JODYAC
JOURNAL OF DYSCALCULIA ACADEMY

Journal of Dyscalculia Academy, 1(1), 62-86, 2024
Research Article

https://jodyac.com Founded: 2022 Publisher: Dyscalculia Association

TEACHING CLOCK TO 3rd GRADE PRIMARY SCHOOL STUDENT USING THE SIX-STAGE INTERVENTION METHOD WITH SUSPICION OF DYSCALCULIA[1]

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Abstract

Teaching time is one of the most difficult subjects for students with mathematics learning difficulties. The clock system is circular and hexagonal, is different from the decimal number system that students have learned, and even has two different types: analog and digital. While the time is understood by reading the numbers directly on digital watches, in order to read analog watches, it is necessary to know the hour and minute hands and the functions of these hands. The aim of this study is to teach clock to 3rd grade primary school student who is suspected of having dyscalculia with a six-step intervention method. In the study, skills such as teaching full time to students, teaching half hour, teaching quarter hour, introducing hour and minute hands, and being able to write and read time in minute and hour format were emphasized. The method followed in the process of teaching this outcome is called the "six-step intervention method" and adopts individual-specific approaches that blend the target outcome with preliminary learning. The study was designed as an action research and was implemented as a single-subject experimental study. As a result, it can be said that the six-step intervention method contributes to the elimination of the problem in teaching time to students with mathematics learning difficulties and to the student's ability to understand time and time.

Keywords: 6-Step Intervention Method, 3rd grade, Clock Teaching, Dyscalculia, Primary School

1. Introduction

Dyscalculia, one of the specific learning disabilities, is defined as difficulty in learning basic mathematical skills that cannot be explained by simple reasons (WHO, 2011). Kauffman and colleagues (Kauffman et al., 2013) stated that the causes of mathematical learning difficulties are due to specific problems at behavioral, cognitive, neuro-psychological and neural levels. According to Büttner and Hasselhorn (2011), performing well below average in mathematics despite the absence of emotional, mental, sensory, intellectual retardation and inadequate education is a mathematical learning disability. Dyscalculia is seen as a condition

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Cite as: Doğan, A. & Arslansoy, A. (2024). Teaching clock to 3rd grade primary school student using the six-stage intervention method with suspicion of dyscalculia. *Journal of Dyscalculia Academy (JODYAC), 1*(1),62-86.

that affects an individual's acquisition of many mathematical skills. They have difficulty in learning, making sense of and maintaining simple numerical operations and their relationships, measuring and making logical inferences as a result of the process.

According to Geary (2006), individuals with mathematical learning disabilities have difficulty in remembering, understanding or retaining number concepts (3<4 e.g.), counting principles (cardinality-last word label e.g.), or arithmetic operations. This study is important because of the difficulties experienced by dyscalculic individuals in the process of learning to read clocks and because there are few studies on time management and time measurement.

1.1. Literature Review

The fact that the sixtieth number system from the ancient Sumerians is used to measure time (Burny, 2012), that the hour and minute hands move at different speeds in an analog clock, and that basic mathematical knowledge and spatial skills are required for clock reading can become an important obstacle and a challenge for dyscalculic children. Although elapsed time can be measured, time cannot be measured and perceived concretely (Hurrel, 2017). Students first learn whole hours (3:00, 12:00, etc.), then half hours (2:30, 6:30, etc.) and quarter hours followed by minutes (4:25, 1:43, etc.) (Van de Walle, 2014).

Research has shown that interventions for students with learning difficulties in mathematics are effective in improving their academic performance and mathematical problem solving skills (Filiz, 2021). These interventions often include a comprehensive assessment of the cognitive and metacognitive strategies that students with learning disabilities use when solving mathematical problems (Özkubat & Özmen, 2018). In addition, the demonstration that the application of schema-based instructional strategies is effective in teaching problem solving skills to students with intellectual disabilities suggests that similar strategies can be applied in mathematics education for students with learning disabilities (Kot & Yıkmış, 2018).

