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Teaching, Maintaining and Generalizing Time Concepts for Students with Disabilities: How Many Sub-Aims Should be Thought?

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The purpose of the present study was to analyze effectiveness of direct instruction method for teaching, maintaining and generalizing time concepts for students with disabilities. It was also tested how many sub-aims should be thought for promoting generalization in this study. Participants included three students (one boy and two girls) whose functioning levels ranged from mild to moderate disabilities. Their age range is between 10 and 16. Effectiveness of direct instruction method was evaluated through the use of a multiple probe design across behaviors and replicated across students. Results indicated that the direct instruction method was successful in teaching targeted behaviors to all three children with disabilities. Students maintained target behaviors at 100% accuracy 17 and 30 days after training and generalized responses across real time materials. Limitations of the study and future research implications are discussed.
Keywords: Direct instruction, time concepts, and students with disabilities

The reduction and correction of learning difficulties prevalent among children with disabilities requires not only eliminating their reasons but also improving the quality of instructional practice. Therefore, it is necessary that the special education teacher include instructional procedures in accordance with the behavior types identified in the sub-aims of the instruction program (Birkan, 2002; Kameenui & Simmons, 1990; Kırcaali-İftar, Birkan, & Uysal, 1998; Merrill & Tennyson, 1987; Ozyurek, 1984; Prater, 1993). Behaviors pointed under instructional sub-aims of school curriculum call for various types of learning, such as concept learning and discriminative learning (Gersten & Carnine, 1986; Heshusius, 1992).

A concept is defined as a set of defining stimuli causing a common response (Kameenui & Simmons, 1990; Merrill & Tennyson, 1987). Teaching concepts bears major importance in instructional programs of students with disabilities (Ergenekon, Özen, & Batu, 2008; Eripek, 2004). The first step of teaching a concept is to analyze the structure of that concept. This will help to form strategies during instruction (Birkan, 2005; Prater, 1993). Teaching a concept is influenced either positively or negatively because of the conversion of defining attribute in lower hierarchy (e.g. dog) into a variable attribute in higher hierarchy (e.g. the concept of domestic animals). Especially the concepts in lower hierarchy should be taught first (Engelman, Carnine, & Steely, 1991; Kember, 1991).

The defining and variable attributes of the concepts have to be taken into consideration in order to teach a concept properly. Defining attribute is prescribed as the ones that determine and distinguish a concept from the others (Merrill & Tennyson, 1987; Prater, 1993; Stanley, 1984). Variable attributes, on the contrary, are defined as the ones existing in the structure of a concept, but not differentiating it. The number of defining attributes determines how difficult a concept is. In other words, a concept becomes more difficult as the number of its defining attributes increases (Merrill & Tennyson, 1987; Nelson & Cummings, 1981; Stanley, 1984).

Examples and non-examples that will be utilized for instruction should be matched with each other on the level of defining and variable attributes. Examples illustrate the concept itself, whereas non-examples exemplify the inappropriate ones. Both simultaneous presentations of examples and non-examples (all of examples or non-examples) and presenting one after another (one example followed by a non-example) during instruction are possible for teaching a concept (Gersten, 1985; Merrill & Tennyson, 1987; Prater, 1993). Presentation of many examples and non-examples, where defining and variable attributes are used consecutively, may result in learning and generalization of a concept. Each non-example helps students learn one of the variable attributes of a concept, and students figure out how different that concept is (Mills, Cole, Jenkins, & Dale,

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2002). Instruction becomes more effective when variable attributes are altered among pairs of examples and non-examples. Besides, alteration of variables attributes provides extended opportunities to increase the number of examples and non-examples (Drecktrah & Chiang, 1997; Kameenui & Simmons, 1990; Merrill & Tennyson 1987; Prater, 1993).

The number of both examples and non-examples have to be high enough to distinguish the concept from the similar ones (Dudley-Marling & Searle, 1988; Kameenui & Simmons, 1990; Park, 1984). Other aspects of a concept—abstract or concrete—should also be considered while choosing an example concept (Wilson & Sindelar, 1991). In addition, the level of similarity among the examples of a concept has a positive impact on learning of the particular concept. Furthermore, the presentation of defining and variable attributes of examples and non-examples of the selected examples should be mixed to facilitate the learning in direct instruction (Schloss, Alper, Young, Arnold-Reid, Aylward, & Dudenhoeffer, 1995).

Differentiating examples and non-examples is not enough to teach concepts. It is also necessary to identify examples in higher hierarchy so that generalization can take effect. These examples should be different from the ones used during instruction (Alberto & Troutman, 1990). All the example pairs should be ordered from the simplest to the most difficult as the process improves from instruction to generalization (Engelman et al., 1991).

Providing a label of a concept in a meaningful context along with examples of the concept makes learning of the concept easier. While presentation of simple and clear examples is an effective onset for defining, the definition should generally precede examples and non-examples (Kameenui & Simmons, 1990; Merrill & Tennyson 1987; Prater, 1993).

Learning is facilitated providing that the presentation of concepts include similar examples. During a presentation where parallel examples are used, each concept is presented in isolation until it is learned (Hupp, 1986; Kameenui & Simmons, 1990; Merrill & Tennyson, 1987). Direct instruction method is known as deductive teaching. It makes use of differential learning, and is based on a systematic program.

Teaching based upon direct instruction is stated as follows by Kırcaali-İftar et al., (1998): (a) concept instruction is directed by teacher, (b) concept instruction program includes components sequenced elaborately according to the needs of the student and features of the concept, (c) behavioral goals related to each of instructional steps in the concept instruction program are determined, (d) instructional materials containing both examples and non-examples of the concept are prepared for each step in concept instruction program, (e) assessment procedures are conducted both at the beginning and end of each instructional session, (f) instruction is constantly held until a student learns the concept, (g) feedback and reinforcement regarding expected responses are provided to student during concept instruction, (h) teacher uses structured language to focus the student's attention on examples during concept instruction (pp.375).

