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THE EFFECTIVENESS OF COMPUTER-BASED INSTRUCTION IN TEACHING COMMUNITY SIGNS TO STUDENTS WITH INTELLECTUAL DISABILITY

ABSTRACT

CBI is effective in teaching various skills to students with intellectual disability. So, this study examined whether the effectiveness of computer-based instruction-which includes peer tutoring-in teaching community signs to students with intellectual disability. It was also assessed whether acquired skills could be maintained in the three, six, and nine weeks following instruction and generalized to signs in real environments. Four students with intellectual disability, from eight to thirteen years of age, participated in this study. The effectiveness of computer-based instruction was determined using a multiple probe design across behavior and replicated with four students. The results indicated that CBI was effective in teaching community signs to students with intellectual disability. Additionally, students could maintain and generalize their behavior.

Keywords: Intellectual Disability, Computer-Based Instruction, Multiple Probe Design across Behavior, Peer Tutoring, Community Signs

ZİHİN YETERSİZLİĞİ OLAN ÖĞRENCİLERE TOPLUMSAL İŞARETLERİN ÖĞRETİMİNDE BİLGİSAYAR DESTEKLİ ÖĞRETİMİN ETKİLİLİĞİ

ÖZET

Bilgisayar destekli öğretim zihin yetersizliği olan çocuklara çeşitli becerilerin öğretiminde etkilidir. Bu nedenle, akran tercihi yoluyla zihin yetersizliği olan bir akran belirlenmiş ve toplumsal işaretlerin bu akran tarafından öğretiminin yapıldığı, öğretim amaçlı bilgisayar destekli bir öğretim uygulaması geliştirilmiştir. Bilgisayar destekli öğretimin etkili olup olmadığı, öğretimi yapılan becerinin öğretim sona erdikten üç, altı ve dokuz hafta sonra korunup korunmadığı ve gerçek ortamlardaki işaretlere genellenip genellenmediği değerlendirilmiştir. Çalışmaya 8-13 yaşları arasında zihin yetersizliği olan dört öğrenci denek olarak katılmıştır. Araştırmada bilgisayar destekli akran öğretiminin etkililiğini belirlemek üzere davranışlar arası çoklu yoklama modeli kullanılmış ve dört denekle yinelenmiştir. Sonuçlar, Bilgisayar destekli öğretimin zihin yetersizliği olan öğrencilere toplumsal işaretlerin öğretiminde etkili olduğunu göstermektedir. Dahası öğrenciler davranışları korumuş ve genelleyebilmişlerdir.

Anahtar Kelimeler: Zihin Yetersizliği, Bilgisayar Destekli Öğretim, Davranışlar Arası Çoklu Yoklama Modeli, Akran Öğretimi, Toplumsal İşaretler

1. INTRODUCTION (GİRİŞ)

Efforts to make education and training more effective, efficient, extensive, and individualized have resulted in the development of a leading innovation-computer-based instruction (CBI). CBI refers to a type of training in which text, pictures, photographs, graphics, sounds, music, films, and animation are used to present information, contribute to developing a skill, put simulation into practice, and obtain data on problem solving. CBI is carried out together with computer programs, allowing for the active involvement of students in this process (Hutcherson, Langone, Ayres, and Clees, 2004; Mechling, 2005; Mechling, Gast, and Langone, 2002; Odabaşı, 1998).

The common categories of CBI (Dowd and Bower, 2010; Odabaşı, 1998) are (a) tutorials, (b) drill and practices, (c) simulations, (d) instructional games, (e) references, and (f) utilities. Tutorials involve presenting new information to students in accordance with the content expected to be studied in a class, performing an assessment of the information presented, and providing feedback to students about the assessment results. Drill and practices comprise providing students with practice exercises on a subject learned before and the assessment of responses that the student has given to these practices. Simulations involve real-life simulations of persons, environments, cases, and phenomena experienced in everyday life and the students' achievement of these skills or behavior using a computer. Instructional games refer to educational computer programs used for teaching certain content or the repetition of this content by means of practice exercises. References imply making use of computers equipped with image richness, motion, and audio properties, using recent software and multimedia, similar to an encyclopedia or library. Utilities involve programs that have been created mainly for the purpose of developing solutions to problems or for the general use of these utilities by people (Dowd & Bower, 2010; Odabaşı, 1998).

CBI has numerous benefits. It; (a) increases motivation for instruction, (b) ensures active participation in instruction, (c) provides different stimuli (visual, auditory, and tactile) during instruction, (d) considers the rate of individual learning, (e) ensures individual learning, (f) enhances the learner's feeling of self-confidence, (g) meets the requirements of students with differing characteristics, (h) extends the time period for engaging in the activity, and (h) decreases problem behavior (Jerome and Barbetta, 2005; Lee and Vail, 2005; Okolo, Bahr, and Rieth, 1993; Ricci, 1994). CBI is also the frequently preferred medium for instructors because it provides effective intervention and reduces the time spent on preparation for education (Lee and Vail, 2005).

Much research is available on the effects of CBI in enhancing various skills of students with intellectual disability. For instance, CBI is used in teaching; to facilitate generalization of match-to-sample skills to a natural setting (Langone, Shade, Cless, and Day, 1999); to purchase (Ayres and Langone, 2002; Hansen and Morgan, 2008); to read grocery aisle signs and locate grocery items in actual grocery stores in response to a photograph shopping list and a typed word shopping list (Mechling et al.,2002); to make purchases using a debit card and an automated payment machine (Mechling, Gast, and Barthold, 2003); to locate grocery items by reading words on aisle signs, which are associated with the target item word (Mechling and Gast, 2003); to increase the fluency of reading aisle signs and locating items in grocery stores (Mechling, 2004); to increase the percentage of correct verbal responses made by students following questions by cashiers in fast food restaurants (Mechling, Pridgen, and Cronin, 2005); to place

orders in fast-food restaurants by using an augmentative, alternative communication device (Mechling and Cronin, 2006); to perform complex, multiple step job tasks in generalized settings (Mechling and Ortega-Hurndon, 2007); to acquire and maintain basic academic skills (Everhart, Alber Morgan, and Park, 2011); and to have knowledge on which emergency service to call in a specific situation and what the number of this emergency service is (Yucesoy Ozkan, Oncul, ve Kaya, 2013).

