

Examining the mistakes of first-grade primary school students regarding time measurement

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Abstract

This study aimed to determine the mistakes of first-year primary students in online education about time measurement, which is the sub-learning area of measurement in the Maths class. According to this aim, the study was conducted as a case study, which is one of the qualitative methods. In order to collect the data in the study, nonparticipant observations made online in the classroom environment, semi-structured interviews with the students individually via video conference, and all the homework assigned to the students by the classroom teacher during the process related to the subject were utilised as document review. In the analysis of the data obtained, content analysis was used. In light of the findings, it was determined that the students made mistakes in showing and saying half hours and whole hours involving hour and minute hand, in the yesterday-today-tomorrow relationship, and in the week-month relationship. Supporting time measurement activities with concrete materials (examples of clock, calendar) and making sense of time measures by associating them with fractions, numbers, and geometry can help reduce mistakes.



1 Introduction

Mankind has always been closely correlated with mathematics to make sense of the environment in which they live and create a living space for themselves. By swapping in a simple shopping or by making a monetary payment today, sometimes counting to determine the quantity of something or collecting to put things together, or sometimes in order to plan their days in daily lives, they are intertwined with mathematics for time control.

One of the main objectives of the mathematics teaching curriculum is to raise people who can comprehend mathematical concepts and apply them to their daily lives (MoNE, 2018). The correct implementation of concept teaching, which is among the main objectives of the mathematics curriculum, is important in terms of comprehending sequential and intertwined mathematical concepts. Concept teaching, which forms the basis of mathematics teaching curriculum, is important for students to understand mathematical concepts and relationships that will be encountered in the future (Erdoğan & Özdemir Erdoğan, 2013). According to Dede and Argün (2004), it is more important that students understand what purposes concepts serve rather than what they are. One of the biggest issues that mathematics teachers and researchers in this field

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face is incomplete or erroneous teaching of concepts in teaching mathematics (Zachoros & Chassapis, 2012). Although concept teaching is such an important process and should be emphasised, everything may not always develop as desired. It is possible to assert that in the mathematics lesson, in which abstract concepts are mostly included due to the structure of the course, primary school children, especially in the concrete operational period, may experience problems in learning abstract concepts accurately and completely.

It is important to identify incorrectly learnt concepts, as students' erroneous or incomplete learning during the learning process of any concept will cause them to have difficulty in learning the next concept and to continue their incomplete learning. (Duatepe Paksu, 2010). At that point, it is important to differentiate between a misconception and a mistake. Although they are intertwined concepts, misconceptions and mistakes actually mean different situations. A misconception is a misinterpretation that arises from rational reasoning of students based on misunderstanding and being misunderstood (Ojose, 2015). In other words, a misconception occurs when students define concepts in a way that is different from the definitions that are acceptable scientifically. Therefore, behaviour that is the result of false learning and misunderstanding of students is a misconception (Yılmaz & Yenilmez, 2008). A mistake is defined as an error made unintentionally and unknowingly, a fault, a mistake, or an error (Turkish Language Association, 2011). When we look at a study, the best way to understand that there is a mistake due to a misconception or for a different reason and to make a decision is to look at the frequency and consistency of the mistake (Spooner, 2002).

One of the abstract subjects in the primary school mathematics curriculum and one of the subjects where mistakes can be made is the subject of time measurement. Measuring time, one of the sublearning areas, is in the primary school mathematics curriculum starting from the first year and getting gradually complicated in subsequent years (MoNE, 2018). One of the most common measurement actions in daily life is the expression of time by quantifying it with the measurement process (Güner & Uygun, 2021; Serin, 2023). Sucu (1996) defined time as an abstract concept that an individual formed in his consciousness consisting of endless subsequent events (as cited in Doğan & Usta, 2019). It is thought that it is not easy for students to tell the time as is assumed because the details that need to be used while telling the time are too many (Karabulut & Yıkılmış, 2010). Learning and making sense of time measurement is important for students to prevent them from making mistakes while measuring time (Jealini et al., 2013). Because of the above-mentioned reasons, it becomes complicated for students to learn time expressions, and it causes them to make mistakes.

Most children have difficulty acquiring clock reading skills (McGuire, 2007; Harris, 2008). According to Altun (2018), children who start school have three basic difficulties in reading the time related to time measures, comprehending the size of a spoken time period, and comprehending what the read time measure tells. Kar and Öçal (2022) stated that one of the most important reasons why the concept of time is difficult to learn is that concept learning is related to different mathematical concepts and the concept has an abstract structure.

The common tool used to measure time is the clock. However, learning to tell time is not so much related to measuring time, but rather to learning to read dial instruments (Van de Walla et al., 2012). The expression of the clock by children may not be simple for them. It can be thought that the reason for this is the fact that there are too many details about the time expression (Karabulut & Yıkılmış, 2010). According to Catterall (2008), it is not an easy skill to teach. Telling the time In

addition, since time measures are related to numbers, geometry, fractions, and operations on these subjects, they should be carried out in relation to these subjects in the teaching process (Serin, 2023). Time measures are closely related to fractions. Knowing that an hour consists of two half-hours and four quarter-hours reveals this relationship (Kar & Öçal, 2022). We then move to half-past, which requires an appreciation of fractions. Most of these young children will be at the stage of 'recognising half' through the use of objects and shapes rather than by number or turning. Children normally recognise half of a circle split horizontally; but with a clock face, half is a circle split vertically. When dealing with half past the hour, there is also the small issue of interpreting the meaning of the hour hand when it is not pointing directly at a number (Catterall, 2008). It may be desirable to paint the clock, especially in the half-hour display. Of course, in this case, it is very important for students to determine what the word half means and how it is displayed (Kar & Öçal, 2022). In daily life, when a chocolate, bagel or half of an apple is mentioned, it should be known that it is one of the equal parts. It is important to understand what it means for the two halves to be a whole. Interpreting these situations will make it easier for a child to relate to the meaning of half-hour and full-hour about clocks. From the point of view of the first grade of primary school, the subject of fractions is covered just before the subject of measuring time. Therefore, learning the concepts of half and full in fractions will provide an opportunity to make connections about time. What does the whole mean for fractions? The meaning of the piece should be explained by the students, and the relationship between the whole piece should be stated. For these, studies should be carried out on concrete examples in the classroom environment. It should be emphasised that the expression of the half is accompanied, that is, the same as each other. In this way, the measurement of time will provide a better understanding of the full and half concept of the clock. As a measuring tool, the analogue clock has 12 equal hour intervals, and the number 12 marks both the zero point and the end point, depending on what the user is participating in. As with any standard measuring instrument, the analogue clock provides even intervals arranged end-to-end, without gaps or overlaps. Of course, the clock doesn't just represent hours; instead, the same 12 intervals reflect both minutes and seconds (Earnest et al., 2018).

