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Effectiveness of Presenting the Touch Math Technique on a Tablet in Teaching Simple Addition to Children with Autism Spectrum Disorder*

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Abstract

Individuals with autism spectrum disorder often struggle with essential skills like mathematics, which are vital for independence. This includes understanding numbers, managing money, shopping, grasping time concepts, recognizing shapes, and arithmetic problem-solving. This research evaluates the effectiveness of the "Touch Math" method, delivered via tablet, in teaching basic addition to individuals with autism spectrum disorder. This technique is recognized in literature for its potential in teaching numbers and arithmetic. The study was conducted using the participant-across multiple probe design, a single-subject research method. The participant-across multiple probe design is a single-subject research method conducted with multiple participants to reveal the effects of an independent variable on a dependent variable. Four students aged 8-10 with autism spectrum disorder participated in the study. The findings indicate that the tablet-based "Touch Math" method effectively teaches them basic addition skills. The data of the study show that the "Touch Math" technique demonstrates 100% success in teaching addition skills to participants after an average of 7 to 9 teaching sessions. The follow-up data of the research show that participants maintained their acquired skills at a 100% level in the follow-up sessions conducted on the seventh, fourteenth, and twenty-first days after the teaching sessions. The study's findings show that participants applied their learned skills across various settings and people. Feedback from participants, their parents, and teachers affirmed the positive social validity of the study's methods, especially the tablet presentation. Based on these findings, suggestions have been made for future studies and practitioners.

Keywords: Touch Math technique, tablet, simple addition process, autism spectrum disorder.

Introduction

Autism Spectrum Disorder [ASD] is a developmental disorder that is part of a widely observed spectrum of developmental disorders. It is characterized by challenges in interpersonal communication and interaction, limited, repetitive patterns in behavior, interests, and activities, and a delay or atypical functionality in at least one of the language or symbolic play skills used in interpersonal interaction and communication before the age of 3 (American Psychiatric Association [APA], 2013). Individuals diagnosed with ASD may exhibit repetitive behaviors and limited areas of interest. Moreover, they may experience deficiencies in daily living skills and academic abilities. Sensory sensitivities in individuals with ASD are also frequently observed, which can manifest in various ways, such as hypersensitivity to light or sound (Lord, Elsabbagh, Baird, & Veenstra-Vanderweele, 2018; Rogers & Ozonoff, 2005). Among academic skills, the importance of mathematical skills for being independent in daily life is significant. Counting, numbers, using money, shopping, time, shapes, and problem-solving requiring arithmetic prodedures are mathematical skills that individuals with developmental deficiencies need in their daily lives (Ministry of National Education [MoNE], 2008, p. 5). To enable individuals diagnosed with ASD to be independent in daily life, these skills need to be imparted. To teach basic mathematical skills to individuals diagnosed with ASD, the tools and materials used in the lesson must be suitable for the student's needs and level, and mathematical skills should be provided systematically and according to the level. If this teaching environment is not established, the difficulty of acquiring mathematical skills increases even more (Cawley, 1978, p. 201).

It is believed that when appropriate methods and techniques are applied to teach mathematical skills to students diagnosed with ASD (Autism Spectrum Disorder), acquiring these skills will be easier and more permanent (King, Lemons, & Davidson, 2016). One of these methods is the Touch Math technique. The Touch Math technique emerged as a result of research by Kramer and Krug (1973) on teaching addition prodedures to students with intellectual disabilities. Later, this technique was

developed for the purpose of teaching arithmetic prodedures (Bullock, Pierce, & McClelland, 1989). The Touch Math technique is a multi-sensory approach used to teach addition, subtraction, multiplication, and division, where dots corresponding to the numerical value are placed on numbers, excluding zero. Students see the numbers, touch the designated dots, say the numbers, and hear the problems spoken aloud. This technique is especially used when teaching numbers and arithmetic prodedures (Nuhoğlu & Eliçin, 2013; Vinson, 2004). In addition to smart boards used in schools, tablets have now been incorporated into educational life. In studies conducted to help individuals diagnosed with ASD acquire academic skills, it has been observed that technological devices are utilized (Acungil, 2014; Bosseler & Massaro, 2003; Burke, Andersen, Bowen, Howard, & Allen, 2010; Coleman-Martin, Heller, Cihak, & Irvine, 2005; Değirmenci & Özen, 2013; Eliçin, 2015; Halisküçük, 2007; Massaro & Bosseler, 2006; Murdock, Ganz, & Crittendon, 2013; Öncül, Yücesoy, & Özkan, 2010; Özkan, 2013; Öztürk, 2016; Sani & Bozkurt, 2011; Williams, 2013).

Technology-based tools, especially tablet computers, have initiated a revolutionary era for individuals with autism spectrum disorder, providing multifaceted benefits for education and communication needs. In particular, tablet computers are believed to be highly effective as augmentative and alternative communication devices. Touchscreen interfaces are intuitive and help individuals who may struggle with traditional verbal communication to express themselves more effectively (Schlosser et al., 2014). Applications designed for users diagnosed with autism spectrum cater to each individual's unique strengths and challenges, providing environments suitable for personalized and adaptable learning experiences (Fletcher-Watson et al., 2016). Additionally, another technological advancement, virtual reality, can offer safe environments for individuals with ASD to practice social scenarios and coping mechanisms without the pressure of real-world interactions (Parsons & Cobb, 2014). Digital games and simulations have been shown to enhance cognitive and motor skills and can be particularly engaging for individuals with ASD, potentially encouraging longer and more effective learning sessions (Whyte et al., 2018). Moreover, technology often provides the predictability and routine preferred by individuals with autism, helping to reduce anxiety (Koegel et al., 2013). Although the literature praises technology, especially tablet computers, for providing therapeutic and educational advantages for individuals with autism spectrum disorder (Kagohara et al., 2013), it is essential to acknowledge and consider the challenges and adverse outcomes associated with its use.

A significant concern is the potential for individuals diagnosed with autism to become overly dependent on tablets, which could lead to a decrease in social interactions (Parsons & Cobb, 2014). Since individuals with ASD already face challenges in social communication, excessive focus on screens could further limit opportunities to practice and develop these crucial skills (Pavlopoulou & Dimitriou, 2020). Moreover, the immersive nature of tablet applications could exacerbate obsessive and repetitive behaviors often associated with autism (Lorah et al., 2015). Screen time can also impact sleep patterns; research indicates that excessive exposure to screens, especially before bedtime, can lead to sleep disorders in children with ASD (Engelhardt et al., 2019). Additionally, while tablets offer personalized learning experiences, they can also be a source of sensory overload for some individuals with ASD due to their heightened sensitivities to auditory and visual stimuli (Robertson & Ne'eman, 2012). From this perspective, the use of tablet computers in individuals with autism should be well-planned, and considerations mentioned in the literature should be taken into account during their use.

When looking at the national literature, there are a limited number of studies where the Touch Math technique is presented with technological applications (Genç, Issı, & Yıldız, 2017; Kot, 2019; Öztürk, 2016). In the literature, no research has been found regarding the effectiveness of presenting the Touch Math technique on a tablet in teaching the basic addition prodedure to students diagnosed with ASD. It is anticipated that conducting research in this area would be beneficial, both because it is believed to be beneficial for students diagnosed with ASD and because there are not enough studies in the literature related to teaching the basic addition prodedure using the Touch Math technique. The aim of this research is to determine the effectiveness of presenting the Touch Math technique using the explicit teaching method on a tablet in teaching simple addition prodedures to children with ASD. In the research, answers to the following questions have been sought:

1. "Is the presentation of the Touch Math technique on a tablet effective in acquisition, follow-up, and generalization when teaching simple addition prodedures to children diagnosed with ASD (Autism Spectrum Disorder)?

2. "After the presentation of the simple addition skill to children diagnosed with ASD (Autism Spectrum Disorder) using the Touch Math technique, to what extent are the acquired skills retained after 1 week, 2 weeks, and 3 weeks?

3. After presenting the simple addition skill to children diagnosed with ASD (Autism Spectrum Disorder) using the Touch Math technique, to what extent are the acquired skills generalized to different people and environments?

4. What are the opinions (social validity) of the students, teachers, and parents of students included in this research regarding the simple addition prodedure using the Touch Math technique?

