European Journal of Special Education Research
ISSN: 2501 - 2428
ISSN-L: 2501 - 2428
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.1162967 Volume 3 | Issue 1 | 2018

EFFECTIVENESS OF CONSTANT TIME DELAY INSTRUCTION WITH ERROR CORRECTION IN TEACHING THE SKILL OF IDENTIFYING THE NUMERALS TO STUDENTS WITH INTELLECTUAL DISABILITY

Ümit Şahbaz[1],
Selda Katlav[2i]
[1]Faculty of Education, Ege University, Turkey
[2]Department of Special Education,
Near East University, Mersin 10-Turkey

Abstract:
The purpose of this study was to investigate the effectiveness of constant time delay instruction with error correction in teaching the skill of identifying the numerals (from 1 to 5) to students with lightly intellectual disability. The experimental design of this study was multiple probe model with probe conditions across subjects which is one of the single subject research models. While the dependent variable of the study was identifying the shown numerals on flash cards by subjects presented by researcher, the independent variable was constant time delay method with error correction in the teaching of skill of telling the numerals. In this study, four students who have the diagnosis intellectual disability were participated. One of the students took a place at the pilot implementation. The research process which was performed by the researcher was organized as instruction, probe, maintenance, generalization and all sessions were proceed for all subjects as one to one instruction. It has been found that constant time delay method with error correction was effective for the skill of identifying numerals by students with lightly intellectual disability. Additionally, it was seen that learned skill after the end of the instruction was maintained and generalized with different materials and conditions.

Keywords: intellectual disability, numeracy, constant time delay, error correction

1. Introduction

To prepare students with intellectual disabilities for independent living, functional academic skills must be taught to them (Snell and Brown, 2000). Learning the figures as

[i] Correspondence: email seldaakatlav@hotmail.com

to the children with intellectual disability, both in daily life skills and mathematical skills, is very important in terms of facilitating their lives and enabling them to survive independently. When the adults count the numbers, use the money, say time and date, the children hear the numbers; they see the number symbols in shopping, on streets, in games, on book pages, and on television (Rousselle and Noël, 2007). Hunting (1999) stated that children develop their skills of counting by mimicking their parents, siblings and others in a relatively mechanical way. Fuson (1988) initially stated that the counting activities did not have any special meaning and that the children considered those activities like a game. The most important pre-condition for success particularly in mathematics is comprehending the concept of number. Numerical relationships should be taught to children with intellectual disabilities without considering their ages (Aydemir and Kayhan, 2013). Bashash, Outhred and Bochner (2003) reported that the fact that children with intellectual disability have limited capacity to acquire basic number concepts, as reported by previous studies in the field, has led to a belief that these children cannot develop numerical skills (Baroody 1987; Deloache, 1978, Cornwell, 1974, Gelman, 1982, Porter, 1993).

Functional academic skills are the skills and abilities learned in school and used in everyday life (Sucuoğlu, 2010). The knowledge and skills to be taught that are intended to be both useful and available to the individual in daily life, at home, in society and in the environment. In this context, mathematics has an important place. In our everyday life, mathematics is frequently performed by people in their in daily life at shopping, for using time, money and simple calculation. However, children with intellectual disability have problems in acquiring mathematical skills and lag behind their peers. This is why it is very important for children with intellectual disability to learn the numbers or mathematical skills in order to facilitate their lives and to survive independently. Because of the importance of math skills in our daily lives, there are different ways to contribute to the education of children with intellectual disabilities. One of them is the constant time delay teaching method. Although the number of studies where teaching methods with constant time delay is considerable, such as Gast, Winterling, Wolery & Farmer (1992) teaching first aid skills, Hughes et al. (2002) word spelling skill, Zhang, Cote, Chen, & Liu (2004) teaching skills of playing bownling, Rogers, Hemmeter, & Wolery (2010) teaching skills of swimming; the number of studies on the use of the method on academic skills is relatively fewer in the field of mathematics. Teaching of multiplication table by Koscinski and Gast (1993) and Şahbaz (2005), teaching of addition and subtraction by Kırcaali-İftar, Ergenekon and Uysal (2008), teaching of division processes of Yıkmış and Çetin (2010), and teaching the skill of showing the told fraction on the picture card by Tongal (2010) can be shown as an example to the studies in the field literature. When the field literature was screened, it was seen that no attempt was made to apply a constant time delay teaching with error correction for the ability to recognize the figure from 1 to 5. This constitutes the reason for need in this research.

The purpose of this research is to determine the effectiveness of teaching the students with students with lightly intellectual disability the ability to recognize numbers by using error-corrected constant time delay teaching methods. In line with this purpose, answers to the following questions were sought.

a. Is the error corrected constant time delay teaching method effective in teaching the students with lightly intellectual disability to recognize the numbers?
b. Can the error-corrected constant time delay teaching method ensure permanency in the teaching of the ability to recognize numbers to students with lightly intellectual disability?
c. Can students with a light intellectual impairment learning who learn the ability to recognize numbers with error-corrected constant time delay teaching generalize these skills that they have learnt?
d. What are the opinions (social validity findings) of mothers about the teaching of the ability to recognize the figures through the constant time delay teaching presented as error correction to their children?

2. Method

2.1 Participants

The study was conducted with four children, three boys and one girl, with mild cognitive impairment at six and seven years of age (one of four children participated in the pilot study). Before starting study, parents of the children were informed about the working conditions of and not be allowed to work at home for the skill to be taught. Participants' real names were not used in the study, but predefined code names were used. Participants received individual education two days a week; and group training one day a week at the Special Education and Rehabilitation Center. In the study, a data collection form was prepared to determine if the participants had the requisite skills for recognizing the numbers, and the prerequisite skills listed below were sought.

a. Can he/she focus least five minutes on the activity at the desk?
b. Can he/she speak appropriately using at least two words?
c. Can he/she make eye contact with the other person for at least four seconds?
d. Can he/she state his/her request himself/herself? (Food, object, etc.),
e. Can he/she follow the verbal directions (look, listen, say)?
f. Can he/she imitate what has been done (when a person stands as a model, can he/she repeat the same after the practitioner)
g. Can he/she distinguish the colors and shapes?

The first participant in the study is 6 years, 11 months, 19 days old. In 2016-2017 academic year, the student has begun the special sub-class. The participant has the ability to thank, apologize, initiate communication. The participant can answer the questions and do matching. Second participant; 5 years, 9 months, 6 days old. In 2016-2017 academic year, the participant has started to the preschool class. The participant relates objects to colors, which is a psychomotor skill, lines materials to the rope, and

replies the question “What is this?” when various cards are shown. The participant has difficulty in maintaining eye contact with the person whom he communicates alone. The third participant; 6 years, 6 months, 18 days old. In the 2016-2017 academic year, the participant has started her first year in primary school. She expresses her needs by establishing two or three vocabulary words. She follows the verbal instructions. She can say name of the object asked on the picture. The rate of participation to the study is one student per each special education and rehabilitation center in all three participants. According to the results of the health board report, the insufficiency rate of the first and third participants is 50% while the second participant is 55%. According to the results of the educational evaluation of the first and third participants; math, language speaking and alternative communication skills, psychomotor and preparation skills modules are needed to be provided for them. According to the results of the second participant's educational evaluation, the participant is expected to benefit from supportive education modules which include self-care skills, language training and alternative communication skills, psychomotor and preparation skills modules. The participant is able to understand the concepts of long, short, and more and less which are among the first and third participants' mathematical skills. Each of the three participants, paints the restricted areas, which is a cognitive preparation skill, fulfills the instruction that states three or more actions, recognizes the colors, and says when asked.