Much research has analyzed the aforementioned uses of CBI. They highlight the use of the following methods-all of which are directly related to skill-in computer programs: tutorials, drill and practices; text and photographs (e.g. Langone et al., 1999); games (e.g. Everhart et al., 2011); and simulations (e.g. Mechling et al., 2003). In the present research, the method of tutorials was used; however, the computer programming was conducted differently compared to previous studies: it included peer tutoring. Peer tutoring is known to be an effective method for teaching various skills to students with intellectual disability (Prater, Serna and Nakamura, 1999; Stenhoff and Lignugaris/Kraft, 2007; Tekin Iftar, 2003). The literature states that peers of different ages and with differing characteristics can function as peer tutors (Tekin Iftar, 2003); further, students with intellectual disability may also provide instruction to their peers of the same age or below (Marchand-Martella et al., 1992; Tekin Iftar, 2003). Therefore, the effectiveness of peer tutoring which includes peer with intellectual disability should be analyzed. Computer-based instruction includes this form of peer instruction, and the model is similar to the student in terms of characteristics such as age, sex, and level of functioning (Bandura, Ross and Ross, 1961). The model also represents peers whose social acceptance levels are high and who are preferred by the students (Marcus and Wilder, 2009).

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

This research, a peer with intellectual disability was identified by means of peer ratings, and a computer program in which community signs teaching was carried out by this peer was developed. Then it was examined whether CBI-which includes peer tutoring-is effective in teaching community signs to students with intellectual disability. It was also assessed whether the acquired skill could be maintained in the three, six, and nine weeks following instruction and generalized to signs in real environments.

The present study is thought to contribute to the related field of research since it focuses on teaching community signs and daily life skills to students with intellectual disability via computer-based instruction. Teaching daily-life skills to students with intellectual disability is important for their full participation in life. Therefore, students' learning community signs could be thought to contribute to their independent living and to the quality of their lives. In addition, based on the findings obtained in the study, computer-based instructional activities could be developed? to teach different skills. For this reason, the results of the study are thought to provide a basis for future research to put into practice the suggestions put forward in the present study.

3. METHOD (YÖNTEM)

3.1. Participants (Katılımcılar)

Four students with intellectual disability, 8-13 years of age, participated in this study. All the students attended a special education classroom in a public elementary school in Eskisehir in Turkey. The characteristics of all the participants are listed in

Table 1. The students participating in this study were expected to have the following prerequisite behavior. They had to (a) participate in the activity for a minimum of 5 minutes, (b) imitate verbal behavior, (c) be able to use a computer mouse, and (d) regularly attend school. All the students fulfilled the prerequisite behaviors and had experience with CBI.

Sema (8 years and 11 months) is a female student with intellectual disability. Sema displays age-appropriate behavior in terms of receptive language and gross motor skills. Because of her articulation disorder, the special education assessment committee proposed educational support for language and speech disorders. She requires support with expressive language, fine motor, daily life, and cognitive skills. She can count from 1 to 20, write by retracing numbers between 1 and 10, and independently write capital and small letters from 'A' to 'O' without looking.

Naz (9 years and 3 months) is a female student with mild intellectual disability. She displays a development appropriate for her age in receptive language, expressive language, gross motor, and fine motor skills. She requires support in social, daily life, and cognitive skills. She can count to 100, one by one, in twos, fives, and tens, and she can count down from 100, one number at a time. She can add 1 under other two-digit numbers, which requires carrying over, and subtracting a two-digit number from another two-digit number, which does not require borrowing. She is able to copy a sentence in writing by looking at it, and she can read on her own.

Faruk (13 years and 3 months) is a male student with intellectual disability. He displays a development appropriate for his age in receptive language, expressive language, gross motor, and fine motor skills. He requires support in social, daily life, and cognitive skills. He can count up to 100, one by one, in twos, fives, and tens; he can also count down from 20, one number at a time, and can do simple addition without carrying over by using two-digit numbers. He can independently read three-digit numbers and write down sentences that are verbally spoken to him; he can also form new sentences on his own and recite his home and school addresses.

Feray (13 years and 6 months) is a female student with intellectual disability. Her gross motor and fine motor skills are appropriate for her age. She needs support in receptive language, expressive language, daily life, social, and cognitive skills. She can count up to 100, one by one, in twos, fives, and tens, and she can count down from 50, one number at a time. She can add two three-digit numbers that require carrying over and can subtract a two-digit number that requires borrowing from another two-digit number. She can indicate place values of two- and three-digit numbers and count by twos in the multiplication table. She is able to write down, from memory, sentences that are verbally spoken to her or sentences from a paragraph she has listened to.

A peer tutor also participated in the computer-based study. This peer was the participants' classmate. A peer rating was used to select the peer tutor and determine this peer's social acceptance level within the classroom. Peer rating is a sociometric technique that aims to determine social acceptance level of students; this technique helps to gauge which peers in the classroom the student or participant is happy to work with during an activity. This technique works on a point system: depending on their preferences, students in the classroom receive plus points for positive preferences and minus points for negative preferences. Thus, the technique helps identify the most preferred and least preferred students (Çolak, 2009; Zirpoli and Melloy, 1997). With regard to the peer rating carried out in this

research, two different questions were directed to each of the students in the class: "Can you write the name of the classmate with whom you are happy to sit?" and "Can you write the name of the classmate with whom you are happy to study?" The students provided written answers to these questions. Belma was the most preferred peer and was therefore selected as the peer tutor.