For teachers working with students with mathematics learning disabilities, the use of number talk has been suggested as an instructional tool as it has been found to improve the number sense of dyscalculic middle school students (Öztürk et al., 2019). It is also important to consider the cognitive and metacognitive strategies that students with learning disabilities use when solving mathematical problems because understanding these strategies is crucial for making corrections in problem solving instruction (Özkubat & Özmen, 2021).

It is important to use effective teaching models to teach time to children with dyscalculia (Tufan et al., 2020). It emphasized the effectiveness of direct instruction models

in teaching students with intellectual disabilities the ability to distinguish the exact class time. Acar et al. (2019) emphasized the importance of teaching various aspects of time such as full hour, half hour, quarter hour as well as introducing the concepts of hour and minute hands. In addition, Özbek and Tülü (2021) discussed the prevalence of studies focusing on strategy instruction to support written expression skills in students with learning disabilities. Collectively, these studies emphasize the importance of using direct instruction models, comprehensive time instruction, and strategy-based instruction to effectively teach time to children with dyscalculia. Although there are many studies on time reading instruction in the literature, no adequate study was found that included a six-step intervention for teaching time reading to individuals with suspected dyscalculia. The six-step intervention method for addressing mathematics learning difficulties involves a multifaceted approach that includes cognitive and metacognitive assessments, schema-based instruction, and the application of specific techniques such as team-assisted individualization and number talk. These strategies have been shown to have positive effects on the academic performance and problem-solving skills of students with math learning difficulties.

1.2. Conceptual Framework

It is important to consider the inhibitory mechanisms and working memory involved in teaching time to children with dyscalculia (Mammarella et al., 2017). For this reason, it is thought that individualized activities should be included in the clock teaching process in children with dyscalculia diagnosis/suspicion, and it is important to teach clock reading with the six-step intervention method in individuals with special learning difficulties as well as the difficulty of clock reading skills in dyscalculic students.

In the literature, the importance of early intervention programs to support children with mathematics learning disabilities and the need to raise awareness among parents and educators are emphasized (Hacıibrahimoğlu, 2022; Oğul & Arnas, 2020). In this study, in which the six-step intervention method was applied, it is thought that informing the parents during the home studies and generalization phase of the learning process and including them in some points in the studies will make positive contributions in terms of supporting the student and increasing parental awareness.

Clock teaching is among the most difficult subjects at primary school level, especially for students with mathematics learning difficulties. The fact that the clock system is circular and in the 60-number order, that it is different from the decimal number system that students

have learned, and even that it has two different types, analog and digital, can be challenging for students. However, reading a clock is very important for understanding and managing time in daily life. Because we live in a digital age where sometimes even 3-5 minutes are of vital importance in daily life. While time is understood by reading the numbers directly in digital clocks, clock hands such as hour and minute hands and the functions of these hands need to be known in order to read analog clocks. At this point, the difficulty starts for students with math learning difficulties. Although there are many studies in the literature on clock teaching for students with intellectual disabilities, there are not many studies for students with learning disabilities.

The Six-Step Mathematical Intervention Program is a sequential planning that helps students with learning difficulties to learn and the steps are described below. This model, which Mutlu (2022) defined as "Six-Step Mathematical Intervention", is also seen in the literature with different steps (Gifford, 2006).

Step One: Student Characteristics

This step involves obtaining information about the student's health status, educational background, working memory level, attention level, mathematical anxiety level, reading and reading comprehension level. For this information, a detailed study of the student is conducted to determine these conditions. In the meantime, children's sense of accuracy and mathematical performance levels are also taken into account.

Second Step: The subject to be learned and the knowledge and skills needed to learn the subject

It consists of stages such as the status of the subject that the student has difficulty in learning, identifying the negativities that may occur during learning, reviewing the sub-achievements and determining the level. The learning area, sub-learning area, achievement and sub-achievements are followed in order and the achievement to be taught is discussed in detail. At this point, the related sub and upper objectives gain importance. Misconceptions about the subject, difficulties experienced and common mistakes are especially identified and the student's level of readiness is fully determined.