2.2 Materials

For the current study, the numbers from one to five were set at 340 points and Times New Roman type at 15x20 cm. The numbers were printed on a white background with black color and flash cards were prepared. To increase the durability of flash cards, they were covered with a transparent protective cover. The cube was used for the running generalization sessions. The cube used for the generalization session was prepared with width, height and length of 25 cm. The cube was covered with yellow fund board. The figures were printed on black paper with a size of 12 cm and 450 puntos on black paper and adhered on the cube. Before starting the research, reinforcements were given to the participants for the ability to recognize numbers in constant time delay teaching sessions. These reinforcements were determined using a reinforcement design form filled in by the participants' families and teachers. Participants' correct answers and their participation in the study were verbally reinforced (such as well done, very good, wonderful) during the study. Before starting the study, the reinforcements that the participants enjoyed were identified in the form of reinforcement and were made available for use during operation. For each student, their own reinforcement form was used. At the end of the workshop, each participant was presented with the reinforcement identified on the consolidation list. Participants were motivated to participate in the study by choosing the most favorite reinforcements, for example by allowing them to play with the car of their choice.

2.3 Research Design

In this study, a multiple probe design with probe session across subject models, which is one of the single subject designs was used to investigate the effect of the ability to recognize numbers with error correction constant time delay teaching method to with lightly intellectual disability.

2.4 Intervention Process

The study's experimental process consisted of daily probe, full probe, instructional sessions, generalization and monitoring (maintenance) sessions. All sessions were held between 10: 00-11: 00 every day of the week in a class in the Special Education and Rehabilitation Center. Sessions were implemented as individual teaching arrangements. Reinforcements were used in the reinforcement list that was set to reinforce the participants' correct responses in the sessions. In addition to reinforcement, the students are encouraged to participate in a variety of activities, including participation. In this study, the experimental process consisted of two phases; pilot intervention and intervention.

2.5 Pilot Intervention

Pilot intervention was carried out with a student. It has been noted that the student participating in the pilot intervention had similar characteristics to those participating in the study. The participant in the pilot intervention was 6 years 9 months 12 days old. In the pilot study, the five-second time delay period was reduced to four seconds, and the trial period was reduced from four seconds to three seconds. The 500 puntos flash cards used in the pilot study was reduced to 340 puntos sizes in the eyes of the expert. Cubes was used in generalization sessions as a result of pilot calculations intended for use in generalization sessions, where other signs and figures on the calculator distract participants.

2.6 Intervention Sessions

In the teaching of the ability to recognize numbers, the implementation phase of the effectiveness of the error-corrected constant time delay teaching method was carried out on an individual basis with three students. Full probe, daily probe, teaching, monitoring and generalization sessions were organized for each student. Base line data were collected simultaneously in all participants in the multiple probe design with probe session across subjects. After stable data were obtained in the first participant for successive three sessions, the base line was terminated and intervention was proceeded with the first participant. While the intervention continued in the first participant, no data was collected for the second and third participants. After meeting the desired criterion in the first participant, a second full probe session was hold simultaneously in all the participants. After stable data was obtained in the second participant for three successive sessions, the probe session was terminated and teaching was preceded with the second participant. After the desired stable data was obtained in the second

participant, the teaching session was terminated and the third full probe session was held for all participants. Teaching has been started in the third participant after three sessions and then three consecutive sessions of stable data. After the desired stable data was obtained in the third participant, the teaching session was terminated. Upon the completion of all participants' teaching sessions, a fourth full probe session was held. Monitoring sessions were held after one, two, three and four weeks following the completion of teaching.

2.7 Probe Sessions

Probe sessions are organized in two ways: a. Full probe; b. Daily probe sessions.

2.7.1 Full Probe Sessions

Full probe sessions were conducted as second, third, and fourth collective probe sessions to collect attendance data for the first base line (first full probe session) and to obtain attendance-based performance data of participants after instruction to achieve performance data prior to attendance training. Following the metering in the first participant to be taught, all participants were simultaneously invited to the second full probe session. This intervention process was repeated, and the full probe sessions were concluded with the fourth full probe session, together with meeting the measure at the final participant. The level of commencement of full probe sessions was done to collect data. Full probe sessions were held simultaneously and simultaneously with all participants in the practice environment. Target stimuli were asked three times in different probe sessions in the full probe sessions. 15 trials were organized in each full probe session. The time between experiments was set to three seconds. A response interval of four seconds was given for presence of participants in the response. The respondents clearly identified how many of the figures shown to them were correct responses during the interval and the correct responses were verbal (very beautiful, well done, etc.). Participants' misrepresentation of the number of the figure shown to them during the response interval or mis-discourse is defined as the wrong response. Wrong responses were overlooked, and the next trial was initiated.

2.7.2 Daily Probe Sessions

Daily probe sessions were held just before the teaching sessions. Daily probe sessions are distinguished from the full probe sessions in that daily probe sessions are only applied to the instructed teaching. The target stimuli were asked three times in different orders during the daily probe sessions as in full probe sessions. A total of 15 trials were also conducted in the daily probe sessions. Up to three consecutive sessions of daily probe sessions were held at the teaching sessions until they met the data at a level that met the criteria of 100%. While the right responses are reinforced with their good work, they come from ignoring the wrong reactions. Participants' business associations and participation behaviors were reinforced by thanking them for participating in the study by the practitioner at the end of the study.

2.8 Teaching Sessions

At the base line, the first participant was transferred to the teaching session for the first participant after three consecutive sessions of stable data were obtained. Teaching sessions were held immediately after the daily probe sessions. Using the error-corrected constant time delay teaching sessions method, teaching of the ability to say the displayed figure started from five figures. The teaching sessions were implemented as error corrected constant time delay instructional sessions with zero-second constant time delay instructional sessions and four-second constant time delay instructional sessions. A total of 15 trials were conducted, three times for the figures presented in a single set.

2.9 Zero Second Constant Time Delay Teaching Sessions

After the practitioner studies about the time delay skill of the individual, practitioner sets up a sufficient number of zero seconds time delay trial. When examining the field (Tekin-İftar and Kırcaali-İftar, 2013), it is possible to decide the number of sessions according to the skills taught and the characteristics of the participants, while there is no certainty that there will be a number of sessions with zero-time delay periods. In the study, trial sessions with zero second time delay time were conducted in which the ability to say the numbers was a one-step behavior and the zero-second time delay instruction sessions performed 80% of each trial. Zero-second time delay time trials are performed to ensure that the correct response occurs during the initial learning (Şahbaz, 2005).