Method

Research Model

In this research, the multiple baseline design across participants, which is one of the single-subject research methods, was used. Single-subject research is an experimental method where the causal or functional relationship between independent and dependent variables is investigated with a single participant over a specific period (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005). The multiple baseline design across participants is a model where the effect of the independent variable is investigated with at least three different participants. The goal is to impart the target to at least three subjects. Participants should be determined independently from each other and from individuals who might be influenced by the independent variable being researched (Tekin-İftar, 2012). In the study, the effectiveness of the Touch Math technique presented on a tablet in teaching simple addition prodedures to three participants diagnosed with ASD was examined. It was aimed to impart the determined target to all 3 participants, ensuring that the environment and application remain the same. One participant took part in the pilot application phase, and it was considered to continue with this participant in case of any participant loss. In the multiple baseline design across participants, a baseline session is first applied to collect starting level data to determine the target skill performance of the participants. After obtaining stable data, the teaching session begins with the first participant to apply the independent variable. The teaching session continues with the first participant until the determined criterion is met. After the criterion is met, second baseline sessions are applied to all participants. Once stable data is obtained, the teaching session begins for the second participant. The teaching session continues with

the second participant until the determined criterion is met, and once the criterion is met, third baseline sessions are applied to all participants. After obtaining stable data, the teaching session begins for the third participant. The teaching session continues until the determined criterion is met, and once the criterion is met, the final baseline sessions are applied to all participants. (Tekin-İftar & Kırcaali-İftar, 2004)

The multiple baseline model allows for the generalization of data results across different participants since it investigates the effectiveness of teaching applied to different participants. The prerequisites for implementing the multiple baseline model are that prerequisite skills are independent of each other and functionally similar (Tekin-İftar, 2012). In the study, participants met the prerequisite skills. The application was carried out one-on-one on different days and times for each participant. In this study, the first baseline session was conducted to obtain the initial performance data of the participants regarding the basic addition skill. This session was conducted with worksheets prepared in advance, each containing 10 basic addition prodedures. The difficulty level of the basic addition prodedures on the papers is the same for all papers. Once stable data was obtained, teaching sessions began with the first participant. The touchpoint technique was presented with a tablet. After the teaching sessions conducted with the first participant, a baseline session was applied. When the determined criterion was met, the second baseline session was organized with all participants. Once stable data was obtained, teaching sessions began with the second participant. After the teaching sessions conducted with the second participant, a baseline session was applied. When the determined criterion was met, the third baseline session was organized with all participants. Once stable data was obtained, teaching sessions began with the third participant. After the teaching sessions conducted with the third participant, a baseline session was applied. When the determined criterion was met, the fourth and final baseline session was conducted. Following the termination of the teaching session, follow-up data was collected once from all participants at the end of the first, second, and third weeks to evaluate the continuity of the basic addition skill.

Dependent Variable

The dependent variable is the characteristic or attribute affected by the independent variable (Cresswell, 2012, p. 115). The dependent variable of this research is the level of performance of individuals diagnosed with ASD in executing the basic addition skill. Basic addition skills are fundamental mathematical proficiencies that individuals typically begin to acquire in early childhood. These skills involve combining two or more groups of objects to determine their total amounts (Baroody, 1987). For many children, initial addition learning begins with fingers, counting beads, or tangible objects to physically combine groups. As students achieve cognitive development, they transition to mental strategies and begin to recognize number patterns, use number bonds, and memorize specific addition prodedures for efficiency. Teaching strategies such as the use of number lines, ten frames, and visual representations have been found to reinforce understanding. More importantly, mastering basic addition prodedures not only aids in daily tasks but also serves as a prerequisite for more advanced mathematical concepts like subtraction, multiplication, and division (Jordan et al., 2007).

Independent Variable

The independent variable of this study is the instructional presentation of the point determination technique, also known as "TouchPoint Math" or Touch Math, on a tablet for teaching basic

addition prodedures to children diagnosed with ASD (Autism Spectrum Disorder). Touch Math, commonly referred to as "TouchPoint Math", is an instructional approach designed to assist students, especially those with learning difficulties and intellectual disabilities, in grasping fundamental arithmetic skills through tactile and kinesthetic strategies. In this method, numbers are presented with designated "touch points." Every digit from one to nine has touch points associated with its numerical value. For instance, the number three has three touch points (Sneider & Beals, 2006). When performing addition or subtraction prodedures, students touch these points in a specific sequence, vocalizing the count aloud, thereby making abstract mathematical processes more tangible and hands-on.

Setting

The study was conducted at the "Atlı Karıncalar Special Education and Rehabilitation Center" located in the city center of Tokat. The applications were carried out in an individual education room within the institution. The room measures 12 square meters. The room is equipped with one bookshelf, one cabinet, one table, three chairs, one small table, two small chairs, one writing board, and one camera.

Materials

In the study, a tablet was used as the primary material, along with a camera and a photo camera for data collection. Additionally, various data collection forms were utilized, including the teaching session implementation reliability form, the collective-daily check-in and follow-up session implementation reliability form, and the generalization session implementation reliability form. Forms for daily check-ins, collective check-ins, monitoring, and generalization sessions were also employed. Furthermore, a reward box was used as a reinforcer during the sessions.

Participants

The researcher who conducted the study is a graduate of the Classroom Teaching program at Tokat Gaziosmanpaşa University. The researcher is currently pursuing a master's degree in classroom education at the same university and is enrolled in the Graduate School of Tokat Gaziosmanpaşa University, Department of Basic Education, Classroom Education Program. The researcher is a specialist instructor and serves as an expert teacher at a special education and rehabilitation center. All applications were carried out by the researcher. The research was conducted at the Tokat Special Atlıkarıncalar Special Education and Rehabilitation Center. Before starting the research, detailed information about the study was provided to the families of the students. Parental consent forms were signed by the parents. Four participants were included in the study, one for the pilot application and three for the experimental process. Two of the participants reside in the city center, while the other two reside in the district. One of the participants continues their education in a special lower class, while the other three continue their education as inclusive students. Participants were selected based on their possession of predetermined prerequisite skills. The identified prerequisite skills are;

1. Follows instructions.
2. Recognizes, verbalizes, and writes numbers.
3. Counts rhythmically by ones.
4. Understands the concepts of big and small, and can identify larger and smaller numbers.
5. Counts objects.
6. Counts by adding on.

Ahmet, who participated in the research process, is an 8-year-old male student. He can follow instructions, recognize, verbalize, and write numbers, count rhythmically by ones, understand the concepts of big and small, count objects, and count by adding on. He is currently continuing to receive support education at a special education and rehabilitation center in the city where the research was conducted.

The second participant, Aslı, is a 9-year-old female student. She can follow instructions, recognize, verbalize, and write numbers, count rhythmically by ones, understand the concepts of big and small, count objects, and count by adding on. She is currently continuing to receive support education at a special education and rehabilitation center in the city where the research was conducted.

The third participant, Çınar, is an 8-year-old male student. He can follow instructions, recognize, verbalize, and write numbers, count rhythmically by ones, understand the concepts of big and small, count objects, and count by adding on. He is currently continuing to receive support education at a special education and rehabilitation center in the city where the research was conducted.

Implementation Process

In this section, information related to the pilot implementation process, baseline sessions, teaching sessions, follow-up, and generalization sessions of the study will be provided.

Pilot Implementation

Before initiating the main phase of this research, a pilot study session was conducted to identify and rectify potential challenges that might be encountered during the implementation process. Erdem, a 10-year-old male student diagnosed with Autism Spectrum Disorder [ASD], participated in the pilot study. He is capable of following instructions, recognizing, vocalizing, and writing numbers, counting rhythmically by ones, understanding the concepts of "big" and "small", counting objects, and adding by counting on. Given that he possesses the necessary prerequisite skills, 10 teaching sessions were conducted using the touch math technique presented via a tablet to teach basic addition. The results of these sessions indicated that no modifications to the approach were necessary.

