International Technology and Education Journal
Vol. 5 No. 2; December 2021
ISSN: 2602-2885
URL: http://itejournal.com/

Yavuz, M., Karaaslan, D., & Yikmis, A. (2021). Effectiveness of concept map presented using augmented reality in teaching basic feature s of animals to children with intellectual disabilities. International technology and education journal, 5(2), 32-44.

Effectiveness of Concept Map Presented Using Augmented Reality in Teaching Basic Features of Animals to Children with Intellectual Disabilities

Mehmet Yavuz, mehmetyavuz23@gmail.com, Trakya University, Turkey, https://orcid.org/0000-0003-0762-1611

Derya Karaaslan, deryakaraaslan53@gmail.com, Abant Izzet Baysal University, Turkey, https://orcid.org/0000-0002-0704-0078

Ahmet Yikmis, ayikmis@hotmail.com, Abant Izzet Baysal University, Turkey, https://orcid.org/0000-0002-1143-1207

SUMMARY

In this study, it was aimed to determine the effectiveness of the concept map presented by using augmented reality technology in the teaching of the basic features of animals to the 6th grade students with mild intellectual disability who benefit from inclusion interventions. Three students with mild intellectual disability who benefited from inclusion interventions participated in the research. One of the single-subject research models, the multiple probe design with probe conditions across subjects, was used in the study. While the dependent variable of the study is the level of learning the basic features of animals of students with intellectual disability, the independent variable of the research is the concept map method presented using augmented reality. The findings of the research shows that the concept map using augmented reality technology in teaching is effective in teaching the basic features of animals to the three participants who participated in the research. Besides, it was observed that the participants retained the basic features of the animals they learned one, three and four weeks after the end of the intervention, and exhibited what they learned when different individuals gave instructions. For the social validity of the research, the teachers of the participants were interviewed, and the they expressed positive opinions about both the target behaviors and the concept map method using augmented reality technology.

Keywords: Intellectual disability, augmented reality, concept map

INTRODUCTION

Today, it is known that the definition of intellectual disability by the American Association on Intellectual and Developmental Disabilities (AAID) is widely accepted. The association defines intellectual disability as "a situation that occurs before the age of 18, showing significant limitations in mental functions and adaptive behaviors as well as practical, social and conceptual skills" (Cited by Colpani & Homem, 2015). Intelligence tests are mostly used to determine the prevalence rates of individuals with intellectual disability (ID), and it is claimed that approximately 3% of the general population consists of individuals with ID. While 2.3% of this rate was composed of individuals with mild ID; 0.6% of them are moderate and 0.1% are individuals with severe or very severe ID (Cavkaytar, Ardıç, Sönmez, Özdemir, & Olcay, 2013; Cited by Yıldız, 2014, p. 22).

Both individuals with ID and individuals with other developmental disabilities need help in almost every aspect of daily life. Therefore, they need support to achieve what is desired and accepted by the society (Standen, & Brown, 2005). To illustrate, it is stated that the speech and language problems of individuals with ID are more pravalent than their typically developing peers. Considering the relationship between cognitive abilities and language development, it is claimed that these problems in language are an expected situation (Bernstein & Tiegerman, 1993; cited by Eripek, 2009, p. 257). Therefore, it is stated that speech and language deficiencies or delays are frequently experienced by children with ID and more than half of these children need a speech and language therapist (Smith, Ittenbach & Patton, 2002; Cited by Eripek, 2009, p. 257). In addition, individuals with ID have difficulty in living or acting independently due to the need for continuous support in completing their daily life tasks (Bridges, Robinson, Stewart, Kwon, & Mutua, 2020). It is also claimed that academic skills such as social sciences, Turkish, mathematics and reading and writing, which constitute one of the most important steps of the independent life of individuals with ID, are very important (Kot, Sönmez & Yıkmış, 2017).

In the presentation of information to children with ID, direct teaching method, educational games, question&answer and concept maps are included. In the literature, direct teaching method and concept maps are widely used among the teaching interventions from easy to difficult for students with ID (Yıkmış & Özçakır, 2019). In creating concept maps, which is one of the techniques that best provide hierarchical arrangement (Gilbert, 2011; cited by Yıkmış & Özçakır, 2019), children can be enabled to create concept maps as groups or individually. In recent years, it has been observed that the use of technology in the support education services offered to individuals with ID has gained weight (Woodward & Reith, 1997; Cited by Çattık & Ergenekon, 2018). In the literature, it is seen that the majority of the studies carried out using technology are conducted employing the video

model intervention (Elmaci & Karaaslan, 2021). When these studies conducted using the video model intervention are examined, it has been determined that the video model intervention is effective in teaching daily life skills (Ertekin, Ece & Yıkmış, 2017), the cooking of pasta (Halisküçük & Çifci Tekinarslan, 2007) and greeting skills (Avcıoğlu, 2013) to students with ID. It is known that Augmented Reality (VR), one of the applications where cutting edge technology is used today, is also used for individuals with ID or other developmental disabilities. With the development of mobile technology, devices such as iPhone and iPod are claimed to be very useful in solving daily problems. Moreover, the use of "Augmented Reality (AR)" technology is becoming increasingly popular (Colpani & Homem, 2015). AR brings together the virtual world and the real world using virtual 3D objects. It allows people to interact with virtual 3D objects created by real world computer-generated sound, images etc. (Tori, Kiner, Siscoutto, 2006; Cited by Colpani & Homem, 2015). In short, augmented reality; (a) combines the real and virtual worlds, (b) provides real-time interaction, and (c) superimposes real objects or places and three-dimensional digital information (Sommerauer & Müller, 2014; Cited by Kellems, Cacciatore, & Osborne, 2019). AR can also function as an assistive technology or educational technology in supporting (McMahon, 2014) and increasing the independence of students with ID or other developmental disabilities in the learning process (Cited in Kellems, Cacciatore, & Osborne, 2019). It is claimed that augmented reality is also an effective tool in increasing students' motivation, self-confidence and learning outcomes (Akçayır & Akçayır, 2017).

Considering the studies carried out by researchers using augmented reality technology, studies have been carried out on teaching daily life skills to students with ID (Bridges, Robinson, Stewart, Kwon, & Mutua, 2020), teaching tooth brushing and oral hygiene/care (Jeon, Oh, & Son, 2021), teaching some scientific concepts/words (McMahon, Smith, Cihak, Wright & Gibbons, 2015), and teaching sense of direction to increase functional capabilities (Smith, Cihak, Kim, McMahon, & Wright, 2017). There are a limited number of studies conducted using augmented reality technology in Turkey (Işık & Karataş, 2019; Turan & Atila, 2021), and it was found that these studies were conducted with students with learning disabilities. To illustrate, in the study conducted by Turan and Atila (2021), where the multiple probe model was utilised, a 15-page book was developed. The participants were four students (two girls, two boys) between the ages of 10 and 13 with learning disabilities. They used a video camera in the making of this book and using AR technology, the researchers added 2D and 3D images and sounds. The results were found to be effective in supporting the learning of some topics related to science with materials prepared using AR technology.

