Pegem Journal of Education and Instruction, Vol. 14, No. 1 , 2024 (pp. 118-126)

RESEARCH ARTICLE WWW.PEGEGOG.NET

Teaching spatial concepts to children with intellectual disabilities: A comparison of simultaneous prompting presented via tablets and visual cards

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Abstract

This study aims to compare the efficacy of simultaneous prompting presented via tablets and visual cards in the instruction of spatial concepts to students with intellectual disabilities. A mobile learning software was developed within portable devices by using simultaneous prompting method to teach spatial concepts. The adapted alternating treatments design which is one of the single-subject research methods was used in the study. The dependent variables of the research are left-right, near-far, up-down concepts and independent variables are simultaneous prompting presented with tablet and simultaneous prompting presented with visual cards. A total of 3 students, 1 girl and 2 boys, studying at a private special education school participated in this research. Teaching sessions were held in an individual teaching arrangement. Results were analyzed by graphical analysis. According to the results of the research, it was concluded that there are different levels of effectiveness between teaching with simultaneous prompting presented with tablets and visual cards. It has been found that simultaneous prompting presented with tablets is more efficient than teaching with simultaneous prompting presented with visual cards. Two of the participants were found to have retained the concepts after 1, 3, and 5 weeks.

Key words: Intellectual disability, concept teaching, simultaneous prompting, adapted alternating treatments design, tablets.

Introduction

Individuals may differ in terms of their characteristics and competencies. Individuals with significant differences are called individuals with special needs. These individuals are also classified in different ways according to the area and level of disability they have. Individuals with intellectual disabilities are one of these groups. Intellectual disability occurs before the age of 18 with marked limitations in both mental functions and conceptual, social and practical adaptive behaviors (AAMR, 2002). One of the most distinctive features that distinguish students with intellectual disabilities from students with typical development is their learning abilities. While learning a skill, students with intellectual disabilities can follow similar learning steps of students with typical development. However, this learning process is slower, difficult and complex for students with intellectual disabilities (Akkose, 2008; Wehmeyer, 2013). The reason for this is that the cognitive characteristics of these students differ from their typically developing peers. Cognitive characteristics of students with intellectual disability cause them to have problems in skills such as attention, memory, motivation and motivation. The inadequacy of attention skills of these students also reflects negatively on their academic skills. This failure causes students with intellectual disability to not be able to focus sufficiently and have problems in motivation. In addition, these students have difficulties in using strategies such as transferring information, planning, organizing and monitoring (Nelson, Cumming, and Boltman, 1991; Birkan, 2002).This difficulty they experience causes students with intellectual disabilities to have difficulties in reading comprehension, which is one of the most basic academic skills. Students with intellectual disabilities cannot perform these skills independently, but they can acquire them when appropriate instruction is given. Similarly, it is emphasized that effective teaching strategies suitable for the type of disability should be adapted and organized in the development of these skills of students with disabilities (Nuri, Direktor, and Numan, 2020; Schalock, Luckasson, and Tasse, 2021).

Concepts enable us to visualize and make sense of what we see around us. When starting to teach a subject; there

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How to cite this article: Karabıyık V, Nuri C, Bağlama B, Haksız M (2024). Teaching spatial concepts to children with intellectual disabilities: A comparison of simultaneous prompting presented via tablets and visual cards. Pegem Journal of Education and Instruction, Vol. 14, No. 1, 2024, 118-126

Source of support: Nil.

Conflict of interest: None.

DOI: 10.47750/pegegog.14.01.14

Received: 17.04.2023

Accepted: 22.07.2023 **Publication:** 01.01.2024

is a consensus that it will be more beneficial to start with clear and clear, general concepts that are easier to learn and understand (Klausmeier, 1992). It is a necessity to have different teaching arrangements that will support inclusive education practices for students with intellectual disabilities. The learning of the concepts is ordered gradually from the lowest level to the highest level, and it is learned at four different levels, respectively: concrete level, recognition level, classification level and abstract level. During this learning, the mental processes that constitute the transition from one level to the next follow the same order (Senemoglu, 2002). While the types of concepts are divided into two as concrete and abstract concepts, the types of concepts include concepts that indicate space (over-under, etc.), concepts that express opposition (warm-cold, etc.), qualifying concepts (big-small, etc.), comparative concepts (smaller-bigger, etc.), concepts of the highest degree (the largest, etc.), concepts of quantity (more or less, etc.), concepts of action (come, take, give, etc.), color concepts (red, yellow, etc.), general concepts expressing names (food, drink, animals, etc.), distinctive concepts expressing names (orange, car, table, etc.) and spatial concepts (near-far, etc.) (Bolat and Dolapcioglu, 2020).