2.10 Constant Time Delay Instructional Sessions with Error Correction

The error-corrected teaching method is the practitioner's expressing that the individual's reaction is wrong when the individual is in the wrong reaction during teaching (Alberto and Troutman, 1995). The following steps have been followed in constant time delay instructional sessions with error correction: The practitioner has made the environment ready. The participant has been informed about the study (eg, today you will learn the figures). Before starting four-second instructional sessions, say "if you know the correct answer to the question we are asking, we will try to figure out how we have worked with you before." The practitioner said: "If you do not know the correct answer or you are not sure, wait for me to give you the right answer, then repeat it to me, after I have told you the right answer," and then immediately asked, "Are you ready?" in order to get the student's attention. A statement indicating that the attendee is ready, word like "Yes", or any gesture mimic movements as such is observed in the participant, the teacher verbally reinforced the student by saying," Well done, then we can start" and then proceeded with the error-corrected fixed-language instruction sessions. In error-corrected constant time delay lectures, after the target stimulus (for example, "Look at the card in my hand, and tell me what the number on the card is") is given, the practitioner counted from 4 seconds silently (1001, 1002, 1003, 1004) to give the respondent the answer and gave the controlling tip (said look, this is 5). The correct

response of the subject after a 4-second time delay period was reinforced verbally by saying "well done, great." The practitioner responded to the incorrect answers given by the participants before the controlling clue in the teaching sessions where constant time delay teaching with error correction was applied: "No, this is not five. You need to wait for me to tell you the right answer" "Look, this is four" the practitioner corrected the error and re-presented the target alert (for example, "Look at the card in my hand, tell me how many cards are on the card"), and immediately followed the controller tip ("Look this is four"). When the participant tells the correct number within 4 seconds (for example, if he / she says four), the right response and participation of the subject was reinforced verbally (such as wonders, athletes) and the next number was asked. The practitioner responded to the erroneous responses (eg "to say four for the asked question of five") by the participants in the wrong response behaviors of the participants in the teaching sessions where the constant time delay instructional presented with error correction was applied. "No, listen to me carefully, I'll tell you the right answer, you'll repeat it after me, look at these five " And the practitioner made error correction by saying "Come on, it is your turn to say" and re-presented the target stimuli (eg "Look at the card on my hand. ") to the subject. When the participant gave right response to the target stimulus, the practitioner reinforced the attention-defying behavior verbally (good, very good) and passed to the next number. Attendees should notify the target alert (for example, "Look at the card in my hand. Tell me what the number on the card is?" And the practitioner responded to the subject's lack of any response as such "Listen me carefully. I will tell you the number I ask you, you will repeat it after me," and requested the subject to repeat the correct answer and then the practitioner passed to the next number. After meeting the criterion in the instructional sessions, the teaching was terminated and the reinforcements were presented at the end of each training (game hurdles, painting, crackers, cars etc.).

2.11 Generalization Sessions

Generalization sessions were conducted as a tool, media and interpersonal generalization exercise. Generalization sessions were held at the desk in a single session pre-test post-test format. Pre-test was performed immediately after the first full probe phase and post-test was performed after the final full probe which was held after the completion of the teaching activities.

2.12 Maintenance Sessions

Monitoring sessions were held at the first, second, third and fourth weeks after the training were finished to determine the extent to which the participants retained the skills they had learned in the teaching sessions. The monitoring sessions were conducted in a similar way to the monitoring sessions. The correct responses of the participants were verbally reinforced, the wrong responses came from ignoring, and their participation in the work was reinforced with reinforcements determined from the form of reinforcement.

3. Collection and Analysis of Data

Four types of data were collected, namely, research efficacy data, inter-observer reliability and social validity data. In this study, data were collected by the practitioner using full probe, daily probe, generalization and follow-up data collection forms. Using single-step behavior recording, the participants recorded the correct and incorrect responses, and the efficacy data were calculated by multiplying the percentages of the true-false response numbers. These collected data have been processed into registration forms. Effectiveness analyzes were obtained by graphical methods. In the efficacy analyzes, the participants' base line data, teaching session data, daily probe data, full probe data monitoring and generalization session data were obtained for each participant. Success rates were obtained by dividing the total correct response numbers by the total target stimulus and multiplying by 100.

In the study, the reliability data were collected as inter-observers reliability and intervention reliability. Within the scope of the study, 30% of the full probe, teaching, monitoring and generalization sessions collected inter-observer reliability and intervention reliability data. Inter-observer reliability was achieved by comparing the assessments obtained by the observer included in the study independently to determine whether the target behavior attained the desired level. In order to obtain the reliability coefficients, it is desirable to compare 30% of the probe sessions, teaching, monitoring and generalization sessions with the researcher's intervention records by selecting them at random and asking the observer to watch the video recordings. The purpose and the intervention reliability data were collected to test the extent to which the study was carried out in accordance with the projected independent variable implementation plan. The observer watched the implementer's sessions and watched them to what extent. Probe sessions were used to calculate the inter-observer reliability coefficient obtained from 30% of teaching, monitoring and generalization sessions. The reliability coefficient between the observers was calculated according to Tekin-İftar and Kırcaali-İftar (2013) reliability calculation: Agreement / (disagreement + agreement) x 100 formula was used for calculating. The obtained coefficient of reliability is considered as the ideal coefficient between 80% and 90%. The data obtained from 30% of all sessions, such as in the analysis of inter-observer reliability, was used to calculate the intervention reliability. The intervention reliability coefficient is calculated with the help of the formula given below (Tekin-İftar and Kırcaali -İftar, 2013):

$$\frac{\text{observed practitioner behavior}}{\text{planned application behavior}} x100$$

In the study, social validity data were collected from the mothers. The video recordings used during the study were displayed after the work was done to see the work done by the families, and then the social validity was filled to the families by asking questions and questions to investigate and emphasize the effects of the study results. For effect size analysis, the effect size analysis model defined by Scruggs, Mastropieri & Casto

(1987) was used. Data analysis for the study's generalization sessions was analyzed as pre-test and post-test. The data obtained for each participant is shown on column charts. In the prepared column graphs, the horizontal axis shows the pre-test and post-test sessions for each participant; while the vertical axis represents the percentages of the correct responses to target behavior.

4. Findings and Discussion

4.1 Reliability Findings and Discussion

Table 1 shows inter-observer reliability data. The lowest inter-observer reliability coefficient was found to be 93% in the error corrected constant time delay instructional sessions with the first participant and the highest inter-observer reliability coefficient was 100% in the generalization and follow-up sessions with the first, second and third participants.

Table 1: Findings of Reliability Between Observers

Participants	Base line	Intervention	Daily probe	Maintenance	Generalization
First participant	%100	%93	%100	%100	%100
Second participant	%100	%100	%100	%100	%100
Third participant	%100	%100	%100	%100	%100

For the first participant from the interrogator reliability data, 93% of the data was obtained in the teaching session, unlike the other participants. The fact that this data is lower than the other 100% data obtained is interpreted as follows. It was stated that in a few attempts of the first participant's teaching sessions, the participant's intervention would respond to the target stimulus at the same time and that it was wrongly assessed by the observer. It can be said that the reliability between the observers is ideal because studying the obtained data is greater than 80% (Tekin-İftar and Kırcaali-İftar, 2013) in terms of the inter-observer reliability. Obtained test results from previous studies; such as; Kurt (2006), Rogers et al. (2010), Fidan (2013), Maiorana (2014), Badır (2014) and Şahin (2015) also support the data obtained for the current study.