When the aforementioned studies are considered and examined as a whole, such interventions like augmented reality are detected to be quite effective in teaching academic skills to students with ID or other special education needs. Besides, the use of such interventions has been increasing in recent years. In addition, it is known that direct teaching method and concept maps, which are among the teaching interventions implemented from easy to difficult, are quite effective in the presentation of information to children with ID (Yıkmış & Özçakır, 2019). Accordingly, it suggested that the augmented reality was effectiveness at providing students with special needs such as students with ID with concrete experiences and it was also observed that students with special needs such as students with ID were more eager about the lesson during the application (Cakir & Korkmaz, 2019). However, since there are no studies on the effectiveness of the concept map using direct teaching method and augmented reality in the teaching of academic skills such as the features of some animals to students with ID in Turkey, research like this study is needed. Therefore, in this study, it was aimed to determine the effectiveness of the concept map using AR technology in teaching the basic features of animals to the 6th grade students with ID who benefit from inclusion interventions. In line with this general purpose, answers to the following questions were sought.

1. Is the concept map presented using AR effective in teaching the basic features of animals to children with ID?
2. Is the concept map method presented using AR in teaching the basic features of animals to children with ID effective one, two and four weeks after the end of the teaching?
3. Can the children with ID generalize the concept map method presented using AR in teaching the basic features of animals to different people after the teaching is over?
4. What are the teachers' opinions of the participants regarding the use of concept maps presented using AR in teaching of the basic features of animals to children with ID?

METHOD

In this section of the research, the participants in the research and the prerequisite features sought in the participants, the model of the research, the dependent and independent variables of the research, the setting in which the research was carried out, the data collection process and the data collection tools, the information about the analysis of the obtained data were discuss

Research Design

In this study, the multiple probe design with probe conditions across subjects, which is one of the single-subject research models, was used to determine the effectiveness of the concept map presented using augmented reality in teaching the basic features of animals to children with ID who benefited from inclusion intervention.

The reason why the multiple probe design with probe conditions across subjects was preferred between probe-phase behaviors is that it is easy to implement and can be used in behaviors that are reversible and irreversible. In the multiple probe design with probe conditions across subjects, that experimental control takes place firstly, by any change in the performance of the initial behavior only when the independent variable is implemented, secondly; in the behaviors where the independent variable is not implemented, no significant change is observed and lastly, the mentioned similar effect is repeated in other behaviors with the intervention of the independent variable in a diachronic manner. Therefore, in this model, baseline data is collected simultaneously for all behaviors. After obtaining stable data in the first behavior, the intervention phase takes place. While the intervention is implemented in the first behavior, the data is not collected in the second and third behaviors. After collecting stable data that will meet the criterion in the first behavior, the first probe phase is held simultaneously in all behaviors. After the stable data is also obtained in the second behavior, the intervention is implemented. While the intervention is implemented in the second behavior, data is collected in the first and third behaviors. After collecting stable data that will meet the criterion in the second behavior, the first probe phase is held simultaneously in all behaviors. Just like the first and second behaviors, after the stable data is also obtained in the third behavior, the intervention phase is initiated. Data is not collected for the first and second behaviors while the third behavior is practiced. After collecting stable data that will meet the criterion in the third behavior, the first probe phase is held simultaneously in all behaviors. Then, generalization and maintenance data are collected (Tekin-İftar, 2012).

Participants

The research was conducted with three male students with ID between the ages of 10 and 12, attending the 6th grade and benefiting from inclusive interventions in a state school affiliated to the Edirne Provincial Directorate of National Education. Besides, the participants receive special education services in an education and rehabilitation center which is also affiliated to the Edirne Provincial Directorate of National Education. Written permission was also obtained from the families who voluntarily wanted their children to be included in the study. The inclusion of students with ID in the study was carried out by considering some prerequisites. These prerequisites are (1) that the participants were diagnosed with ID, (2) that the participants with mild ID, who receive education in a special education rehabilitation center, benefit from inclusive education in a public school, (3) that they do not exhibit behavioral problems at a level that prevents the teaching of the basic features of animals (for example, no spitting, hitting, etc.), (4) that they can follow and fulfill verbal instructions, (5) that they can pay attention to visual, auditory or tactile stimuli for 10 minutes, (6) that they can watch an AR intervention for at least 10 minutes and (7) that they were not included in any previous study on teaching the basic features of animals using augmented reality technology.

The real names of the three students included in the study were not used in this research, so code names were used instead. For the first participant, the code name Ali was used instead of his name. Ali is 11 years old with mild ID. He receives education from a special education and rehabilitation center provided free of charge by the Ministry of National Education (MNE), and also benefits from inclusive education in a public school. He has basic literacy and maths skills. In addition, he can read 10-word reading texts and answer the questions directed to him. He has the ability to engage in an activity for 10 minutes. As a result of the teacher interview forms, it was determined that he did not have knowledge about the basic features of animals. Just like the first participant, a code name, which is Veli, was used for the second participant. Veli is 10 years old with mild ID. He not only receives education from a special education and rehabilitation center provided free of charge by the MNE but also benefits from the inclusion education in a public school. He has basic literacy and maths skills. He can describe daily events by specifying the place and time. As a result of the teacher interview forms, it was found that he did not have knowledge about the basic features of animals.

Similar to the first and second participants, a code name, Isa, was used instead of the real name of the third participant. Isa is 12 years old with mild ID. He receives special education services from a special education and rehabilitation center provided free of charge by the MNE, and also benefits from the inclusion education in a public school. He has basic literacy and maths skills. He can also read 10-word reading texts and answer questions directed to him. He can describe daily events by specifying the place and time. As a result of the teacher interview forms, it was determined that he also did not have knowledge about the basic features of animals.

Dependent and Independent Variable of the Research

The dependent variable of the study is the level of learning the basic features of animals of the students with ID. The independent variable of the research is the concept map method using augmented reality.

Setting and Data Collection Tools

The intervention was carried out in a 6x6 m^2 individual education room of a special education and rehabilitation center affiliated to the Edirne Provincial Directorate of National Education. In the individual education room where the study is carried out, there is a table, two chairs, a bookcase, a material cabinet and a portable white-board. During the intervention, after the distracting stimuli in the setting were removed, the tools and materials used in teaching were placed in the setting in a way that both the student could easily see and the researcher could easily access.

