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# INVESTIGATING CLOCK READING SKILLS OF THIRD GRADERS WITH AND WITHOUT DYSCALCULIA RISK

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**Abstract**

This paper aims to investigate the clock reading skills of third graders with and without dyscalculia risk. Data were collected from 290 (136 girls, 154 boys) third graders from three different primary schools located in the city center of Mus. Of the participants, 29 were at risk of dyscalculia while 261 were normally achieving. The study employed the triangulation method, one of the mixed-method research design patterns. Data collection tools include a mathematics achievement test, a clock-reading test developed by the researchers, and an interview form designed for children who are at risk of dyscalculia. Analysis of data from all participants revealed that there is no significant difference between boys' and girls' mathematics achievements. There is a significant difference in terms of clock reading skills in favor of boys. There is a moderate (.56) relationship between mathematics achievement and clock reading skills, and ability to read clocks explains 31% of the total variance in mathematics achievement. The means of the scores of children with and without dyscalculia risk from the 28-item clock-reading test were 5.45 and 11, respectively. During the interviews with 20 children at risk of dyscalculia, the majority of children (13) were able to draw an analog clock but only 50% of the children were able to draw the given time correctly on the clock. It was also found that most of the children (12) confused hour and minute hands and could not tell why there are 12 numbers on an analog clock while there are 24 hours in a day (average number of correct answers 8). Besides, only four students gave correct answers to the question regarding five-minute intervals. The results indicate that children with and without dyscalculia risk have difficulty reading clocks. Furthermore, our results show that, considering the predictivity of clock reading skills for mathematics achievement, difficulties in reading clocks at an early age can be considered as an early indicator of dyscalculia in children.

**Keywords:** Dyscalculia, mathematics-learning difficulty, reading clock, analog clock

## INTRODUCTION

Dyscalculia is defined as difficulty acquiring basic arithmetic skills that is not explained by low intelligence or inadequate schooling (WHO, 2011). Two hypotheses are proposed for the causes of dyscalculia, with a prevalence in the community ranging from 3% to 6% (Butterworth, 2005): dysfunctional brain regions associated with mathematical skills (Butterworth & Laurillard, 2010, von Aster & Shalev, 2007; Piazza et al., 2010) or working memory deficit (Geary, 2010; Andersson and Östergren, 2012).

Every student with dyscalculia is unique; although not all children exhibit the same difficulty (Desoete & Grégoire, 2006; Dowker, 2009, Gifford & Rockliffe, 2012), some common behavioral features can be observed. Children with dyscalculia have difficulty learning numbers (Geary, 2006); they are inadequate in understanding relationships between numbers (Sharma, 2015) and performing simple arithmetic operations (Shalev et al., 2001); they are slow in performing mathematical operations (Ansari & Karmiloff-Smith, 2002; Geary, 2004); they tend to use the finger counting strategy which their peers have already abandoned (Geary, 1990; Bender & Beller, 2012); they have a poor sense of direction and therefore confuse directions (Williams, 2013). In addition, dyscalculic children experience difficulties reading clocks, which is extremely important for daily life (Anderson, 2008; Burny, Valcke & Desoete, 2012).

A majority of children have difficulty acquiring clock-reading skills (McGuire, 2007; Harris, 2008). The reasons for the difficulties especially in reading analog clocks can be listed as follows: First, although the passage of time is part of human experience, time itself is naturally abstract: it cannot be directly perceived or manipulated (William, 2004). Secondly, it requires the ability to count and calculate (addition, subtraction, multiplication). Individuals who have difficulty counting and calculating most probably have difficulty-reading clocks, as well. Third, unlike physical quantities such as length, weight, volume, and money, to measure time, rather than the decimal numeral system, we use the sexagesimal numeral system that originated with the ancient Sumerians (McGuire, 2007; Burny, Valcke & Desoete, 2012). In this system, an hour is sixty minutes, a minute is sixty seconds, and sixty is divisible by 12, 5, etc. Fourth, the numbers are interpreted differently depending on the hour, minute, and second hands, which may make reading the time difficult. Fifth, understanding the movement of hour and minute hands in the clockwise direction may be difficult especially for children with poor spatial skills (Burny, Valcke, & Desoete, 2012). Considering the causes of difficulties in reading clocks together with the procedural, semantic, and spatial deficiencies of dyscalculic individuals (Geary, 1993), the ability to read clocks can become an obstacle that is very difficult to overcome for most of dyscalculic individuals.