Step Three: Justified Adaptation Proposals

It is the stage of explaining and adapting the work and activities to be applied to the student with learning difficulties. At this stage, the feeling that teaching will be carried out with a remarkable and different approach by using games and mathematical manipulatives that will attract the student's attention is conveyed to the student. Adaptation studies are carried out regarding the content. The content is concretized and staged as much as possible. Materials

should be in different colors, concrete and suitable for use in multiple representations. Whenever possible, the content should be interactive and suitable for mental processes.

Step Four: Adapted Lecture Process

The lecture process should be handled at the concrete level, semi-concrete level and abstract level, respectively. At the concrete level, activities should be designed with three-dimensional objects as much as possible. Semi-concrete activities can include interactive processes created with worksheets and web tools. At the abstract level, only examples for processing can be included, not with multiplicities.

Step Five: Evaluation

Evaluation studies are carried out in a way that deals with all the achievements of the subject in detail and in a way that can be understood with its stages whether learning has taken place or not. These assessment tools can be done with concrete or abstract studies. Assessment questions should represent the content and be appropriate for the student to be able to realize the sub-learnings and achievements. They should also ensure the level of readiness for higher learning.

Step Six: Home Support

In the home support section, it should be aimed to provide not only parental support but also daily life adaptations and examples. When the learning outcomes are reinforced with daily life adaptations, it can be expected that the learning will be more permanent and will take place in life.

The aim of this study is to teach time with the six-step intervention method to 3rd grade primary school student with suspected dyscalculia and math learning difficulties. For this purpose, the acquisition of "Tells, reads and writes time in minutes and hours", which is the part that should be realized in the primary school mathematics curriculum, was taken into consideration. In line with the study, skills such as teaching the student a full hour, teaching a half hour, teaching a quarter hour, introducing the hour and minute hands, writing and reading the time in minutes and hours were emphasized. The way followed in the process of teaching this outcome is called the "six-step intervention method" and adopts an individual-specific approach that blends prior learning with the target outcome.

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2. Method

2.1. The Design of The Study

This study was designed as action research and was implemented as a single-subject experimental study. Action research is a type of research that helps teachers and task managers to reach better conclusions by making sense of their work (Glanz, 1999, p.302). According to Karasar, action research is the work of researchers and those who participate in the problem in order to contribute to and improve the existing situation. Based on the explanations, the point that makes action research different is to improve the practice rather than theoretical knowledge, to actually participate in the process, to add a solutionist perspective to existing problems, and to support social development (Aksoy, 2023).

Single-subject quasi-experimental action research is a widely used research method, especially in the fields of education and psychology. This type of research is used to examine individuals' behaviors, reactions and/or performances under a specific intervention or condition (Hayes, 1983). Single-subject research is frequently preferred to evaluate the effectiveness of teaching methods, especially in the field of special education (Aydin et al., 2019). This type of research is used to understand the effect of a particular intervention on an individual and to ensure that this effect is scientifically proven (Özkubat et al., 2022). In this study, action research-based instruction was designed for a student with a suspected math learning disability who had difficulty learning clocks.

2.2. The Data Collection Process and Tools

The implementation was carried out in six sessions of 40 minutes each during out-of-class hours in the primary school where the student continued his/her education. The training was conducted in a classroom environment where there were enough tables and chairs, but no lessons were being taught. The materials used for the activities were prepared by the researchers and hourly teaching materials were used as data collection tools. The rationales and contents of the studies and activities to be used in clock teaching for students with learning disabilities are given in step 3 in the findings section.

2.3. The Participants

Depending on the purpose of the study, the sample was selected by purposive sampling, which allows in-depth research by selecting information-rich situations. With this type of sampling, the researcher tries to understand natural and social events or phenomena in the context of selected situations and to discover and explain the relationships between them. In purposive sampling method, situations rich in information are preferred. It is a method that allows the researcher to conduct in-depth research by selecting information-rich situations for a specific purpose (Akbayrak & Kuru, 2022; Bayar & Zengin, 2021; Bütüköztürk et al., 2021; Koyuncu, 2022; Topçu & Öztürk, 2018). This method is preferred when it is desired to study one or more specific situations with certain characteristics (Akbayrak & Kuru, 2022). In addition, thanks to this method, researchers can conduct in-depth research by selecting information-rich situations in accordance with the purpose of the study (Topçu & Öztürk, 2018).