Table 1. Participant characteristics
(Tablo 1. Katılımcı özellikleri)

Peer Tutee					
Student	Sex	Age	Class	Score	Test
Sema	Female	8y, 11m	Grade 2	- 43	Stanford Binet Intelligence Test (Assessment incomplete) Leiter International Performance Test
Nehir	Female	9y, 3m	Grade 3	-	NA
Faruk	Male	13y, 3m	Grade 6	51 26 57	Stanford Binet Intelligence Test Peabody Picture Vocabulary Test Leiter International Performance Test
Feray	Female	13y, 6m	Grade 7	51	Stanford Binet Intelligence Test
Peer Tutor					
Student	Sex	Age	Class	Score	Test
Belma	Female	13y, 1m	Grade 6	36 55	Peabody Picture Vocabulary Test Leiter International Performance Test

Belma (13 years and 1 month) is a female student with intellectual disability. Belma displays age-appropriateness in terms of gross motor, fine motor, and receptive language skills. She requires support in expressive language, daily life, and social and cognitive skills. She can count up to 100, one by one, in twos, fives, and tens and can count down from 20, one number at a time. She can add two single-digit numbers side-by-side, add two-digit numbers that do not require carrying over to a single-digit number, and a two-digit number to another two-digit number by writing one under the other. She can write letters orally spoken to her without looking, and she can form sentences on her own.

To realize the goals of this study, the school assistant manager and the special education teacher were interviewed. During this meeting, they were informed about the nature of the study and elicited some information about the students from them. Based on this information, it was applied to the Provincial Directorate of National Education to obtain legal permission to carry out the study. Upon receiving permission, the families of the students were contacted and informed about the study, and sought their approval. All sessions were conducted by the first author, who has experience in instructing students with intellectual disability; this author holds a master's degree in special education. The inter-observer reliability and treatment integrity data were collected by the second author, who holds a doctorate in special education.

3.2. Setting (Ortam)

All sessions (screening, full probe, daily probe, training, and maintenance and generalization) were conducted in the guidance and counseling classroom located in the participants' school of attendance. The layout of the classroom was as follows: there was a bookcase and couch to the left side of door; on the right were a rectangular table and desktop computer; in the middle of the room were a large table and two chairs. Apart from the instructor and the student, a senior student, also from the department of special education, was present to record all the sessions using a video camera.

The first author conducted the sessions in the form of a one-to-one instructional arrangement, three days a week, from 13.00 to 14.45. For the training and generalization sessions, a laptop computer equipped with an auxiliary mouse was placed on the table in the middle of the classroom; the student and instructor sat on chairs, side-by-side, so they could both face the screen. For the screening, full probe, daily probe, and maintenance sessions, the student and instructor sat face-to-face so as to maintain eye contact across the table. All the sessions were recorded using a digital video camera.

3.3. Materials (Araç-Gereçler)

Photo cards were prepared, as follows, for use in the study. Photographs of community signs identified for teaching were downloaded from Google Images; color printouts of these photographs were taken and stuck on 15 cm × 15 cm paperboards. Following this, the photographs were covered with a transparent PVC material. These cards were used in the screening, full probe, daily probe, and maintenance sessions.

The authors created video records for use in the training sessions. Each student underwent three training sets (Table 2) pertaining to the community signs to be taught; therefore, there were three video recordings for each student, one for each training set. In the video records, only the head and chest of the peer tutor could be seen. The peer tutor raised the first photo card so that the photograph faced the camera, provided the target stimuli (What is the name of this sign?), and immediately after, gave the controlling prompt (Pedestrian crossing). Later, the peer tutor raised the second photo card, provided the target stimuli (What is the name of this sign?), and gave the controlling prompt (Roadwork) right after. This process continued until all the signs, the instruction of which was targeted, were presented three times. The second author created raw images of the training using Windows Movie Maker® Program, and obtained three video records for each student. The generalization sessions involved the use of video records pertaining to the places where the taught community signs are available in real environments. In this recording, the sign in the real environment appeared on the screen along with a voiceover of the target stimuli (What is the name of this sign?). Five seconds later, the second sign appeared. We also used data collection forms and computer games as reinforcers in the study.

Table 2. Students, Training Sets and Community Signs
(Table 2. Öğrenciler, Öğretim Setleri ve Toplumsal İşaretler)

Students	Training Sets		
	Set 1	Set 2	Set 3
Sema	Trolley Crossing School Crossing Hospital	Pedestrian Crossing Cycle Route Bus Stop	Overcrossing Roadwork Attention
Nehir	Trolley Crossing School Crossing Hospital	Pedestrian Crossing Cycle Route Bus Stop	Overcrossing Roadwork Attention
Faruk	Trolley Crossing Roadwork Bus Stop	First Aid No bikes Hospital	Historical Site Attention No Entry
Feray	Trolley Crossing Roadwork No Entry	Railway Crossing First Aid Emergency Trolley Stop	Overcrossing Historical Site Attention

3.4. Experimental Design (Araştırma Modeli)

The effectiveness of CBI was determined using multiple probe design across behavior (Horner and Baer, 1978; Tekin Iftar, 2012) and replicated with four students. The dependent variable was the students' vocalization of the names of the target community signs; the independent variable was CBI. Experimental control was established when the student respond at or near baseline levels during full probe conditions before the intervention had been implemented and the criterion was reached only after the intervention had been implemented (Tekin Iftar, 2012).