In this study, the baseline, full probe sessions, daily probe sessions, intervention sessions conducted with the concept map using augmented reality technology, generalization and maintenance sessions were held after the intervention ended. During the intervention sessions of the research, augmented reality interventions prepared in 3D form of 15 animals using a 10-inch iPad, augmented reality application on Google and Octagon Animal Augmented Reality Cards were utilised. The intervention, which was created in 3D using augmented reality technology for each animal, was prepared to respond to information about five basic features of each animal (for example, the name of the animal, the place where it lives, the food it eats, the sound it makes, how it moves). Picture cards of basic features of animals were employed in the baseline, probe sessions, maintenance and generalization sessions, where augmented reality technology was not used. All sessions were recorded with Sony brand HD camera. In addition, not only a teacher interview form was prepared in order to collect social validity data in the research but also a data recording form was used to keep the records of each participant's performance in the study.

General Process

First, official permission for the research was obtained from the Edirne Provincial Directorate of National Education. Afterwards, the families of the participants were interviewed before the intervention. In the interview, the information about the research was presented to them. Next, a written permission was obtained from the parents who voluntarily let their children to participate in the study and then the intervention phase was initiated. In this phase, the baseline, full probe sessions, daily probe sessions, concept map intervention sessions presented to the students with direct teaching method using augmented reality consisted of generalization and maintenance sessions.

Baseline Probe Sessions

The baseline probe sessions were held simultaneously in all behaviors and they were conducted by the first researcher in the individual education room of a special education rehabilitation center in Edirne, where the student receives special education services. For each behavior, at least three consecutive sessions were conducted until stable data were obtained. During baseline probe sessions; in order to obtain baseline data, the researcher and the student were seated face to face at a table where picture cards containing the basic features of the animals presented were placed. In baseline, the researcher gives instruction and a tip to the student to grab his attention by saying “We will start working together now. Are you ready?" When he receives a word or sign from the student meaning that he is ready, he provides a reinforcment to the student by saying "You are great". The researcher shows the picture of each animal and directs these questions: "Which animal is this? What does it eat? Where does it live? What sound does it make? and “How does it move?” If the student responds correctly, he is reinforced. If he is wrong, the answer is ignored. The student responses are recorded in the criterion-referenced test.

As for daily probe sessions, they are implemented by the researcher with each participant before all other teaching sessions except for the first teaching session. In the daily probe sessions, the baseline is implemented similarly to the probe session. In teaching the basic features of animals that are aimed to be taught in the full probe sessions, after the student perform three consecutive sessions meeting the criteria, a full probe session is applied for all students. The session is carried out in the same way as in the baseline probe session in the full probe sessions.

Teaching Sessions

After the baseline sessions end, teaching sessions are held five days a week and once a day. In the teaching sessions conducted with each participant individually, 3D augmented reality videos prepared for the basic features of each animal in each teaching set are used. In addition, during the teaching of the videos prepared on the basic features of animals using augmented reality technology, the concept map is utilised through the direct teaching method.

The researcher sat around a table with each subject next to each other. In teaching sessions, the first teaching set prepared on the basic features of animals using augmented reality is studied with each student. After the criteria are met in the first teaching set, the second teaching set is taught. Then, the second teaching set about the basic features of animals is studied and after the criteria are met in the second teaching set, the third teaching set is started. Therefore, after the criteria are met in each teaching set, full probe sessions are held for the three teaching sets.

Before starting the teaching sessions, a question like "Are you ready to study?" is asked, and when the student says that he is ready to study, or when he uses any gestures or facial expressions like nodding his head, a reinforcement such as "very good, now we can start studying" by the implementer. In addition, during the teaching sessions with each student, some foods such as “pretzels, chocolate, bonbons” are given as reinforcers for the correct behavior of the student, and after the teaching sessions are ended, the students are encouraged using verbal reinforcements like “Well done, you did very well with me….”. In this study, the teaching sessions are implemented by the first author/researcher. During the teaching sessions, the implementer have the student watch the video prepared with augmented reality about each animal, and then tells the student what the basic characteristics of the animals are based on the concept map he prepared, and he becomes a model. After being a model for the student, if the student does not tell the features of the animal in the concept map, he guides the student by offering verbal clues. After the guided intervention phase, the independent intervention phase is lauched. In the independent intervention phase, the student is expected to independently state the basic features of each animal in the concept map, and the teaching is terminated when the student explains the basic features of the animal. In the teaching sessions, the videos prepared with augmented reality about each animal that are determined for each student are presented in random order.

Maintenance and Generalization Sessions

After the teaching sessions of the participants included in the study, which are conducted with the concept map presented by the direct teaching method using augmented reality technology, maintenance sessions are held to test the level which the subjects retained the behaviors they learned. Maintenance sessions are organized one, three, and four weeks after the last full probe session, similar to the baseline probe sessions. The generalization sessions of the research, on the other hand, are carried out in line with an interpersonal generalization study with another implementer other than the person conducting the intervention to see whether the information learned are generalized. Generalization sessions are conducted in a similar way to baseline probe sessions, using the pre-test and post-test model. No help or tips are offered to the participants in the maintenance and generalization sessions.

Data Collection and Analysis

Probing, maintenance, generalization, effectiveness, social validity and reliability data were collected in the intervention of the concept map using augmented reality in teaching the basic features of animals to children with ID who benefit from inclusion interventions. The effectiveness data of the study were collected by recording the correct and incorrect responses of the participant obtained from daily probe, full probe, generalization and maintenance sessions in the criterion-dependent test. While collecting the effectiveness data, the correct behaviors of the participants were recorded using the (+) symbol and the wrong behaviors were recorded using the (-) symbol. Then, the percentage of correct behavior was calculated for each participant and the data were utilized to make a graph.

Reliability Data

In this study, 'Inter-Observer Reliability' data and 'Intervention Reliability' data were collected.

Inter-Observer Reliability: In order to obtain the inter-observer reliability data, the data on the basic features of the animals, which are the dependent variable of the research, were video recorded. Inter-observer reliability data were obtained from 30% of full probe, daily probe, maintenance and generalization sessions. Which video recordings would be examined was decided randomly. For inter-observer reliability data, a doctoral student who had previous experience in the implementation of the direct teaching method made observation. Information was presented to the observer, who would assist in obtaining inter-observer reliability data, on how the full probe, daily probe, maintenance and generalization sessions were implemented. In the research, the “Agreement/(Agreement + Disagreement X 100” formula (Ayres & Gast, 2010) was used for inter-observer reliability data. Inter-observer reliability data of the participants' teaching, full probe, maintenance and generalization sessions are presented in Table 1.