Errorless teaching methods are teaching methods developed with the view that students' learning of skills and concepts in the best way is not due to mistakes they make during teaching, but to positive responses and exercises they perform. Errorless teaching methods are one of the most effective methods used for individuals with special needs (Tekin-Iftar and Kırcaali-Iftar, 2004). Errorless teaching methods are divided into two groups as teaching methods in which stimulus adaptations are performed and response clues are presented. Simultaneous prompting is one of the errorless teaching methods used in teaching concepts and skills to individuals with intellectual disabilities and its effectiveness has been shown in many studies (Waugh, Alberto and Fredrick, 2011; Brown and Cariveau, 2022). Due to the ease of application, the methods in which response cues are more preferred are the methods that include the presentation of the target stimulus and the cue to the students. One of the methods in which response clues are presented is the teaching method with simultaneous prompting. In the method of teaching with simultaneous prompting, a controlling cue is presented immediately after the skill instruction, and a controlling cue is presented in all instructional trials in order to provide teaching with the least mistakes in the method. Whether the transfer of stimulus control is achieved is tested in probe sessions held just before the teaching sessions. In this study, it is aimed to use the teaching method with simultaneous hinting. Because it is emphasized that the simultaneous prompting method is more effective in teaching many concepts and skills, it is stated that the simultaneous prompting teaching method has many important positive features such as being easily applicable, easy to learn, reducing the error rate of the student and being reliable.

Technology provides individuals with intellectual disabilities with different ways of learning, enabling them to overcome the difficulties they face, and also offers many opportunities in terms of increasing their participation in social life and improving their quality of life. Today's electronic technologies such as computers, mobile phones, internet, tablets provide individuals with intellectual disabilities to have control over their lives by providing equal opportunities for them to interact with their environment, do work at home and be intertwined with the society. Research shows that technology contributes to individuals with intellectual disabilities in all areas of life. When the literature is examined, it is seen that there are studies in which low-level and advanced technological tools are used in teaching skills to students with intellectual disabilities (Bahcali and Ozen, 2019; Xuereb, 2020; Roldan-Alvarez, Martin and Haya, 2021; Kartal, 2021). Tablet computers are interactive tools similar in size to smartphones, but larger in size. It performs functions such as connecting to the Internet, watching animations and videos, recording and listening to sound, taking photos, using office software and using multimedia applications. The positive effect of tablet computers on students in terms of motivation in teaching activities helps students to focus their attention by reducing behavioral problems and increases the time they are interested in teaching activities (Baglama, Yikmis and Uzunboylu, 2022). Therefore, in this study, it is aimed to examine whether teaching via tablets to students with intellectual disabilities is effective in teaching spatial concepts.

The literature review revealed a lack of research on the use of mobile learning software, specifically employing the simultaneous prompting teaching method via a tablet computer, in teaching spatial concepts to individuals with intellectual disabilities. As a result, it became essential to develop a program focused on spatial concepts and assess its effectiveness. This research holds significant importance as it can contribute to the field, offer insights for future studies, guide practitioners in the field, and potentially serve as a valuable method and strategy for individuals with intellectual disabilities. Moreover, the study has the potential to be incorporated into teacher in-service activities.

Furthermore, this research is groundbreaking, as it can be considered a pioneering study both nationally and internationally. It aims to evaluate the effectiveness of a tablet-based software program utilizing the simultaneous prompting method in teaching spatial concepts to children with intellectual disabilities and assess the effectiveness of this method through tablet presentations. The presentation of simultaneous prompting via tablets in the acquisition of spatial concepts is believed to foster the development of independent working skills, thus empowering children to achieve academic,

self-care, and daily life skills independently, as these concepts are essential prerequisites.