When the literature on time measurement is reviewed in Turkey, it is seen that there are not many studies. One of the studies in the literature is the one conducted by Doğan and Usta (2019). In their study, they aimed to examine the knowledge of fourth-grade primary school students about time measurement and, if they had, to identify their mistakes. At the end of the study conducted with 120 fourth-grade primary school students, it was found that students confuse 'past' with 'to' concepts, could not differentiate what hour hand and minute hand show, and they made mistakes while drawing hour hand and minute hand (Doğan & Usta, 2019). Another study in the literature was carried out by Karabulut and Yıkılmış, in which they aimed to determine the efficacy of the 'telling the time' teaching skill with simultaneous hints to mentally disabled individuals.

When the time measurement literature is reviewed abroad, it is seen that the number of studies is limited. Studies in the literature were about other sub-dimension of measurement, and there is no study about time measurement. One of the studies in the literature is by Jealani et al. (2013). It was carried out with third-grade primary school children with the purpose of learning to measure the time, a complicated topic to learn for students, by linking it with daily activities. They have been conducted as the Indonesian version of Realistic Mathematics Education, and used a traditional 'gassing' game to teach time measurement. At the end of the study, it was suggested that the students made progress in learning to measure time using the non-standard unit, comprehending the standard unit, and measuring time using a standard unit (Jealani et al., 2013).

In the literature research, it is thought that there are few studies on time measurement and identifying the mistakes made by students in measuring time, which has an abstract meaning for students, will help the teaching processes to prevent these mistakes and plan the lessons more effectively.

1.1 Purpose of the study

One of the common objectives of the curricula prepared by the Ministry of National Education (MoNE) for primary school students is to prepare them for life. In this study, which will be carried out in this direction, the subject of measuring time was chosen among numerous abstract topics in mathematics of first-grade primary school students who have just started their basic mathematics education life and are in the concrete operations stage. The field of measurement is one of the disciplines in which both students and teachers have difficulty in the teaching process and where the conceptual process of measurement should be incorporated into the learning process (Zachoros, 2006). One of the subjects in the field of measurement is time measurement. Time measurement starts from the first grade in the primary school mathematics programme and has achievements at all levels of primary school. Primary school has 3 gains as reading full and half hours in the 1st grade, determining the day, week and month on the calendar, and ordering certain events and situations as reference (MoNE, 2018).

One of the reasons for choosing the subject of time measurement; It is to see whether students make mistakes during and after learning the concepts of planning the day, reading the time, and using the yesterday-today-tomorrow relationship, which they have to use in their daily lives at every moment of their lives. Another reason is; The aim of this study is to determine the errors in time measurement and to contribute to the literature on this subject, which has not been studied much in the domestic and foreign literature. After determining the errors related to the subject, the mistakes made by the first grade students of the primary school in measuring time were examined to inform the classroom teachers about these issues and to plan the teaching processes more effectively by reducing the frequency of mistakes of the students.

In this regard, the fundamental problem of the study is: 'What are the mistakes that first-grade primary school children make about measuring time?' Within the framework of this question, it is aimed to find answers to the following subquestions:

1. What are the mistakes made by primary school 1st grade students about reading whole and half hours?
2. What are the mistakes made by primary school 1st grade students about determining the day, week, and month on the calendar?
3. What are the mistakes made by students in primary school 1st grade in determining the order of certain events and situations by reference?

2 Method

2.1 Research design

In this study, the objective was to examine the mistakes made by first-grade primary school students about measuring time. According to the purpose of the investigation, the study was conducted with appropriate qualitative research methods. Accordingly, it was decided to conduct the research with case study, which is one of the qualitative research models. Case study research is a detailed and comprehensive approach by the researcher through multiple sources of

information (e.g., observations, interviews, audio-visual materials, and documents and reports) about a real-life, current limited system (a situation) or multiple constrained systems (states) over a period of time. It is a qualitative approach in which in-depth information is collected, a situation description, or situation themes are revealed (Creswell & Poth, 2016). As this study aimed to examine one case, the mistakes that the students made about measuring time, it was decided to employ a single descriptive case study, which is one of case study models. Single descriptive case studies are studies in which a single case aims to be explained in a descriptive manner.



Figure 1 Research Design

2.2 Validity and reliability

Structural Validity: Variation in data sources is important to ensure structural validity. Accordingly, the data were collected by using three different data collection instruments from different sources in order to be able to conduct this study.

Internal Validity (Persuasiveness): To ensure the significance of the study findings, field experts received support in the presentation and interpretation of the findings.

Reliability (consistency): In order to ensure the reliability of the study, starting from the data analysis process, during all other processes; presenting findings and study results, expert assistance was received. At the end of the comparison of evaluation made by the researcher and expert, it was seen that their evaluation of data, findings, etc. was consistent.

2.3 Participants

The study participants were made up of 14 students from first grade primary schools attending a state primary school (Tahir primary school Code Name) in Selçuk district of İzmir province during the second term of the academic year 2020-2021. During the choice of participants, the purposeful sampling method was used. In this method, the researcher evaluates who will be included in the study group and identifies the participants who are the most suitable for the purpose of the research (Balci, 2001). Eight of the participants were men and six of them were female. The students are between 7 and 8 years old. The names of the students were coded as S1, S2, S3,.....S14.

Table 1 Participants

Code Name	Gender	
S1	Male	
S2	Female	
S3	Male	
S4	Female	
S5	Female	
S6	Female	
S7	Male	
S8	Male	
S9	Female	
S10	Male	
S11	Female	
S12	Male	
S13	Male	
Distribution of participants by gender		
Gender	n	%
Male	8	57
Female	6	43

2.4 Study Setting

Due to the Covid-19 pandemic, face-to-face education was not possible, so virtual classrooms that students and the teacher joined with the help of tablets, computers, smartphones, etc. from their homes using the EBA system were identified as the setting of the study. There were two types of virtual classrooms. In the first, there was a log-in screen where students first logged in, and the images of all teachers and students could be seen. In the second, the class teacher reflected the resources related to the subject and the lesson when the lesson started, besides the images of the students, and both the teacher and the students had drawings, paintings, writings, etc. on it. This virtual classroom setting within the online course where students could perform transactions was determined as the study setting.