Multiple Probe Sessions

Multiple probe sessions were utilized to assess the participants' baseline performance on the target skill before the introduction of any intervention. For the first participant, these sessions continued until data from three consecutive sessions demonstrated stability. Once stable data were secured, the instructional intervention was initiated for the first participant. After the first participant met the predetermined criterion in the instructional sessions, another multiple probe session was conducted across all participants. This procedure was replicated for each participant. After every participant achieved the predetermined criterion in the instructional sessions, a final multiple probe session was carried out to evaluate their performance.

During the multiple probe sessions, the participant and the practitioner sat face-to-face. The practitioner initiated the session by saying to the participant, "I have a paper here with addition problems, let's look at them together," and then placed a worksheet containing 10 simple addition problems without reference points on the table. After the participant had a chance to review the worksheet, the practitioner instructed, "I'd like you to solve the addition problems on this paper. Let me know when you're ready to start." The practitioner waited for a positive response from the participant.

Once the participant signaled readiness, the practitioner directed, "Please read the numbers aloud as you solve the addition problem, and after finding the result, say it out loud and then write it down." The expectation was for the participant to count the touch points on the first number and then continue counting using the touch points on the second number to arrive at the sum. No reactions were given to the participant's correct or incorrect answers. Responses were recorded on a data collection form. After the session was completed, the participant was thanked for their participation, and the session was concluded.

Daily probe sessions were conducted during the instructional phase to assess the participants' performance on the targeted skill. Throughout the instructional sessions, the touch math technique was actively employed, utilizing reference points. Therefore, to monitor the participants' performance without the use of reference points, daily probe sessions were designed using worksheets containing 10 simple addition problems without reference points. The criterion was set as the participant's ability to respond correctly independently across three consecutive sessions. Once this was achieved, the instructional sessions were concluded, and a multiple probe session was conducted with all participants.

The procedures followed in the daily probe sessions were identical to those in the multiple probe sessions. The instructor presented the participant with a statement, "I have a paper with addition problems, let's look at it together," and then placed a worksheet containing 10 simple addition problems without reference points on the table. After the participant examined the worksheet, the instructor said, "I'd like you to solve the addition problems on this paper. When you're ready, let's begin," awaiting a positive response from the participant. Once the participant gave a positive response, the instructor instructed, "Read the numbers aloud as you solve the addition problem, and after stating your answer, write it down." The instructor did not react to the participant's correct or incorrect answers. Responses were recorded on a form. After the session was completed, the participant was thanked for their participation, and the session was concluded.

Teaching Sessions

Following the determination of the baseline performance in the probe sessions and the attainment of stable data, the teaching sessions for simple addition instruction using the tablet presentation of the touch math technique were initiated. The teaching sessions were conducted at the Tokat Special Merry-Go-Round Special Education and Rehabilitation Center. The touch math technique with tablet presentation was implemented using the explicit instruction method. Accordingly, the teaching process consists of three stages: modeling, guided practice, and independent application.

Modeling stage: The instructor sits face-to-face with the student and reminds them of the numbers with touch points. Then, the instructor says, "Now, I'm going to teach you how to do addition." capturing the student's attention. The instructor explains the importance of doing addition with touch point numbers and says, "Now, we will do addition using touch point numbers on the tablet. By counting the touch points on the numbers for addition, you won't need to open your fingers, and you'll complete the addition in a shorter time. If you listen to me and follow my instructions, you can choose a reward from the basket at the end of the lesson." This motivates the student. The instructor places the tablet, which contains simple addition tasks with touch point numbers, on the table and asks, "Are you ready?" After receiving a positive response from the student, the lesson begins.

The instructor says, "I will do the prodedures by explaining them to you, so listen carefully." and demonstrates the first prodedure. The instructor asks, "What is the name of this prodedure?" and without waiting for an answer from the student, says, "This is an addition prodedure." The instructor points to the first prodedure on the tablet and asks, "What is 4+2?" Without waiting for an answer, the instructor says, "I will rhythmically count the number of touch points on the second number, starting from the first number, and then mark the number that matches the result I found." The instructor shows the number options on the tablet screen. Pointing to the top number, the instructor says, "The number 4 is the first addend in this prodedure." Then, pointing to the bottom number, says, "The number 2 is the second addend in this prodedure." The instructor continues, "Let's add 4 and 2 now. Let's keep the number 4 in our mind and add the touch points on the number 2 to it." Pointing to the touch points on the number 2 and counting on from 4, the instructor says, "5, 6" and then asks, "What did I find?" Afterward, the instructor says, "I found 6. So, 4 plus 2 equals 6. Now, I'm selecting the result I found from the numbers on the tablet."

Guided practice stage: The instructor points to the prodedure on the tablet and asks, "What is the name of this prodedure?" After the student responds with "Addition prodedure," the instructor asks, "Which numbers do we need to add?" The student answers, "4 and 2." The instructor then instructs, "Now, just like I showed you, keep the top number in your mind, and add the number of touch points on the bottom number to it. Then, mark the result you found from the numbers on the tablet." Following the guidance, the student counts, "5, 6," and selects the number 6 on the tablet.

Independent practice stage: The instructor says, "Now, you will do it on your own, just like I showed you. 4+2=? What's the result? Perform the addition prodedure on the tablet and mark the result from the numbers displayed on the tablet." The student counts the touch points on the bottom number and adds it to the top number. After determining the result, the student selects the corresponding number on the tablet. If the student makes an error, the instructor reverts to the guided practice stage to assist and guide the student.

Concluding the instruction sessions: After completing the exercises on the tablet, the instructor says, "Well done! You did a great job in the lesson. In our next session, we will continue to practice addition. You can choose a reward from the reward basket." After listening, the student selects a reward from the reward box, and the lesson is concluded. At the end of the lesson, the session's activities are summarized, and the student is given the chosen reinforcer from the reward box to conclude the lesson.

Follow-Up and Generalization

Once the participants were able to independently perform basic addition prodedures using the point determination technique presented on the tablet, follow-up sessions were conducted to determine the retention of this skill. Follow-up sessions were held at the end of the first, second, and third weeks after learning was achieved. Similar to the initial assessment sessions, the follow-up sessions were implemented to determine the participants' performance in achieving the targeted skill.

During the follow-up sessions, the participant and the practitioner sat face-to-face. The practitioner said to the participants, "I have a paper with addition prodedures here, let's take a look together." and placed a worksheet containing 10 basic addition prodedures without reference points on the table. After the participant examined the worksheet, the practitioner said, "I want you to do the addition prodedures on the paper, let's start when you're ready." waiting for a positive response from

the participant. Once the participant gave a positive response, the practitioner instructed, "Read the numbers aloud as you do the addition prodedure and write down the result after saying it out loud." and asked the participant to start. No reaction was given to the participant's correct or incorrect answers. The answers were recorded on the data collection form. After the session was completed, the participant was thanked for their participation, and the session was concluded.

To determine the generalization effect of presenting the touch math technique with a tablet on the basic addition prodedure skill, generalization sessions were organized. The generalization sessions were conducted by teachers working at the Tokat Atlıkarıncalar Special Education and Rehabilitation Center in their own classrooms. Like the initial level sessions, they were conducted as a pre-test – post-test. The pre-test was applied after the first collective probe level sessions were completed, and the post-test was applied after the last collective probe sessions were completed. The teachers who conducted the generalization sessions only gave instructions, did not react to correct or incorrect answers, and recorded the answers.

Reliability

In the study, interobserver reliability data and implementation reliability were collected. The reliability data of the study were collected by a special education expert who completed postgraduate education and another person who completed postgraduate education in another field.

Interobserver reliability and implementation reliability data were collected in 30% of the sessions recorded on video. Within the scope of the research, data were collected by watching video recordings of collective probe sessions, daily probe sessions, follow-up sessions, and generalization sessions and recording them on data collection forms. To calculate the interobserver reliability data, the formula "(agreement) / (agreement + disagreement) x100" was used (Tekin-İftar, 2012).

Interobserver reliability was calculated as 100%. For the calculation of implementation reliability, the formula "(observed implementer behavior) / (planned implementer behavior) x100" was used (Tekin-İftar, 2012). The implementation reliability related to the multiple probe, daily probe, instruction, follow-up, and generalization sessions of the study was found to be 100%.