Literature review reveals that there are many studies on concept instruction applied through direct instruction for children with various disabilities. Findings of these studies state that direct instruction is effectively and efficiently used for concept instruction. Following are some examples: learning time concepts (Horak & Horak, 1983; Maertens, 1980); learning functions of words (Schloss et al., 1995); identifying words (Dimino, Taylor, & Gersten, 1995); learning basic preschool concepts (Gersten, Darch, & Gleason, 1988; Seifert & Schwarz, 1991); learning math concepts (Crawford & Snider, 2000; Harper, Mallette, Maheady, & Brenman, 1993; Jitendra & Hoff, 1996; Montague, Applegate, & Marquard, 1993; Stein, 1987; Wilson & Sindelar, 1991; Woolgar, 1986); learning monetary concepts (Hasting, Raymond, & McLaughlin, 1989); gaining learning strategies (Drecktrah & Chiang, 1997); learning various academic skills (Myles, Simpson, & Smith; 1996).

Dağseven (2001) taught time concepts to children with disabilities in a single subject study, compared the effectiveness of instructional materials prepared according to direct and sequential instruction in terms of teaching, maintaining, and generalizing of basic math and time concepts for children with disabilities. Findings reveal that direct instruction is more effective than sequential instruction. In addition, direct instruction facilitated maintaining and generalizing of time concepts. There are also some studies which are summarized below conducted with single-subject design and investigated the effectiveness of direct instruction in terms of concept instruction.

Batu (2006) examined the effectiveness of direct instruction through the group instruction settings for teaching to identify vegetable names expressively to children with down syndrome and found out that direct instruction was effective. Also all subjects of the research maintained and generalized identifying vegetable names expressively on novel vegetables after teaching ended. Ekergil (2000) examined the effectiveness of direct instruction through natural language use for teaching opposite concepts to children with disabilities. Results showed that direct instruction through natural language use was effective in teaching concepts like long/short and big/small to each student, and all the subjects preserved the acquired concepts in the follow-up. Yıldırım-Alptekin (2000) compared the effectiveness of individualized instructional materials prepared according to direct and sequential instruction for children with disabilities. Findings proved that direct instruction was more effective acquiring the sub-aims regarding color and shape concepts. Varol (1992) figured out that individualized materials prepared according to direct instruction were more effective in teaching concepts like red, yellow, big, circle, triangle, long, one piece, two pieces, and thick to children with disabilities. Kırcaali-İftar et al., (1998) found out that individualized materials presented along direct instruction through natural language use were highly effective in teaching color and shape concepts to children with disabilities. Polat (1996) searched for the effectiveness of individualized materials presented along direct instruction to teach time, multiplication, and measurement of length to children with visual impairment, and found out that direct instruction was effective.

Literature review depicts that studies using direct instruction to teach concepts strived to realize all the sub-aims in order to reach generalization. However, some of the children with disabilities can generalize most of the concepts by just fulfilling few sub-aims. Trying to conduct all the sub-aims with these children seems to be a waste of time allocating for instruction. On the other hand, no single study supporting these findings could be found in the literature. Furthermore, results of studies mentioned above set forth that direct instruction method is effective in teaching concepts. Yet, one can observe that all studies concerning concept instruction to children with disabilities focused only on effectiveness, and studies about preservation and generalization of concepts are sparse. Therefore, it is necessary to designate more studies so as to test the effectiveness of learned concepts in terms of maintaining and generalizing as well as the effectiveness of direct instruction in teaching concepts. Moreover, procedural reliability analyses are not conducted for a certain amount of concept instruction studies based upon direct instruction particularly in Turkey (Batu, 2006; Dağseven, 2001; Kırcaali-İftar et al, 1998; Polat, 1996; Varol, 1992; Yıldırım-Alptekin, 2000). This evokes some suspicions about reliable application of direct instruction and internal and external validity of studies. Thus, it is hypothesized that more studies proving that direct instruction method can be applied reliably will contribute and expand the existing literature.

The present study aims to investigate the effectiveness of direct instruction method in teaching time concepts to students with mild to moderate disabilities. The following sub-aims are formed in accordance with the overall aim: (a) is direct instruction method effective in teaching sub-aims of teaching time concepts to three children with disabilities? (b) If three students with disabilities can learn the sub-aims of time concepts through direct instruction method, how many of the sub-aims should be performed before generalizing time concepts to real life? (c) If three children with disabilities can generalize time concepts to real life via direct instruction method, do they maintain the acquired concepts 17 and 30 days after the instruction?

METHOD

Participants

Three children with disabilities (one boy and two girls) participated in the study. Their age range is between 10 and 16. Based on the results of Time Concepts Criterion Assessment Instruments (TCCAI), one (Osman) of the subjects was instructed on halves, quarter past, and quarter to whereas the other two (Selma and Gamze) were trained about hours, halves, and quarter pasts. All of the subjects have received support services in a private clinic for disabilities twice a week, and one hour each time in a 1:1 teaching.

Following prerequisite skills were required in the subjects: (a) to engage in activities for at least 10 to 15 minutes; (b) to imitate the teacher verbally and physically; (c) to communicate through understandable two-word sentences; (d) to understand at least two-word directions; (e) to point and read numbers between 1 and 12; (f) to point and tell hour hand, minute hand and second hand on any clock; (g) to attend the study regularly. None of the subjects had health problems impeding their participation. First, students were observed during group and individual activities, then families and teachers were interviewed, and finally individualized education plans of students were examined thoroughly in order to see if they had prerequisite skills to participate in the study. Findings of all observation, interview, and examination steps showed that the subjects above were suitable for the study.

Osman is a 16 years 9 months old boy. His intellectual level is 60 according to *Stanford Binet IQ Test*. He has basic reading, math, and monetary skills, but suffers from problems regarding speaking, communication, and social interaction more than his peers. He attends to an apprenticeship school with 18 normally developing children twice a week, and 5 hours each time. Besides, he works at a hairdresser's four days a week, and six hours each day.

Selma is a 14 year-two-month old girl. Her intellectual level is 48 according to *Stanford Binet IQ Test*. She has basic reading, math, and monetary skills, but suffers from problems regarding comprehension, directing attention, and social interaction more than her peers. She attends to the sixth grade of a primary school with 30 children with normal developed five times a week, and 5 hours each time.

Gamze is a 10 year-three-month old girl. Her intellectual level is 56 according to *Stanford Binet IQ Test*. She has the skills of initiating and maintaining communication, self-care, and daily life, but suffers from problems regarding and social interaction, reading, writing, and math more than her peers. She goes to the special class of a school for disabilities with 12 children with disabilities five times a week, and 5 hours each time.