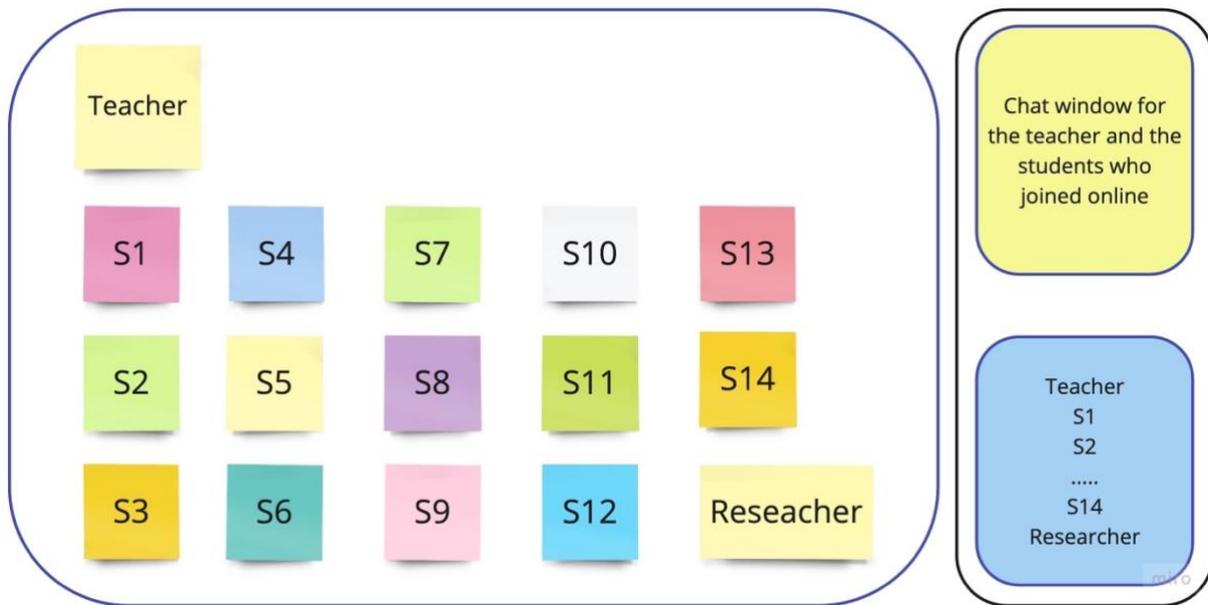


Figure 2 Online classroom setting (First login page)

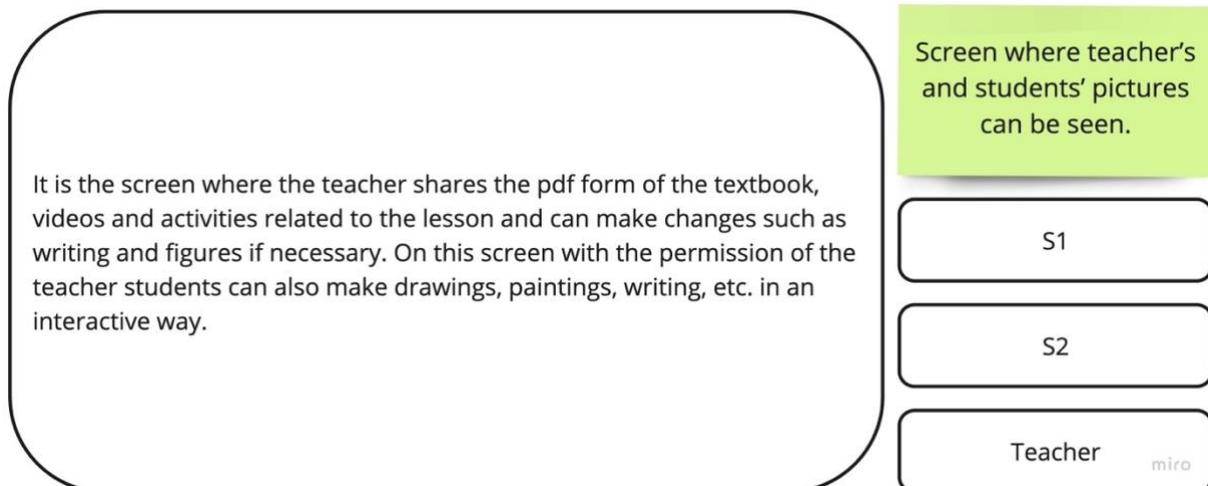


Figure 3 Classroom setting during an online course

2.5 Role of the researcher

The researcher actively participated in all the study processes from the beginning until the end. Meanwhile, the researcher had participated in all lessons that were conducted remotely in the observation part of the study but never turned on his/her camera or microphone. In this way, the students did not notice that there was a different person in the learning environment, so their learning process was not affected. In addition, semi-structured interviews were conducted by the researcher by first talking to the parents of the students and asking the questions prepared for the students at a time when the student was comfortable. In the document collection phase of the study, the researcher was added to the parents' group by the teacher and contacted the parents to get the daily homework of the students.

2.6 Data collection tools

Within the scope of the case study, more than one data collection tool was used while collecting data, in order to carry out the research properly and achieve the correct results. Nonparticipant

observation, semi-structured interviews with the classroom teacher, document review, and observation notes were used to collect data.

2.6.1 Nonparticipant observation

Nonparticipant observation was preferred in this study as the researcher would only be an observer in the teaching environment.

2.6.2 Semi-structured interview

Generally, it has a more flexible structure. It is a technique in which the questions prepared in advance for the subject and purpose to be researched by the researcher are asked during the interview and different questions related to the subdimensions of the main questions can be added during the interview when necessary (Türnükü, 2000). In this study, an 8-question semistructured form prepared by the researchers was asked at a prearranged time to 14 first-grade primary school students, and their responses were recorded. The whole process was conducted with the consent of the parents of their students. These interview questions were prepared in accordance with the acquisitions of time measurement from the 1st grade of primary school and were prepared to help students express what they learnt. Before applying these questions, the opinions of a field expert and a classroom teacher were taken, and the questions were finalised.

2.6.3 Observation notes

During the non-participant observation carried out by the researcher, the points that the researcher noticed and considered important for the study were taken in the form of notes, specifying the date and time, and included in the data analysis process.

2.7 Data collection process

First, Mr. Cahit (Code Name), who is the class teacher, sent the link and the password to the researcher so that he could access the classroom through EBA and the nonparticipant observation process started. At the end of the interview with Mr. Cahit, the days the researcher would participate in the distance lessons were determined. Accordingly, the researcher first attended a lesson (30 minutes) on April 22, 2021, to make pilot observations. Then, starting from April 26, 2021, the researcher attended one lesson (30 Minutes) every day for two weeks. In total, the researcher observed 10 lessons. After the homework assigned by the teacher was completed by the students, it was sent to the researcher via WhatsApp by the parents. After the observation period was over, an interview was held with the students on 11-12 May 2021. The interview questions were prepared by the researcher in advance, and during the preparation process, the questions were checked by the class teacher, Mr. Cahit and the expert who was advising the researcher. The interviews were recorded with the consent of the parents.