The second reliability data applied in the study was evaluated for intervention reliability. In the study, it was seen that the first and second participants of the intervention reliability coefficient were 96.29% and 98.89% in the intervention sessions and 96% in the generalization sessions, respectively. The highest intervention reliability coefficient is 100% for the third participant in the generalization session; and 100% for all participants in the base line, daily probe and monitoring sessions.

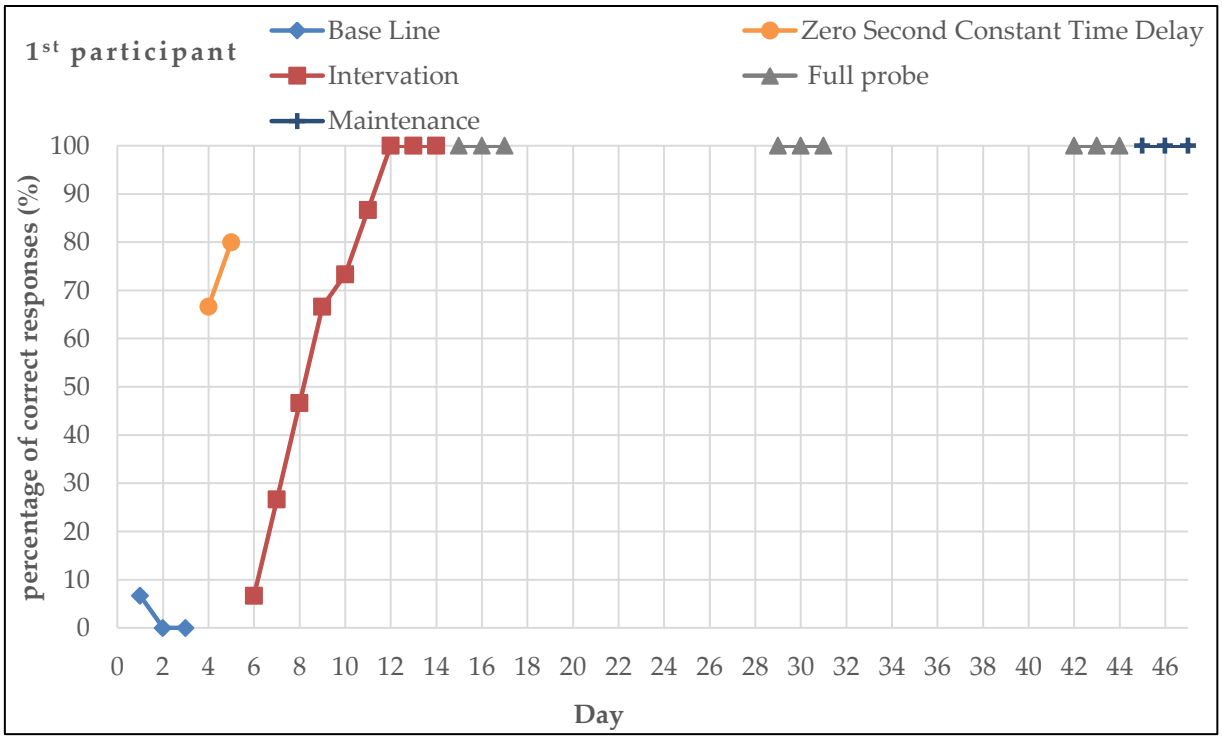
Table 2: Intervention Reliability Findings

Participants	Base line	Intervention	Daily probe	Maintenance	Generalization
First participant	%100	%96.29	%100	%100	%96
Second participant	%100	%98.89	%100	%100	%96
Third participant	%100	%100	%100	%100	%100

In Table 2, 96.29% and 98.89% of the data obtained in the first and second participants' teaching sessions and 96% findings obtained in generalization sessions can be interpreted as follows. Realization of the work with participants with intellectual disability can be explained as having five seconds to four seconds of time delay in the teaching sessions of the first and second participants. It can be said that since the obtained intervention reliability was more than 80% (96,29% and 98,89%) and does not affect the work and intervention reliability data are ideal. The fact that the first and second participants showed lower performance than the %100 in their other performances can be explained by the fact that the generalization sessions were made by another practitioner and partial mistakes were made. Again, it can be said that in the generalization sessions, the data obtained was more than 80% (96%), and therefore the data obtained in the generalization sessions were ideal and did not affect the study. The text of the field is also scanned by Rogers et al. (2010); Yüksel (2012), Maiorana (2014), Sahin (2015) intervention reliability data support the data obtained for the current study.

4.2 Findings and Discussion on the Effect of Constant time delay instructional with Error Correction on the First, Second and Third Participants

In Fig. 1, there is the instruction about the skill of recognizing the figures with the error correction constant time delay instructional method belonging to the first participant. As shown in Fig. 1, the level of initiation of the first participant has a percentage of correct response of 6.67% (one true from 15 questions) in the first session of sessions whereas it is 0% in the second and third sessions without response to target stimulus.