3.5. Procedure (Deney Süreci)

3.5.1. Screening Sessions (Öneleme Oturumları)

Students' target behavior was selected by the classroom teacher from the objectives put forth in the IEP. After consensus was reached on the target behavior, 21 community signs that children encounter frequently in their neighborhoods and schools were selected. To determine the students' familiarity with these signs, three successive screening sessions were conducted. In the screening sessions, the instructor and student sat face-to-face, and the instructor explained the rules. (Sema, I will now ask you the names of certain signs. If you know the answer, say it; if not, say that you do not know.) Later, the instructor called the student's attention to study by asking whether she was ready (Sema, are you ready for the study?); after receiving an affirmative response from the student, the instructor provided the target stimulus (What is the name of this sign?) and waited five seconds by counting silently (1001, 1002, 1003, 1004, 1005.) for the student to respond. If the student gave the correct response to the target stimulus, the instructor noted this with a plus sign and then provided the second target stimulus. If the student did not give any response or gave the incorrect response, the instructor noted this with a minus sign and proceeded to the next target stimulus. At the end of each session, the student's participation and cooperation behavior were reinforced. The screening sessions threw up nine unknown community signs for each student; we aimed to provide instruction for these.

3.5.2. Full Probe Sessions (Toplu Yoklama Oturumları)

Before starting instruction in each training set and after the criteria for each training set had been fulfilled, three successive full probe sessions were conducted in three training sets. With regard

to the full probe sessions, the students were asked to name every sign three times, and 27 trials were carried out. The full probe sessions were conducted as follows: The instructor and student sat face-to-face, and the instructor explained the rules. Thereafter, the instructor called the student to attention by asking him/her whether he/she was ready; upon receipt of affirmation, the instructor provided the target stimulus and waited five seconds for the student to respond, by counting silently. If the student gave the correct response to the target stimulus, the instructor noted this down using the plus sign and provided reinforcement to the student. After waiting for two seconds, the instructor provided the second target stimulus. If the student gave the incorrect response or did not respond, the instructor noted this response using a minus sign. Later, the instructor waited two seconds and proceeded to the new trial by providing the next target stimulus. This procedure was followed for all target stimuli. At the end of the session, the instructor thanked the student and reinforced his/her participation and cooperation.

3.5.3. Daily Probe Sessions (Günlük Yoklama Oturumları)

The daily probe sessions aimed to determine whether or not students had acquired knowledge of the community signs. Except for the first training session, the daily probe sessions were conducted before the training sessions, and data gathered in these sessions constituted the instruction data. Daily probe sessions were conducted in exactly the same way as the full probe sessions; however, the daily probe sessions were conducted only to gather data for the training set instructions.

3.5.4. Training Sessions (Öğretim Oturumları)

In the training sessions, the instructor and the student sat side-by-side so that they were both facing the computer. Then, the instructor asked the student if he/she was ready (Sema, are you ready for the study?). After receiving confirmation, the instructor asked the student to open the program (Click on the icon and open the program.). After this had been done, the instructor directed the student's attention to the target stimuli (Watch carefully!). If the student asked questions while watching the program or if he/she was distracted by something else, the instructor answered the questions and redirected the student's attention to the program. When the student had watched the program with attention, his/her behavior was verbally reinforced, and the session was completed upon closing the program. The training sessions continued in this manner until the student gave the correct responses in all three successive daily probe sessions.

3.5.5. Maintenance and Generalization Sessions (İzleme ve Genelleme Oturumları)

Maintenance sessions were conducted three, six, and nine weeks after completion of the training; the objective here was to determine the extent to which the students were able to maintain the behavior acquired immediately after training. Maintenance sessions were carried out in exactly the same way as the full probe sessions; however, students were reinforced only at the end of the session, instead of immediately after each correct response.

Generalization sessions were carried out in the pre-test post-test manner by the second author. Similar to the full probe sessions, the pre-test was performed before training, and the post-test was conducted after training completion; training was not provided in the generalization sessions. Video records of the community signs

available in real environments were included in the generalization sessions. In the video records, the sign appeared along with a voiceover target stimulus (What is the name of this sign?). If the student gave the correct response within five seconds, the response was recorded as a plus sign; if the student gave an incorrect response or did not respond, the response was recorded as a minus sign. Five seconds later, the second sign appeared on the screen.

3.6. Data Collection (Veri Toplama)

Effectiveness data were collected by the first author, by making use of discrete behavior record forms. In the screening, full probe, daily probe, and maintenance and generalization sessions, two types of student responses-correct and incorrect-were recorded. To collect data, the target stimulus was provided, and a response was awaited from the student. If the student responded correctly within five seconds, a plus sign (+) was put on the record form; if he/she responded incorrectly or did not respond, a minus sign (-) was noted.

3.7. Reliability (Güvenirlik)

Inter-observer reliability data and treatment integrity data were collected for this research. Reliability data were collected by the second author, upon the records that had been determined randomly at least in 30% of all sessions were viewed. Inter-observer reliability was calculated using the following formula: [agreement / (agreement + disagreement) × 100] (Kırcaali-Iftar and Tekin, 1997). Inter-observer reliability in all sessions was found to be 99% (range = 99–100) for Sema, 100% for Nehir, 98% (range = 96–100) for Faruk, and 97% (range = 95–100) for Feray.

Treatment integrity was calculated using the formula [(observed instructor behavior / planned instructor behavior) × 100] (Billingsley, White and Munson, 1980). Treatment integrity data for the full probe, daily probe, and maintenance and generalization sessions were collected in terms of the instructor's behavior of (a) securing the student's attention, (b) providing the target stimuli, (c) waiting for the response interval, (d) reinforcing the correct responses, (e) ignoring the incorrect responses, and (f) completing the session. Treatment integrity was 98% for the full probe, 97% for the daily probe, and 100% for the maintenance and generalization sessions for all students. Treatment integrity data for the training sessions were collected in terms of the instructor's behavior of (a) securing the student's attention, (b) providing the target stimuli, (c) instructing the student to view the record when required, (d) reinforcing participation, and (e) completing the session. Treatment integrity was 98% for the training sessions for all students.