The overall objective of this study is to compare the effectiveness of simultaneous prompting presented via tablets with that of visual cards in teaching spatial concepts to students with intellectual disabilities. Additionally, the research seeks to explore the generalization and maintenance performance of the acquired skills.

Method

Research Design

The adapted alternating treatments design which is one of the single-subject research methods was used in the study. The adapted alternating treatments design is the research in which the effectiveness of two or more independent variables on two or more irreversible dependent variables is compared (Tekin-Iftar, 2012). This particular design allows for the comparison of the effects of two or more independent variables on two or more irreversible dependent variables (Holcombe, Wolery and Gast, 1994; Kurt, 2012).

During the application phase of the research, rapid transformations were introduced to the tablet and visual card application of the simultaneous prompting teaching method. These transformations aimed to transition from one teaching approach to the other in a sequential manner. The teaching sessions were conducted on the same day and with at least one hour apart between each approach. Both teaching practices comprised an equal number of sessions and trials.

Independent variables

The study's independent variables include the presentation of simultaneous prompting instruction via tablet and visual card application. For the tablet presentation of simultaneous prompting (utilizing the "I'm Learning Concepts" software), the researcher developed a criterion-based measurement tool to assess spatial concepts (left, near, up). The software was then designed with visuals related to spatial concepts, incorporating six steps for teaching and evaluating each concept.

In contrast, for the visual card presentation of simultaneous prompting, a different set of criterion-based measurement tools was developed for spatial concepts (right, far, down), and suitable images were prepared accordingly. Both teaching practices concluded their respective teaching sessions when the students achieved the criteria of 100% mastery in learning the spatial concepts.

Dependent variables

The dependent variables of the study are left-right, near-far, and up-down concept sets among spatial concepts. One of the students in the study group, Hasan was taught the concept of "left" with the presentation of simultaneous prompting via tablet and "right" with the presentation of visual cards. Mert was taught the concept of "near" with the presentation of teaching with simultaneous prompting via tablet and "far" with presentation via visual cards. Ela was taught the concept "up" with the simultaneous prompting method via tablet and "down" in the presentation of the teaching via visual cards.

Participants

This research was carried out in the 2022-2023 academic year with 3 students diagnosed with mild intellectual disabilitiy. The ages of the participants ranged from 5-8. Whether the participants had the necessary prerequisite skills for the purpose of the research was evaluated according to the results of the interviews with their teachers and the observations made by the researcher using the interview and observation forms consisting of semi-structured questions.

As a result of the interviews with the teachers and the observations made by the researcher, it was determined that the students have the following prerequisite skills:

(a) ability to follow directions,
(b) be able to pay attention to visual and auditory stimuli for at least five minutes,
(c) accept manual referrals,
(d) the ability to choose from images
(f) ability to match/discriminate

In addition to the prerequisite skills determined in the selection of the students participating in the research, the precondition of not having received a systematic education about the dependent variables of the research, namely left, right, near, far, up, down, was also sought. Three children (two boys, one girl) aged between 5 and 8 who were diagnosed with mild intellectual disability participated in the study. Hasan is 5 years old and attends special education institution for 3 years; Mert is 7 and attends the institution for 1 year and Ela is 8 and attends the institution for 9 months.

Criterion-Based Measurement Tools

Concept analyzes of the concepts to be taught within the scope of the research were prepared. For spatial concepts, criterion-based measurement tools were developed by the researcher in line with the information included in the concept. The opinion of an expert from the Department of Special Education regarding the criterion-based measurement tools prepared was taken and the final version of the tools were prepared. One question was prepared for each step of each concept and there are three questions in total in the measurement tools.

Experimental Process

In this study, the difficulty levels of each dependent variable were assessed to ensure their comparability. The target behaviors were identified through logic analysis, which

considered the required number of attempts for each behavior or skill, and whether the behaviors were equal, similar, or closely related (Kurt, 2012). Consequently, the six dependent variables were carefully selected to be of equal difficulty, functionally relevant, and similar to one another.