Social Validity

Social validity refers to the data collected to determine the social necessity of dependent and independent variables. It involves evaluations made by the relatives of the participants regarding the dependent and independent variables (Kurt, 2012, pp. 375-376). To collect social validity data, three forms were created: the student social validity data collection form, the parent social validity data collection form, and the teacher social validity data collection form. Teachers and parents were informed about the study, and they were asked to fill out the forms.

Ethical Permissions of the Research

In this study, all the rules that need to be followed within the scope of the "Regulations on Scientific Research and Publication Ethics of Higher Education Institutions" have been adhered to. None of the actions specified under the title "Actions Against Scientific Research and Publication Ethics" in the second section of the regulation have been performed.

Ethical Committee Approval Information:

Name of the committee conducting the ethical evaluation = Tokat Gaziosmanpaşa University Social and Humanities Research Ethics Committee

Date of the ethical review decision =19/09/2022

Publication number of the ethical evaluation document =12-04

Findings

Effectiveness Findings

Looking at the graph area for Ahmet in Figure 1, it is observed that the percentage of correct responses is 0% based on the data obtained from the collective probe sessions conducted to determine the baseline level. In the 10 simple addition problems prepared in advance to determine the baseline level, the number of correct answers is 0. In the three collective probe sessions conducted for the baseline level, it was determined that the percentage of correct responses was 0, and with the acquisition of stable data, teaching sessions were started with Ahmet.

In the daily probe session conducted with Ahmet, the percentage of correct responses in the first session was 0%, in the second session 0%, in the third session 0%, in the fourth session 30%, in the fifth session 50%, in the sixth session 80%, in the seventh session 100%, in the eighth session 100%, and in the ninth session 100%. A total of 9 teaching sessions and 9 daily probe sessions were conducted with Ahmet. In each daily probe session, a set of 10 simple addition problems was given. When the correct response rate was 100% in three consecutive daily probe sessions, stable data was obtained, and the teaching and daily probe sessions were terminated. In the subsequent nine collective probe sessions, it was observed that Ahmet gave a 100% correct response in the simple addition prodedure. Based on this data, it was observed that the presentation of the touch math technique with a tablet in teaching the addition prodedure was effective on Ahmet.

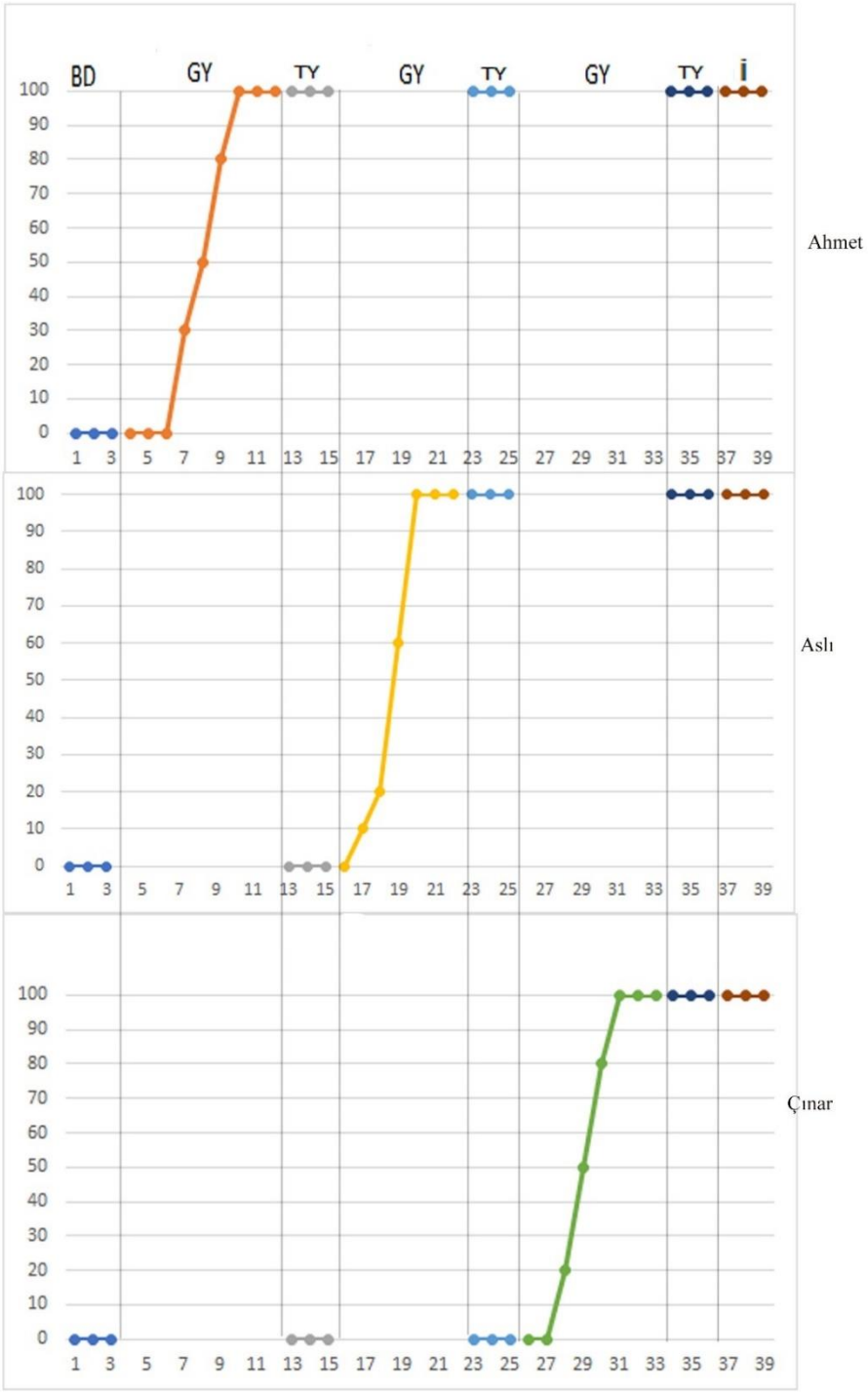

Figure 1. The percentages of correct responses in the baseline, daily probe, collective probe, and follow-up sessions for Ahmet, Aslı, and Çınar regarding the simple addition prodedure.

In Figure 1, looking at the graph area for Aslı, it is observed that the percentage of correct responses in the collective probe session conducted to determine the baseline level is 0%. For the 10 simple addition problems prepared in advance to determine the baseline level, the number of correct answers is 0. After obtaining stable data in the daily probe sessions with Ahmet, three collective probe sessions were conducted with all participants. It was determined that Aslı's percentage of correct responses in these collective probe sessions was also 0%. After obtaining stable data, teaching sessions with Aslı commenced.

In the daily probe sessions conducted with Aslı, the percentage of correct responses in the first session was 0%, in the second session it was 10%, in the third session it was 20%, in the fourth session it was 60%, in the fifth session it was 100%, in the sixth session it was 100%, and in the seventh session it was 100%. A total of 7 teaching sessions and 7 daily probe sessions were conducted with Aslı. In each daily probe session, 10 simple addition problems were presented. Once a stable data of 100% correct response rate was achieved in three consecutive daily probe sessions, the teaching and daily probe sessions were concluded. In the subsequent 6 collective probe sessions, it was observed that Aslı gave a 100% correct response in the simple addition task. Based on this data, it was observed that the presentation of the touch math technique on a tablet was effective in teaching the addition task to Aslı.

When looking at the graph area for Çınar in Figure 1, it is observed that the correct response rate is 0% based on the data obtained from the collective probe session conducted to determine the starting level. The number of correct answers in the previously prepared 10 simple addition problems is 0. After obtaining stable data in the daily probe sessions with Ahmet, three collective probe sessions were conducted with all participants. It was determined that Çınar's correct response rate was also 0% in these conducted collective probe sessions. After obtaining stable data in the daily probe sessions with Aslı, three more collective probe sessions were conducted. It was again determined that Çınar's correct response rate was 0% in these sessions. After obtaining this stable data, teaching sessions were initiated with Çınar.