The study was conducted with Leyla (as she was called in the study), a 3rd grade student with suspected specific learning disabilities, who was studying in Kahramanmaraş province in the 2023-2024 academic year. Leyla was studied since she met the prerequisites determined before the study (being able to count rhythmically by writing one, five and ten up to 60; being able to understand and interpret the concepts of whole, half, long and short correctly). More detailed information about the student is provided in the first step of the 6-step intervention method.

2.4. Ethics, Acknowledgements, Conflict of Interest and Authorship Contribution Statement

In order to conduct the study, permission was obtained from Kahramanmaraş Sütçü İmam University Social and Human Sciences Ethics Committee. In addition, the study was conducted in a school affiliated to the Ministry of National Education, and for the participant student, codenamed Leyla, a consent document was obtained from her parents and the necessary support for parental support was also obtained.

Both researchers contributed equally to each section of the article. However, the second researcher, who is a classroom teacher, carried out the implementation. On the other hand, the first researcher contributed to the study with conceptual framework field research. Therefore,

there is no conflict of interest between the researchers and their authorship contribution rates are equal.

3. Findings

The Six-Step Mathematical Intervention Program is a sequential planning that helps students with learning difficulties to learn and whose steps are described below. In this study, these steps were followed and the findings are shared systematically in the following order.

3.1. Step One

Parent and teacher interviews were conducted separately to obtain information about the participant's health status, educational background, working memory level, attention level, mathematical anxiety level, reading and reading comprehension level. It was learned that he did not have a chronic disease and that he was in good health in general. He did not change schools and teachers since the first grade, and schools were reopened for education only after the February 6 Kahramanmaraş Earthquake, but since the participant's classroom teacher was out of the province, he continued his education with a different teacher for two months. As a result of the interviews with parents, teachers and the participant, it was determined that his attention level was sufficient, he had no problems in retention, transferring the information he learned to use it for another purpose at another time, and that he was interested in learning and mathematics lessons. In this section, please cover all your findings according to your research problem. Please use sub-topics for each problem statement.

3.2. Second Step

It consists of stages such as the status of the subject that the student has difficulty in learning, determining the negativities that may occur during learning, reviewing the sub-achievements and determining the level. The learning area, sub-learning area, achievement and sub-achievements are followed in order and the achievement to be taught is discussed in detail. At this point, related sub- and super-achievements also gain importance.

3.2.1. Preparation of Hourly Skill Analysis

While preparing the skill analysis, it is aimed for students to be able to read and write full and half hours in the first grade, full, half and quarter hours in the second grade, and hours and minutes in the third grade in line with the Mathematics Course Curriculum in the MoNE (2018). In the study, the skill analysis of teaching clock reading developed by Aksoy (2023) was used. The steps of this skill analysis are as follows:

1) When shown a model of an analog clock with hour and minute hands set to the exact time, the child tells what time it is by saying "the clock is exactly ...".

2) When shown an analog clock model with hour and minute hands set according to the exact time, writes the time in numbers as "...00".

3) Shows the exact time written in numbers by drawing the hour and minute hands on a clock model without hour and minute hands.

4) When the clock model with hour and minute hands adjusted according to half an hour is shown, tells the time as "hour ... half past".

5) When the clock model with hour and minute hands adjusted according to half hour is shown, he/she writes the time in the form of "... : 30" with numbers.

6) Shows the half-hour written in numbers by drawing the hour and minute hands on a clock model without hour and minute hands.

7) When shown a model of an analog clock with hour and minute hands set according to quarter-hour time, tells what time it is by saying "the clock is ...- .....".

8) Writes the time as "... : 15" when shown a model of an analog clock whose hour and minute hands are set according to quarter past the hour.

9) It shows the quarter hour written in numbers by drawing the hour and minute hands on a clock model without hour and minute hands.

10) When shown a model of an analog clock whose hour and minute hands are set according to the quarter-hour, tells what time it is by saying "it is a quarter to ...".

11) When shown a model of an analog clock with hour and minute hands set according to quarter-hour, writes the time in numbers as "... : 45".