To determine the spatial concepts commonly taught to individuals with intellectual disabilities, two academicians from the field of special education and two teachers working in a special education institution were consulted. Based on their expert opinions, six dependent variables were chosen to represent the acquisition levels, focusing on the spatial concepts of left-right, near-far, and up-down.

The implementation process of the research encompassed several phases, including the pilot application, baseline, intervention (teaching), daily probe, generalization, and follow-up sessions. Throughout these sessions, one-on-one teaching between the teacher and student was conducted, and all sessions were recorded using a video camera.

To validate the instruction sets related to spatial concepts, a pilot study was conducted with a student who shared similar characteristics with individuals with intellectual disabilities but did not possess the target behavior of the study. This pilot aimed to ensure that all six instruction sets required an equal or similar number of correct/false responses and sessions until reaching the criterion of 100% acquisition level, which was accepted for concept teaching.

During the application phase of the research, great care was taken to ensure the presentation of the simultaneous prompting teaching method through a tablet computer. Furthermore, the presentation without the use of a tablet was rapidly transformed to teach concepts sequentially. The order in which the treatments were applied was determined through unbiased assignment. An equal number of teaching sessions and trials were included for both independent variables throughout the day.

To address potential threats to internal validity, such as external factors, the teachers of the students in the research group were interviewed before the study. They were instructed not to teach spatial concepts to the students during the research period. Additionally, to prevent the loss of subjects, participants were selected from among eighteen students who continued their education and voluntarily agreed to take part in the research. Three students who did not possess the spatial concepts under investigation were chosen through interviews with their teachers, and the research was conducted with these three students.

In order to provide experimental control during the implementation phase of the research, attention was paid to ensure that the transformations of the simultaneous prompting provided with the tablet application and the simultaneous prompting provided without the use of the tablet were rapid. This transformation was implemented in the form of teaching sessions held on the same day and at least one hour apart. An equal number of sessions and trials were included in both teaching practices. The order in which the independent variables are applied is determined by unbiased assignment. In both teaching practices, attention was paid to the fact that there were equal or close target-behaviors, and that similar reinforcers were organized in a similar environment and by the same practitioner.

The adapted alternating treatments design consists of two phases, the initiation phase and the implementation phase. First of all, each participant's knowledge levels of the target concepts and baseline data were obtained. Baseline data were collected until stable data were obtained for at least three consecutive sessions at baseline. After the stable data were obtained, the implementation phase was started. The application phase was started in order to realize the simultaneous hint teaching method, which is one of the concepts that is aimed to be taught to each participant, and the other is to provide simultaneous hint teaching without using a tablet. Teaching sessions and intermittent probe sessions were organized independently of each other. In this context, if the criterion is met in any of the dependent variables, the teaching with that method was terminated, and the teaching with the other method was continued. Follow-up sessions were held in the first, third and fifth weeks after the teaching was over. In 30% of the sessions held in the research, application reliability and inter-observer reliability data were collected.

Pilot Study

Before starting the study, a pilot application was carried out for both teaching practices related to the simultaneous prompting method with a student who had the same characteristics and prerequisite characteristics as the participant students. The aim of the pilot application is to foresee the negative situations that may occur during the working process and to ensure that the necessary corrections are made. A 6-year-old male student with intellectual disability participated in the pilot study. As a result of this pilot application, it was deemed appropriate to teach each step in stages and to evaluate each step in itself in the criterion-based measurement tool for gaining the concepts.

Baseline Sessions

Instruction consisted of three steps (same type, same visuals; different type same visuals and different types, different visuals) in accordance with introductory probe sessions, presentation of simultaneous prompting method teaching related to the acquisition of spatial concepts via tablet computer and visual cards. Before proceeding to the teaching of each step, the student's performance related to that step was determined and baseline data were collected. Within the scope of this research, baseline probe sessions were held in order to determine the level of functioning of the participant

students before the teaching process for spatial concepts. These sessions were held for at least three consecutive sessions until stable data were obtained and data collection forms prepared for each participant's dependent variables were used. These sessions were organized according to the teaching set and teaching practice selected by random assignment.