4. FINDINGS (BULGULAR)

4.1. Training Data (Öğretim Verileri)

Figures 1, 2, 3, and 4 list the percentages of correct response for the full probe, daily probe, and maintenance sessions for Sema, Nehir, Faruk, and Feray respectively. Daily probe data were used to assess the transfer of stimulus control. As evident from the data in the figures, CBI is effective in teaching community signs to students with intellectual disability. In other words, all the participants achieved 100% accuracy in all three training sets. In the first full probe sessions, the students performed at the level of 0%; however, they fulfilled the criteria by displaying a 100% performance level in all training sets after CBI had been implemented; further, they were able to maintain this performance, as evidenced in the maintenance sessions.

Additionally, the size of functional relationship between the dependent and independent variables was scored using the percentage of data points exceeding the mean (PEM) (Ma, 2006). The PEM scores were as follows. Sema: 1.0, 0.9, and 0.8 for the first, second, and third training sets, respectively; Nehir, Faruk, and Feray: 1.0 for all three training sets, respectively. Therefore, the PEM scores also highlight the high level of effectiveness of CBI (Ma, 2006; Olive and Franco, 2007).

The full probe, daily probe, training, and generalization and maintenance sessions were carried out repeatedly until the criteria were fulfilled for all the students in all the training sets as follow. A total of 63 sessions were carried out for all the students and in all the training sets, and 567 trials. The students had to meet the criteria in each of the three training sets. Therefore, 22 sessions and 198 trials were performed for Sema; 11 sessions and 99 trials for Nehir; 14 sessions and 126 trials for Faruk; and 16 sessions and 144 trials for Feray. The total amount of time for all criteria to be met was 1 hour 17 minutes and 48 seconds: 25 minutes and 53 seconds for Sema; 13 minutes and 10 seconds for Nehir; 17 minutes and 28 seconds for Faruk; and 21 minutes and 17 seconds for Feray.

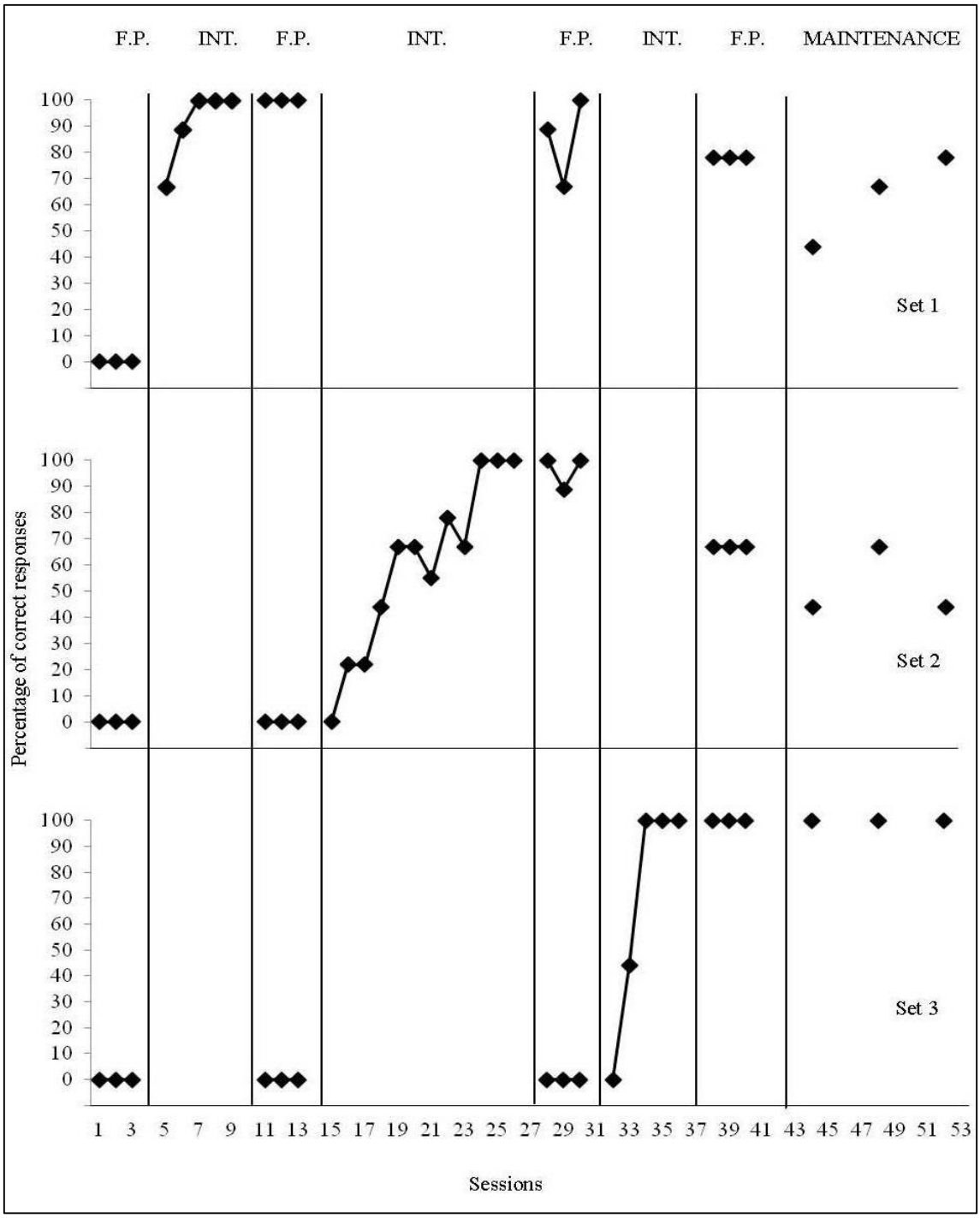


Figure 1. The percentage of correct responses during full probe, daily probe, and maintenance sessions for Sema
(Resim 1. Sema'nın toplu yoklama, günlük yoklama ve izleme oturumlarındaki doğru tepki yüzdeleri)