In the first daily probe session conducted with Çınar, the correct response rate was 0%. In the second daily probe session, it was 0%, in the third session, it was 20%, in the fourth session, it was 50%, in the fifth session, it was 80%, and in the sixth, seventh, and eighth sessions, it was 100%. A total of 8 teaching sessions and 8 daily probe sessions were conducted with Çınar. In each daily probe session, 10 simple addition problems were given. Once a stable data was obtained with a correct response rate of 100% in three consecutive daily probe sessions, the teaching and daily probe sessions were concluded. In the subsequent 3 collective probe sessions, it was observed that Çınar gave a 100% correct response in the simple addition prodedure. Based on this data, it is observed that the presentation of the touch math technique on a tablet is effective on Çınar in teaching the addition prodedure.

Follow-Up Findings

After the study conducted to teach the simple addition prodedure using the touch math technique presented on a tablet with the explicit teaching method, three follow-up sessions were conducted 7, 14, and 21 days later to determine whether the participants, Ahmet, Aslı, and Çınar, maintained the simple addition prodedure skill they acquired. The graph in Figure 2 shows that the correct answer percentage for the simple addition prodedure in the follow-up sessions conducted for Ahmet, Aslı, and Çınar was 100%. When looking at the data, it is observed that even 7, 14, and 21 days after the completion of the simple addition prodedure teaching using the touch math technique presented on a tablet with the explicit teaching method, the participants' correct answer percentages remain at 100%.

Generalization Findings

In the study, generalization sessions were organized to determine whether Ahmet, Aslı, and Çınar could perform at the desired level with the simple addition prodedure skill they acquired in different environments and with different individuals. For the generalization sessions, they were

conducted with the teachers at the special education and rehabilitation center where the research was carried out and in the teachers' classrooms. Data was collected using a pre-test – post-test application. The data from the conducted pre-test – post-test application can be seen in the graph in Figure 2.

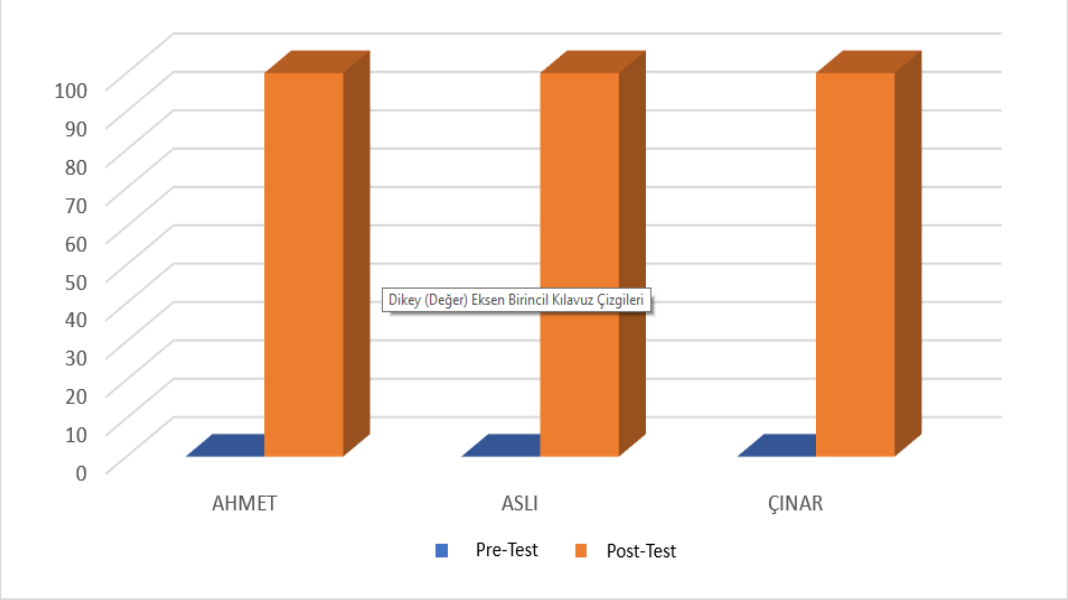

Figure 2. Ahmet, Aslı, and Çınar's generalization percentages for the simple addition prodedure skill to different individuals and environments through the pre-test – post-test application.

As seen in Figure 2, while Ahmet, Aslı, and Çınar's correct response percentages are 0% in the pre-test session, they are observed to be 100% in the post-test session. Considering these findings, the fact that Ahmet, Aslı, and Çınar's correct response percentages are 100% indicates that the presentation of the touch math technique via tablet in teaching addition prodedures to children diagnosed with ASD is effective in generalizing the acquired skill to different environments and individuals.

Social Validity Findings

To collect the social validity data of the study, the student social validity data collection form, the parent social validity data collection form, and the teacher social validity data collection form were filled out by the participants. Opinions were obtained from the students, their parents, and the teachers working at the rehabilitation center.

Based on the information obtained from the social validity form applied to the participants, all participants expressed that the addition prodedure is significant in their lives. They were satisfied with the use of the touch math technique in teaching and stated that they were able to learn the addition prodedure through this method.

All parents stated that the addition prodedure is a lifelong necessary and essential skill. They noticed an improvement in their children's ability to perform addition prodedures with the provided instruction. Therefore, they expressed that the touch math technique is beneficial and effective.

All teachers mentioned that there was a positive difference in the students' ability to perform addition prodedures during the teaching process. They found that presentations made with tablets effectively increased student motivation. They also expressed their intentions to use this method for different students and would recommend the touch math technique presented on tablets to their colleagues.

Discussion and Conclusion

Based on the findings obtained in the study, it has been determined that the presentation of the Touch Math technique on tablets is effective in teaching the addition prodedure to children diagnosed with ASD. Students were able to maintain the basic addition skill they acquired even after the first, second, and third weeks following the completion of the application. They were also able to generalize this basic addition skill to different individuals and environments. Furthermore, it was observed that students, parents, and teachers have positive opinions regarding the social validity of the study.

Before delving into a detailed discussion of the research findings, one of the most crucial topics that needs to be addressed is whether instructional activities presented on tablet computers are beneficial, especially for individuals diagnosed with autism. The use of tablets for students diagnosed with autism can sometimes lead to overstimulation due to the multifaceted sensory inputs provided by the devices, such as bright screens and auditory stimuli (Kuznekoff et al., 2015). Additionally, tablets can inadvertently encourage repetitive and restrictive behaviors, which are characteristic challenges for individuals with autism (Boucenna et al., 2014). On the other hand, it is undeniable that there are many studies in the literature that have yielded positive results when using tablets. In this context, presenting the Touch Math technique via tablets stands out as a tangible, predictable, and low-tech method that caters to multiple senses and aims to enhance motivation while minimizing distractions. Beyond mathematics, this tactile strategy can be extended to other learning areas. For instance, understanding reading sequences, marking progressions on historical timelines, and even tracing patterns in basic scientific concepts can be achieved with touch-based techniques (Anderson et al., 2017).

Indeed, while technology offers countless advantages, it is believed that the presentation of traditional tactile methods like the Touch Math technique on tablets can be extremely beneficial for certain students. In this context, the primary finding of this research is the effectiveness of presenting the Touch Math technique on tablets for teaching addition to children diagnosed with Autism Spectrum Disorder [ASD]. According to the findings, this study appears to be effective. When looking at the literature, there are many studies that have proven the effectiveness of the Touch Math technique. The findings of this study are consistent with those of previously conducted quasi-experimental (Badır, 2014; Berry, 2007; Cihak and Foust, 2008; Can-Çalık, 2008; Eliçin et al., 2013; Fletcher et al., 2010; Littlefield, 2003; Newman, 1994; Pupo, 1994; Simon and Hanrahan, 2004; Yıkmış, 2016) and experimental (Velasco, 2009) studies. Individuals diagnosed with ASD often struggle to grasp abstract concepts. Consequently, they face challenges in learning mathematical skills. The Touch Math technique is believed to be more effective as it caters to multiple senses.

In the study investigating the effectiveness of presenting the Touch Math technique on tablets for teaching addition to children diagnosed with Autism Spectrum Disorder [ASD], there is no difference in the students' initial levels. However, there are differences in the data obtained from the number of instructional sessions conducted to impart the targeted skill and daily check-in sessions. 9 instructional sessions were conducted with Ahmet, 7 with Aslı, and 8 with Çınar. From this, it can be inferred that even though students learn a skill using the same method, individual differences also play a role in the learning process.