12) It shows the quarter-hour written in numerals by drawing the hour and minute hands on a clock model without hour and minute hands.

13) When shown a model of an analog clock whose hour hand and minute hand are adjusted according to the minute elapsed time, tells what time it is by saying "the clock ...- .... minute elapsed".

14) When shown a model of an analog clock whose hour and minute hands are set according to the minute elapsed time, writes the time in the form "... : ...".

15) It shows the minute time written in numerals by drawing the hour and minute hands on a clock model without hour and minute hands.

16) When shown a model of an analog clock with hour hand and minute hand set according to the time with minutes left, tells the time by saying "it is minutes to ...".

17) When the model of an analog clock with hour hand and minute hand adjusted according to the time in minutes is shown, he/she writes the time as "... : ...".

18) Shows the minute and minute hand written in numbers by drawing the hour and minute hands on the clock model without hour and minute hands.

As a result of the skill analysis, 18 main outcomes were determined and the education process was planned for each main outcome. One training process was included for the skills of full, half and quarter hours, quarter past/stay and minute past/stay.

3.2.2. Preliminary Evaluation

Misconceptions, difficulties and common mistakes are specifically identified and the student's level of readiness is precisely determined.

The second step was conducted one-on-one with the student. It was determined that the participant was able to count rhythmically by writing one, five and ten up to 60, which are the prerequisites for learning the clock, and to understand and interpret the concepts of whole, half, long and short correctly. The pre-assessment was conducted in three stages and the performances were recorded in the table. Three questions were asked about the basic learning outcomes; in the first question, the student was asked to demonstrate on a model, in the second question to write, and in the third question to draw the given clock. A neutral attitude was displayed towards the student's answers and reactions, and the answers were not reinforced in any positive or negative way.

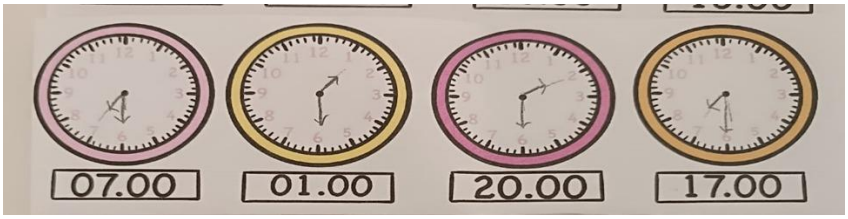

Figure 1. *Example from Pre-Application Student Answer*

In the pre-assessment conducted before the training, it was observed that the student made random and illogical drawings.

Table 1. *Student's Knowledge of Time Before the Application*

Skill / Gain	tells what time it is in an appropriate way.	What time is it? "... : ...".	Draws the hour and minute hands on the clock model.
When a model of an analog clock with hour and minute hands set to the exact time is shown	x	x	x
When a model of a clock with hour and minute hands set to half an hour is shown	x	x	x
When a model of an analog clock with hour and minute hands set to quarter past the hour is shown	x	x	x
When a model of an analog clock with hour and minute hands set to quarter-hour is shown	x	x	x
When a model of an analog clock with hour and minute hands set to the minute elapsed time is shown	x	x	x
When a model of an analog clock with hour and minute hands set to the minute mark is shown	x	x	x

According to the skill analysis for clock teaching prepared according to the student's situation, there was no correct answer among the answers given by the student.

3.3. Step Three

It is the stage of explaining and adapting the studies and activities to be applied to the student with learning difficulties.

The use of games in mathematics education has been a topic of interest in educational research. Various studies have emphasized the positive effects of game-based learning on student engagement and academic achievement in mathematics (Toraman et al., 2018; Ergül & Doğan, 2022). It has been determined that game-based teaching methods have a positive effect on student achievement compared to traditional teaching methods (Ergül & Doğan, 2022). In addition, the use of educational mathematics games in mathematics teaching has been suggested (Topçu et al., 2014). The inclusion of game-based activities in mathematics teaching has been associated with improved student attitudes and access to the subject (Usta et al., 2017). In addition, the use of concrete materials in mathematics teaching is emphasized to facilitate better understanding of mathematical concepts in students (Özdemir et al., 2020). The use of

games in mathematics education has been associated with increased teacher satisfaction and positive perceptions as well as positive effects on student learning (Çil & Sefer, 2021; Hava & Şen, 2021). In addition, the inclusion of game-based instruction has been associated with increased student participation in mathematics lessons (Kaya, 2018).