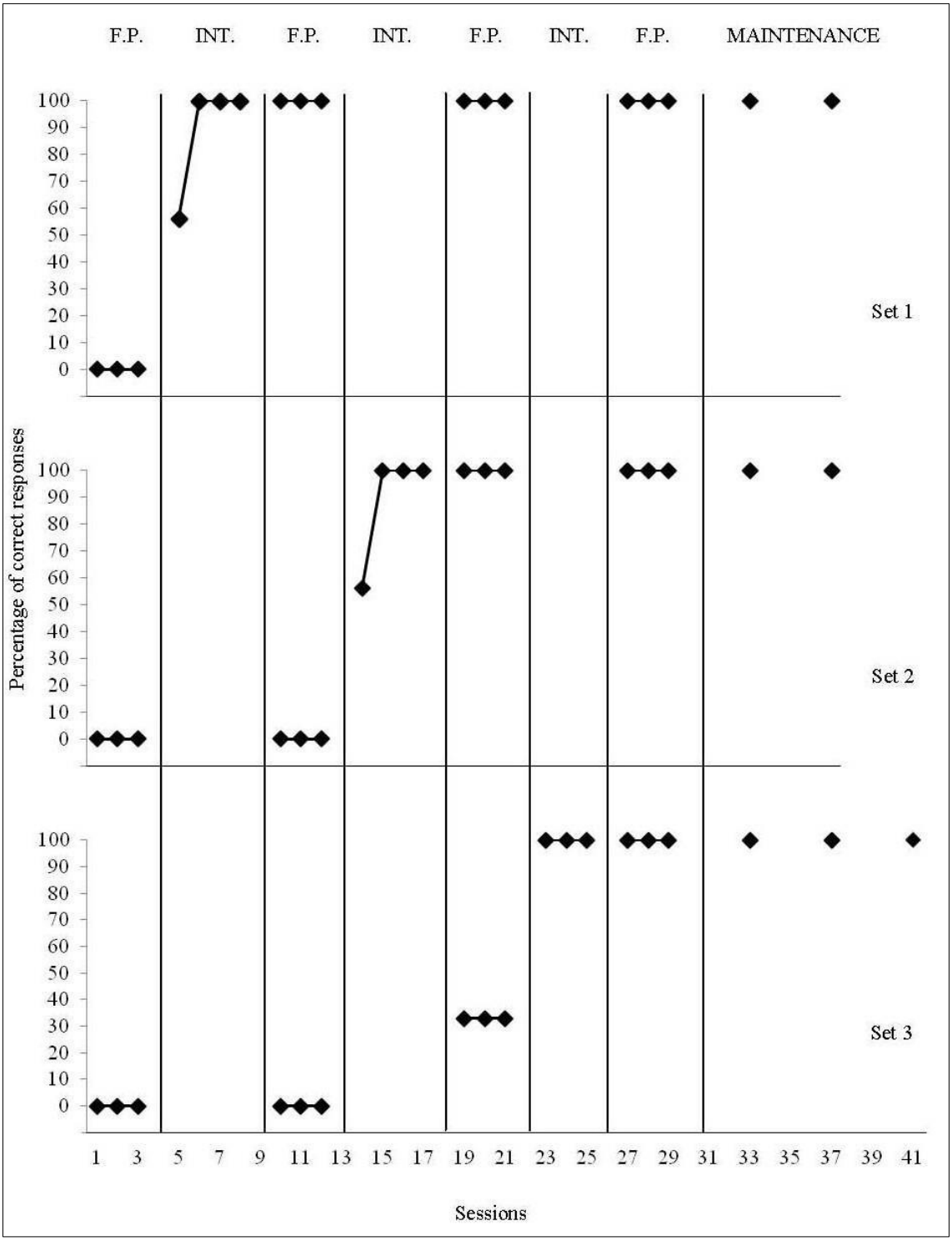
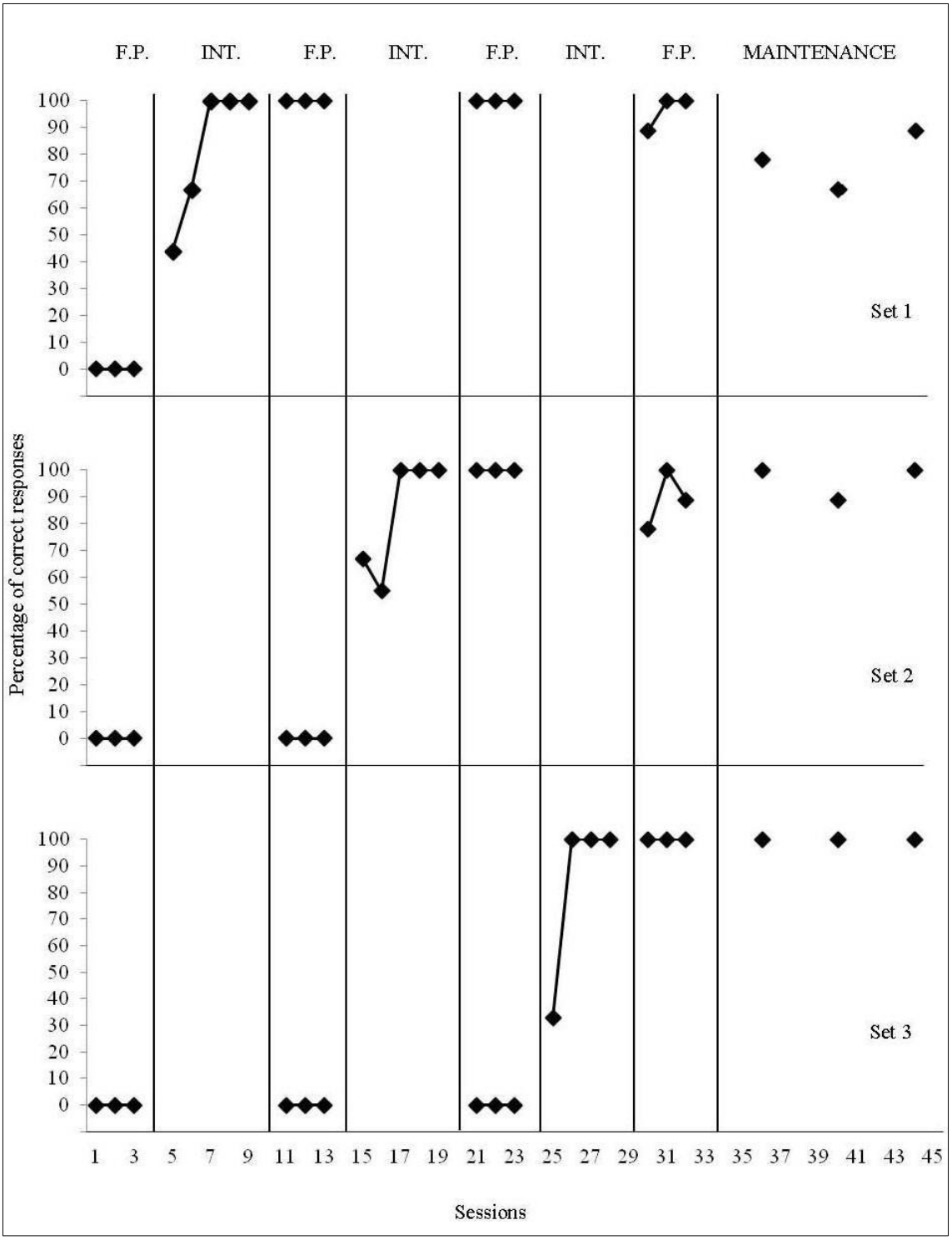