Table 1. Inter-Observer Reliability Data of the Participants' Daily Probe, Full Probe, Maintenance and Generalization Sessions

Sessions	Inter-Observer Reliability Data
Daily Probes	%96 (range %92-100)
Full Probes	%96 (range %92-100)
Maintenance Sessions	%94 (range %88-100)
Generalization Sessions	%96 (range %92-100)

Intervention Reliability: The "observed practitioner behavior/planned practitioner behavior X 100" (Ayres & Gast, 2010) formula was used to analyze the intervention reliability data of the study. As a result of the calculation, it was observed that the researcher conducted the intervention with a 100% reliability level in all sessions.

Social Validity

Social validity serves to determine socially meaningful and functional goals, as well as to develop realistic programs (Vuran & Sönmez, 2008). In a different definition, social validity is expressed as the degree to which the behavior change in the learner has a positive effect on consumers (Carr, Austin, Britton, Kellum, & Bailey, 1999). In this study, social validity data were collected by interviewing the teachers of the students who participated in the research after the research was completed. There are seven (7) questions in the social validity form. The first six closed-ended questions were scored as Yes I think so ( ), No I do not think so ( ) and I am uncertain ( ), and one (1) question was designed as an open-ended question.

FINDINGS

In this study, the graphs of the data on the effectiveness of the concept map prepared using augmented reality in teaching the basic features of animals to children with ID who benefit from the inclusion intervention were given in figure 1, figure 2 and figure 3. In the figures below, there are graphs showing the data on three students with ID, Ali, Veli and İsa, who participated in the research, and the percentage of correct answers of the basic features of animals in the probe, intervention and maintenance data.

Findings About the Participants

With Ali, 10 teaching sessions were conducted with the concept map prepared by the direct teaching method using augmented reality in each teaching set, and a total of 30 teaching sessions were held with three teaching sets. Considering the teaching sessions conducted with concept maps using augmented reality in three teaching sets, in the 1st teaching set, an average of 73% (range 40%-100%), an average of 72% (range 20%-100%) in the 2nd teaching set, and 75% in the 3rd teaching set, the last teaching session, (range 32%-100%) it was determined that Ali learned the features of animals correctly. As a result, it was determined that Ali met the criteria in the last three sessions of the teaching sessions, which were carried out with the concept map with the direct teaching method using augmented reality in each teaching set. In other words, it was revealed that he performed at a level that met the criteria in all three teaching sets.

Ten teaching sessions were conducted with Veli with the concept map prepared by the direct teaching method using augmented reality in each teaching set, and a total of 30 teaching sessions were held with three teaching sets. At the end of the teaching sessions, it was found that Veli learned the features of the animals in the three teaching sets. Considering the teaching sessions conducted with concept maps using augmented reality in three teaching sets, Veli learned the features of animals correctly an average of 74% (range 56%-100%) in the 1st teaching set, 76% in the 2nd teaching set (range 44%-100%) and 71% in the 3rd teaching set (range 24%-100%). As a result, it was found out that Veli met the criteria in the last three sessions of the teaching sessions, which were carried out with the concept map using augmented reality in each teaching set. In other words, it was discovered that he performed at a level that met the criteria in all three teaching sets.

Ten teaching sessions were conducted with the concept map with the direct teaching method using augmented reality in each teaching set with İsa, and a total of 30 teaching sessions were held with three teaching sets. At the end of the teaching sessions, it was determined that İsa learned the features of the animals in the three teaching sets. At the end of the teaching sessions, it was indicated that İsa learned the features of the animals in the three teaching sets. Considering the teaching sessions conducted with concept maps using augmented reality in three teaching sets; An average of 74% (range 40%-100%) in the 1st teaching set, 67% (range 36%-100%) in the 2nd teaching set, and 68% in the 3rd teaching set (range 32%-100%), it was determined that İsa learned the features of animals correctly. As a result, it was revealed that İsa met the criteria in the last three sessions, which were carried out with the concept map by the direct teaching method using augmented reality in each teaching set. In other words, it was found out that he performed at a level that met the criteria in all three instruction sets.