In the introductory sessions, remarkable clues were presented to attract the attention of the student ("Hello…! Today we are going to work with you on ….. Are you ready to study?") The study started when the participant received a verbal or non-verbal response from the student that he or she was ready ("Great, you are ready to work. Let's get started.") Immediately after, questions were asked from the participants in accordance with the instructions in the data collection form among the visuals related to the concept studied and 5 seconds were given for the student to react. expected. Student's correct responses were marked as "+" on the Probe and Maintenance Sessions Data Collection Form and "-" in case of incorrect responses or no response. If the participants did not fulfill any of the steps, the experiment was terminated and another trial was started. No feedback or corrections were given to the student participants during the baseline probe sessions and students' positive behaviors were reinforced with primary reinforcers. The reinforcers to be used were determined by using the Reinforcement Identification Form during the pre-interview with the parents and teachers after the students were identified.

Intervention Sessions

In this study, intervention (teaching) sessions commenced after the baseline sessions. Spatial concepts were taught using two methods: the simultaneous prompting method presented via tablet and the simultaneous prompting method presented via visual cards. The instruction sets for both applications were determined through random assignment before the teaching phase. Teaching sessions took place in a serene classroom environment at the students' school, where they were studying. The researcher and participant sat opposite each other during these sessions. Individual students were selected from their classes during the education period to participate in the sessions. Each participant underwent two teaching sessions per day, totaling six teaching sessions conducted daily. All materials and reinforcers used in the teaching sessions were prepared and easily accessible to the researcher in the teaching environment.

Teaching sessions were conducted for three consecutive sessions until stable data were achieved. To mitigate the potential impact of multiple applications observed in the adapted alternating treatments design, the teaching sessions involving simultaneous prompting with tablets and visual cards were separated by a 30-minute interval. In this approach, the teaching session for the first participant was conducted impartially with one of the application methods. Subsequently, a half-hour break was taken before proceeding with the teaching session using the other independent variable, i.e., without the use of a tablet. In this process, the teaching method was determined by the second participant. The order of the teaching practice used to control the sequencing effect in each session was determined through unbiased assignment. If the same sequence was observed for three consecutive sessions, the other option was then applied.

Teaching sessions were conducted following the teaching plans designed based on the simultaneous prompting method. Special attention was given to ensuring that the reinforcers, reinforcement schedules, and application instructions used within the teaching plan were consistent between both types of application (i.e., simultaneous prompting presented via tablet computer and simultaneous prompting presented without the use of a tablet).

For instance, the "on" concept curriculum was taught using simultaneous prompting via tablet computer, while the non-concept curriculum was taught without the use of a tablet. Each concept consisted of three steps, and four attempts were made for the four tool sets associated with each step in the teaching set. The teaching sessions and materials used were tailored accordingly to align with these steps. Upon meeting the criteria for each step, the next step in the teaching process was initiated.

Task and Materials

Throughout the research, all sessions, with the exception of the generalization sessions, were conducted in the students' institution, specifically in their regular classroom measuring 4mx4m. The generalization sessions took place in a different classroom, sized 3mx3m, and involved the use of distinct materials. The researcher led all sessions, conducting two sessions per day on weekdays between 13:30 and 16:30.

To facilitate the teaching, probe, and maintenance sessions, a tablet equipped with software for spatial concepts, a video camera, and visual materials related to the concept of "near" were utilized. Generalization sessions incorporated chairs, boxes, pillows, and various toys. Additionally, the research data were collected using a video camera, data collection forms, pencils, and various reinforcers provided to the students.

Development of Tablet-Based Software for Spatial Concepts

In line with the dependent variables of the research, three different mobile software were developed regarding the concepts of left-right, near-far, up-down. The developed software was prepared by a software developer. The software has been developed using the java programming language, written on the Android Studio operating system. This software

works with minimum Android 4.1. (Jelly Bean) and this means that it works on 99.8% of all android devices.

To teach the concepts, a six-step program was devised, with three steps included in the criterion-based measurement tool and the remaining three dedicated to evaluating each teaching step. The program provided instructions during the teaching sessions, followed by a controlling prompt lasting 0 seconds. If the student responded correctly, the program reinforced the response. However, if the student provided an incorrect response, the program reiterated the instruction and controlling prompt. When the student did not respond, the program reintroduced the instruction after a 5-second delay to draw the student's attention back to the tablet. During the probe sessions, only instructions were presented by the program, and the student was expected to respond independently without receiving any controlling prompts. The program structured each step's teaching and probe session as a teaching phase followed by a probe phase. Upon meeting the 100% criterion during the probe session for a specific step, the next step was taught. However, if the criterion was not met, the program repeated the teaching of that step.