The effectiveness of game-based learning environments in increasing academic achievement was supported by a meta-analysis study that included mathematics as one of the subject areas where game-based learning showed positive effects (Toraman et al., 2018). In general, the literature suggests that the use of games in mathematics education can lead to a positive increase in student engagement, academic achievement, and attitudes towards mathematics.

Including games at the beginning of mathematics teaching is very effective in terms of introducing concepts, and including games at the end is very effective in terms of reinforcing concepts (Mutlu & Atmaca, 2021). In the preparation of the materials, it was tried to include figures and colors that could attract the student's visual, affective and cognitive interest.

3.3.1. The Tangible Analog Clock:

The clock is made of wooden material and has a diameter of 14 cm. It is CE certified and does not contain paint harmful to health. Two long and short fish represent the hour and minute hands.

Figure 2. *Analog Clock Used in Teaching*

In the education process, the game "Fish Who Don't Like Waiting" was included in order to both concretize the subject and to attract the student's interest. The story of two fish who are very good friends and want to go everywhere together was told, meeting times were

set for their different jobs, and the student was expected to bring the hour and minute hands to the desired time by touching them.

3.3.2. Cookie Girl Puzzle:

This activity was done by printing colored printouts on A4 size background cardboard and cutting them at certain points. Students were expected to match the analog clock display with the cookie girl holding the correct sign.

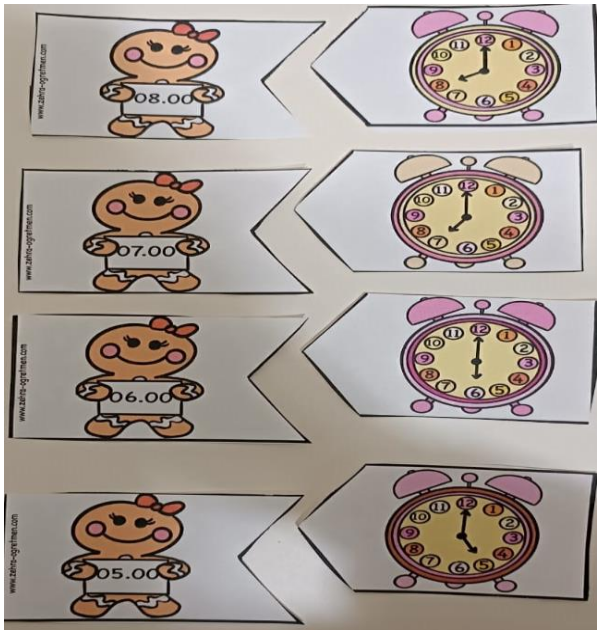

Figure 3. *Cookie Girl Puzzle Used in Teaching*

3.3.3. Patterning the Watch Dress:

A4 size white background cardboard was printed in color and laminated to make it suitable for the write-erase activity. The material was prepared from materials that are suitable for repeated use, low cost and easy to obtain. The student should draw a clock instruction (sometimes of his/her own choice) on the analog clock template on the dress.

Figure 4. *Patterning the Watch Dress Used in Teaching*

3.3.4. Worksheets:

Since worksheets are considered as materials that help students to reveal their knowledge, they were also included in this study. Separate worksheets were prepared for each of the main learning outcomes. Below are a few examples of these worksheets.