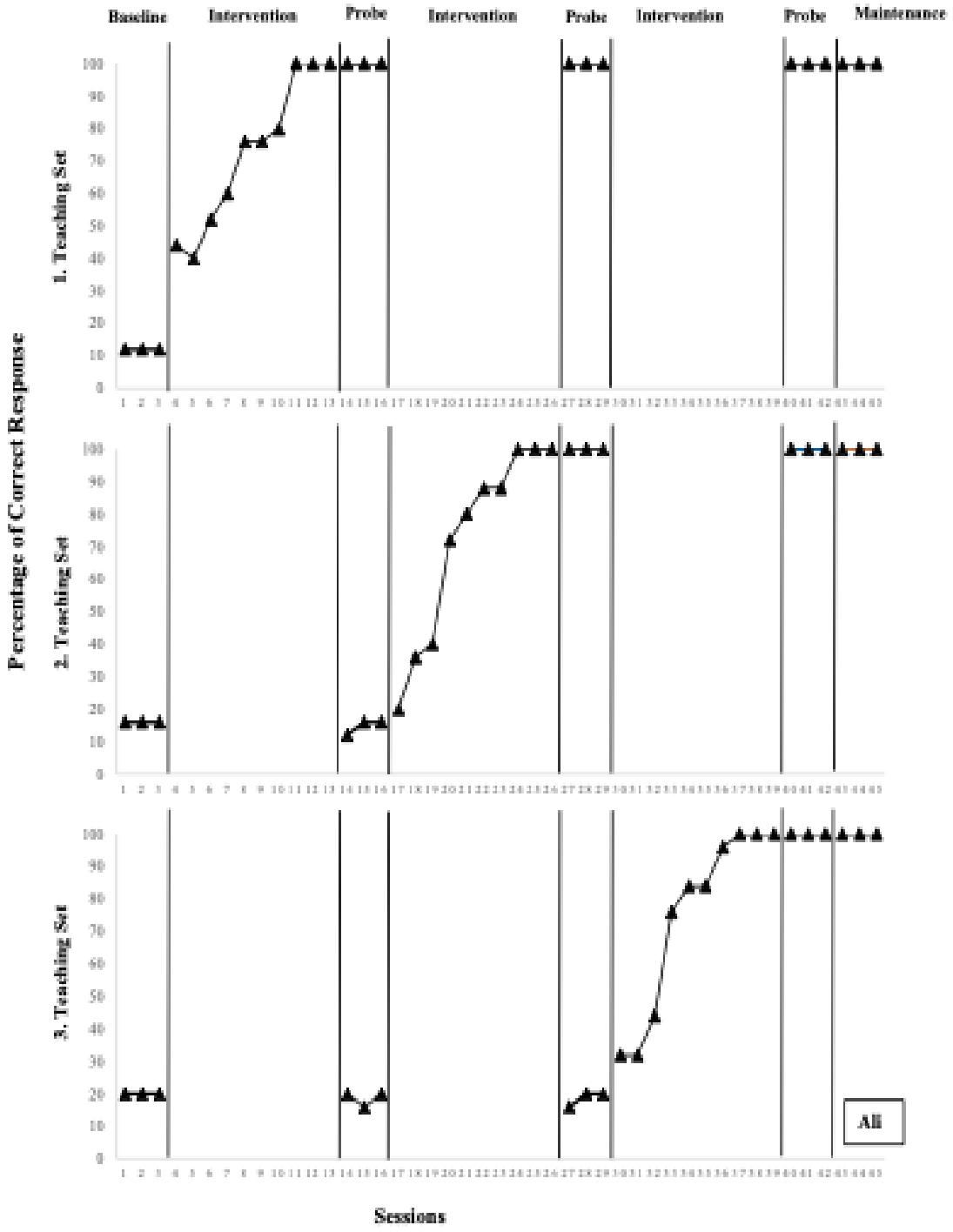

Figure 1. Percentages of Ali's correct answers regarding basic features of animals in probe, intervention and maintenance sessions in three teaching sets.

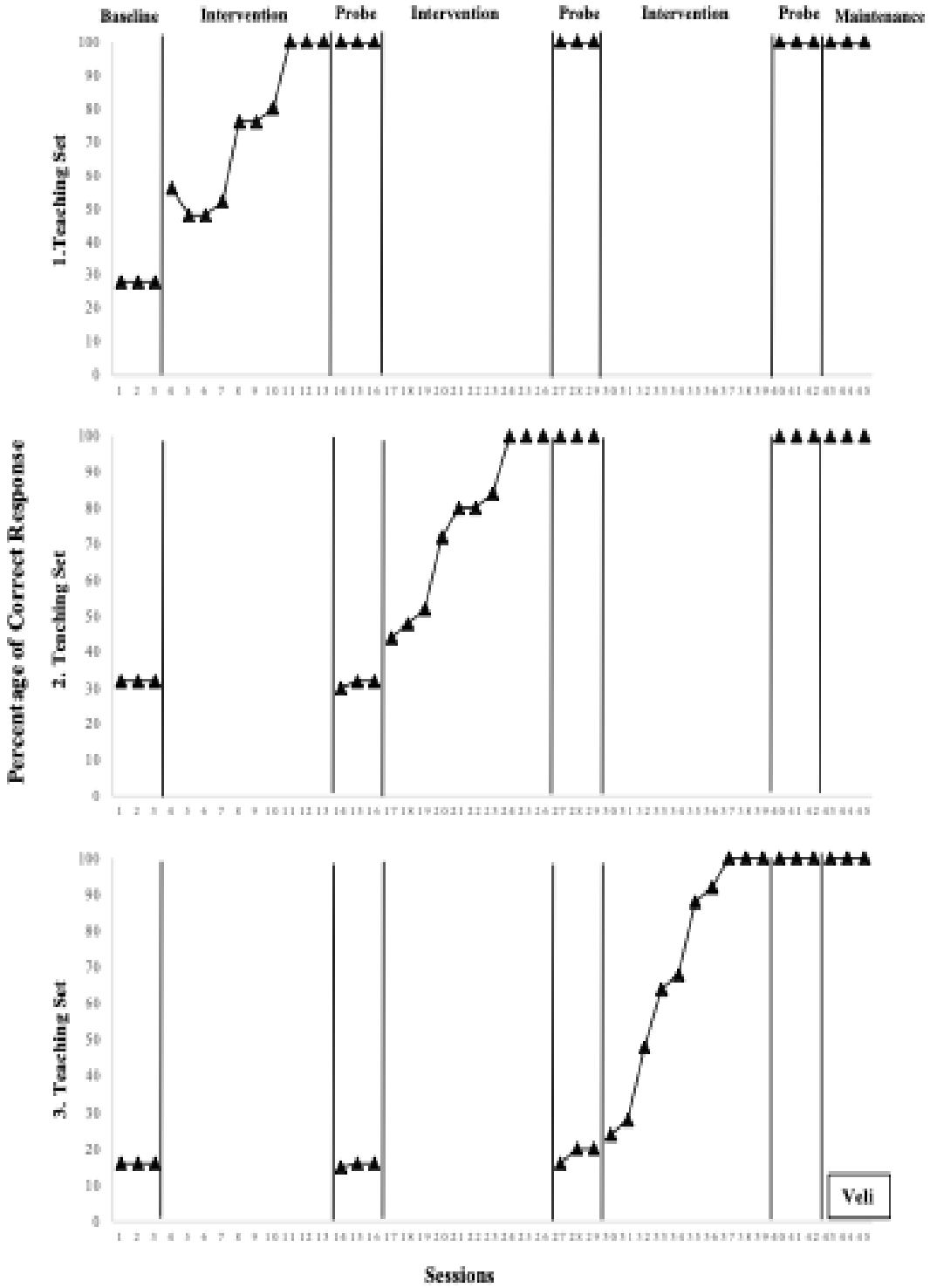

Figure 2. Percentages of Veli saying the basic features of animals correctly in probe, intervention and maintanence sessions in three teaching sets.