Procedure

Probe Sessions

As part of the research, baseline data were collected to assess the students' pre-teaching function levels before introducing spatial concepts instruction. For all students, collective probe sessions were conducted, with at least three consecutive sessions held to ensure stable data were obtained for each individual. The organization of these sessions was based on the neutral assignment of teaching practice (tablet/visual card).

To gather data for the application phase of the research, daily probe sessions were conducted before each teaching session (excluding the first session) for every student. In these sessions, a single trial was performed to assess the students' responses.

Teaching Sessions

In the research, spatial concepts were taught using both tablet and visual card presentations, employing simultaneous prompting. The instruction sets for both applications were determined through random assignment. The teaching sessions took place in the students' classroom with the researcher sitting opposite them. Each student received two teaching sessions per day, and the sessions continued for three consecutive days until stable data were obtained.

For each concept, a trial was conducted for the four tool sets in the teaching set, comprising three steps. After meeting the criteria for each step, the subsequent step was introduced. The outcomes of the teaching sessions were analyzed graphically, encompassing data from baseline, intervention (teaching), probe, and follow-up sessions. Additionally, the students' correct responses during the generalization sessions were depicted using a column chart in a pre-test-post-test format.

Maintenance (Follow-up) and Generalization Sessions

As a result of the research, follow-up sessions were held in order to determine the level of maintenance of the learned concepts by the students. Follow-up sessions were carried out as probe sessions with each student 1, 3 and 5 weeks after the completion of the instruction.

Reliability

Throughout the research, interobserver agreement and procedural reliability data were collected for baseline, teaching, generalization, and follow-up sessions. To ensure unbiased and random selection, 30% of the sessions were observed to obtain the reliability data.

Procedural reliability

In the study, baseline, teaching, daily probe, maintenance and generalization sessions were analyzed separately with procedural reliability forms. Procedural reliability was calculated by dividing the number of observed teacher behaviours by the number of planned teacher behaviours multiplied by 100.

When Hasan's procedural reliability findings are examined, while the reliability findings related to the baseline, daily probe, generalization and follow-up sessions in the teachings regarding the concepts of "left" and "right" are 100%; the teaching (intervention) session of the concept of "left" was 96.42% and the teaching session of the concept of "right" was 95%. According to the findings on Mert's procedural reliability data, it was found that while the reliability findings related to the baseline, daily probe, generalization and follow-up sessions in the teachings regarding the concepts of "near" and "far" are 100%; the teaching (intervention) session of the concept of "near" was 92.85% and the teaching session of the concept of "far" was 90%. When Ela's procedural reliability findings are examined, while the reliability findings related to the baseline, daily probe, generalization and follow-up sessions in the teachings regarding the concepts of "up" and "down" are 100%; the teaching (intervention) session of the concept of "up" was 92.75% and the teaching session of the concept of "down" was 95%.

Interobserver agreement reliability

Interobserver agreement was calculated using the point-by-point method with a formula of the number of agreements divided by the number of agreements plus disagreements multiplied by 100 (Alberto and Troutman, 2009).

Within the scope of the research, it was concluded that the data for the baseline, daily probe, generalization and follow-up sessions regarding the inter-observer reliability findings regarding the concepts taught to all three students were 100%.

INDINGS

The results regarding the effectiveness of the simultaneous prompting method presented to the children with intellectual disability, who participated in the research via tablets and visual cards, in concept teaching are shown in Figure 1, Figure 2 and Figure 3.