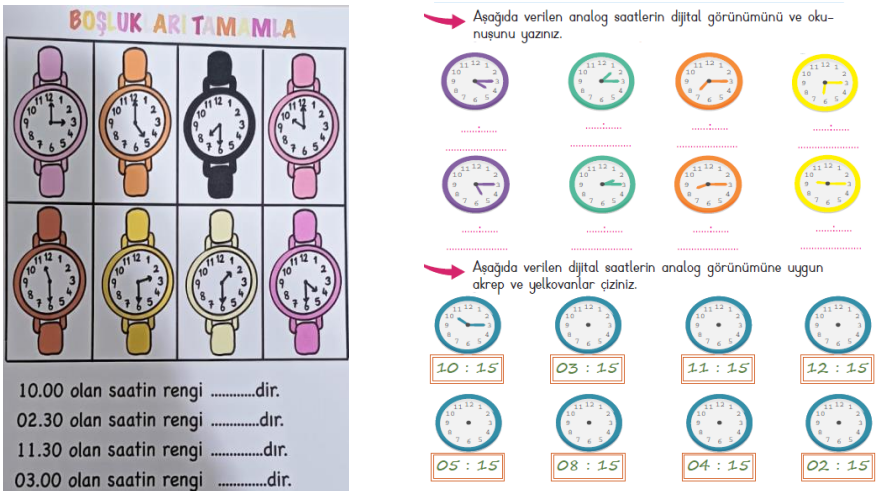

Figure 4. *Worksheets Used in Teaching*

3.3.5. Virtual Games:

The use of virtual manipulatives in education is becoming indispensable, especially in the digital age. They are concrete materials that can be touched and edited by students in order to concretize abstract concepts by modeling them (NCTM, 2000). Especially in courses such as mathematics where abstract and relational concepts are taught, it is important to develop computer software called "virtual manipulatives" for the conceptual relationship emphasized

in order to make concretization (Karakırık, 2008). In this study, web2 tools such as wordwall, Storyjumper and Iconfinder were used.

3.4. Step Four

Teaching processes are planned as 40-minute training sessions. At the beginning of the process, the participant was informed and an introduction was made about the materials / designed applications. Necessary tables, chairs, etc. where the practitioner and the student can sit alone. Teaching was carried out in a classroom environment where the materials were prepared in advance and there were no distracting stimuli.

The lecture process was discussed sequentially at the concrete level, semi-concrete level and abstract level. Activities were designed with three-dimensional objects as much as possible on a concrete level.

Figure 5. *Example that Student Tangible Material Application*

Semi-concrete studies were progressed by incorporating interactive processes created with working papers and web tools.

Figure 6. *Example that Virtual Interactive Manipulative*

At the abstract level, prepared worksheets were used. Care was taken to include all questions regarding clock reading skills in these worksheets. The worksheets are not given as a whole, but are given in parts.

Figure 7. *Worksheets Example*

3.5. Step Five

Evaluation studies have been carried out in a way that covers all the achievements of the subject in detail and can be understood in stages whether the learning has been achieved or not. These evaluation tools were also made with concrete, semi-concrete and abstract studies. Evaluation questions were prepared and applied to the skill analysis table prepared to represent the content and to be suitable for the student to achieve the sub-learnings and achievements.

Figure 8. *Example from Student Response after the Training Application*

After the completion of the teaching processes, three questions were asked about the basic achievements; in the first question, they were asked to show by making it on a model, in the second question, they were asked to write, and in the third question, they were asked to draw the given clock.

In the final evaluation after the training, it was seen that the student could not only show the hour and minute hands by minute on the analog clock model set according to the remaining time, but also gained all other time reading skills.

Table 2. *Student's Knowledge of Time After the Application*

Skill / Gain	tells what time it is in an appropriate way.	What time is it? "... : ...".	Draws the hour and minute hands on the clock model.
When a model of an analog clock with hour and minute hands set to the exact time is shown	✓	✓	✓
When a model of a clock with hour and minute hands set to half an hour is shown	✓	✓	✓
When a model of an analog clock with hour and minute hands set to quarter past the hour is shown	✓	✓	✓
When a model of an analog clock with hour and minute hands set to quarter-hour is shown	✓	✓	✓
When a model of an analog clock with hour and minute hands set to the minute elapsed time is shown	✓	✓	✓
When a model of an analog clock with hour and minute hands set to the minute mark is shown	x	✓	x

Pre-test and post-evaluation results were compared with the records in the performance forms of showing on a model in the first of three questions for each basic acquisition, writing on a model in the second questions, and drawing on a clock template in the third questions. It was observed that the clock reading skill of the third grade primary school student was formed, increased and improved with the six-step intervention.