Trainer and Observer

The trainer (the author) completed his undergraduate study and MA in special education. He works at a private special education school, and mainly focuses on individual and group studies with children with autism and other disabilities. The trainer conducted all experimental sessions. Reliability data regarding the dependent and independent variables of the present study were collected by both the trainer and a special education teacher.

Setting and Materials

All sessions of the present study were conducted in an individual study room (4m X 3m) at a clinic for disabilities. The trainer and students worked in a one-to-one instruction setting at a rectangular table (1.5m X 0.8m) during all experimental sessions. Individual study room contained a table, two chairs and another table that the trainer used to put record sheets and assessment set. A video-cam was placed in the individual study room to record data. During the assessment and instruction of time concepts the same type of toy clocks, different type of toy clocks (e.g. the trainer selected a clock of which diameter was 19 cm and 1 to 12 numbers printed two cm high using a permanent black marker and with the minute hand turning just like a real clock) and different types of real clocks (e.g. kitchen clock, wall clock, wrist watch, and clock) were used. The video-cam was placed at a point where it could record subjects' responses and hours on the same screen. Assessment and teaching sessions were held for three days in a week, a session at a time, from 9:00 am to 10:30 am, and the setting for both assessment and teaching was one-to-one instructional design. Follow-up sessions were conducted in the same room 17 and 30 days after the termination of teaching for all three subjects.

Data Collection Instruments

Time Concept Generalization Criterion Assessment Instruments (TCCAI) was developed for the present study. These instruments were developed for students with disabilities in order to (a) identify the sub-aims of the targeted behavior in this study; (b) to determine students' levels of performance regarding the sub-aims of time concepts before and after the instruction; (c) identify

students' level of generalizing the acquired time concepts to real clocks; and, (d) see if students maintain the acquired concepts 17 and 30 days after the instruction.

Two professors and three teachers working at a special education school for student with disabilities contributed to the development of TCCAI. In addition, studies related to concept instruction and relevant chapters of math books advised by Ministry of National Education to primary schools were inspected. As a result of this inspection, the time concept was divided into six sub-concepts (hours, halves, quarters, quarter to, past X o'clock, and to X o'clock). Then, each sub-concept is divided into three items. Afterwards, items of sub-concepts were formed by sequencing the defining and variable attributes from the simplest to the most complex based on concept analysis. Criterion was set by forming four appropriate questions for each item.

TCCAI that was developed to select target behaviors and to identify performance levels before and after instruction contained the criterion, three distinct items, and 12 questions (four for each item). Moreover, each question has three sub-questions.

In addition, Time Concept Generalization Criterion Assessment Instruments (TCGCAI) was also formed in order to collect data concerning generalization and maintenance. Four real clocks (kitchen clock, wall clock, wrist watch, and clock) that were different from the ones used for teaching of last sub-aims were utilized in the assessment scale of generalization and maintenance. TCGCAI contained four items, criterion, and 12 questions (three for each item). The assessment scale used for maintenance was the same.

SelectingTarget Behaviors

The purpose of this study was to teach the sub-aims of three time concepts determined through TCCAI to three children with disabilities who did not know time concepts, but had the prerequisite skills according to their families, teachers, and individualized special education plans. Time concept was divided into six; ranging from the simplest to the most complex. Since the study had multiple probe design across behaviors, planning the instruction of three concepts to each child was enough to show the experimental control in the study. However, other time concepts were planned to be taught after the instruction, and families were informed about it.

Time concepts (target behaviors) to be instructed were identified as follows: levels of children with disabilities were identified by first applying TCCAI from the simplest to the most complex (hours, halves quarter past, quarter to, past X o'clock, and to X o'clock). Then, target behaviors were selected according to their levels of performance. Students' levels of performance regarding the time concept were that they achieved three forth of sub-aims determined by items of TCCAI in all three sessions.

The first three-time concepts whose sub-aims students could not achieve were selected as target behaviors. Based on the results, target behaviors for Osman, Selma, and Gamze were identified as 'halves-quarter past-quarter to', and 'hours-halves-quarter past' respectively. Selma and Gamze shared the same target behaviors.

Preparation of Instructional Material

Instructional modules were developed for the instruction of each target behavior (hours, halves, quarter, quarter to). Each instructional module contained one instructional unit. Instructional units involved sub-aims, and instructional plan. Research conducted by using direct instruction method was analyzed in order to form instructional units accordingly. Next, development of instructional units was initiated making use of the research and concept instruction plans.

The items in TCCAI contributed to the formation of instructional units. Converted into behavioral sub-aims, items constructed the sub-aims part of instructional units. Instructional plans were designed according to students' levels of performance. Instructional plans involved students' level of performance determined by TCCAI, instructional objective chosen according to the level of performance, materials to use, and instructional process where the concept is presented through direct instruction method. Materials were prepared by choosing the examples and non-examples of concept in accordance with the objective. Direct instruction method requires the examples and non-examples of concept be presented consecutively, and student gives correct responses to both

examples and non-examples. Student is reinforced following a correct response, whereas instruction is restored following an incorrect response or no response in 5 second.

Experimental Design

A multiple probe design across behaviors was used and replicated across subjects to find out if direct instruction method was effective in teaching time concepts. The dependent variable was percent of correct responding on telling time concept and the independent variable of the study was direct instruction (Alberto & Troutman, 1990; Cooper, Heron, & Heward, 1987; Gay, 1987; Tawney & Gast, 1984; Wolery, Bailey, & Sugai, 1988).

Experimental control was built in when the participant was performing at or near to baseline levels during full probe conditions before the intervention had been introduced and the criterion was reached only after the intervention was introduced (Tekin & Kırcaali-İftar, 2001; Wolery, et al., 1988).

Maintenance probe sessions phase were conducted 17 and 30 days after the final probe session. The trainer expected the students to perform target behaviors for real clocks during the maintenance session. In addition the trainer videotaped all the sessions for the sake of data collection and recorded the subjects' responses.