Considering the baseline level findings, it is seen that Hasan performs at the level of 18% regarding the concept of both left and right. During the implementation phase, 6 probe sessions were held for Hasan both to present the teaching with simultaneous prompting for teaching the concept of "left" via tablet and to present the teaching with simultaneous prompting for teaching the concept of "right" via visual cards. Upon reviewing the data from Hasan's teaching sessions, it was observed that both teaching methods demonstrated performance meeting the criteria after the 4th teaching session. During the last three probe sessions following the teaching sessions for both left and right concepts, Hasan achieved a 100% success rate, meeting the 12/12 criterion (number of correct responses divided by total responses multiplied by 100). The follow-up data, collected after the teaching sessions on both concepts concluded, indicated that Hasan maintained a 100% retention level for both concepts. The results highlighted that simultaneous prompting was equally effective in teaching both left and right concepts, whether presented via tablet or visual card.

According to the baseline level findings, it is seen that Mert exhibited a 10% level of performance for both in and behind

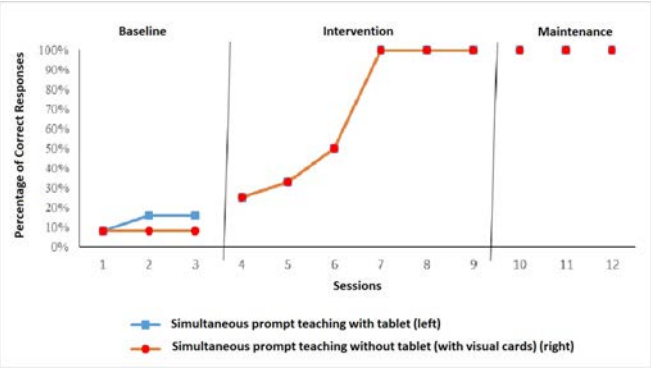

Fig. 1: Hasan's percent correct responses during baseline, intervention and follow-up sessions for teaching "left" and "right" concepts through simultaneous prompting presented with tablet and visual cards

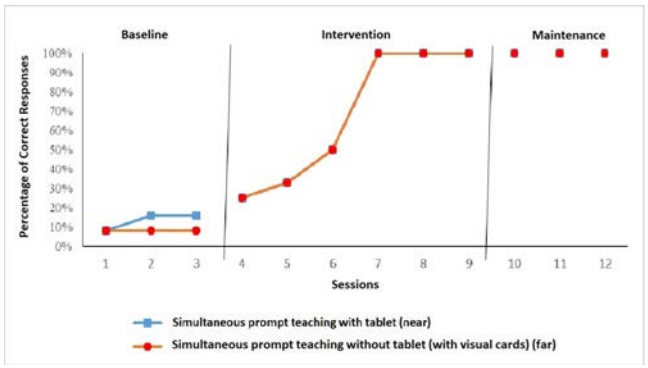

Fig. 2.: Mert's percent correct responses during baseline, intervention and follow-up sessions for teaching "near" and "far" concepts through simultaneous prompting presented with tablet and visual cards

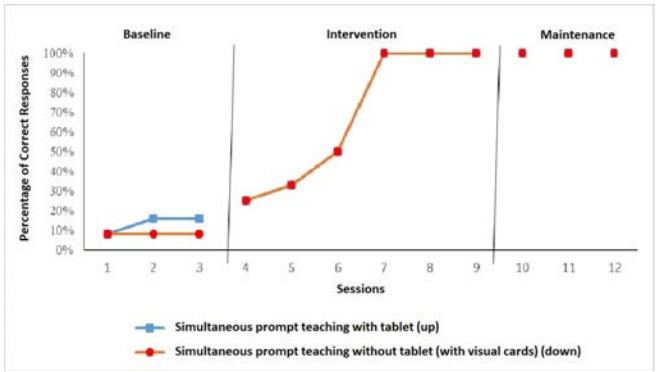

Fig. 3: Ela's percent correct responses during baseline, intervention and follow-up sessions for teaching "up" and "down" concepts through simultaneous prompting presented with tablet and visual cards

concepts. During the implementation phase, a total of 10 probe sessions were held for Mert both with simultaneous prompting for teaching the concept of "near" with a tablet and for teaching the concept of "far" with visual card. When Mert's teaching sessions data were examined, both teaching practices showed a performance that met the criteria a er the 8th teaching session. Mert performed at the level of 100% by meeting the 12/12 criterion in the last three probe sessions held a er the teaching sessions on the concept of both in and behind. According to the follow-up data collected a er the teaching on both concepts ended, it is seen that the concept "near" was performed at the level of 100% and the concept "far" at the level of 96%. According to the ndings, it was concluded that both presentations of simultaneous prompting were equally e ective in teaching Mert the concepts of near and far.