2.8 Data analysis

As a result of the semistructured interview, the data obtained during the observation and from the student course documents were carried out by the content analysis method. The data obtained with these data collection tools were compared and analysed, and the codes that emerged from the data were formed by consulting the opinions of two experts, and the main themes were formed by bringing together the themes and subthemes. In the process, the codes and themes were shared with experts by receiving the support of two field experts. To determine the reliability of the coding in the research, the reliability calculation of the formula (Reliability = consensus / (Agreement + Disagreement)) developed by Miles and Huberman (1994) was used. According to Miles and

Huberman (1994), values above 70% of the calculation result are considered reliable. The consistency coefficient between the two researchers regarding the codes determined in this context was determined to be 0.83.

3 Findings

In this section, at the end of the data analysis obtained from the student interviews, the three themes that emerged and five subthemes formed depending on these themes, the findings within the scope of them are presented.

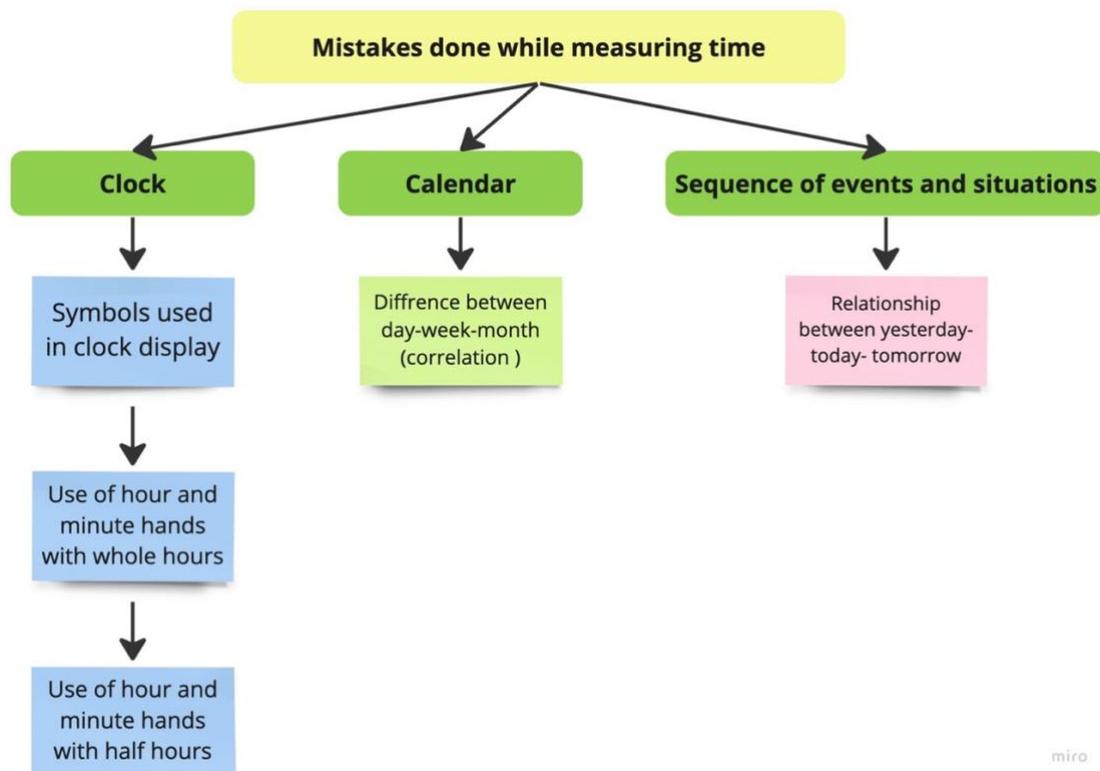


Figure 4 Mistakes made while measuring time

As can be seen from Figure 1, As seen in Figure 1, as a result of semi-structured interview results with students, observation notes and examination of students' documents, it was seen that they were gathered on three main themes: 'Clock', 'Calendar', and 'Sequence of events and situations'. In line with the data obtained in the study, the results were tried to be explained with examples in the context of the subthemes formed within the scope of the main themes.

Table 5 Frequency and percentage of mistakes made according to semi-structured interviews

Theme	Sub -Theme	n	%
Clock	Symbols used in clock display.	5	35,71
	Use of hour and minute hands with whole hours.	2	14,28
	Use of hour and minute hands with half hours.	5	35,71
Calendar	Relationship between day- week-month.	6	42,85
Sequence of events and situations	Relationship between yesterday-today and tomorrow.	4	28,57

3.1 Clock

The mistakes made by the students with the knowledge of time in the subject of measuring time are explained under the theme of 'Clock'. There are mistakes made by students while reading time and symbols used while displaying time. Each of the subthemes created from the interviews with the students was examined in detail, and in the explanation of the subthemes created, it was supported by quotations from the student interviews, quotations from the document analysis, and one-to-one quotations from the observation process.

Symbols used in clock display. Based on the answers given to the questions about the symbols used in the time display in the interviews with the students, it was seen that the students made mistakes such as using the hour and minute hands interchangeably about what the hour and minute hands are for the symbols used in the time display. The answers given by the students to the interview question about the symbols used in the clock display are given below.

S2: (paused) short stick is a minute hand. The long stick is the hour hand.

S4: (paused / mm) Let me think. (pause). The short stick mmm I don't know. The long stick is the crab.

S5: The short stick mmm... apostrophe. Half. The long stick is minute hand.

S10: The short one is the minute hand. Long one is hour hand.

S14: The short one is the minute hand. Long one is hour hand

It is observed that students coded as S2, S10 and S14 confused the symbols used in the clock display with each other. It was observed that students with the code S4 and S5 gave nonrelated answers such as crab and apostrophe, completely independent of the meanings of the symbols used in the clock display.

The Use of Hour and Minute Hand with Whole Hours. In the interviews with the students, the answers given by the students who gave the wrong answer to the question about the place of the hour and minute hands on the clock in the display of the whole time (when it is eight o'clock) are given below.

S5: Two. The hour hand is on 2. The minute hand is on 10.

S10: (whispering with mom) Minute hand is on 8 and hour hand is on 12.