Experimental Procedures

Full Probe Sessions

The purpose of full probe sessions is to identify the level of performance of children with disabilities regarding the sub-aims of targeted behaviors, and to measure the extent they generalize the learned skills to real clocks. The sub-aim of the first full probe session was to simultaneously gather baseline data concerning all sub-aims of target behaviors and generalization for all subjects. Data were collected individually. Full probe sessions were conducted both prior to the instruction of a target behavior and right after the criterion was met for that target behavior by using TCCAI, and TCGCAI. First full probe session for all students lasted until three stable data were collected regarding the generalization of the first target behavior. Having reached a stable data, and met the generalization criterion for the first target behavior, second full probe session was introduced. Third full probe session was commenced after a stable data was reached and the generalization criterion was met for the second target behavior. TCCAI, on the other hand, was only used to figure out the student's level regarding the sub-aim of the target behavior.

Students' points for generalization and all the sub-aims of target behaviors during full probe sessions were scored by using assessment instruments, and recorded by the trainer. Students were given no feedback for their correct responses during full probe sessions although activity reinforcers were delivered for engagement and appropriate behavior. For instance, 'Osman, you tried to do whatever I asked. In addition, your attention was also good during training. So, now you can go to free-play corner and perform an activity you like'.

Daily Probe Sessions

Daily probe sessions were conducted to see if the subaims were in the repertoire of students. Data regarding only the sub-aim being instructed were collected during daily probe sessions, and no single data about the other sub-aims were recorded. Daily probe sessions were held through the assessment instrument of the time concept whose sub-aim was being instructed.

Prior to each instructional session, a daily probe session about generalization was also held together with the other daily probe session directed to the sub-aim that was being instructed. The purpose of those daily probe sessions of generalization was to see how far the students with disabilities generalized what they had learned. Daily probe sessions of generalization were conducted through TCGCAI of the target behavior being addressed. The data in daily probe session was counted towards criterion and plotted on the graphs.

The trainer recorded all the points that students scored for assessment instrument onto relevant data sheets. During daily probe sessions directed to sub-aims and generalization, students were provided with no feedback for their correct responses, but their engagement and appropriate behavior(s) were reinforced via activity reinforcers.

Instruction of Time Concepts According to Direct Instruction

Following the identification of baseline levels of students according to TCAI, the sub-aim expressed through the item right after baseline became the instructional sub-aim. Setting, materials, and reinforcers were prepared accordingly. Direct instruction method urges the examples (e.g. for 2 o'clock, saying 'Selma, look at it's two o'clock' after putting the hour hand onto 2 and minute hand onto 12) and non-examples (e.g. saying 'But, it is not two o'clock now' after putting the hour hand between 2 and 3 and minute hand onto 6) of the concept (e.g. hours, 1st example in the 1st material set) be presented one after the other. Afterwards, the student was expected to respond appropriately to the examples and non-examples of the concept (e.g. the hour hand was re-put onto 2 and minute hand onto 12, then asked 'Selma, what is the time?', then the hour hand was re-placed between 2 and 3 and minute hand onto 6, and asked 'Selma, is it two o'clock now?'). If the student answered questions correctly without hesitation (e.g. 'It is two o'clock!', or 'No, it is not two o'clock!'), s/he was praised with social reinforcers like 'Well-done, you are great'. If the student gave an incorrect answer, the presentation of examples and non-examples was repeated without saying anything. Presented during training session, examples and non-examples (four material sets, each having three different time spots) of the concept were put away. Different examples of the concept were used to assess training session.

First, examples and non-examples were presented to the student consecutively during assessment, and the student was expected to respond to both example and non-example correctly. Student was reinforced following a correct response, but presentation of example and non-example was repeated without saying anything after an incorrect response. Student was expected to respond accordingly after the repetition of example and non-example. Presentation was continued until the student provided correct responses for the example and non-example s/he had failed previously. Then, the trainer continued assessment with the second example and non-example. Session was terminated when the student responded correctly to all the examples and non-examples in four material sets. Instruction of sub-aim was discontinued when the student met three correct responses out of four examples in daily probe sessions held three times consecutively, and next sub-aim was introduced. Instruction of sub-aims was stopped when the student generalized the target behavior whose sub-aims had been taught to real clocks. During concept instruction, students were reinforced through a continuous reinforcement schedule by way of reinforcers determined for each of them.

Maintenance Probe Sessions

Maintenance probe sessions were conducted 17 and 30 days after the final probe session to see if students maintained what they had learned. Maintenance probe sessions were conducted just like probe sessions. Engagement and appropriate behaviors of students were reinforced through activity reinforcers at the end of the sessions.

Interobsever and Procedural Reliability

Reliability data were collected for 35% of full probe, daily probe, and training sessions, and 50% of maintenance probe sessions by observing the sessions assigned randomly. Inter-observer reliability was calculated by using point-by-point method with a formula of the number of agreement divided by the number of agreements plus disagreements multiplied by 100 (Tawney & Gast, 1984). Procedural reliability was calculated by using point-by-point method with a formula of the number of observed the trainer behavior divided by the number of planned the trainer behavior multiplied by 100 (Billingsley, White & Munson, 1980). For procedural reliability, following the trainer behaviors were observed: (a) preparation of materials, (b) trying to draw the attention of students, (c) presenting examples, (d) presenting non-examples, (e) assessing examples and non-examples, and re-present them if necessary, (f) assessing the set with which he is finished presenting, (g) reinforcing the student because of his/her engagement at the end of a session. All trainer behaviors were evaluated for full probe, daily probe, and follow-up sessions in isolation.

The mean percentage of inter-observer reliability was 94% for Osman (100% during full probe sessions, 83% during daily probe sessions, and 100% during maintenance probe sessions) whereas it was 98% for Selma (100% during full probe sessions, 95% during daily probe sessions, and 100% during maintenance probe sessions), and was 91% for Gamze (93% during full probe sessions, 81% during daily probe sessions, and 100% during maintenance probe sessions).

The mean percentage of procedural reliability, on the other hand, the trainer implemented the behaviors with an overall mean accuracy of 98% for both Gamze and Osman (95% during full probe sessions, daily probe sessions, and maintenance probe sessions. 100% during training sessions) while it was 97% for Selma (94% during full probe sessions, daily probe sessions, and maintenance probe sessions. 100% during training sessions).

RESULTS

Effectiveness and Generalization

Findings related to time concepts instructed through direct instruction method are depicted in Figure 1, Figure 2, and Figure 3 for Osman, Selma, and Gamze respectively.