The findings of the study share common results with studies investigating the effectiveness of the Touch Math technique in teaching addition to children diagnosed with Autism Spectrum Disorder

[ASD]. Yıkmış (2016), who researched the effectiveness of the Touch Math technique in teaching addition to children diagnosed with ASD, and Cihak and Foust (2008), Fletcher et al. (2010), who compared the effectiveness of the Touch Math technique and the number line technique in teaching addition to children diagnosed with ASD, have concluded that the Touch Math technique is effective in teaching addition. The findings of this study are consistent with previous research and support this study. There are also differences between previous research and this study. Unlike previous studies, in this study, the Touch Math technique was presented on a tablet. In this respect, it is believed to contribute to the literature and serve as an example for future studies.

The second finding of the study is whether the students can maintain the basic addition skill they have acquired. Looking at the findings, it is observed that all children with ASD can maintain the basic addition skill they have acquired even after the first, second, and third weeks following the completion of the application. When the follow-up findings are examined, it is seen that the correct response percentage for the basic addition skill in the follow-up sessions conducted at the end of the first, second, and third weeks for all three students is 100%. Accordingly, it is consistent with previous studies that investigated the permanence of the Touch Math technique (Badır, 2014; Çalık 2008; Eliçin et al., 2013; Simon & Hanrahan, 2004).

The third finding of the study is whether the students can generalize the basic addition skill to different people and environments. Looking at the findings, it is observed that all three participants were able to generalize the basic addition skill they acquired to different people and environments. This is consistent with the generalization findings of previous studies (Avant & Heller, 2011; Badır, 2014; Can-Çalık, 2008; Eliçin et al., 2013; Yıkmış, 2016).

The fourth and final finding of the study pertains to the social validity data based on the opinions of students, parents, and teachers. The findings indicate that students, parents, and teachers have expressed positive views regarding the Touch Math technique. Only one student responded with "undecided" to the question "Do you like math class?". It is believed that this response may be due to the student's lack of confidence in their math skills. Students, parents, and teachers have expressed the view that the presentation of the Touch Math technique via tablet is useful, effective, generalizable, and lasting. The social validity findings of this study are consistent with those of previous studies (Badır, 2014; Can-Çalık, 2008). This research is also expected to contribute to the literature as it is the first study that examines the opinions of students, parents, and teachers regarding the tablet presentation of the Touch Math technique for teaching addition prodedures to children diagnosed with ASD.

The research findings highlight the effectiveness of the Touch Math technique presented via tablet in teaching addition prodedures to children diagnosed with ASD. Despite the different presentations in other studies, the effectiveness of the Touch Math technique in teaching addition prodedures remains consistent. This consistency stems from the flexible nature of the Touch Math technique's presentation. The fact that the Touch Math technique was presented via tablet for the first time to children diagnosed with ASD will also contribute to the literature.

The findings of the study indicate that the Touch Math technique presented via tablet is effective for students diagnosed with ASD in teaching basic addition prodedures. Additionally, the findings demonstrate that the skills imparted to the students can be generalized to different environments and individuals and are lasting. These findings are consistent with previous research. The implementation

of the study using the explicit instruction method has facilitated easier learning for the students due to the modeling and guiding stages. It is believed that the research can be further developed based on the findings and observations obtained. Some recommendations have also been provided to shed light on future research.

Recommendations

Suggestions for Implementation

1. It is recommended to provide training to teachers on the planning and implementation of the Touch Math technique.
2. The presentation of the Touch Math technique via tablet is not only recommended for addition prodedures but also for subtraction, multiplication, and division prodedures.

Suggestions for Future Research:

1. The participants of the study consist of students diagnosed with ASD (Autism Spectrum Disorder). In future research, it is suggested that studies be conducted on the presentation of the touch math technique on tablets for teaching basic addition prodedures to individuals with special needs who have other disabilities.
2. The number of participants in this study is three students. It is suggested that studies investigating the effectiveness of the touch math technique be conducted with larger study groups.
3. In this study, the effectiveness of presenting the touch math technique on tablets has been researched. It is suggested that studies be conducted to compare the effectiveness of the touch math technique's presentation on tablets with different presentations.
4. It is suggested that the touch math technique be compared with different teaching techniques in terms of efficiency.
5. In this study, the effectiveness of presenting the touch math technique on tablets for teaching basic addition prodedures has been researched. It is suggested that the effectiveness of the touch math technique for teaching more complex addition prodedures be investigated.

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BIOGRAPHICAL NOTES

Contribution Rate of Researchers

Author 1: 40%

Author 2: 30%

Author 3: 30%

Conflict Statement

There is no material or individual organic connection with the people or institutions involved in the research and there is no conflict of interest in the research.

Genişletilmiş Türkçe Özet

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Otizm Spektrum Bozukluğu Bulunan Çocuklara Basit Toplama İşlemi Öğretiminde Nokta Belirleme Tekniğinin Tablet ile Sunumunun Etkililiği

Giriş

Otizm spektrum bozukluğu [OSB], yaygın olarak görülen gelişimsel bozukluklar arasında yer alır. OSB, kişiler arası iletişim ve etkileşimde zorluklar, tekrarlayıcı davranışlar ve sınırlı ilgi alanları ile karakterizedir (American Psychiatric Association [APA], 2013). Bu bireyler, dil veya sembolik oyun becerilerinde 3 yaşından önce gecikme veya atipik bir fonksiyonellik gösterebilirler. Ayrıca, günlük yaşam becerileri ve akademik yeteneklerde eksiklikler yaşayabilirler. OSB tanılı bireylerde sıklıkla sensoriyel duyarlılıklar gözlemlenir; bu, ışığa veya sese aşırı duyarlılık şeklinde belirebilir (Lord et al., 2018; Rogers & Ozonoff, 2005).

Günlük yaşamda bağımsızlık için matematik becerileri büyük önem taşır. Sayma, sayılar, para kullanımı, alışveriş, zaman kavramı, şekiller ve problem çözme gibi matematik becerileri, gelişimsel yetersizliği olan bireyler için hayati öneme sahiptir (Millî Eğitim Bakanlığı [MEB], 2008). Bu nedenle, OSB tanısı almış bireylerin günlük yaşamda bağımsız olabilmeleri için bu becerilerin kazandırılması esastır.

OSB tanılı öğrencilere matematik becerileri kazandırmak için uygulanan yöntemlerin, bu becerilerin daha etkili ve kalıcı öğrenilmesine yardımcı olabileceği belirtilmiştir (King vd., 2016). Nokta belirleme tekniği, bu yöntemlerden biridir ve zihinsel yetersizliği olan öğrencilere toplama işlemi öğretimi için Kramer ve Krug (1973) tarafından geliştirilmiştir. Bu teknik daha sonra dört işlem becerisinin öğretimi için genişletilmiştir (Bullock vd., 1989). Teknik, çok duyulu bir yaklaşım sunar ve öğrencilere rakamları hem görsel hem de dokunsal olarak öğretir (Nuhoğlu & Eliçin, 2013; Vinson, 2004). Teknolojik araçların, özellikle tabletlerin, OSB tanılı bireylerin akademik beceri kazanımında etkili olduğu gözlemlenmiştir (Acungil, 2014; Bosseler & Massaro, 2003; Eliçin, 2015; Öztürk, 2016).

Teknolojik araçlar, özellikle tabletler, otizm spektrum bozukluğu [OSB] olan bireyler için eğitim ve iletişimde devrim yaratmıştır. Tabletler, dokunmatik ekranlarıyla bireylerin kendilerini ifade etmelerine yardımcı olurken, OSB için özel uygulamalar kişiselleştirilmiş öğrenme deneyimleri sunar (Schlosser vd., 2014; Fletcher-Watson vd., 2016). Sanal gerçeklik ve dijital oyunlar, sosyal becerilerin geliştirilmesi ve bilişsel-motor becerilerin artırılmasında faydalıdır (Parsons & Cobb, 2014; Whyte vd., 2018). Ancak, tabletlerin aşırı kullanımı, sosyal etkileşim azalması ve takıntılı davranışlarda artış gibi olumsuz sonuçlara yol açabilir (Pavlopoulou & Dimitriou, 2020; Lorah vd., 2015). Ayrıca, ekran süresinin uyku düzenini bozabileceği ve bazı bireyler için duyusal yüklenmeye neden olabileceği belirtilmiştir (Engelhardt vd., 2019; Robertson & Ne'eman, 2012). Bu nedenle, tablet kullanımı dikkatli bir şekilde planlanmalıdır.