S14: The minute hand is on 8. The hour hand is on 12.

It was observed that students with codes S5, S10, and S14, who made mistakes with the symbols used in the time display, continued to make the same mistake with the position of the hour and minute hands in the display of the whole hours. It was observed that although the student with code S2 made mistakes about the symbols used in the clock display, she gave the correct answer to the question asked in the interview about the whole hour display. However, in the findings obtained from the observation, it was seen that she made a mistake in reading all hours. In the observation made about the entire reading, the process is as follows: it was seen that he gave the correct answer to the question posed in the interview.

Teacher: Can you write the time shown on this clock?

S2: Twelve

Teacher: No, it is not twelve.

Ö7: (pause and whisper of mom) Ten.

Teacher: Yes. Exactly ten. What is the time on my other clock?

.....

(D.R. date: 4 May 2021/12.30-13.00)

Teacher: What is the time on the clock next to the third picture?

S9: It is 12 o'clock.

Teacher: My dear, it is not 12, it is 10 o'clock. The short one on ten. The long one is on 12. The long one shows the minute, and the short one shows the hour. It is exactly ten o'clock.

.....

Teacher: Yes, it is exactly one. S5 it is your turn, what is the time?

S5: (pause) mmm. Half past six.

Teacher: Exactly six. The hour hand is on six and the minute hand is on twelve, it is exactly six o'clock.

(D.R. Date: 5 May 2021/12.30-13.00)

The students coded as S2, S9, and S5 gave correct answers to the question asked in the interview, but it was observed that they made mistakes during the observation process carried out with distance education both when the teacher gave them the opportunity to speak and when the teacher himself answered the questions and asked them only to write the answers. (Data recoding date: 3-4-5 May2021/12.30-13.00).

The excerpt from the homework documents of the students who made a mistake regarding the use of the hour and minute hands in the display of the whole hours is given below.

S5: It's 5 o'clock It's 1 o'clock It's 12 o'clock. It's 7 o'clock

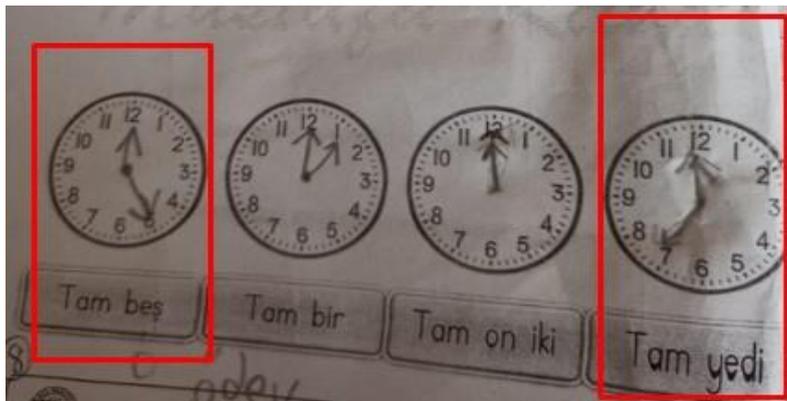


Figure 5 S5 homework document

S14: It is 2 o'clock. It's 1 o'clock. It's 4 o'clock. It's 10 o'clock.

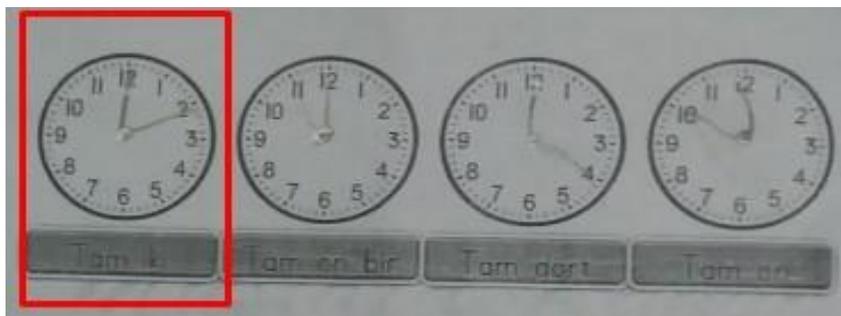


Figure 6 S14 homework document

When the extracts taken from the homework documents of the students coded S5 and S14 were examined, it was seen that the long (minute hand) and short (hour hand) sticks were used in the wrong places while the students were drawing all the time on the Turkish style clock.

Use of Minute and Hour Hands with Half-Hours. The answers given by the students who gave the wrong answer to the question about the use of the minute hand and the hour hand in the display of half-hours (the expression of half hour) during the interview with the students (it's half past) given below.

S4: I will think. Long stick is on 12. Half past eight. It is half past eight. Long stick is on 12 short stick is half past eight.

S12: (pause) Hour hand is down. The minute hand is up.

Researcher: Can you tell me which numbers they are on?

S12: it is half past eight. It is half past eight. (Pause) hour hand is coming on eight. The minute hand is up.

Researcher: When you say that it is up, do you mean that it is on 12?

S12: Yes, it is on 12. It is pasting 6.

S14: Minute hand 6, hour hand 7.

S9: The small one is getting on 6. Between 8 and 7 the long one.

Considering the mistakes made by the students regarding the use of the hour and minute hands while showing the half-hours, S4 and S12 expressed half-hours over whole hours, S9 made a mistake because of using hour and minute hand in different places, S14 made a mistake because of telling the number that hour hand shows incorrectly, although he was able to tell the number minute hand indicating correctly. Extracts taken from the homework documents are given below.

S14: It's half past four. It's half past eleven. It's half past six. It's half past twelve.

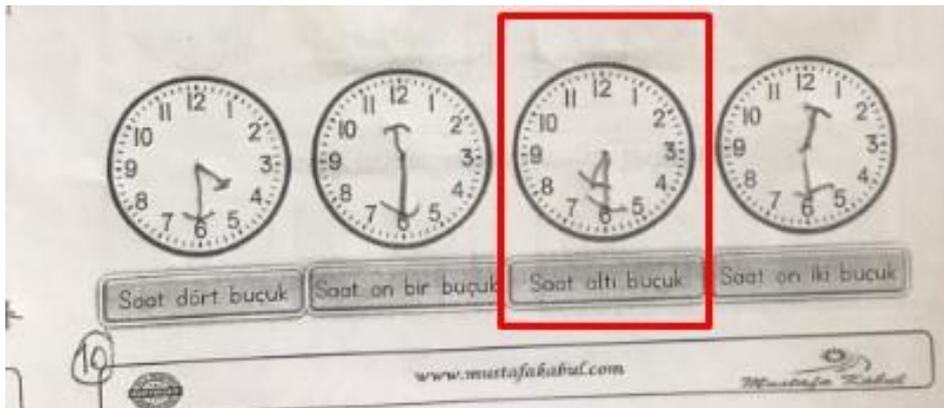


Figure 7 S14 homework document

S9: It's half past eight. It's half past one. It's half past three. It's half past nine.