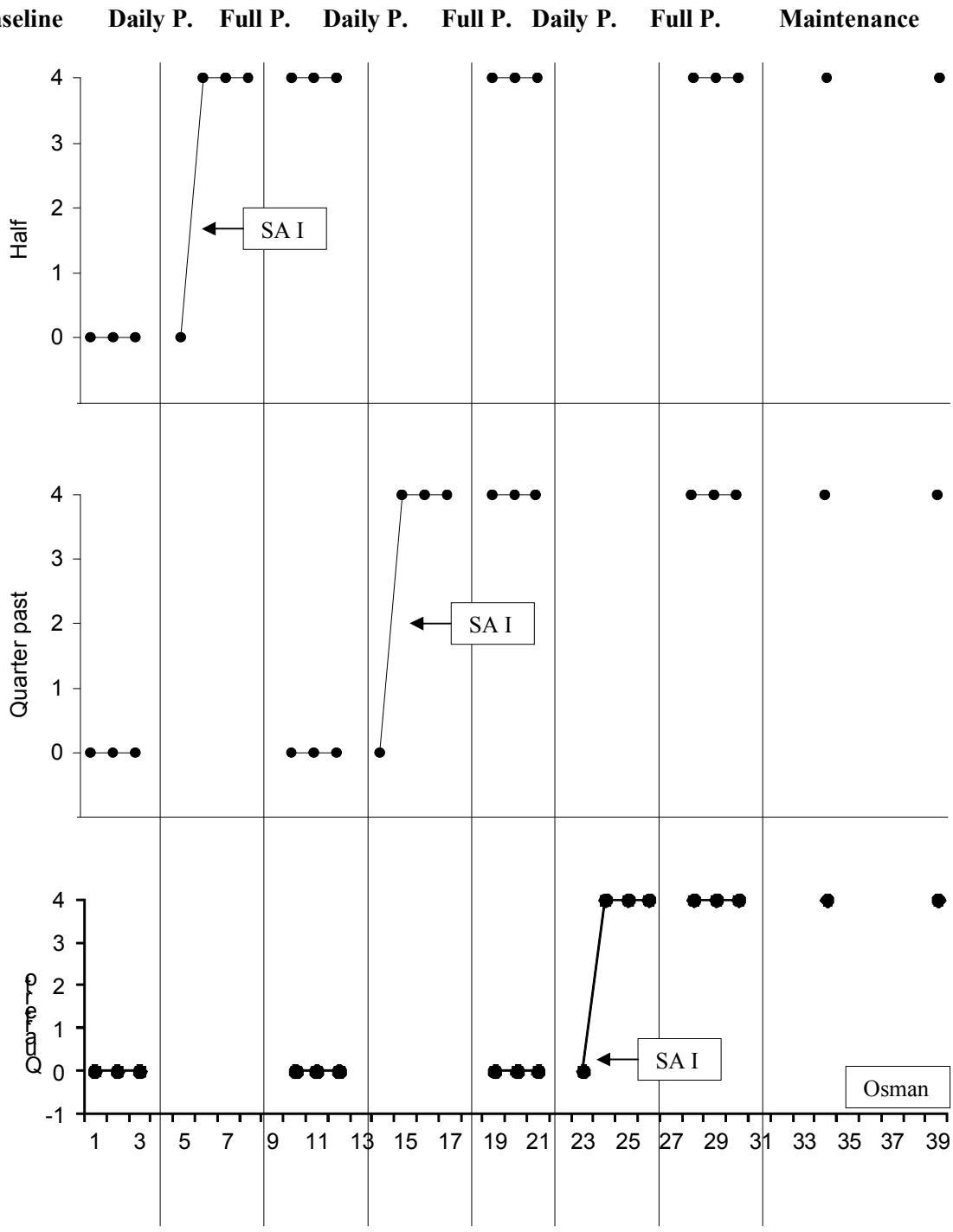

Figure 1. The number of correct responses of generalization for Osman at baseline, full, daily and maintenance probe sessions. Boxes on the graph indicate to which sub-aim the related line belongs.