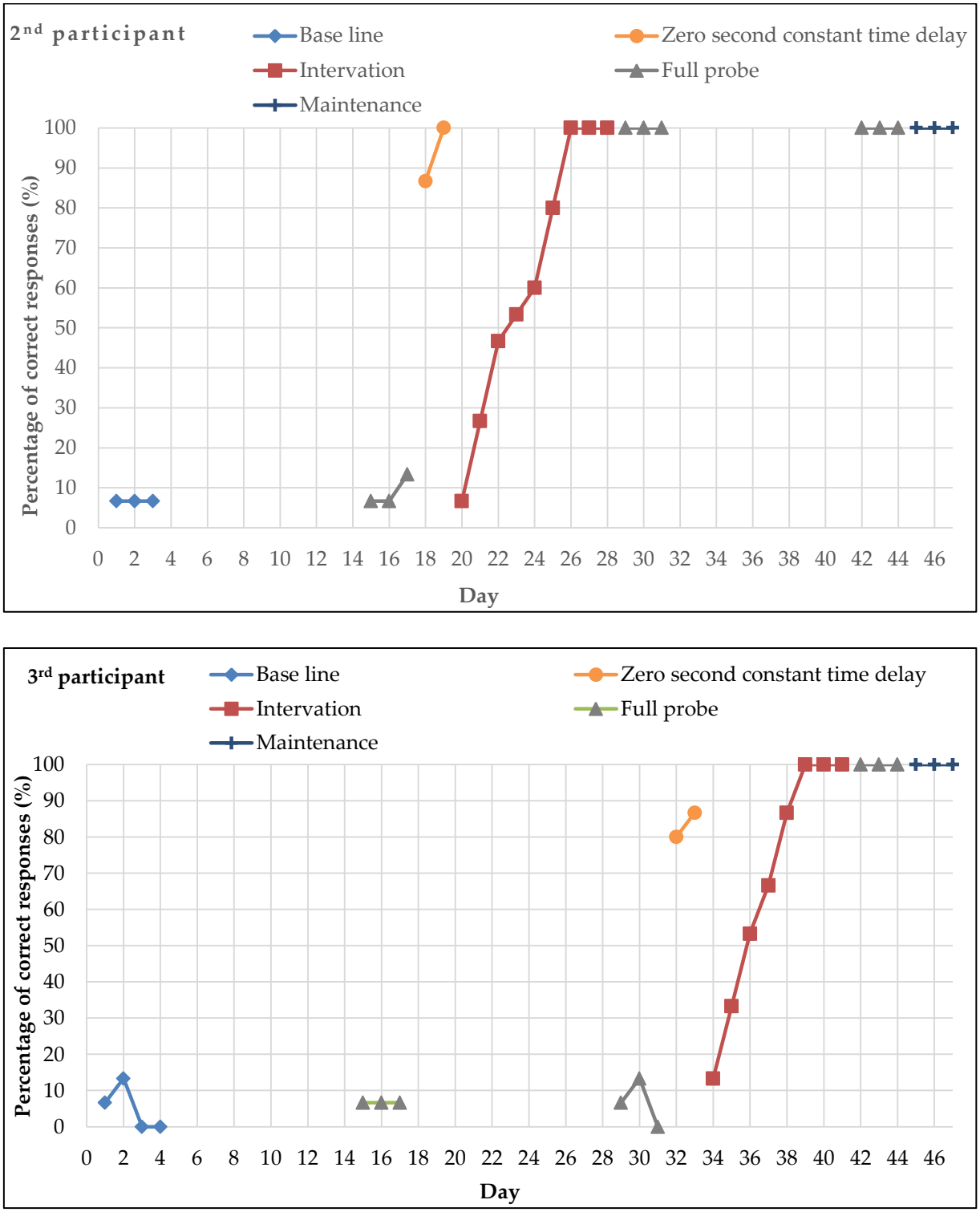


Figure 1: The Correct Response Scores for the Ability of the First, Second and Third Participants to Recognize Figures in the Base Line, Intervention and Follow-Up Sessions

After the first participant's level of initiation session was taken, two session zero seconds time delay sessions were held for the ability to recognize the numbers. It was determined that the first participant said 66.67% in the first session and 80% in the second session. For the first participant, nine instructional sessions of 4 seconds and nine daily probe data were collected. When the participants' teaching sessions are

examined, there seems to be a steady increase in learning from the first session. On the ninth and tenth days, the rate of increase was slowing down. From the eleventh day, the success rate has increased to 100% in the last three sessions. This percentage of success was maintained in the second, third and fourth full probe sessions following the implementation phase. With the completion of teaching at the first participant and the second batch enrollment being performed, the second participant's session of the zero seconds base line was initiated. In Fig. 1, there is a description of the skill of recognizing the figures with the error-corrected constant time delay instructional method of the second embodiment. As shown in Fig. 1, the first baseline level of the second participant has a percentage of correct response of 6.67% (one true from 15 questions) in the first, second and third sessions of the session.

After base line session of the second participant was taken and instruction of the second participant was completed, the first two sessions of the second full probe of the second participant was 6.67% and the third session was 13.33%. After the full probe session, two sessions of zero-second time delay were held for the ability to recognize the numbers. Teaching session was started seeing that in the first session of the second participant, the participant said the numbers by 86,86%, and in the second session by 100%. Nine times 4 seconds teaching session and nine daily probe data were collected for the second participant. When the participants' teaching sessions were examined, there was a steady increase in their learning from the first session, while a deceleration in the rate of increase was seen on the twenty-second and twenty-third days. From the eleventh day, the success rate has increased to 100% in the last three sessions. This percentage of success was maintained in the third and fourth full probe sessions following the implementation phase. With the completion of instruction in the second participant and the execution of the third full probe, the third participant's session of zero seconds was started. In Fig. 1, the third participant's error corrected constant time delay instructional method and the data about the ability to recognize the figures are given. As shown in Fig. 1, the percentage of correct response in the first session of the third participant's initiation level sessions is 6.67% (one true from 15 questions), 13.,33% in the second session (two true from 15 questions) and 0% in the last two sessions. After the second participant has met the teaching session, the second full probe session was held. The three sessions of the second full probe session of the third participant was 6.67%. After the second participant meets the criteria for the teaching session, the third full probe session was held. The third participant completed the third session with 6.67% for the first session, 13.33% for the second session, and 0% for the third session. After the full probe session, two sessions of zero-second time delay time were held for the ability to recognize the numbers. It was determined that the third participant said the numbers by 80% in the first session and 86.67% in the second session and the session was started. For the third participant, eight 4 seconds teaching sessions and eight daily probe data were collected. When the participants' teaching sessions are examined, there is a steady increase in their learning from the first session and they have met the 100% criterion in the last three sessions. This percentage of success was

maintained in the third and fourth full probe sessions following the implementation phase.

In this research, which is carried out with error correction constant time delay instructional, the longest session in teaching sessions lasted 7 minutes 38 seconds (initial teaching sessions); the shortest session (when participants got enough knowledge and learned the skills) took 2 minutes. The minimum number of sessions for criterion fulfillment in the probe occurred with the third participant; the longest session was held in the first and second participants. Because the difference in session numbers is due only to one session and there is no significant difference; it is considered that the difference in the number of sessions between the participants is not a factor in influencing the results of the study. During the teaching of numbers, teaching sessions were held with zero seconds and four seconds time delay time. Among the participants, the response was found to be 65,93% correct on the average before the first participant clue in the four-second delay teaching sessions after two zero seconds sessions; and 11.1% on the average after the controlling clue. The second participant showed a correct response of 62.96% on the average before the inhibition, and a correct response of 16.29% on average after the control inhibition. For the third participant, these values averaged 63.33% before the tip; showed an accurate response of 17.5% on average after the control agent. In the following days, participants responded before the controlling clue and the time delay period decreased over time. The participants' reactions before and after the clue were verbally reinforced in the same way and the correct responses before the clue were accepted to meet the measure. In the study, error corrections were made for the wrong responses and it is thought that these error corrections prevent the participants from reacting too much wrong. No attendance training was needed. It is thought to shorten the duration of education. Although the percentage of correct responses in the practice room increased in each of the three trials, the rate of increase in participants' learning curve varied. In Fig. 1 the rate of increase in the learning curve of the third participant is more regular than that of the other two participants. The rate of increase in the learning trends of the intervention phases of the other two participants in Fig. 1 was slowed down. For the first participant there is a decrease in the rate of increase in the tilt of the ninth and tenth applications and for the second participant twenty-two, twenty-three and twenty-fourth intervention phases. Although the decline in the rate of this trend did not affect learning performance outcomes due to the increase in percentage, this behavior can be explained by the participants' transfer of information processed in sensory memory to short-term memory and the inability to recall information stored in long-term memory when processed. It is seen that when the studies in the field of which the constant time delay instructional method is used and the slope analyzes are taken into consideration, it is seen that the subjects tend to increase their learning tendencies but there may be differences in the increase rates (for example, Bozkurt 2001; Kurt 2006; Yıkmış and Çetin 2010, Yüksel, 2012).

4.3 Generalization Findings Regarding the Effectiveness of Constant Time Delay Teaching with Error Correction for All Participants

Fig. 2 shows the generalization of the teaching of the constant time delay and the ability to recognize numbers for all participants. In Fig. 2, first participant to recognize the figures in the pre-test session before the teaching performed at the 0% level; and 100% in the final test session for the post-teaching session. At the pre-test session of the second participant in the pre-teaching session, 0% of the ability to recognize figures; and 100% in the final test session for the post-teaching session. At the pre-test session of the third participant in the pre-teaching session, the rate of 6.67% on the ability to recognize figures; and 100% in the final test session for the post-teaching session. It can be said that during the instruction sessions using error-corrected constant time delay teaching in the direction of the findings obtained in the generalization and follow-up sessions, the participants can generalize with different skills, different tools and teachers.