Figure 8 S9 homework document

S4: It is half past eight. It is half past one. It is half past three. It is half past nine.



Figure 9 S4 homework document

S11: It's half past four. It's half past eleven. It's half past six. It is half past twelve.

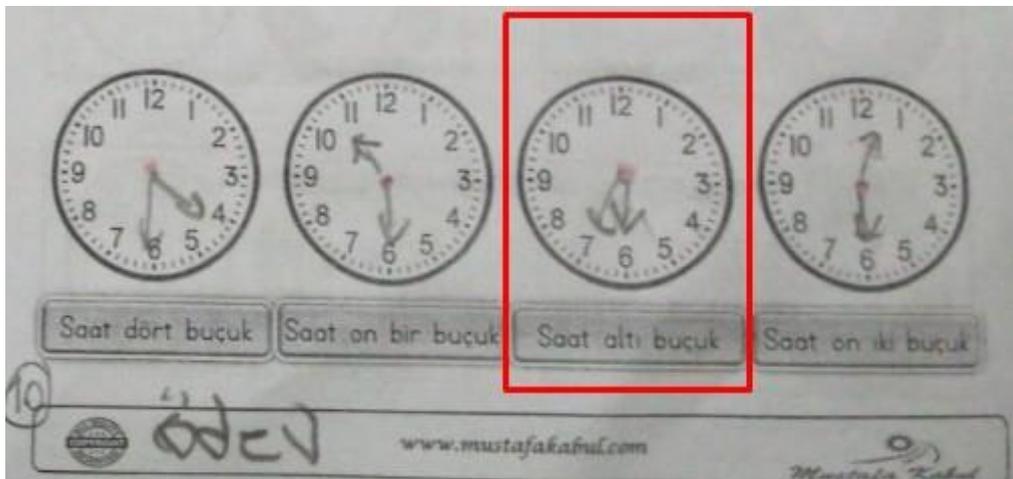


Figure 10 S11 homework document

S9: It's half past four.

It is nine o'clock

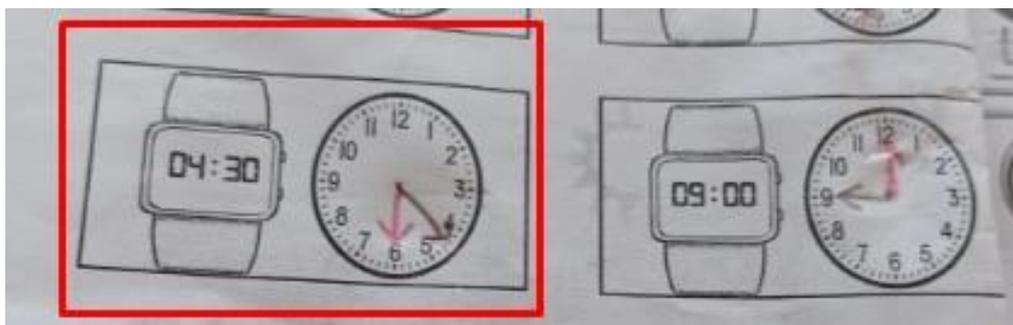


Figure 11 S9 homework document

S12:

It is half past eight. It is half past one. It is half past three. It's half past nine.
It is half past five. It is half past ten. It is half past two. It's half past seven.
It is half past four. It is half past eleven. It is half past six. It is half past twelve.

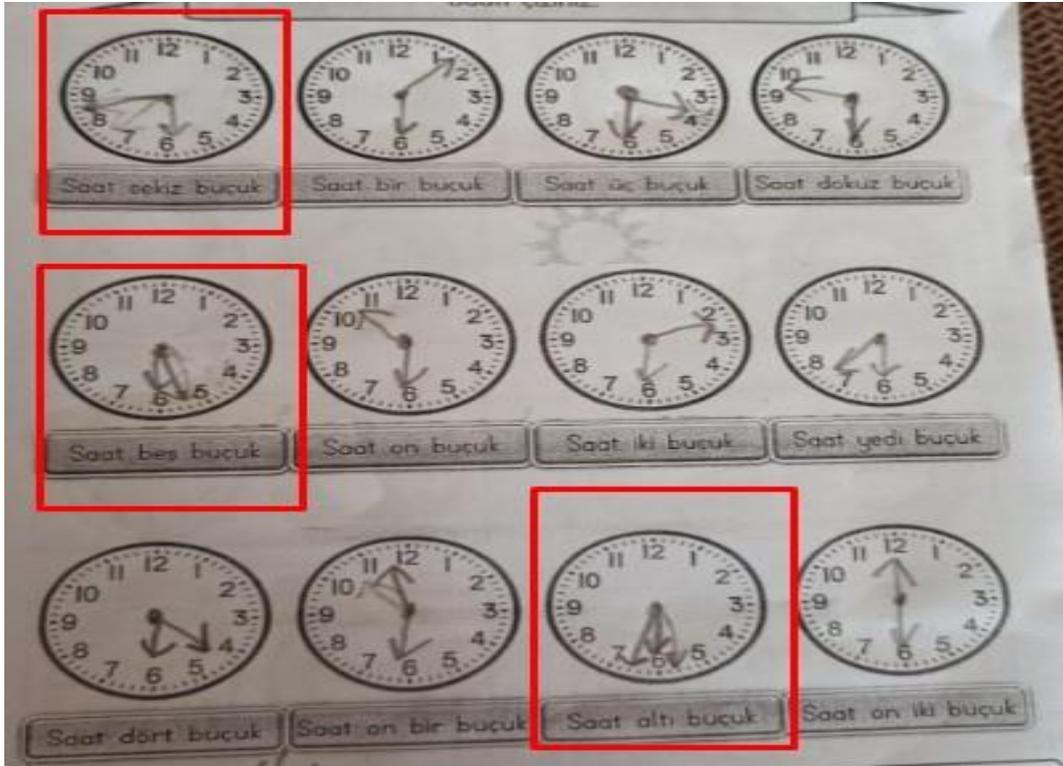


Figure 12 S12 homework document

When the extracts taken from the students' homework are examined, it was seen that the students with the codes S4, S9, S12 and S14, who made mistakes about the use of the hour and minute hands in the half-hour (half past) display in the interview, also made mistakes in the drawings made in the homework. Moreover, when the homework document of S11, who did not make a mistake during the interview, is examined, as can be seen in the above extract, he made a mistake. During the observations, these students made mistakes as well. The observation process was given below:

...