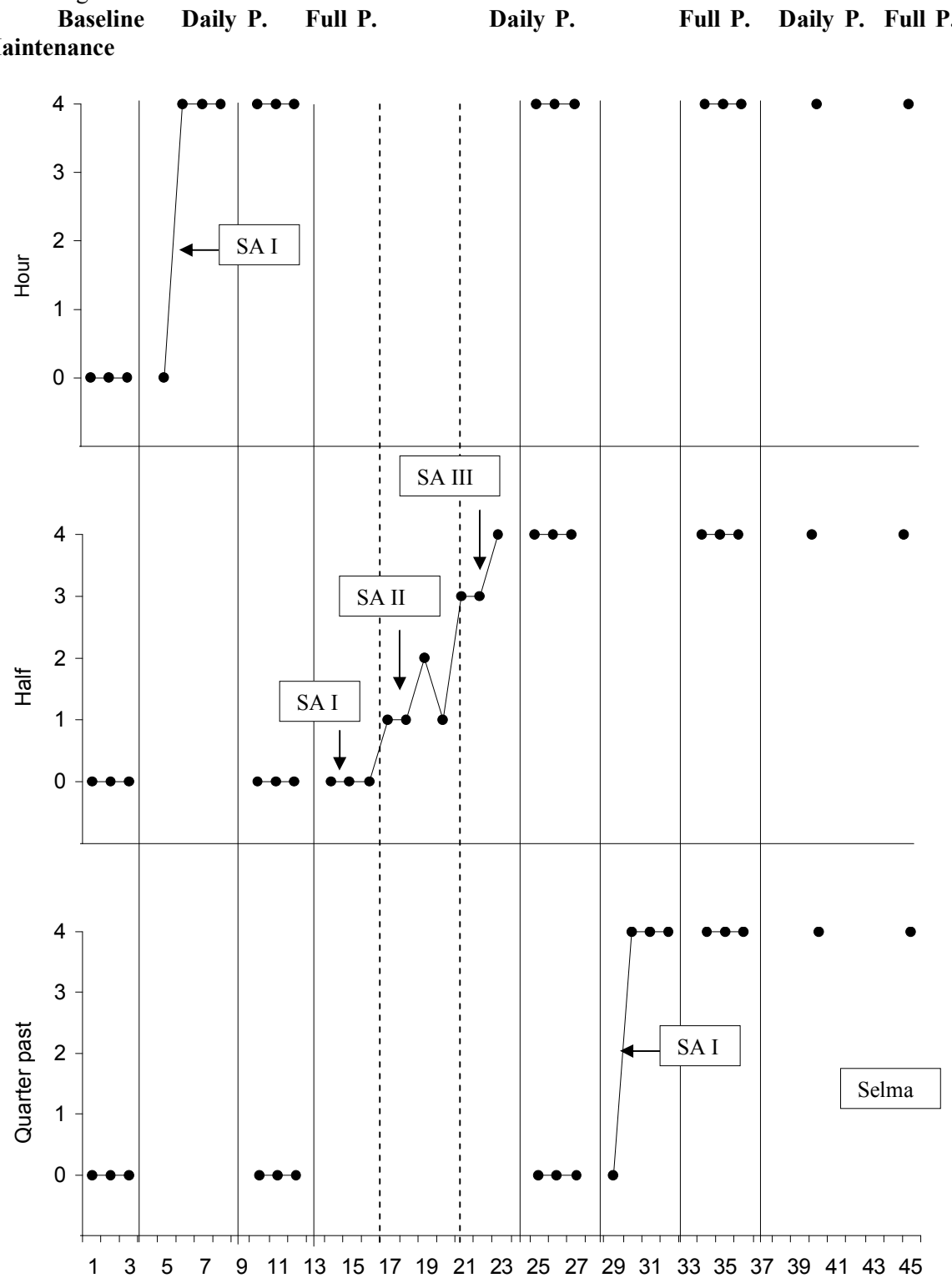

Figure 2. The number of correct responses of generalization for Selma at baseline, full, daily and maintenance probe sessions. Boxes on the graph indicate to which sub-aim the related line belongs.

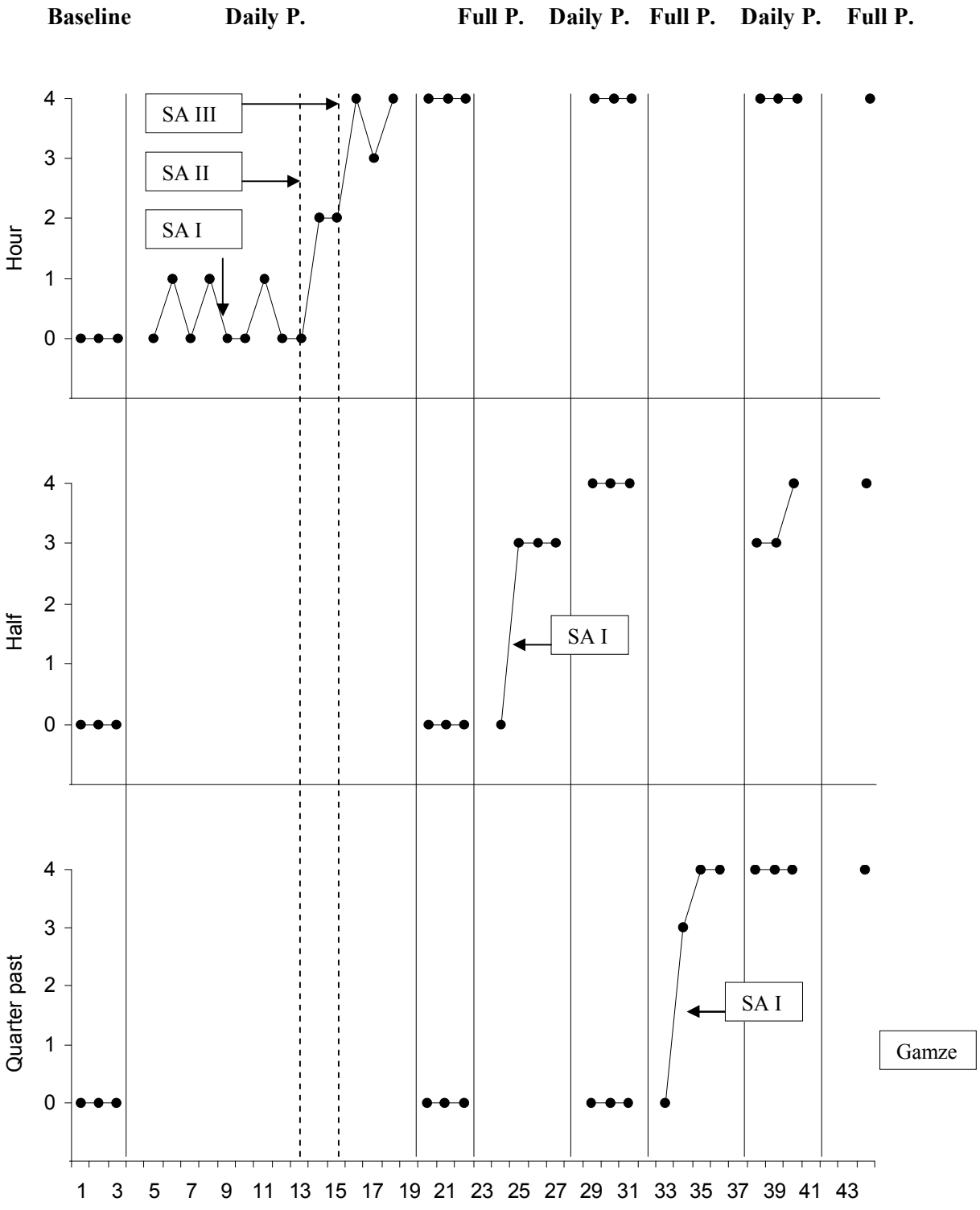

Figure 3. The number of correct responses of generalization for Gamze at baseline, full, daily and maintenance probe sessions. Boxes on the graph indicate to which sub-aim the related line belongs.

Osman did not exhibit any of three target behaviors (0/4) prior to instruction. As soon as 'halves', 'quarter past', and 'quarter to' be introduced via direct instruction method, his level of performance started to improve. Osman met the criterion by displaying correct responses for 'halves' (4/4) 'for quarter past' (4/4), 'for quarter to' (4/4) during the last three sessions. Osman's

correct responses regarding halves were four out of four during the second, third and fourth full probe sessions.

As it can be seen in Table 1, Osman met the generalization criterion for each of three target behaviors by only achieving three subaims out of nine sub-aims (3/9; three sub-aims for each target behavior equals to nine sub-aims) through direct instruction method. Osman achieved one of the sub-aims of halves, one of the sub-aims of quarter past and one of the sub-aims of quarter to, and met generalization criterion.