Yöntem

Bu araştırmada, tek denekli araştırma yöntemlerinden biri olan katılımcılar arası çoklu yoklama modeli tercih edilmiştir. Tek denekli araştırma, belirli bir zaman diliminde, bağımsız ve bağımlı değişkenler arasındaki ilişkiyi tek bir katılımcı üzerinde inceleyen deneysel bir yaklaşımdır (Horner vd., 2005). Katılımcılar arası çoklu yoklama modeli ise, bağımsız değişkenin etkisinin en az üç farklı katılımcı üzerinde değerlendirildiği bir modeldir ve bu modelle en az üç deneğe belirli bir beceri veya bilginin kazandırılması hedeflenir. Seçilen katılımcılar, araştırılan bağımsız değişkenin potansiyel etkisinden bağımsız olmalıdır (Tekin-İftar, 2012). Bu çalışmada, OSB tanılı üç deneğe tablet kullanılarak sunulan nokta belirleme tekniği ile basit toplama işlemi öğretiminin etkililiği ele alınmıştır. Çoklu yoklama modeli, farklı bireyler üzerinde gerçekleştirilen öğretimin etkililiğini değerlendirir ve bu, sonuçların farklı bireyler için de geçerli olup olmadığını belirlemeye yardımcı olur. Bu modelin başarılı bir şekilde uygulanabilmesi için, katılımcıların ön koşul becerilere sahip olması, durumların birbirinden bağımsız ve işlevsel olarak benzer olması gerekmektedir (Tekin-İftar, 2012).

Bağımlı Değişken

Bağımlı değişken, bağımsız değişken tarafından etkilenen özellik ya da niteliktir (Cresswell, 2012, s. 115). Bu araştırmanın bağımlı değişkeni, araştırmaya katılan OSB tanısı almış bireylerin, temel toplama işlemi becerisini gerçekleştirme düzeyleridir.

Bağımsız Değişken

Bu araştırmanın bağımsız değişkeni, OSB tanısı almış olan çocuklara basit toplama işleminin öğretiminde nokta belirleme tekniğinin tablet ile sunumunun yapıldığı öğretimdir. Genellikle "TouchPoint Math" olarak adlandırılan Touch Math, özellikle öğrenme güçlüğü ve zihinsel yetersizliik çeken öğrencilerin dokunsal ve kinestetik stratejiler yoluyla temel aritmetik becerileri kavramalarına yardımcı olmak için tasarlanmış bir öğretim yaklaşımıdır.

Ortam

Araştırman Tokat il merkezinde bulunan Atlı Karıncalar Özel Eğitim ve Rehabilitasyon Merkezinde gerçekleştirilmiştir. Uygulamalar kurum içerisinde bulunan bireysel eğitim odasında gerçekleştirilmiştir. Oda 12m2 büyüklüğündedir. Odada 1 adet kitaplık, 1 adet dolap, 1 adet masa ve 3 adet sandalye, 1 adet küçük masa ve 2 adet küçük sandalye, 1 adet yazı tahtası ve 1 adet kamera bulunmaktadır.

Araç-Gereçler

Araştırmada materyal olarak tablet ve veri toplamak amacıyla kamera ve fotoğraf makinesi, öğretim oturumları uygulama güvenirliği veri toplama formu, toplu -günlük yoklama ve izleme oturumları uygulama güvenirliği veri toplama formu, genelleme oturumları uygulama güvenirliği veri toplama formu, günlük yoklama, toplu yoklama, izlenme ve genelleme oturumları veri toplama formu kullanılmıştır. Aynı zamanda pekiştireç için de ödül kutusu kullanılmıştır.

Katılımcılar

Araştırmayı gerçekleştiren uygulayıcı Tokat Gaziosmanpaşa Üniversitesi Sınıf Öğretmenliği mezunudur. Araştırma Tokat Özel Atlı Karıncalar Özel Eğitim ve Rehabilitasyon Merkezi'nde gerçekleştirilmiştir. Araştırmaya başlamadan önce öğrencilerin ailelerine yapılacak çalışma ile ilgili ayrıntılı bilgi verilmiştir. Velilerine, veli onay formu imzalatılmıştır Araştırmaya; biri pilot uygulama, üçü deney sürecinde olmak üzere 4 katılımcı dahil edilmiştir

Pilot Uygulama

Bu araştırmanın uygulanma sürecinde karşılaşılabilecek engellerin uygulamaya başlamadan önce belirlenebilmesi, düzeltilebilmesi amacıyla, araştırmanın uygulama sürecine başlanmadan pilot çalışma oturumu gerçekleştirilmiştir.

Yoklama Oturumları

Toplu yoklama oturumları, ilk öğrencide üst üste 3 oturumun verileri kararlı olana değin devam ettirilmiştir. Kararlı verirlerin elde edilmesiyle birlikte ilk öğrenciyle öğretim oturumuna başlanılmıştır. İlk öğrenci öğretim oturumlarında belirlenen ölçütü karşıladığında tüm katılımcılarla birlikte tekrar toplu yoklama oturumu gerçekleştirilmiştir. Günlük yoklama oturumları, öğretim oturumu sürecinde katılımcıların istendik beceriye yönelik performansını tespit etmek için yapılmıştır.

Öğretim Oturumları

Başlama düzeyi performans belirlemek için gerçekleştirilen yoklama oturumunda kararlı verilerin elde edilmesinden sonra, nokta belirleme tekniğinin tablet sunumu ile gerçekleştirilen basit toplama işlemi öğretimi oturumlarına başlanmıştır. Öğretim oturumları Tokat Özel Atlı Karıncalar Özel Eğitim ve Rehabilitasyon Merkezi'nde gerçekleştirilmiştir. Nokta belirleme tekniğinin tablet ile sunumu açık anlatım yöntemi ile uygulanmıştır. Buna bağlı olarak öğretim süreci model olma, rehber olma ve bağımsız uygulama aşaması olmaz üzere 3 aşamadan oluşmaktadır.

İzleme ve Genelleme

Tablet ile sunulan nokta belirleme tekniği ile basit toplama işlemi öğretiminde katılımcılar bağımsız bir şekilde basit toplama işlemi becerisini gerçekleştirebildiklerinde kalıcılığını tespit etmek amacıyla izleme oturumları gerçekleştirilmiştir. İzleme oturumu öğrenme gerçekleştikten birinci, ikinci ve üçüncü hafta sonunda gerçekleştirilmiştir. Başlama düzeyi yoklama oturumunda olduğu gibi izleme oturumu da katılımcıların hedeflenen beceriyi gerçekleştirme performanslarını tespit etmek için uygulanmıştır.

Güvenirlik

Araştırmada gözlemciler arası güvenirlik verileri ve uygulama güvenirliği toplanmıştır. Araştırmanın güvenirlik verileri lisansüstü eğitimi tamamlamış olan bir özel eğitim uzmanı ve başka bir alanda lisansüstü eğitimini tamamlamış bir kişi tarafından toplanmıştır.

Sosyal Geçerlik

Bağımlı ve bağımsız değişkenlerin sosyal yönden gerekliliğini tespit etmek için katılımcıların yakınlarının bağımlı ve bağımsız değişkenlere yönelik değerlendirmeleri için toplanan veridir (Kurt, 2012, ss. 375-376). Sosyal geçerlik verilerinin toplanabilmesi için öğrenci sosyal geçerlik veri toplama formu, veli sosyal geçerlik veri toplama formu ve öğretmen sosyal geçerlik veri toplama formu olmak üzere 3 adet form oluşturulmuştur.