Teacher: S12. Look, my son, there are half-hours here. Minute hand is down. What is the time S12?

S12: It is six past eleven.

Teacher: Half past. Half past what?

S12: Eleven...

Teacher: It is not eleven yet. It is before eleven, look at what?

S12: Half past sixteen.

Teacher: Half past ten. Why? The minute hand is down to half. Well, what time is my teacher? The hour is between ten and eleven. It is already past ten. It is half past ten.

...

Teacher: Yes. Half past one. S11 What is the time on the other clock?

S11: Half-nine.

Teacher: No. It is not nine yet.

S1: Half past eight.

Teacher: Yes. Half past eight. Look, it is not nine yet. It is about to be nine, so it is still eight. But it is on half of eight, and it is exactly half past eight. Yes, S13 what time is it on the other?

...

(D.R. Date: 3 May 2021/ 12.30-13.00)

Teacher: S4 it is your turn.

Ö4: half past eight.

Teacher: Not, it is not eight yet.

S1: Half-seven.

Teacher: Yes, half past seven. Then, as it says, zero seven, half colon thirty we are writing.

...

Teacher: S12, it's your turn. The clock in the middle.

S12: Half past nine

Teacher: It is not yet nine.

S12: ten, half past eight.

Teacher: No. It is still half past eight, it is not nine, yet it is on. It is half past eight.

(D. R. Date: 5 May 2021/ 12.30-13.00)

It was observed that the students made mainly mistakes in the representation of half- (half-past) hours. Taking into account the reactions of the students during the course process, some of the students finished the activity before the teacher and some of them deleted what they did constantly despite looking at the screen (S9, S11). (Observation Recording Date: 5 May 2021/12.30-13.00).

3.2 Calendar

The mistakes made by the students about the calendar information in accordance with the acquisitions in the subject of measuring time are explained under the 'Calendar' theme. Based on the day-week-month relationship, students have made mistakes regarding before and after, within the scope of reading the calendar and the yesterday-today-tomorrow relationship. Each of the subthemes created based on the interviews with the students was examined in detail, and the explanation of the subthemes was supported with one-to-one quotations from the student interviews and one-to-one quotations from the observation process.

Relationship between day-week- month. In the interviews conducted with students, within the scope of the relationship between day-week-moth, the wrong answers of the student who were asked questions about this relationship are given below.

Researcher: How many days are there in a week? Can you tell them in order?

S3: There are 4 days. (Pause). Monday, Wednesday, Friday, Saturday, Tuesday.

S4: two days. One week. I don't know. Friday, (Pause) Monday, Friday, Saturday Sunday. I don't know

When the answers given by the students about the number of days in a week and the names of the days in a week were examined, it was seen that the students who made a mistake in the number of days in a week also expressed the names of the days in a week in the wrong order and incompletely. The answers given by the students to another question directed at them are given below.

Researcher: Do you think the number of days in one month is more or the number of days in one week is more?

S1: The number of days in a week is more. Because there are seven days in a month.

S4: (Pause) Week.

S8: One week

S9: More in one week.

S12: More days in one week. There are 30 days.

Considering the answers given by the students to the question about the comparison of the days in a week and a month, the students coded S1, S8, S9, and S12 did not make any mistakes regarding the number of days in a week in the previous question, when comparing the number of days in a month and a week, it was seen that they stated that the number of days in a week was higher and they made a mistake. It is possible to claim that the reason for the mistake is carelessness, as well as the fact that the teacher uses the concept of 'week' more in the lesson. When the students homework documents on the subject were examined, no mistakes were found. It is possible to state that the reason for this is due to the fact that the task given by the teacher as homework is a drawing that contains more content presentation.

3.3 Sequence of events and situations

The mistakes made by the students in determining the ordering of certain events and situations in accordance with the acquisitions in time measurement are explained under the theme of 'Sequence of Events And Situations'. It is seen that there are some mistakes in expressing the relationship between yesterday, today, and tomorrow, based on the days of the week.

Relationship yesterday-to-today-tomorrow. The answers given by the students who gave wrong answers to the questions posed to the students in the context of the yesterday-to-day-tomorrow relationship during the interviews with the students are given below.

Researcher: If today is Wednesday, what is the day tomorrow?

S3: (pause ummm). Friday

It was noted that only the student coded S3 gave the wrong answer to the question directed to the students about the relationship between today and tomorrow, while the other students made no mistakes.

Researcher: If today is Tuesday, what was the day yesterday?

S2: (Pause. Then his/ her mother interfered) Monday.

His/Her Mother: Teacher, he confuses yesterday and tomorrow.

S3: mmm. Friday

S4: (Pause). Immm. Friday

S5: Thursday

S12: Wednesday

Students coded as S3, S4, S5 and S12 are observed to have given wrong answers to the question about the relationship between yesterday and today and made mistakes. S4, S5 and S12 who made a mistake about the relationship between yesterday and today, also made a mistake about the today-tomorrow relationship as well. Moreover, it is possible to say why we did not see that S2 made any mistake about the today-tomorrow and yesterday relationship is due to the interference of the parent of the student with the question asked to the student. The procedure regarding the mistakes detected during the observation process within the context of yesterday-today-tomorrow relationship is as follows.

Teacher: If yesterday was Monday, what is the day tomorrow? I will answer this question. If yesterday was Monday, today is Tuesday. Then tomorrow is Wednesday. I will do the rest, you just listen.

If today is Friday, what is the day tomorrow? What does tomorrow mean is what tomorrow will mean the next day. Then tomorrow is Saturday. Moving to the third question.

If tomorrow is Tuesday, what is the day today?

S9: (He intervened, the teacher had not asked him). Thursday

Teacher: No, wait. Tomorrow is Tuesday, which means that it will be Tuesday later, then today is Monday.

S9: (He intervened again). Wednesday.

Teacher: Tomorrow is Tuesday, which means it will be Tuesday later. On what day is Tuesday after? After Monday it is Tuesday. That is, what Tuesday means is that today is Monday.

...

Teacher: After what day does Tuesday come?

S6: Thursday

Teacher: Does Tuesday come after Thursday? Thursday Tuesday....

S13: Monday

Teacher: Yes. Well! After Monday comes Tuesday.

Teacher: What day is it before Wednesday?

S14: Thursday

Teacher: No. It is Tuesday. Monday, Tuesday, Wednesday.