Table 1
Information Regarding the Target Behaviors and the Sub-Aims of Subjects

Subjects	Target Behaviors	The Number of Acquired Sub-aims
	Halves	1
Osman	Quarters past	1
	Quarters to	1
	Hours	1
Selma	Halves	3
	Quarters past	1
	Hours	3
Gamze	Halves	1
	Quarters past	1

Selma did not exhibit any of three target behaviors (0/4) prior to instruction. As soon as 'hours', 'halves, and 'quarter past' were introduced via direct instruction method, her level of performance started to improve. Selma met the criterion by displaying correct responses for 'hours' (4/4) 'for quarter past' (4/4), 'for quarter to' (4/4) during the last three sessions. Selma's correct responses regarding hours, halves, and quarter past were four out of four during the second, third and fourth full probe sessions.

As depicted in Table 1, Selma met the generalization criterion for each of three target behaviors by only achieving five sub-aims out of nine sub-aims (5/9; three sub-aims for each target behavior equals to nine sub-aims) through direct instruction method. Selma achieved one of the sub-aims of hours, three of the sub-aims of halves and one of the sub-aims of quarter past, and met the generalization criterion.

Gamze did not have any of three target behaviors (0/4) prior to instruction. As soon as 'hours', 'halves, and 'quarter past' were introduced via direct instruction method, her level of performance started to improve. Gamze met the criterion by displaying correct responses for 'hours' (4/4) during the last three sessions. Gamze's correct responses regarding hours were four out of four during the second, third and fourth full probe sessions.

Gamze met the criterion by displaying correct responses for halves (4/4) during the last three sessions. Selma's correct responses concerning halves were four out of four during the third probe session and three out of four during the fourth full probe session.

Gamze met the criterion by displaying correct responses for quarter past (4/4) during the last three sessions. Selma's correct responses regarding quarter past were four out of four during the fourth full probe session.

As shown in Table 1, Gamze met the generalization criterion for each of three target behaviors by only achieving five sub-aims out of nine sub-aims (5/9; three sub-aims for each target behavior equals to nine sub-aims) through direct instruction method. Gamze achieved three of the sub-aims of hours, one of the sub-aims of halves and one of the sub-aims of quarter past, and met the generalization criterion.

Maintenance Data

Maintenance data revealed that Selma and Osman maintained time concepts 17 and 30 days after the instruction had stoped. Gamze could maintain relevant concepts 17 days after the instruction. Gamze could not attend the second maintenance probe session (30 days after the instruction) due to her health problems.

DISCUSSION

In this study, teaching and generalization of time concepts for three children with disabilities via direct instruction method were tested. In addition, maintenance of concepts was also tested 17 and 30 days after the instruction.

Findings of this study sets forth that direct instruction method is effective in teaching 'hours-halves-quarter past-quarter to' concepts for children with disabilities. Direct instruction facilitates not only learning of sub-aims but also maintenance and generalization of time concepts to real clocks.

Results prove that time concepts are learned through direct instruction. These findings are consistent with the results of Maertens (1980), Horak & Horak (1983), and with studies that Polat (1996) and Dağseven (2001) conducted about the same subject, and finally with other studies investigated the effectiveness of direct instruction (Batu, 2006; Crawford & Snider, 2000; Dimino et al., 1995; Drecktrah & Chiang, 1997; Ekergil, 2002; Gersten et .al., 1988; Haper et al., 1993; Hasting et al., 1989; Heshusius, 1992; Jitendra & Hoff, 1996; Kırcaali-İftar et al., 1998; Schloss et al., 1995; Mills et al., 2002; Montague et al., 1993: Myles et al., 1996; Prater, 1993; Seifer & Schwarz, 1991; Stein, 1987; Wilson & Sindelar, 1991; Woolgar, 1986; Varol, 1992; Yıldırım-Alptekin, 2001).

Findings show that it was Selma and Gamze, who had to learn the most sub-aims in order to generalize three target behaviors to real clocks. Teaching of five sub-aims to both Selma and Gamze resulted in the criterion level for generalization of the target behaviors. Osman, on the contrary, had to learn only three sub-aims in order to generalize time concepts to real clocks. Selma's and Gamze's levels of performance in expressing, directing attention, communicating, reading, writing, and math skills were significantly lower than those of Osman's. Therefore, this may be stated to be the reason why Selma and Gamze had to learn five sub-aims before generalizing time concepts to real clocks.

As the finding suggested, contrary to similar studies, it was not necessary to teach all the sub-aims in instructional plans for the subjects to reach generalization, except the second target behavior for Selma. Thus, we may conclude that time allocated for instruction was used efficiently.

Procedural reliability of the study is quite high. Direct instruction method was applied at a reliability level 98% during training sessions. Reliability findings indicate that direct instruction method is easy to implement. As mentioned before, no single study conducted by using time concepts teaching in Turkey analyzed the procedural reliability.

Generalization of most target behaviors by all subjects did not require all the sub-aims that had been determined to earlier be instructed. Therefore, quick generalization of concepts through direct instruction method means that training time will be shortened.

The importance of this study is two fold. First, findings reveal that direct instruction method is effective in teaching, maintaining, and generalizing time concepts for children with disabilities. These findings display consistency with other studies where concept instruction was directed to children with other disabilities. Thus, the present study supports findings concerning direct instruction, and expands related literature. Second, this study is the first to teach time concepts to children with disabilities to maintain and generalize time concepts to real clocks, and finally to include procedural reliability.

It is necessary to use effective instructional procedures in order to teach various concepts to children with disabilities. Therefore, teaching concepts through direct instruction that is based on concept analysis can be given as one of the examples of effective instructional approaches.

Teaching 'hours-halves-quarter past-quarter to' and checking maintenance only 17 and 30 days after the final probe session can be stated as limitations of the present study.

Findings encourage us to advise teachers, families, and peers to use direct instruction method for any piece of training. Findings also urge us to make some future research suggestions. For instance, a similar study may be conducted in a different setting and with different subjects. The comparison of the effectiveness and efficiency of direct instruction method can be tested on teaching different concepts. As stated earlier, this study focused on teaching only hours, halves, quarter past and quarter to through direct instruction. Other studies to teach '-past X o'clock and to X o'clock-' via direct instruction can be designed.