Unlike many other units of measure for length, mass, etc., the unit of time cannot be seen or perceived. Although the passage of time can be measured, time cannot be perceived as something concrete (Hurrel, 2017). In the process of teaching children mathematical concepts, math manipulatives such as geometric blocks, beads, and geoboards are often used. Mathematics educators have long advocated the use of such materials to facilitate concept development in children. However, it is impossible to find concrete examples for direct measurement of time. Even clocks and hourglasses measure the passage of time only indirectly (Burton & Edge, 1985).

For children, reading digital clocks is easier than reading analog clocks. However, this still may not mean that children fully understand what they are reading (Boulton-Lewis, Wilss, & Mutch, 1997; Van de Walle, 2001). For example, to know that 7:58 is about 8, the student needs to know that there are 60 minutes in one hour, 58 is close to 60, and 2 minutes is not a long time. Most first-grade students and many second-grade students do not have this knowledge (Van de Walle, 2001). Besides, it can be said that learning to read digital clocks involves quite different processes compared to learning to read analog clocks. Reading the time in a digital clock (e.g., 13:25) is very similar to reading one and two-digit numbers (e.g., 9, 22) since the hours and minutes are presented as numbers in digital clocks (Friedman and Laycock, 1989). On the other hand, reading the time in an analog clock requires quite complex and different skills.

Digital clocks are more common today, so some kids may think that there is no need to learn the analog clock. However, learning both ways to tell the time is important to be an independent individual (Thompson, Wood, Test & Cease-Cook, 2012). Starting from the first grade, students usually learn to read firstly hours (e.g., 5:00, 6:00, etc.), then half-hours, quarter-hours, and finally minute times (e.g., 5:05, 9:25, etc.) (Van de Walle, 2001).

Acquiring the ability to read clocks requires having many prerequisite skills. In order for students to learn to read clocks, teachers should make sure that they have acquired the prerequisite skills. They should be specific about which part of the task the focus is on and make sure students know it too (Burton & Edge, 1985). Children need to acquire the ability to use words correctly, to put events in the correct order, to predict the time and cyclic events, and to use the information they obtained from reading clocks. In addition, various mathematical knowledge and skills are necessary to acquire clock-reading skills. First, clock-reading skill is based on the number sense and ability to count. Secondly, a basic knowledge of fractions is needed to understand the clock face divided by halves and quarters. Finally, measuring time intervals requires addition and subtraction skills (Burny, Valcke, & Desoete, 2009).

Unlike length or angle, which can be measured by concrete manipulatives, reading the clock should be taught through hypothetical activities and problem solving (McInerney & McInerney, 2002). In addition, some guidelines to help students acquire clock-reading skills include: (1) use experiences that are part of everyday life, (2) set challenging but achievable goals, and (3) use confirmed-approved practices. Remember that the concept of time develops gradually in children. Spreading the teaching of components of this task throughout one school year will reduce the frustration level of both the teacher and the students (Burton & Edge, 1985).

Although clock-reading skill is important to meet our daily needs, it has attracted very little scientific interest (Burny, Valcke, & Desoete, 2012). Moreover, very few studies on clock reading skills have examined these skills with a focus on dyscalculic children (Anderson, 2008; Burny, Valcke, & Desoete, 2012). This paper aims to investigate the analog clock reading skills of third graders who are/are not at risk of dyscalculia. To this end, answers to the following questions were sought.

1. Do third graders's clock reading skills show a statistically significant difference in terms of gender?
2. Is there a significant relationship between third graders' mathematics achievements and clock reading skills?
3. To what extent do third graders' clock reading skills predict their mathematics achievements?
4. What is the level of clock reading skills of third graders who are at risk of dyscalculia?

## METHODS

The study employed the triangulation method, one of the mixed-method research design patterns. In data triangulation, qualitative and quantitative methods are used to examine different dimensions related to the research problem. Qualitative and quantitative methods are used for different dimensions of the research. The results obtained for these different dimensions complement each other, resulting in a more comprehensive conclusion regarding the research problem (Greene, Caracelli, & Graham, 1989). The purpose of the triangulation pattern is to use qualitative and quantitative methods together and to diversify, compare, and merge the obtained data, and thus, to obtain various data that is directly related to research questions (Morse, 1991).