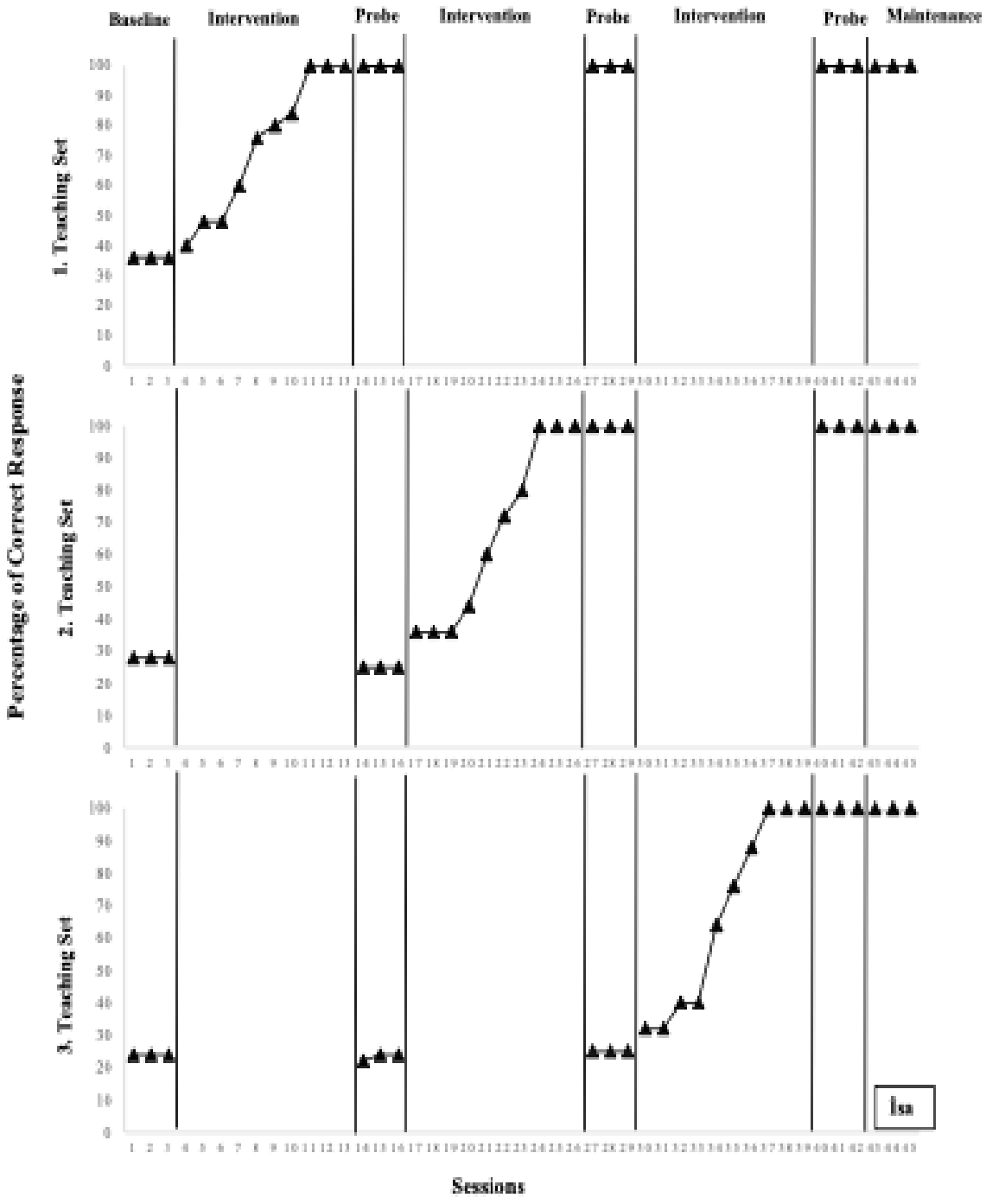

Figure 3. Percentages of İsa saying the basic features of animals correctly in probe, intervention and maintanence sessions in three teaching sets.

Findings of Participants Regarding Maintanence and Generalization

Maintanence sessions were held one, three and four weeks after the end of the teaching sessions, which were carried out with the concept map using augmented reality and the direct teaching method in each teaching set. It was observed that in all of the maintanence sessions held after Ali, Veli and İsa completed each teaching session, all three participants maintaned to tell the basic features of the animals they had learned in the teaching sessions 100% correctly. Therefore, the results obtained revealed that the behavior of maintaning the basic features of animals taught with the concept map using augmented reality and the direct teaching method was maintaned one, three and four weeks after the end of the teaching. In addition, it was observed that Ali and İsa could generalize the behavior of maintaning the basic features of animals to other people at the level of 20% in the pre-teaching

pre-test and at the level of 100% in the post-teaching test. On the other hand, it was found out that Veli could generalize the behavior of maintaning the basic features of animals to other people at the level of 28% in the pre-teaching pre-test and at the level of 100% in the post-teaching test.

Social Validity

The social validity data of the study were collected from the teachers of the students participating in the research. The data obtained through teacher interview forms were used for social validity, and there are a total of seven questions in the questionnaire, six of which are closed-ended and one open-ended. In the first six closed-ended questions in the questionnaire, the teachers were asked to indicate their views on the study by marking one of the categories as "Yes, I think so", "No, I don't think so" and "I am not certain". In an open-ended question in the questionnaire, the opinions of the teachers about "the positive or negative aspects of the study" were sought at the end of the study. During the interviews regarding the open-ended question, the teachers' opinions were noted by the researcher.

When the teachers' answers to the closed-ended questions in the questionnaire are examined, it is seen that the teachers found "having the students learn the target behaviors that are offered in the study is important and including their students in the study is positive". Moreover, the teachers explained that "When the students were asked the basic features of the animals studied in the intervention, they could maintain the information in their classroom, which contributed positively to their daily life". In addition, teachers stated that "they find the concept map offered in the intervention using augmented reality, which is used to have the students learn the pre-determined target behaviors, effective and they plan to use it in their classrooms in the future". Considering the the teachers' answers to the closed-ended questions in the interview, they made positive comments by stating that "with the study, the students gained experience of studying with a different teacher in a different setting and their participation in the lessons increased at the end of the study".

DISCUSSION

Considering the findings obtained in this research, it was determined that the three participants included in the research learned the features of animals at the end of the teaching sessions conducted with concept maps using augmented reality. In other words, concept mapping using augmented reality was found to be effective in teaching the features of animals to students with mild ID. In addition, it was observed that the students maintained the basic features of the animals they had learned correctly after the end of the intervention. Moreover, in the data obtained from the interview used to determine the opinions of the teachers for the social validity of the study, they stated that the target behavior chosen for their students is very important, that the students who learned the basic features of animals maintained them in the classroom when asked, and they found the intervention very useful.

As seen above in the findings related to effectiveness and maintainence and social validity, interventions using technological devices such as augmented reality, virtual reality, etc. are revealed to be effective in teaching academic skills such as the features of animals students with ID. When the findings obtained in the current study are considered as a whole, it is seen that the results are in parallel with the results obtained in similar studies carried out in the literature. However, when the studies in the literature are examined, while the ability to use navigation to find direction using augmented reality (Smith, Cihak, Kim, McMahon, & Wright, 2017), science subjects (McMahon, Smith, Cihak, Wright & Gibbons, 2015), tooth brushing (Jeon, Oh, & Son) , 2021) and daily life skills (Bridges, Robinson, Stewart, Kwon, & Mutua, 2020) were aimed to teach, we tried to teach the basic features of animals in our study. Another aspect of this study that differs it from the studies in the literature is that it aims to determine the effectiveness of concept teaching using augmented reality during the intervention.

