 2. Mixed results were obtained regarding the efficiency parameters. For Erkan and Gokhan CTD instruction with high and low treatment integrity seemed to be equally efficient in terms of number or training sessions and trials to criterion. For these participants, high treatment integrity condition seemed to be more efficient than low treatment integrity condition in terms of number and percentage of student errors. For Mehmet, low treatment integrity condition seemed to be more efficient than high treatment integrity condition in terms of number of training sessions and trails, and number and percentage of student errors to criterion. Lastly, low treatment integrity condition seemed to be more efficient on the efficiency parameter of total time to criterion for all participants.

Discussion

The purpose of this study was to compare CTD instruction with high and low treatment integrity in teaching receptive and expressive object naming to three students with autism. The following conclusions can be drawn based on the data.

First, the findings of the study showed that no difference in favor of one condition was found in terms of the effectiveness of the CTD instruction with high and low treatment integrity conditions in teaching receptive and expressive object naming to children with autism. In Holcombe, Wolery, and Snyder (1994), these two conditions were found equally effective in 4 out of 6 students. In

this study, both conditions were equally effective in one student, CTD instruction with high treatment integrity condition was slightly more efficient than the other in one student, and low treatment integrity condition seemed to be more effective than the other condition in the last student. When the findings of this study are interpreted in terms of providing prompt during instruction, it could be stated that ignoring a procedural parameter of treatment integrity to a certain extend in terms of integrity of instruction may not have negative effects on the student outcomes.

Second, when looking from a different perspective it can be concluded that whether it was delivered with high or low treatment integrity, CTD was found to be effective in teaching object naming to students with autism. The findings of this study are consistent with the findings of the previous studies and enhanced their findings (Bozkurt & Gursel, 2005; Fiscus et al., 2002; Gast et al., 1988; Graves et al., 2005; Hall et al., 1992; Kırcaali-İftar et al., 2008; Koscinski & Gast, 1993; Schuster et al., 1998; Schuster & Griffen, 1991).

The findings of this study are more positive than the findings of Holcombe, Wolery and Snyder (1994). That is to say that low treatment integrity condition was found to be as effective as high treatment integrity condition. Low treatment integrity was defined as not providing prompt during 30% of teaching trials in this study whereas it was defined as 44% of all teaching trials in the previous study. Decreasing this percentage in this study would be considered a possible factor for these positive effects in student outcomes.

Third, although minimal differences were found on the maintenance findings of both conditions, it can be concluded that both conditions were effective on maintaining the acquired skills over time and these findings are consistent with the findings of earlier studies (Bozkurt & Gursel, 2005; Fiscus & et al., 2002; Gast et al., 1988; Graves et al., 2005; Hall et al., 1992; Koscinski & Gast, 1993; Schuster et al., 1998; Schuster & Griffen, 1991).

Fourth, both CTD instruction with high and low treatment integrity conditions were seemed to be effective for proving generalization of the acquired skills across settings and people on criterion level. The differences were minimal. These findings are also consistent with the findings of earlier studies (Bozkurt & Gursel, 2005; Fiscus & et al., 2002; Gast et al., 1988; Graves et al., 2005; Hall et al., 1992; Koscinski & Gast, 1993; Schuster et al., 1998; Schuster & Griffen, 1991).

Fifth, mixed findings were obtained regarding efficiency measures. Therefore, a conclusion in favor of one condition cannot be stated in the study.

Besides obtaining positive findings in the study, the study has also some strength. First, there is limited number of study comparing the effects of instruction with high and low treatment integrity in classroom settings. Second, this study showed that CTD instruction could be provided with high reliability. Findings of this study showed that except providing prompt, the teacher in the study delivered CTD with high reliability.

Although the findings of the study were positive, it should be kept in mind that the study was limited with teaching object naming to three children with autism. Besides this limitation, it was also limited with using pool-out strategy and delivering teaching with one on one instruction.

Based on the findings, the following recommendation to the practice and future research can be stated. Even though there would be a problem in delivering CTD instruction reliably, teachers and other practitioners are recommended to use it in classrooms. Although they do not have a formal training for delivering systematic instruction, parents, siblings, peers, other caregivers and/or paraprofessionals are encouraged to use it in their lives to teach children with disabilities. As it is well known there is a gap between school and home and having these persons to participate in teaching process would be an interface for closing this gap. The future research recommendations can be as follows. This is the second study addressing this issue. Therefore, to generalize the findings, a replication of the study is needed to be conducted by the future researchers. The effectiveness of other response prompting strategies such as simultaneous prompting, graduated guidance will be examined in terms of high and low treatment integrity. This study was designed to teach discrete skills to preschool students with autism, future research are needed to analyze the effects of the same instruction in teaching children with other disabilities. Future researchers are recommended to conduct the same study in teaching chained skills to children with autism. Low treatment integrity was defined as by not delivering prompt. In the future research, the researchers are recommended to control other treatment integrity steps of the instruction in promoting learning. Lastly, comparing the effectiveness and efficiency of high and low treatment integrity in group teaching arrangement is recommended to the future researchers.

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