### Participants

While determining the study group, sequential sampling (quantitative-qualitative) applied in mixed-method research was used. The sequential quantitative-qualitative technique is the most widely used technique in the literature. In this technique, the sample used in the quantitative stage is decisive in determining the study group in the qualitative stage (Baki & Gokcek, 2012).

The study group comprises a total of 290 (136 girls, 154 boys) children from three primary schools located in the city center of Mus, a province in eastern Turkey. Mathematics achievement tests and clock reading tests were applied to three randomly determined classrooms in each of these three schools.

Generally, a score of lower than 20-25% is used as a criterion to determine dyscalculic children (Fletcher, Francis, Morris, & Lyon, 2005; Geary, 2004). While determining the students who are at risk of dyscalculia at the qualitative stage of this study, a score of less than 10% from the mathematics achievement test was taken as a criterion. Of 29 students who met this criterion, a total of 20 (8 girls, 12 boys) were interviewed.

**Table 1.** Mathematics achievement test scores of children at risk of dyscalculia (Out of 15 points)

| Variable | n | Mean |
|---|---|---|
| **Girl** | 13 | .92 |
| **Boy** | 16 | 1.56 |
| **Total** | 29 | 1.27 |

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### Data Collection Tool

One of the data collection tools used in the study was the mathematics achievement test consisting of 15 open-ended items developed by Fidan (2013) for primary school third grades. This achievement test was developed based on the learning objectives specified in the 'number learning' learning area of the mathematics curriculum for third grades (Turkish Ministry of National Education [MoNE], 2004). This learning area includes subjects such as counting, number patterns, four operations, and fractions. The KR-20 reliability coefficient of the test was calculated as 0.93. Another data collection tool used in the study was the 28-item Clock Reading Test (CRT) (Annex 1) developed by the researchers to measure third graders' clock reading skills. When developing the CRT, the researchers considered the following learning objective specified in the 'measuring time' sub-learning area of the 'measurement' learning area of primary school mathematics curriculum (MoNE, 2018): "Tells and reads the time in minutes and hours and solves the problems using time measurement units." While developing the test items, the views of three academicians, two mathematics educators and a classroom educator, were taken, and the test items were revised according to their feedback. The KR-20 reliability coefficient of the CRT was calculated as .87.

During the interviews with students at risk of dyscalculia, the questions in Annex 2 were used. In the first question, the children were asked to draw an analog clock. Then, the children were instructed to draw any whole hour on the analog clock. Afterwards, using the analog clocks drawn by the students and other readily available analog clock drawings (for those who were not able to draw a clock), we asked questions developed based on five developmental stages (identification of early impressions of a clock; awareness of the numerals on a clock; awareness of the importance of the twelve numerals; partitioning of the twelve numerals becomes significant; and recognition of minute markers) in regards to children's understanding of the clock identified by Pengelly (1985; cited in Clarke, 1998). Wright (2007) argues that the "drawing-telling" process gives students the opportunity to create and share meaning in two modes. By asking "Tell us about your drawing," children may be provided with an additional opportunity to express their ideas in different but complementary ways. This drawing-telling process has proven to be much more informative and insightful than the drawing process alone.

### Data Analysis

Since the skewness and kurtosis values of quantitative data met normality assumptions (Tabachnick, Fidell, & Ullman, 2007) (see Table 2), parametric tests such as t-test, correlation, and regression were used to analyze the data. For the analysis of qualitative data, descriptive analysis was performed, tables were created, and frequencies were calculated.

**Table 2.** Skewness and kurtosis values of MAT and CRT scores

| | N | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|
| **MATS** | 290 | 9.53 | 4.56 | -.508 | -.977 |
| **CRTS** | 290 | 10.43 | 6.17 | .408 | -.726 |

## RESULTS

CRT mean scores of children who are/are not at risk of dyscalculia were found to be 5.45 and 11, respectively. In addition, independent sample t-test analysis was performed to determine whether there is a significant difference between boys and girls in terms of CRT scores. The results of the analysis are presented in Table 3.

**Table 3.** Comparison of MAT and CRT scores by gender

| Test | Groups | N | Mean | df | t | *p* |
|---|---|---|---|---|---|---|
| **CRT** | Girl | 136 | 9.96 | 5.26 | 1.222 | .000* |
| | Boy | 154 | 10.85 | 6.88 | | |

*$p<.05$

As can be inferred from the comparison of CRT scores in terms of gender [t (288) = -1.222, p<.05] as presented in Table 3, there is a significant difference between boys and girls in favor of boys. This suggests that boys performed better in the CRT.