Considering the relevant literature, it is seen that the augmented reality interventions conducted with individuals with ID is effective not only in the teaching of academic skills, but also in the teaching of skills such as daily life, self-care (eg tooth brushing) and finding direction. For example, in the study conducted by Smith, Cihak, Kim, McMahon, & Wright (2017), it was aimed to teach high school graduate students with ID the skill of using an augmented reality application and navigation on iPhone to go to the determined places on the university campus on foot. The results show that students with ID use their navigation skills to go where they want to go on foot. In addition, social validity data were collected with a 5-point Likert-type questionnaire with eight questions. In the finding regarding social validity, the students stated that they liked to use the mobile phone application to find directions, that the application helped them improve their direction skills, that they would recommend the application to their friends, and that they preferred the application to a traditional map. In brief, augmented reality (AR) seems to be effective in teaching direction skills to increase the functional capabilities of individuals with ID. In addition, technological devices and applications that can be installed on devices (for example, Apple iPhone and Heads Up Navigator applications) can provide continuous support to students at any time in any setting. These findings can be interpreted as virtual reality intervention is effective in providing the clues needed by students with ID. Thus, the advantage of using such applications as augmented reality is that students with ID can access these applications wherever and whenever they need, without needing for another person (Smith, Cihak, Kim, McMahon, & Wright, 2017).

In the study conducted by Bridges, Robinson, Stewart, Kwon, & Mutua (2020), a cross-behavioral multiple baseline design was used to examine the effectiveness of augmented reality intervention to teach daily life skills to three high school graduate students with ID. At the end of the research, it was determined that with the augmented reality intervention, students with ID learned the skills of making their beds, ironing and setting the alarm clock, and they performed these skills independently. In addition, in the social validity study, the participants stated that they had difficulty in holding the iPad for a long time to watch the video, but they found the augmented reality intervention very useful. In the study conducted by Jeon, Oh, & Son (2021), using augmented reality, individuals with ID living in Korea were taught tooth brushing and oral hygiene/care. The results obtained in the study revealed that tooth brushing training based on AR using a smart toothbrush and oral hygiene/care using augmented reality is more effective than training using visual materials. Therefore, it is suggested that augmented reality-based education using a smart toothbrush can be implemented with people with ID living in residential care facilities.

In the study conducted by Kim, & Lee (2016), the opinions of both students with ID and the teachers of these students were taken about whether science subjects can be taught using augmented reality. In the study, feasibility evaluation was carried out with 23 special school teachers and 18 students with ID. As a result, both special school teachers and students with ID expressed a positive opinion stating that science subjects can be learned with augmented reality. In a study on science conducted by McMahon, Smith, Cihak, Wright & Gibbons, (2015) using augmented reality, it was aimed to teach some scientific vocabulary to university students with ID and autism spectrum disorder (ASD). The results obtained at the end of the research show that both students with ID and students with ASD learn scientific vocabulary. In addition, in the findings regarding social validity, it was seen that the students liked the augmented reality intervention and found it quite useful.

Direct teaching method and concept maps are widely used among the teaching interventions from easy to difficult for students with ID (Yıkmış & Özçakır, 2019). Considering the studies carried out in the literature, it is seen that studies using concept teaching technique and direct teaching method together (Oktav, 2021; Varol, 2018) as well as a study on the effectiveness of computer-assisted concept teaching technique offered with direct teaching method (Tufan, 2018) can be found, however; unlike the studies in the literature, it can be seen that the effectiveness of the concept teaching technique using augmented reality was examined. It was revealed that when the concept teaching technique is used both in the current research and in the studies conducted in the literature, effective results are obtained on the learning of students with ID.

In another study conducted by Oktav (2021), the effectiveness of the concept map using the direct instruction method in teaching vehicles to children with ID was examined. The obtained results revealed that the concept teaching technique using direct instruction was effective in teaching vehicles to children with ID, 7, 14 and 21 days after the end of the instruction, the children maintained what they learned and were able to generalize what they learned in different settings and to other people. In addition, teachers expressed positive opinions about the concept map technique. In the study conducted by Tufan (2018), the effectiveness of the computer-assisted concept teaching technique with the direct instruction method was examined. In the study, in which the interbehavioral multiple probe design, which is one of the single-subject research models, was used, the computer-assisted concept teaching technique using the direct instruction method was found to be effective in teaching cube, cylinder and cone shapes to students with mild ID, and the students maintained in the 3rd, 4th and 5th weeks after the instruction. In addition, it was determined that they could generalize the objects they learned.

As in studies conducted with a single-subject research design in the literature, this study was conducted with a total of three participants with ID to determine the effectiveness of the intervention. Therefore, the small sample size is the limitation of the study, and it is recommended to conduct new studies with more participants and participants with different disabilities to increase the generalizability of the results obtained in the study. By using augmented reality, students with ID can be also teached to different subjects. Additionally, research can be conducted comparing the effectiveness of augmented reality and virtual reality applications in teaching academic skills to students with ID.

REFERENCES

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review,* 20, 1–11. doi:10. 1016/j.edurev.2016.11.002.

Artar, T. M., & Cavkaytar, A. (2020). Hafif düzeyde zihin yetersizliğine tarihsel bir bakış: klinik yaklaşımdan çok boyutlu yaklaşıma geçiş. *Anadolu Journal of Educational Sciences International,* 10(1), 629-653. doi.org/10.18039/ajesi.682119

Avcıoğlu, H. (2013). Zihinsel yetersizliği olan öğrencilere selam verme becerisinin öğretiminde videoyla model olmanın etkililiği. *Kuram ve Uygulamada Eğitim Bilimleri*, *13*(1), 455-477.

Ayres, K. & Gast, L. D. (2010). Dependet measures and measurement procedures. In David L. Gast (Ed.), *Single subject research methodology in behavioral sciences (*pp. 129- 165). Routledge.

Bridges, S. A., Robinson, O. P., Stewart, E. W., Kwon, D., & Mutua, K. (2020). Augmented reality: Teaching daily living skills to adults with intellectual disabilities. *Journal of Special Education Technology,* 35(1), 3-14. doi.org/10.1177/0162643419836411

Cakir, R., & Korkmaz, O. (2019). The effectiveness of augmented reality environments on individuals with special education needs. *Education and Information Technologies*, *24*(2), 1631-1659.