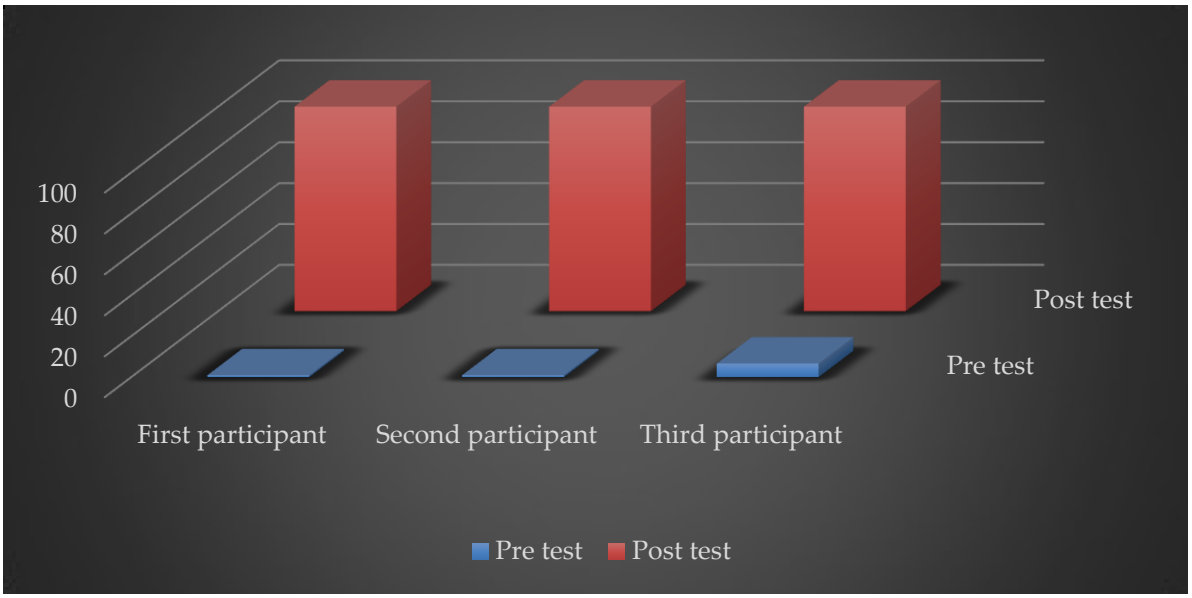
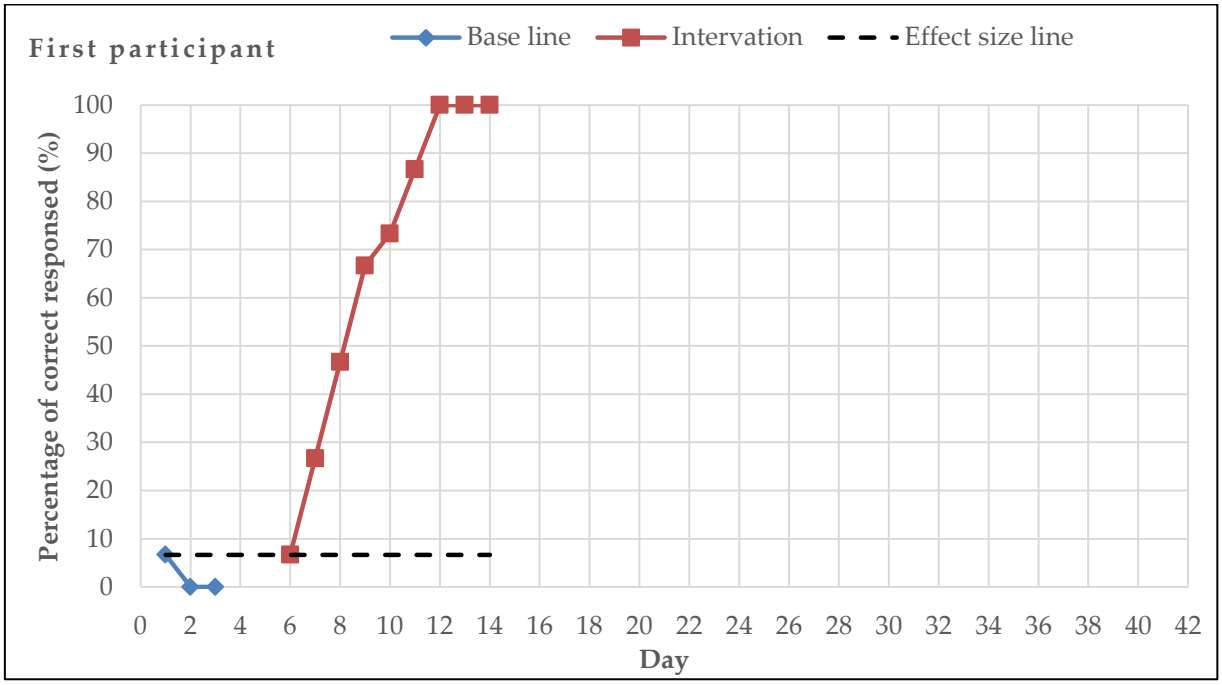
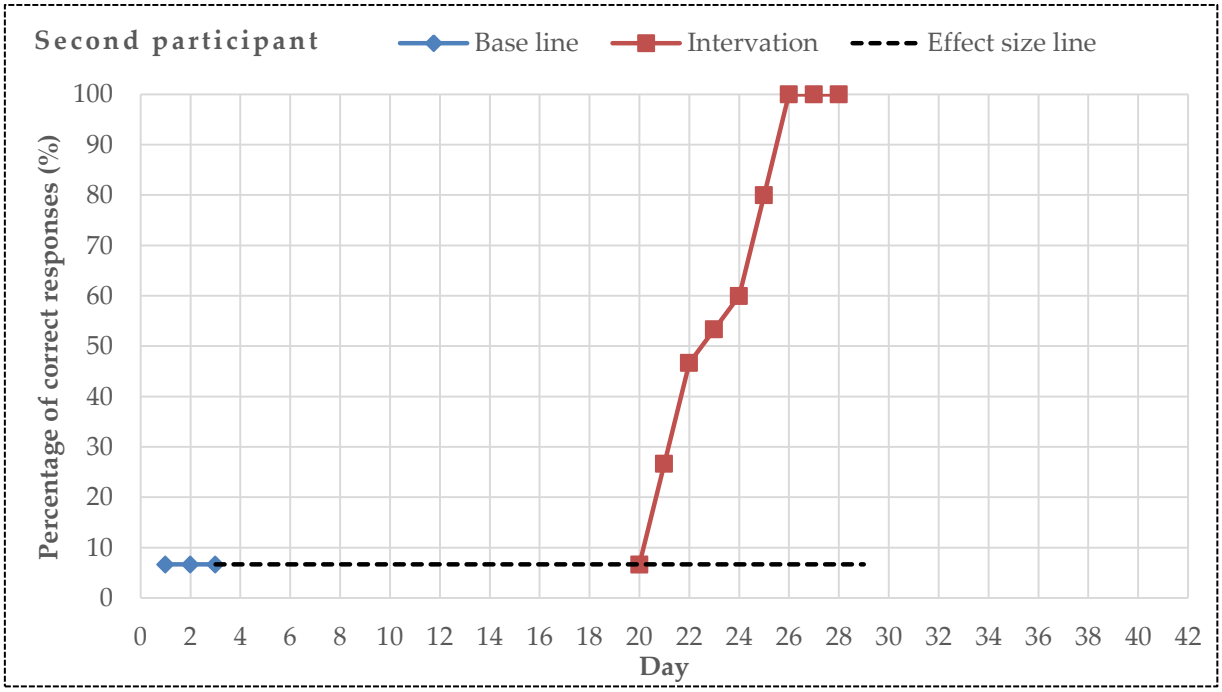