Figure 2. The percentage of correct responses during full probe, daily probe, and maintenance sessions for Nehir
(Resim 2. Nehir'in toplu yoklama, günlük yoklama ve izleme oturumlarındaki doğru tepki yüzdeleri)



(Figure 3. The percentage of correct responses during full probe, daily probe, and maintenance sessions for Faruk)
(Resim 3. Faruk'un toplu yoklama, günlük yoklama ve izleme oturumlarındaki doğru tepki yüzdeleri)

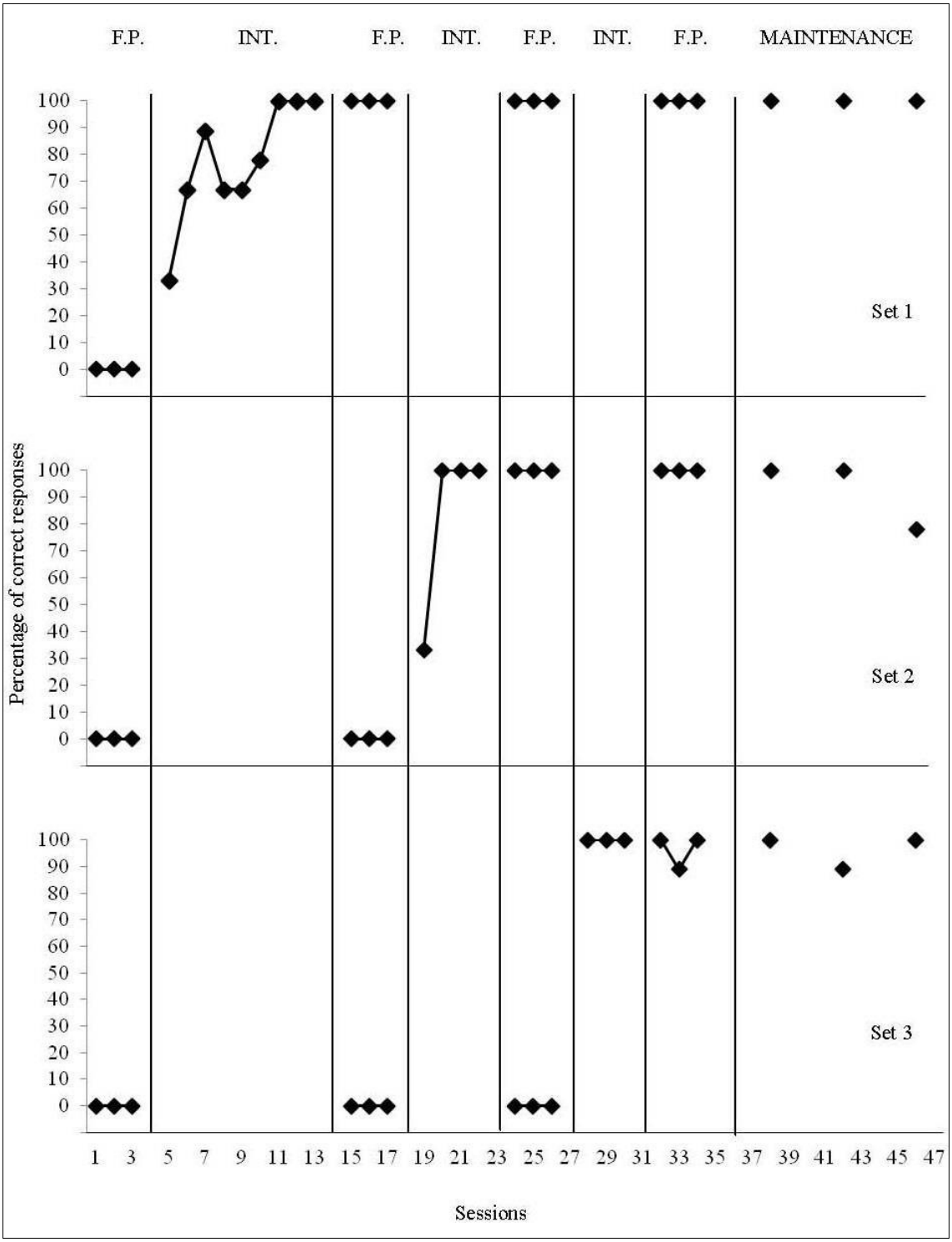


Figure 4. The percentage of correct responses during full probe, daily probe, and maintenance sessions for Feray
(Resim 4. Feray'ın toplu yoklama, günlük yoklama ve izleme oturumlarındaki doğru tepki yüzdeleri)