Based on the baseline level findings, Ela demonstrated a performance of 8% for the concept "up" and 18% for the concept "down." In the implementation phase, a total of 10 probe sessions were conducted using simultaneous prompting via tablet for the concept of "up," and 7 probe sessions were held using simultaneous prompting via visual cards for the concept of "down."

Upon analyzing the data from Ela's teaching sessions, it was observed that her performance met the criteria after the 8th teaching session for simultaneous prompting via tablet and after the 5th teaching session via visual cards. Ela achieved a 100% success rate, meeting the 12/12 criterion, during the last three probe sessions conducted after the teaching sessions for both "up" and "down" concepts. The follow-up data collected after the teaching of both concepts concluded indicated a 100% retention level for both "up" and "down" concepts.

Discussion and Conclusion

When the research findings of the present study are examined, it can be said that the developed software teaching material presented with tablets is effective in gaining spatial concepts to students with intellectual disabilities. The results of the study revealing that tablet assisted instruction is effective in teaching various concepts or gaining academic and functional skills to students with intellectual disabilities are similar to the findings of this study (Kumar and Chaturvedi, 2014; Larson, Juszczak and Engel, 2016; Felix, Mena, Ostos and Maestre, 2017; Cullen, Albert-Morgan, Simmons-Reed and Izzo, 2017; Karabulut and Yikmis, 2021). It is observed that individuals with intellectual disabilities generally have difficulties in skills such as memory, attention, rehearsal, generalization and learning through observation. The fact that instructional materials embody the content and appeal to many senses plays a very important role in the realization of more effective and permanent learning (Usun, 2012). It can be said that the developed instructional material contains auditory, visual, animated and interactive elements that appeal to more than one sense organ, which is effective in obtaining these findings. It is supported by various research findings that materials containing multimedia objects that allow multiple repetitions in the teaching process and that appeal to more than one sense organ support the learning of individuals with intellectual disabilities and are effective in eliminating the difficulties experienced in this process (Dewi and Dalimunthe, 2019; Cheng and Lai, 2020).

Findings obtained from the research showed that simultaneous prompting presented through software used in this research is effective in teaching spatial concepts to students with intellectual disability. These results are similar with previous studies examining the effectiveness of simultaneous teaching in teaching concepts (Ciftci, 2013; Celik and Vuran, 2014) are similar. In addition, it was observed that the subjects continued the skills they had acquired in the follow-up sessions after the end of the teaching, so it was also effective in ensuring the permanence of the teaching with simultaneous prompting.

It is seen that there are studies on acquiring academic, social and self-care skills for individuals with intellectual disabilities, but studies on teaching basic concepts are limited. At the same time, considering the ages of the students with intellectual disabilities in the study, it is thought that the teaching of spatial concepts will contribute to the development of high-level academic skills of the students. Teachers working in special education schools or general education schools can use computer-assisted instructional materials developed using various software for students who are affected by disability to enrich course activities, facilitate the process of acquiring a new concept or skill, and focus students' interest and attention on teaching activities. In addition, by using similar software, teachers can develop content and teaching materials in line with the individual needs of students in their classes. Based on the results of the research, it can be suggested that in further research, the effectiveness of both teaching practices should be carried out with different disability groups and their effectiveness should be examined on these groups. Software applications can be prepared for the acquisition of different concepts and academic skills by using the tablet of the simultaneous hint teaching method. This is a single-subject study and small number of participants might be considered as a limitation for the study. Therefore, further experimental research with larger samples might be carried out to increase the evidence-based research on this area.

The research can be designed by developing a software for teaching other spatial concepts on the tablet computer application by using other error-free teaching methods. In a different study, the application can be developed and its effectiveness can be examined by adding the behavior of students to show the concept on the tablet together with the behavior of naming the concept. In teaching concepts to students with intellectual disabilities, its efficiency can be investigated by applying simultaneous prompting with other teaching models in errorless teaching methods in different subjects and different behaviors.

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