Bulgular

Ahmet'e ait bulgular bakıldığında, başlama düzeyini belirlemek için gerçekleştirilen toplu yoklama oturumunda elde edilen verilere göre doğru tepki yüzdesinin %0 olduğu görülmektedir. Öğretimin başlamasından sonra gerçekleştirilen dokuz toplu yoklama oturumu sonundan Ahmet'in basit toplama işleminde %100 doğru tepki verdiği görülmüştür. Bu verilere bakılarak toplama işlemi öğretiminde nokta belirleme tekniğinin tablet ile sunumunun Ahmet üzerinde etkili olduğu görülmüştür. Aslı'ya ait bulgular incelendiğinde, başlama düzeyini belirlemek için gerçekleştirilen toplu yoklama oturumunda elde edilen verilere göre doğru tepki yüzdesinin %0 olduğu görülmektedir. Başlama düzeyini belirlemek için önceden hazırlanan 10 basit toplama işleminde doğru cevap sayısı 0'dır. Öğretim oturumları sonrasında gerçekleştirilen 6 toplu yoklama oturumlarında da Aslı'nın basit toplama işleminde %100 doğru tepki verdiği görülmüştür. Bu verilere bakılarak toplama işlemi öğretiminde nokta belirleme tekniğinin tablet ile sunumunun Aslı üzerinde etkili olduğu görülmüştür. Çınar'a ait veriler incelendiğinde, başlama düzeyini belirlemek için gerçekleştirilen toplu yoklama oturumunda elde edilen verilere göre doğru tepki yüzdesinin % 0 olduğu görülmektedir. Çınar'ın basit toplama işleminde %100 doğru tepki verdiği görülmüştür. Bu verilere bakılarak toplama işlemi öğretiminde nokta belirleme tekniğinin tablet ile sunumunun Çınar üzerinde etkili olduğu görülmüştür.

Ahmet, Aslı ve Çınar'ın gerçekleştirilen izleme oturumlarında basit toplama işlemine yönelik doğru cevap yüzdesinin %100 olduğu, verilere bakıldığında açık anlatım yöntemiyle uygulanan nokta belirleme tekniğinin tablet ile sunumunun basit toplama işlemi öğretimi tamamlandıktan 7, 14 ve 21 gün sonra da katılımcıların doğru cevap yüzdelerinin %100 olduğu görülmektedir.

Ahmet, Aslı ve Çınar'ın ön test oturumunda doğru tepki yüzdeleri %0 iken son test oturumunda doğru tepki yüzdelerinin %100 olduğu görülmektedir. Bu bulgulara bakıldığında Ahmet, Aslı ve Çınar'ın doğru tepki yüzdelerinin %100 olması, OSB tanısı almış olan çocuklara toplama işlemi öğretiminde nokta belirleme tekniğinin tablet ile sunumunun, kazanılan becerinin farklı ortam ve farklı kişilere genellenmesinde etkili olduğunu göstermektedir.

Katılımcılara uygıılanan sosyal geçerlilik formundan elde edilen bilgiler doğrultusunda, tüm katılımcıların toplama işleminin yaşamlarında önemli olduğunu, nokta belirleme tekniğinin öğretiminde kullanılmasından honut olduklarını ve bu sayede toplama işlemini öğrenebildiklerini ifade etmişlerdir.

Ebeveynlerin tamamı; toplama işleminin yaşam boyu gerekli ve önemli bir beceri olduğunu, yapılan öğretim ile birlikte çocuklarının toplama işlemi yapma becerisinde gelişme olduğunu ve bu nedenle nokta belirme tekniğinin faydalı ve etkili olduğunu ifade etmişlerdir.

Öğretmenler tamamı ise öğretim sürecinde öğrencilerin toplama işlemi yaoma becerilerinde olumlu yönde farklılık olduğunu, tablet ile yapılan sunumların öğrenci motivasyonunu artırmada etkili olduğunu, bu yöntemi farklı öğrenciler içinde kullanıcakalrını ve tablet üzerinden sunulan nokta belirleme tekniğini diğer meslektaşlarına önereceklerini ifade etmişlerdir.

Tartışma ve Sonuç

Araştırma sonuçları, OSB tanılı çocuklara tablet ile sunulan nokta belirleme tekniğiyle toplama işlemi öğretiminin etkili olduğunu göstermektedir. Bu teknik, öğrencilere kazandırılan beceriyi sürdürebilmeleri ve farklı ortamlara genelleyebilmeleri için faydalıdır. Ancak, tabletlerin OSB tanılı bireylerde aşırı uyarılmaya yol açabileceği ve tekrarlayıcı davranışları teşvik edebileceği belirtilmiştir (Kuznekoff vd., 2015; Boucenna vd., 2014). Yine de tabletlerle yapılan eğitimin birçok olumlu yönü vardır ve nokta belirleme tekniği, dokunsal bir yaklaşım sunarak öğrenmeyi destekler (Anderson vd., 2017). Araştırma bulguları, alan yazınında da desteklenen nokta belirleme tekniğinin etkililiğini teyit etmektedir (Badır, 2014; Velasco, 2009; Yıkmış, 2016). OSB tanılı çocuklara tablet ile sunulan nokta belirleme tekniğiyle toplama işlemi öğretimi etkilidir. Ancak, öğrenciler arasında öğrenme sürecinde bireysel farklılıklar gözlemlenmiştir. Örneğin, Ahmet için 9, Aslı için 7 ve Çınar için 8 öğretim oturumu gerçekleştirilmiştir. Bu çalışmanın bulguları, Yıkmış (2016), Cihak ve Foust (2008) ve Fletcher ve diğerleri (2010) gibi önceki çalışmalarla tutarlıdır. Ancak bu çalışma, nokta belirleme tekniğini tablet üzerinden sunarak alan yazınına yeni bir katkı sağlamaktadır.

Araştırmada, OSB tanılı çocukların tablet ile sunulan nokta belirleme tekniğiyle toplama işlemi becerisini sürdürebildikleri, bu beceriyi farklı ortamlara ve kişilere genelleyebildikleri ve teknik hakkında olumlu görüşlere sahip oldukları tespit edilmiştir. Öğrencilerin, velilerin ve öğretmenlerin bu tekniği etkili bulduğu görülmüştür. Öğrencilerin %100 başarıyla toplama işlemi becerisini sürdürdükleri belirlenmiştir (Badır, 2014; Çalık 2008; Eliçin ve diğerleri, 2013). Genelleme yeteneği, önceki çalışmalarla tutarlıdır (Avant & Heller, 2011; Yıkmış, 2016). Öğrenci, veli ve öğretmen görüşleri de teknik hakkında olumlu bulgular sunmaktadır (Badır, 2014; Can-Çalık, 2008). Bu çalışma, teknik hakkında öğrenci, veli ve öğretmen görüşlerini inceleyen ilk araştırma olup, alan yazınına katkı sağlamaktadır.

Öneriler

Uygulama Önerileri

1. Öğretmenlere nokta belirleme tekniğinin planlanması ve uygulanması konusunda eğitim verilmesi önerilmektedir.

2. Nokta belirleme tekniğinin tablet üzerinden sunulması sadece toplama işlemleri için değil aynı zamanda çıkarma, çarpma ve bölme işlemleri için de önerilmektedir.

Gelecekteki Araştırmalara Yönelik Öneriler:

1. Araştırmanın katılımcıları OSB (Otizm Spektrum Bozukluğu) tanısı alan öğrencilerden oluşmaktadır. Gelecekte yapılacak araştırmalarda, özel gereksinimli ve diğer engelleri olan bireylere

temel toplama işlemlerinin öğretilmesi amacıyla nokta belirleme tekniğinin tabletlerde sunulmasına yönelik çalışmaların yapılması önerilmektedir.

2. Bu çalışmanın katılımcı sayısı üç öğrencidir. Nokta belirleme tekniğinin etkililiğini araştıran çalışmaların daha geniş çalışma grupları ile yapılması önerilmektedir.

3. Bu çalışmada nokta belirleme tekniğinin tabletlerde sunulmasının etkililiği araştırılmıştır. Nokta belirleme tekniğinin tabletlerde sunumunun etkililiğini farklı sunumlarla karşılaştıracak çalışmaların yapılması önerilmektedir.

4. Nokta belirleme tekniğinin verimlilik açısından farklı öğretim teknikleriyle karşılaştırılması önerilmektedir.

5. Bu çalışmada, temel toplama işlemlerinin öğretiminde nokta belirleme tekniğinin tabletlerde sunulmasının etkililiği araştırılmıştır. Daha karmaşık toplama işlemlerinin öğretilmesinde nokta belirleme tekniğinin etkililiğinin araştırılması önerilmektedir.