Carr, J. E., Austin, J. L. Britton, L. N. Kellum, K. K. ve Bailey, J. S. (1999). An assessment of social validity trends in applied behavior analysis. *Behavioral Interventions,* 14(4),223-231. doi.org/10.1002/(SICI)1099-078X(199910/12)14:4<223::AID-BIN37>3.0.CO;2-Y

Colpani, R., & Homem, M. R. P. (2015, July). *An innovative augmented reality educational framework with gamification to assist the learning process of children with intellectual disabilities. In 2015* 6th International Conference on Information, Intelligence, Systems and Applications (IISA), 1-6.

Çattık, E. O., & Ergenekon, Y. (2018). Zihinsel yetersizliği olan bireylere toplum kaynaklarını kullanma becerilerinin öğretiminde işitsel teknoloji desteğiyle sunulan videoyla model olmanın etkililiği. *Eğitim ve Bilim,* 43(193). dx.doi.org/10.15390/EB.2018.7182

Elmaci, E., & Karaaslan, Ö. (2021). Kaynaştırma uygulamalarından yararlanan otizm spektrum bozukluğu olan 7. sınıf öğrencilerine fen bilgisi deneylerinin öğretiminde video destekli resimli etkinlik çizelgesinin etkililiği. *Eğitim ve Bilim*, *46*(207), 203-230.

Eripek, S. (2009). *Zihinsel yetersizliği olan çocuklar.* Maya Akademi

Ertekin, T., Ece, A. S., & Yıkmış, A. (2017). Zihinsel yetersizliği olan çocuklara günlük yaşam becerilerinin öğretiminde video ile model olma ve şarkıyla video model olmanın etkililik ve verimliliklerinin karşılaştırılması. *Kalem Uluslararası Eğitim ve İnsan Bilimleri Dergisi*, *7*(1/12), 99-117.

Halisküçük, E. S., & Çifci Tekinarslan, İ. (2007). Zihinsel yetersizliği olan öğrencilere makarna pişirme becerisinin öğretiminde videoyla model olmanın etkililiği. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *7*(2), 113-127.

Işık, D., & Karataş, S. (2019). Özel öğrenme güçlüğü olan öğrencilerin eğitiminde artırılmış gerçeklik teknolojisiyle zenginleştirilmiş içeriklerin kullanım. *5th International Social and Education Sciences Studies Congress, 11 - 14 Temmuz 2019, Balıkesir, Türkiye.*

Jeon, B., Oh, J., & Son, S. (2021). *Effects of Tooth Brushing Training, Based on Augmented Reality Using a Smart Toothbrush, on Oral Hygiene Care among People with Intellectual Disability in Korea. In Healthcare*, 9(3), 348. 1-11. doi.org/10.3390/healthcare9030348

Kellems, R. O., Cacciatore, G., & Osborne, K. (2019). Using an augmented reality–based teaching strategy to teach mathematics to secondary students with disabilities. *Career Development and Transition for Exceptional Individuals,* 42(4), 253-258. doi.org/10.1177/2165143418822800

Kim, J. S., & Lee, T. S. (2016). Designing and exploring the possibility science contents based on augmented reality for students with intellectual disability. *The Journal of the Korea Contents Association,* 16(1), 720-733. doi.org/10.5392/JKCA.2016.16.01.720

Kot, M., Sönmez, S., & Yıkmış, A. (2017), Zihinsel yetersizliği olan öğrencilere toplama işlemi öğretiminde doğrudan öğretim yöntemiyle sunulan nokta belirleme tekniği ile sayı doğrusu stratejisinin karşılaştırılması, *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi,* 18(2). 253-269. doi.org/10.21565/ozelegitimdergisi.323011

McMahon, D. D., Smith, C. C., Cihak, D. F., Wright, R., & Gibbons, M. M. (2015). Effects of digital navigation aids on adults with intellectual disabilities: Comparison of paper map, Google maps, and augmented reality. *Journal of Special Education Technology,* 30(3), 157-165. doi.org/10.1177/0162643415618927

Oktav, B. (2021). Zihin yetersizliği olan öğrencilere ulaşım türlerine göre taşıtların öğretiminde kavram haritalarının etkililiği. Yayınlanmamış *Yüksek lisans tezi*. Bolu Abant İzzet Baysal Üniversitesi Lisansüstü Eğitim Enstitüsü.

Smith, C. C., Cihak, D. F., Kim, B., McMahon, D. D., & Wright, R. (2017). Examining augmented reality to improve navigation skills in postsecondary students with intellectual disability. *Journal of Special Education Technology,* 32(1), 3-11. doi.org/10.1177/0162643416681159

Standen, P. J., & Brown, D. J. (2005). Virtual reality in the rehabilitation of people with intellectual disabilities. *Cyberpsychology & behavior,* 8(3), 272-282. doi.org/10.1089/cpb.2005.8.272

Tekin-İftar, E. (2012). Çoklu başlama düzeyi modelleri. İçinde Elif Tekin-İftar (Ed.), *Eğitim ve davranış bilimlerinde tek-denekli araştırmalar* (ss.181-215). Türk Psikologlar Derneği Yayınları

Tufan, M. (2018). *Doğrudan öğretim modeli ile geliştirilmiş bilgisayar destekli öğretiminin zihinsel engelli öğrencilerin kavramları edinmelerine etkisi* [Yayınlanmamış doktora tezi]. Ortadoğu Teknik Üniversitesi.

Turan, Z., & Atila, G. (2021). Augmented reality technology in science education for students with specific learning difficulties: its effect on students' learning and views. *Research in Science & Technological Education,* 39(4), 506-524. doi.org/10.1080/02635143.2021.1901682

Vuran, S. ve Sönmez, M. (2008). Sosyal geçerlik kavramı ve Türkiye'de özel eğitim alanında yürütülen lisansüstü tezlerde sosyal geçerliğin değerlendirilmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi,* 9(1), 55-65. doi.org/10.1501/Ozlegt_0000000114

Yıkmış, A., & Özçakır, M. V. (2019). Zihin yetersizliği olan çocuklara hayvanların temel özelliklerinin kazandırılmasında doğrudan öğretim yöntemiyle sunulan kavram haritasının etkililiği. *Bingöl Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* 9(17), 71-90. doi.org/10.29029/busbed.523309

Yıldız, G. (2014). *Çok özel bir durum: Zihinsel engellilik.* İçinde *Aile eğitim rehberi: zihinsel engelli çocuklar* (ss. 17-29). Aile ve sosyal politikalar bakanlığı engelli ve yaşlı hizmetleri genel müdürlüğü, Grafer Tasarım Baskı Ambalaj