3.6. Step Six

The home support section aims to provide not only parental support but also daily life adaptations and examples.

The participant's ability to demonstrate the targeted skills in environments independent of teaching processes and their generalization levels were investigated. The participant's parents were interviewed individually and information was given about clock reading skills and their evaluation. An evaluation form was prepared, and questions that parents could ask for evaluation purposes were also included in the form.

When the acquired gains are reinforced with daily life adaptations, learning can be expected to be more permanent and included in life. For this reason, while normal education was continuing at school, the practice was achieved by asking questions only to Leyla, such as

how many minutes until recess, how many minutes until leaving school, how many minutes has it been since the lesson started.

4. Discussion

Making sense of time measurement tools such as clocks and calendars is included in the primary school curriculum of all countries and is considered important (Burny, Valcke, & Desoete, 2012). The ability to read a clock is an important skill that children should learn at the age of 6-7 and use throughout their lives (Freedman & Laycock, 1989). According to the results of many experimental studies (Case, Sandieson & Dennis, 1986; Friedman & Laycock, 1989), analog clock reading skills reveal that there is a process that primary school children develop depending on different periods. The ability to perceive time in primary school is not a process that develops alone. It is stated that clock reading skill develops based on literacy, arithmetic operations, number sense, place value perception, memory and spatial skills (Foreman et al., 2007). Our findings showed that the student coded Leyla, who is at risk of dyscalculia, met the 18-item analog clock reading skill criterion with the six-step intervention method. In their studies showing that children at risk of dyscalculia cannot read clocks (McGuire, 2007; Mutlu & Korkmaz, 2020), they stated that these students had difficulty in developing clock reading skills. As a result of the pre-test in this study, the student with suspected dyscalculia did not have much knowledge about reading time, and after the teaching processes with the six-step intervention method, it was seen that he improved his time reading skill, excluding minute display.

While studies in the literature (Burny, Valcke & Desoete, 2012; Harris, 2008; Andersson, 2008; Van Steenbrugge, Valcke & Desoete, 2010) point out the difficulty of the clock reading skill, it has been shown with the results of this study that it can be taught as a result of teaching with a planned teaching model. In order to develop clock reading skills, it is necessary to know calculation, counting, conceptual knowledge and spatial relations. However, students with dyscalculia experience problems in these matters. Considering that they experience these problems, it seems normal that dyscalculic children cannot read clocks (Geary, 2006; Mutlu & Korkmaz, 2020; Shalev et al., 2001).

Considering that difficulties in reading time, especially in the first years of primary school, may be an early indicator of dyscalculia (Burny et al., 2012), prrimary school teachers may need to pay close attention to this issue.

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5. Conclusion

The clock reading teaching process was examined with the six-step intervention method prepared for a 3rd grade student aged 8-9 with suspected dyscalculia. First, the clock reading skill analysis was made, then the designed/planned activities were implemented, and as a result of the teaching process, the level of generalization of the skill with different people in different environments was examined.

The participant achieved the goal of being able to show and tell the hours on the model and to show them by drawing them on the analogue template regarding the hours of full hours, half hours, quarter past and minute, minutes past. In addition, it was determined that the participant exhibited the knowledge he learned and the skills he acquired in environments and people independent of the teaching sessions. Therefore, it can be said that the six-step intervention method is effective in gaining clock reading skills.

After the application, it was observed that the participant could not fully comprehend the gains related to the hours with only minutes left. Due to the limited number of studies on teaching time with the six-step intervention method with dyscalculic students, difficulty with minute-to-minute hours could not be foreseen and the number of sessions could not be made accordingly. It is thought that this skill can be gained with additional teaching sessions.

The six-step intervention technique can be tested with different activities in accordance with the content of the subject in subjects where students with learning disabilities have difficulties.

6. Suggestions and Limitations

In this study, a single-subject study was conducted with a suspected diagnosis of dyscalculia. Although the student reached the 3rd grade, he could not acquire the skill of reading a clock. Other studies can be conducted in lower classes and with multiple subjects. Additionally, by developing a clock reading skill test or scale, a general screening can be done in primary school and their relationship with dyscalculia can be investigated.

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