Reinforcement is not delivered during probe sessions. Therefore, the combined effect of instruction and reinforcement in the training session is not obtained. The future researchers may investigate the effectiveness of the instruction developed in this study separately by delivering reinforcement during probe sessions.

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Gelişimsel Yetersizliği Olan Çocuklara Saat Kavramı Kazandırma, Genelleme ve Sürdürme: Kaç Alt Amaç Öğretilmeli?

Bu çalışmanın amacı, gelişimsel yetersizliği olan öğrencilere saat kavramlarının öğretilmesi, genellemesi ve sürdürülmesinde doğrudan öğretim yönteminin etkililiğini incelemektir. Ayrıca bu çalışmada genellemeye ulaşılabilmesi için öğrencilere kaç alt amacın öğretilmesi gerektiği de test edilmiştir. Çalışmaya orta ve ağır düzeyde gelişim yetersizliği olan biri erkek, ikisi kız üç öğrenci denek olarak katılmıştır. Denekler 10 ile16 yaş arasında değişmektedir. Doğrudan öğretim yönteminin etkililiği davranışlar arası çoklu yoklama modeli kullanılarak ve denekler arası tekrar edilerek değerlendirilmiştir. Araştırma sonuçları, doğrudan öğretim yönteminin gelişimsel yetersizliği olan 3 öğrenciye, hedeflenen saat kavramlarını kazandırmada etkili olduğunu ortaya koymuştur. Öğrenciler öğretim sona erdikten 17 ve 30 gün sonara hedef davranışları %100 düzeyinde sürdürebilmişler ve bu davranışları gerçek saat genelleyebilmişlerdir. Makalede çalışmanın sınırlılıkları ve ileri araştırmalara ilişkin öneriler de tartışılmıştır.
Anahtar sözcükler: Doğrudan öğretim, saat kavramları, gelişimsel yetersizliği olan öğrenciler,

ÖZET

Amaç: Bu çalışmanın amacı, orta ve ileri derecede gelişimsel yetersizliği olan öğrencilere saat kavramlarının öğretiminde doğrudan öğretim yönteminin etkililiğini araştırmaktır. Genel amaçtan yola çıkarak şu alt amaçlar oluşturulmuştur: (a) doğrudan öğretim yöntemi gelişimsel yetersizliği olan öğrencilere saat kavramlarını kazandırmada etkili midir? (b) doğrudan öğretim yöntemi ile eğer öğrenciler saat kavramlarını öğrenebilirler ise bu kavramları gerçek saatlere genelleyebilmeleri için kaç alt amacın öğretimine gereksinim duyarlar? (c) doğrudan öğretim yöntemi ile eğer öğrenciler saat kavramlarını gerçek saatlere genelleyebilirlerse edindikleri kavramları öğretim sona erdikten 17 ve 30 gün sonra sürdürebilirler mi?

Yöntem: Bu çalışmaya yaşları 10 ile 16 arasında değişen ve gelişimsel yetersizliği olan biri erkek, ikisi kız 3 öğrenci katılmıştır. Çalışmanın bağımsız değişkeni doğrudan öğretim yöntemidir; bağımlı değişkeni ise öğrencilerin kendileri için hedeflenen saat kavramlarını kazanım düzeyleridir. Çalışmada bağımsız değişkenin bağımlı değişken üzerindeki etkisini belirlemek amacıyla tek-denekli araştırma yöntemlerinden davranışlar arası çoklu, yoklama modeli kullanılmış ve denekler arası tekrar edilmiştir. Saat Kavramı Ölçme ve Değerlendirme Aracı kullanılarak denek öğrencilerden biri olan Osman için buçuk, çeyrek geçe ve çeyrek kala saat kavramlarının öğretimi hedeflenmiş; diğer iki denek öğrenci olan Selma ve Gamze için ise tam, yarım ve çeyrek geçe saat kavramlarının öğretilmesine karar verilmiştir. Tüm hedef davranışlar için her deneğin performans düzeyine ve öğrenme özelliklerine uygun ayrı ayrı bireyselleştirilmiş öğretim programı geliştirilmiş ve bu program araştırma desenine uygun olarak uygulanmıştır. Hedef davranışların kazanım, genelleme ve sürdürme oranlarını belirlemek için davranış ölçme yöntemi ve veri formları geliştirilmiş ve elde edilen verilerin grafiksel analizi yapılmıştır. Grafikte oluşan eğrilere bakılarak deneklerin performansları ayrı değerlendirilmiştir.

Bulgular: Çalışmanın sonucunda her 3 denek kendileri için hedeflenen saat kavramlarını kazanmışlar ve gerçek saatlere genelleyebilmişlerdir. Ayrıca denekler gerçek saatlere genellemiş oldukları kavramları öğretim bittikten 17 ve 30 gün sonra sürdürebilmişlerdir. Selma yarım saat kavramlarını, Gamze ise tam saat kavramlarını 3'er alt amaç öğrendikten sonra gerçek saatlere genelleyebilirken; Gamze ve Selma diğer hedef saat kavramlarını Osman ise kendisi için belirlenen tüm hedef saat kavramlarını sadece 1'er alt amacı gerçekleştirerek gerçek saate genelleyebilmişlerdir.

Sonuç ve Tartışma: Bu çalışmada elde edilen sonuçlar, doğrudan öğretim yönteminin gelişimsel yetersizliği olan öğrencilere saat kavramlarının öğretiminde, genelleme ve sürdürülmede etkili olduğunu ortaya koymuştur. Ayrıca bu çalışmada elde edilen sonuçlar, doğrudan öğretim yönteminin gelişimsel yetersizliği olan çocuklara kavram öğretiminde etkililiğini ortaya koyan diğer araştırma sonuçları ile de tutarlılık göstermektedir. Ayrıca bu çalışmanın sonuçları, gelişimsel yetersizliği olan çocuklar için geliştirilen bireyselleştirilmiş öğretim programlarında yer alan tüm alt amaçların öğretimine gerek kalmadan da öğrencilerin genellemeyi gerçekleştirebildiklerini göstermesi açısından da önemlidir. Çalışmanın bu boyutuyla alan yazına yeni bir katkı getirdiği sonucuna varılabilir.