Figure 2: Generalization Data on the Teaching of Constant Time Delay and the Ability to Recognize Numbers

4.4 Findings and Discussion for Effect Size Analyses

For effect size analysis, a line was drawn that cuts the intervention horizon to the intervention phase from the highest percentage of correct response that all participants achieved at initiation level sessions. Fig. 3 shows the line required to account for the impact size plotted in the intervention phase from the highest base lines for all participants. The data remaining on the line drawn in the intervention phase are counted and multiplied by one hundred divided by the total number of data points in the intervention phase. The calculated effect size for the three participants in Fig. 3 is 88.89%.


First participant
Base line
Intervation
Effect size line
Percentage of correct responsed (%)
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
Day


Second participant
Base line
Intervation
Effect size line
Percentage of correct responses (%)
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
Day

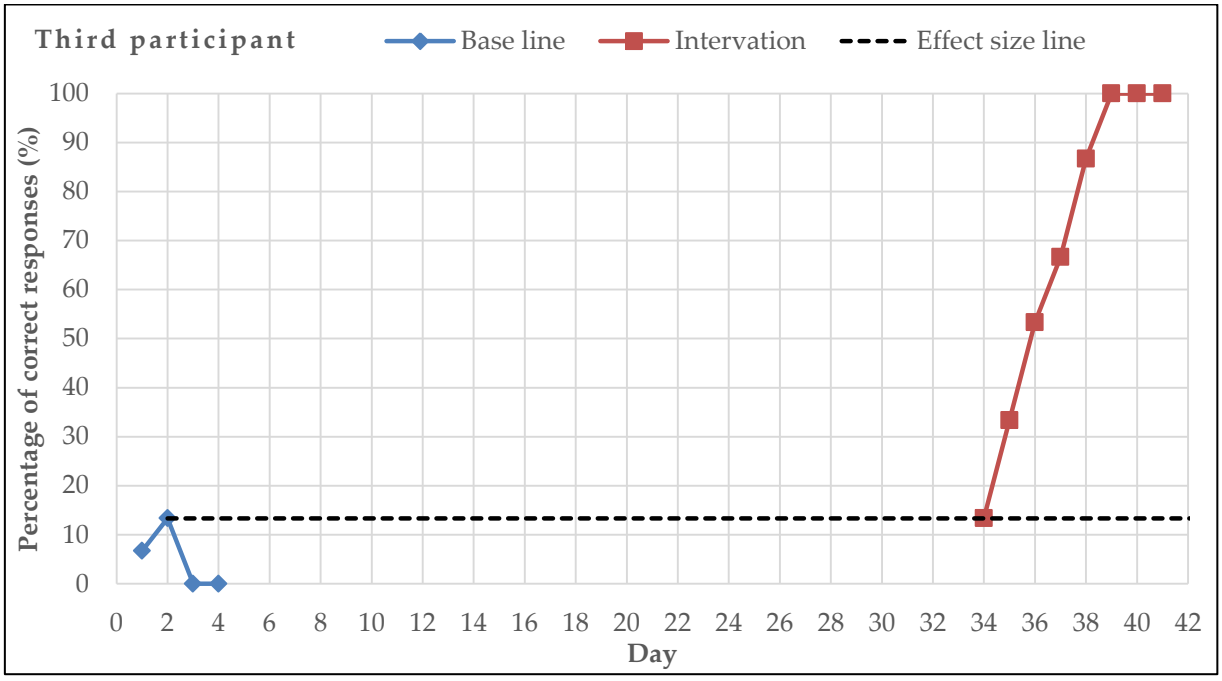


Figure 3: The effect size of the teaching of the ability to recognize numbers with constant time delay for the first, second and third participants

The effect size analysis data using the non-overlapping data percentage method was 88.89% in all three participants. In the model developed by Scruggs et al. (1987) and measuring the magnitude of the effect of the application, the value obtained for the intervention effect is high; if it is between 70% and 90%, the intervention is said to be acceptable. The number of correct responses they have given randomly in any session of the participants' levels of initiation (giving five digits three times and one or two corrects in total of 15 digits); this ratio is 88,89% due to the horizontal axis cut from the base line data to the intervention phase. Because the value obtained is very close to 90%, and because the intervention remains within the limits given by Scruggs et al. (1987) for acceptable boundary levels (70% -90%); It can be said that the intervention is feasible and the intervention is very close to the height.

4.5 Opinions of Mothers on Social Validity

Mothers; "Do you think that the numbers taught are important for your child?" all (3) were marked as satisfied. When asked if you are pleased that your child has been taught the figures with a researcher, yes they have marked the answer to your satisfaction. The figures your child learned; they show on different materials except for the materials used during teaching and they pointed out yes. When asked if you would like to reveal the direction you most like to work, that they use the taught figures on their phone keys in their daily lives; one of them used the elevator, the other used the television. When asked; "Do you explain the direction you do not like to study?" mothers stated that they wanted to include their child in a similar study again, stating that they did not have anything negative or wrong. As a result of the study, when the mothers were asked "does your child have any changes or improvements?" one of the

mothers stated that the child wanted to print three keys when the child entered and departed at the end of the study and the other mother stated that the child had spoken the numbers 1 to 5 anywhere and pressed the keys of these numbers on the phone; and the other mother said that she felt happy that she was beginning to trust her with this work.

5. Conclusion

Considering this research and previous research, the following conclusions can be drawn.

Firstly, constant time delay method is an easy and inexpensive teaching method and it can be used easily in individual education.

Secondly, in this study, which is realized with error correction constant time delay instructional method, the longest session in teaching, daily, and probe sessions was 7 minutes 38 seconds; the shortest session lasts for 2 minutes, and the intervention method was considerably shorter in the following days and saves time.

Thirdly, the child's misunderstanding of numbers or misconceptions in the environment also allows the teacher to see the student's misconceptions or lack of knowledge from the environment. Errors also indicate whether the student's figure, the figure, understands the color.

Taking into account the steps followed in the error corrected teaching method, the correcting the error is carried out with a softer method, the participant is able to pass the learning process more positively since he does not hesitate to make mistakes and does not affect his motivation. However, the participant becomes more willing to learn the relationship between the target stimulus, behavior and reinforcements. Along with the method that is followed in error correction, the participant has the opportunity to correct the error. Therefore, it can be said that constant time delay with error corrected method is effective, has low error probability and can be applied effectively. Findings from the study indicate that the constant time delay teaching method with error correction is an effective method for teaching the figures. Thus, for students with inadequacy, it may be advisable to use a constant time delay instructional method with error correction in teaching single-step behaviors.