4.2. Maintenance and Generalization Data (İzleme ve Genelleme Verileri)

Maintenance sessions were held in the three, six, and nine weeks following training completion. We observed that the students were able to maintain knowledge of the signs taught to them during training even

after training was concluded. In the maintenance sessions, for the three training sets related to vocalizing community signs, Sema responded correctly at a level of 70%, Nehir at a level of 100%, Faruk at a level of 91%, and Feray at a level of 96%. In the generalization sessions, we collected data on whether the students were able to generalize the community signs learned to the signs available in real environments. In the generalization pre-test session, Sema, Nehir, and Feray responded at a level of 0%, and Faruk responded at a level of 7%. In the post-test, Nehir and Feray responded with 100% accuracy, Faruk responded with 93% accuracy, and Sema with 63% accuracy. Therefore, the research findings show that CBI was effective because the students were able to generalize the community signs learned to the signs available in real environments.

5. DISCUSSION AND IMPLICATIONS (TARTIŞMA VE SONUÇ)

The purpose of this study was to determine the effectiveness of CBI by teaching community signs to students with intellectual disability. It is also examined whether the students were able to maintain the skill for a period of three, six, and nine weeks after training and generalize to signs in real environments. It was arrived at the following conclusions and put forth the following contributions. First, the data highlighted the effectiveness of CBI in teaching community signs to students with intellectual disability. This finding is consistent with those of previous research that emphasized the effectiveness of CBI in teaching various behavior to students with intellectual disability (e.g. Ayres and Langone, 2002; Mechling et al., 2002; Mechling and Gast, 2003). Therefore, this research adds to the existing literature on the effectiveness of CBI.

Second, we found that the students were able to maintain their knowledge of the community signs learned during training for a period of three, six, and nine weeks after training completion. This finding is also consistent with the findings of previous research that revealed the effectiveness of CBI in teaching various behavior to students with intellectual disability (e.g. Mechling, 2004; Mechling et al., 2003). Third, the data showed that after training, the students were able to generalize, to a certain extent, the community signs they acquired to the signs available in real environments. The generalization range was 63%–100%. Therefore, it can be said that the generalization effect of CBI is positive. This finding is also consistent with the findings of previous research (Mechling and Cronin, 2006; Mechling et al., 2002).

Considering the findings of this and previous research, we can make certain inferences. First, teaching community signs to students with intellectual disability helps increase their quality of life (Wehmeyer, Agran and Hughes, 2003). In terms of the importance of the research objective, the social validity of the research is high (Yucesoy Ozkan, Oncul and Kaya, 2013). Based on the results, we recommend that practitioners teach certain skills to students with intellectual disability, thereby helping them to improve their quality of life. Second, this research differed from previous ones through the inclusion of peer tutoring. Including peer tutoring within the scope of CBI has made a significant contribution to the existing literature. In addition, it can be regarded that the participation of the peer enhanced the social validity of the research by virtue of the fact that this peer was identified on the basis of peer ratings, and the fact that her social acceptance was high amongst students.

Third, the 97%–100% reliability range achieved by this research has exceeded the reliability level thus far reported in the literature. The high reliability rates attained and the additional

views of the instructor allow us to say that CBI is an effective method that can be used easily in natural settings by the friends and families of students with intellectual disability (Lee and Vail, 2005; Yucesoy Ozkan, Oncul and Kaya, 2013).

Apart from its strengths, this research also has some limitations that should be considered. First, the training sessions were performed using a one-to-one training arrangement. This arrangement is highly time consuming, and its use in educational environments is quite difficult. This can be considered as a limitation in terms of the efficiency of the research. Second, the computer program used was a conventional program, and it has been presented in a linear form. Although photographs, sounds, and video were available for use, this program does not enable interaction, making student participation passive; this can be listed as the second limitation. Third, although the students frequently expressed positive opinions related to the research, social validity data was not systematically obtained from them. Fourth, the generalization of behavior to real signs was not proven in real environments but examined by using images taken from real environments. This poses a limitation related to the generalization of this research.

Considering the research findings and limitations, we can make certain suggestions for future studies. It is necessary to include peer tutoring in CBI within the scope of the research; it is also necessary to replicate the research with different participants and behavior. In this research, the computer program only included the most preferred peer. Future research should include within CBI the most preferred and least preferred peers to compare effectiveness and efficiency. CBI is an intervention that can be carried out easily by using a small group arrangement. If the small group arrangement is considered to be a variable that can enhance efficiency, then future research should employ this arrangement for a more thorough exploration of the effectiveness of CBI. Updated computer programs involve interaction based on students' responses to the stimulus received from the computer by using the mouse, keyboard, monitor or other supporting technologies; similarly, response presentation to student behavior by the computer program enables the students' participation in the process to be more active (Mechling, 2005). Therefore, future studies should examine the effectiveness of CBI wherein peer tutoring and interactive programs are involved. It is also necessary to deal with the collection of social validity data from participating students by means of subjective assessments.

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