(D.R.Date: 29 April 2021/ 12.30-13.00)

Regarding the yesterday-today-tomorrow relationship, it was observed that students with the codes S9, S6, S13, and S14, who did not make mistakes in the interview, made mistakes in teaching the lesson. When the worksheets given as homework by the teacher on the subject were collected and examined as documents, it was seen that there were no mistakes in the students' homework about the subject. It is possible to assert that this is because students do homework at home under the control of their parents.

4 Discussion

In this study, which was conducted to determine the mistakes made by first-grade primary school students about measuring time in online education, students made mistakes about what hour and minute hands used in clock displays were, the use of hour and minute hands while displaying whole and half-hour, while reading whole and half hours. They also made mistakes within the scope of the day-week-month relationship while expressing and comparing the relationship between week and month. Finally, within the scope of the yesterday-to-today-tomorrow relationship, they made mistakes about the application of concepts tomorrow (later) and yesterday (before). However, it has been observed that they did not make mistakes in matters such as reading the calendar or showing the weeks in the calendar, which are within the scope of time measurement. Additionally, as a result of the examination of homework documents taken from students, it was seen that students did not make the mistakes they made in homework they did outside of the lesson, in observations during the lesson and in the interview.

In this study, which was conducted to determine the mistakes made by first-grade primary school students about measuring time;

It was determined that the students made mistakes in the use of the hour and minute hands on the display of the clocks. In the study conducted by Doğan and Usta (2019), they concluded that primary school fourth grade students confuse the concepts of hour and minute hands and what they indicate, and they make mistakes in the drawing of hour and minute hands, which is concurrent with the results of this study. According to the data collected during the online education process, the teacher shows the hour and minute hands on the textbook and worksheet during the lesson. Taking into account the arrival and departure times of students who have just started school, it can be said that they may have a little prior knowledge of the hours. According

to Tarm and Dinç Artut (2019), students should first practise watches in activities for reading clocks. Accordingly, students working on clock models in their classrooms can help correct these errors.

The study conducted by Karabulut and Yıkılmış (2010) examined the effectiveness of the simultaneous prompting teaching technique in teaching the skill of telling time to mentally disabled individuals and they concluded that there was an increase in the skills of mentally disabled individuals in telling whole hours, half-hours, and quarter past. According to the results of their study (Karabulut & Yıkılmış, 2010), it can be asserted that the skills of mentally disabled individuals were quite low while telling whole, half and quarter past hours before the programme. This finding is parallel to one of the findings of this study; students made mistakes in displaying whole and half hours. As seen in this study, the online education process is shorter than normal course hours. Considering this situation, it can be said that the students' active participation in activities decreases a little. According to Kar and Öçal (2022), the importance of the short dial on the analogue clock represents the hours, and its position relative to the numbers on the clock should be especially felt during events. Accordingly, it can be seen that it is more appropriate for the teacher to start by working on the model of single-dial watches. Mutlu and Korkmaz (2020) concluded in their study that children with and without dyscalculia risk have difficulty reading clocks. Furthermore, considering that clock reading skills predict mathematics achievement, it shows that difficulties in reading a clock at an early age can be considered as an early indicator of dyscalculia in children.

In the study conducted by Jealani et al. (2013), it was concluded that the use of the 'natural gassing game', which is used in the structure of the learning process of the subject of time measurement in third-grade primary school students, encourages students to measure time using nonstandard units, comprehend the standard unit and measure time using standard units, and improve their learning. According to the results of this study, it can be said that the method used in the learning process of the students about time measurement improves the students' use of standard and non-standard measurement units and making accurate measurements (Jealani et al., 2013). This situation; one of the results of the study carried out to reveal the mistakes made by primary school first-grade students in measuring time, what the hour and minute hands are, was that the errors made in the use of the hour and minute hands in the display of full and half hours matched with the result. When the national and international literature is examined, the comparison of the results of this study with the results of other studies has been limited due to the insufficient number of studies, especially on time measurement.

In this study, when the answers given by the students about the number of days in a week and the names of the days in a week in calendar reading were examined, it was seen that the students who made mistakes in the number of days in a week stated the names of the days in a week in the wrong order and incompletely. According to Tarm and Dinç Artut (2019), it is expected to gain the skills to find the desired dates on the calendar, read the dates of the day, and show the important days on the calendar. According to this, it can be thought that the reason for the teacher to show the calendar in the textbook during the lesson and directly tell the week-day relationship on it.

According to Hansen et al. (2020), putting time into meaningful contexts allows children to begin to understand cyclical patterns such as seasons such as days of the week, and also facilitates the meaning of time transition by using the words today, tomorrow, and yesterday (Serin, 2023). In

this study, it was observed that four students who did not make mistakes in the interview about the yesterday-to-day-tomorrow relationship made mistakes in teaching the lesson. When the worksheets given by the teacher as homework were examined as documents, it was seen that the students did not make any mistakes with their homework related to the subject. This situation shows that there is a problem in making sense of the passage of time. It also brings to mind the idea that students do homework at home under the control of their parents.

According to the results obtained in the investigation, it was seen that the first grade students of primary schools included in the study made mistakes about the symbols (hour and minute hands) used in the display of the clock, and depending on this mistake, they also made mistakes in the display and reading of the whole and half hours. In addition, it was observed that students made mistakes within the scope of the relationship between yesterday-today-tomorrow and day-week-month within the scope of calendar knowledge. In order to be able to solve these mistakes of the students before they evolve into misconceptions, action research can be done, which is one of the qualitative research methods in which different action plans can be prepared and the plan can be applied to resolve the mistakes.

When the results of the research were evaluated, it was tried to indicate the mistakes made by the students during the online education process. For this reason, the situation in the online education process has been tried to be explained. In the formal education process, the time measurement errors of the students can be revealed with the studies that are to be carried out at different grade levels.

The results obtained in the research may be due to the children as well as the teaching method. For this reason, a quasi-experimental study can be conducted on first-grade students in primary school, and it can be checked whether the teaching method is effective on the mistakes made by students in measuring time. In this way, if there is an impact, classroom teachers can be asked to change the teaching method they use, which would provide a healthier educational environment.

Due to the lack of studies on time measurement in both national and international literature, investigating the subject of time measurement at different grade levels and from different perspectives in primary school can help fill the gap in time measurement and guide both academics and classroom teachers who play a role in teaching.

5 Statement of researchers

5.1 Researcher contribution rate statement

Researchers contributed equally to the research. Decisions were taken together at every stage of the investigation and the study was carried out.

5.2 Conflict statement

There is no conflict of interest to declare. The publication rights of the article have been transferred to the Pedagogical Perspective Journal.

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