References

1. Alberto, A.A., & Troutman, A.C. (1995). *Applied behaviour analysis for teachers*. New Jerse: Prentince Hall.
2. Aydemir, T., & Kayhan, H.C. (2013). Number relationships on students with mild mental retardation. *Procedi-Social and Behavioral Sciences, 106(2013), 1949-1957*.

3. Badır, T. (2014). *The effectiveness of the touch math technique presented with constant time delay method on teaching the mentally retarded individuals subtraction integrity* (master's thesis). Department of Education of Mentally Handicapped Children, Abant İzzet Baysal University, Institute of Educational Sciences.
4. Baroody, A.J. (1987). *Children's mathematical thinking: A developmental framework for preschool, primary, and special education teachers.* New York: Teachers College Press.
5. Bashash, L., Outhred L., & Bochner, S. (2003). Counting Skills and Number Concepts of Students with Moderate Intellectual Disabilities. *International Journal of Disability, Development and Education, 50(3), 325-345.*
6. Bozkurt, F. (2001). *The effectiveness of the constant time delay procedure on teaching snack and drink preparation skills to children with mental retardation* (master's thesis). Special education major, Anadolu University, Institute of Educational Sciences.
7. Brown, A.L., & Deloache, J.S. (1978). Skills, plans and self-regulation. In R. S. Siegler (Ed.), *Children's thinking: What develops?* (pp. 3–55). Hillsdale, NJ: Erlbaum.
8. Cornwell, A.C. (1974). Development of language, abstraction and numerical concept formation in Down's syndrome children. *American Journal of Mental Deficiency, 79, 179–190*.
9. Fidan, A. (2013). Comparison of effectiveness and efficiency of pre-service teacher delivered constant time delay with high and low treatment integrity (master's thesis). Department of Special Education Graduate School of Educational Sciences Anadolu University
10. Fuson, K.C. (1988). *Children's counting and concepts of number*. New York: Springer-Verlag.
11. Hardin, T. (2016). *The effects of constant time delay in teaching recognition of braille words* (master's thesis). College of Education at the University of Kentucky.
12. Hughes, T. A., Fredrick, L. D., & Keel, M. C. (2002). Learning to effectively implement constant time delay procedures to teach spelling. *Learning Disabilities Quarterly, 25, 209–222.*
13. S (1999). Rational number learning in the early years: What is possible?. In J.V. Copley (Ed.), *Mathematics in the early years* (pp. 80-87). Reston, VA: National Council for Teachers of Mathematics.
14. Gast, D.L., Ault, M.J., Wolery, M., Doyle, P.M., & Belanger, S. (1988). Comparison of Constant Time Delay and System of Least Prompts in Teaching Sight Word Reading to Students with Moderate Retardation. *Education and Training in the Mental* Retardation, *23, 117-128.*
15. Gast, D.L., Winterling, V., Wolery, M. & Farmer, J.A. (1992). Teaching first-aid skills to students with moderate handicaps in small group instruction. *Education and Treatment of Children, 15(2), 101-124.*
16. Gelman, R. (1982). Basic numerical abilities. In R.J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (pp. 181-205). Hillsdale, NJ: Erlbaum.

17. Kırcaali-İftar, G., Ergenekon, Y., & Uysal, A. (2008). Teaching addition and subtruction via constant time delay procedure to a student with intellectual disabilities. *Anadolu University Journal of Social Sciences, 8*(1), 309–320.
18. Koscinski, S. T., & Gast, D. L. (1993). Use of constant time delay in teaching multiplication facts to students with learning disabilities. *Journal of Learning Disabilities*, *26,* 533–567.
19. Kurt, O. (2006). A comparison of constant time delay and simultaneous prompting within embedded instruction on teaching chained leisure skills to children with autism (doctoral dissertation). Special Education Major, Anadolu University, Institute of Educational Sciences.
20. Maiorana, M.J. (2014). *Using a decoding strategy with constant time delay to teach word reading to children with Down syndrome* (doctoral dissertation). College of the University of Illinois.
21. Porter, J. (1993). What do pupils with moderate learning difficulties understand about counting? *British Journal of Special Education, 20, 72–75.*
22. Rousselle, L., & Noël, P.M. (2007). Basic numerical skills in children with mathematics learning disabilities: A comparison of symbolic vs non-symbolic number magnitude processing. *International Journal of Cognitive Science, 102(3), 361-395.*
23. Rogers, L., Hemmeter M.L., M., & Wolery, M. (2010). Using a constant time delay Procedure to teach foundational swimming skills to children with autism. *Topics in Early Childhood Special Education*, *30(10).*
24. Rogers, L., Louise Hemmeter, M., ve Wolery, M. (2010). Using a constant time delay Procedure to teach foundational swimming skills to children with autism. *Topics in Early Childhood Special Education*.
25. Şahbaz, Ü. (2005). *Comparison of constant time delay procedure with and without error correction in teaching multiplication table to mentally retarded students* (doctoral dissertation). Anadolu University, Institute of Educational Sciences.
26. Şahin, Ş. (2015). *A comparison of the traditionally presented constant time delay instruction and constant time delay instruction with embedded teaching on teaching community alert signs to children with autism spectrum disorders* (doctoral dissertation). Anadolu University, Graduate School of Social Sciences.
27. Scruggs, T.E., Mastropieri, M.A. & Casto, G. (1987). The quantitative synthesis of single subject research: Methodology and validation. *Remedial and Special Education*, *8(2), 24-33.*
28. Snell, E. M., & Brown, F. (2000). Instruction of students with severe disabilities. New Jersey: Merrill Publishing Company.
29. Stevens, K. B., & Schuster, J. W. (1988). Time delay: Systematic instruction for academic tasks. *Remedial and Special Education*, *9,* 11–16.
30. Sucuoğlu, B. (2010). Otizm ve Otistik Bozukluğu Olan Çocuklar. A. Ataman (Ed.), *Özel Gereksinimli Çocuklar ve Özel Eğitime Giriş*. Gündüz Eğitim ve Yayıncılık., Ankara.

31. Tekin-İftar, E. Kırcaali-İftar, G. (2013). Yanlışsız öğretim yöntemleri [Methods of errorless teaching]. Vize publishing: Ankara.
32. Tongal, S.Ş. (2010). *Effectiveness of constant time delay instruction in teaching the skill of showing the told fraction on the picture card to individuals with mental deficiency.* (master's thesis). Department of Special Education, Abant İzzet Baysal University.
33. Yıkmış, A., Çetin, M.E. (2010). Teaching students with mental retardation by constant time delay instructional *Journal of Abant İzzet Baysal University, 10(2), 69-78.*
34. Yüksel, E. (2012). The effectiveness of constant time delay instruction in teaching the skills of identifying Money to mentally handicapped children (master's thesis). Department of Education of Mentally Handicapped Children, Abant İzzet Baysal University, Institute of Educational Sciences
35. Zhang, J., Cote, B., Chen, S. & Liu, J. (2004). The effect of a constant time delay procedure on teaching an adult severe mental retardation a recreation bowling skill. *Physical Educator, 61(2), 63-75.*