**Table 4.** The level of predictivity of CRT scores for success in the MAT

| | B | SH | Beta | t | p |
|---|---|---|---|---|---|
| **Constant** | 5.240 | .438 | | 11.952 | .000 |
| **CRTS** | .412 | .036 | .557 | 11.386 | .000 |
| R= .557 $R^2$=.310 | | | | | |
| $F_{(1.379)}$ = 129.634 p = .000 | | | | | |

The correlation between mathematics achievement test scores and clock reading test scores was calculated as .557. This suggests that there is a moderate relationship between mathematics achievement test scores and clock reading test scores.

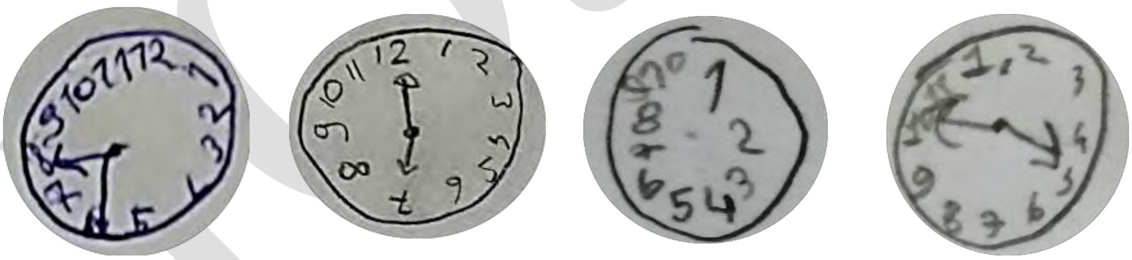
Simple linear regression analysis was performed to determine the level of predictivity of CRT scores for MAT scores. As a result, CRT scores explained 31% ($R^2$ = .310) of the total variance in MAT scores. The equation between MAT scores and CRT scores can be formulated as MATS = 5.240 + (.412) x (CRT).

The next section includes data from the interviews with children at risk of dyscalculia. Codes and categories emerged from the analysis of the data by content analysis.

**Table 5.** Analysis of correct/incorrect clock drawings

| Category | Code | Sample | Frequency |
|---|---|---|---|
| Clock drawing | Correct drawing | S2, S3, S6, S7, S9, S11, S14, S15, S16, S18, S19, S4, S20 | 13 |
| | Incorrect drawing | S1, S5, S8, S10, S12, S13, S17 | 7 |

As can be seen in Table 5, a total of 13 students (e.g., S20, S18) were able to place the numbers on the clock face correctly. On the other hand, 7 students failed to place the numbers on the clock face correctly.



S20 Correct | S18 Can be considered correct | S10 Incorrect drawing | S17 Incorrect drawing

**Figure 1.** Samples drawings

**Table 6.** Drawing hands on the clock for the time given

| Category | Code | Sample | Frequency |
|---|---|---|---|
| Ability to position hands correctly | Correct | S2, S3, S6, S7, S9, S11, S14, S15, S18, S19 | 10 |
| | Incorrect | S1, S4, S5, S8, S10, S12, S13, S16, S17, S20 | 10 |

The participants' answers to the question of drawing hands for the time given led to two codes: correct drawing and incomplete-incorrect drawing. While 10 students were able to draw the given time correctly, the other 10 students drew either incorrectly or incompletely. Also, three (S4, S16, S20) of the students who were able to draw an analog clock failed to draw the given time correctly.

S15 4:00-Correct | S19 4:00-Correct | S4 2:00-Incorrect | S13 9:00-Incorrect

**Figure 2.** Samples drawings

The students were also asked to indicate the hour and minute hands on a given clock face. Their answers and frequencies are demonstrated in Tables 7 and 8. As can be inferred from Table 7, seven students indicated the hour hand correctly, eight incorrectly, and 5 left this question unanswered.

**Table 7.** Indicating the hour hand

| Category | Code | Sample | Frequency |
|---|---|---|---|
| Hour hand | Correct | S3, S7, S8, S11, S14, S18, S19 | 7 |
| | Incorrect | S1, S4, S5, S6, S15, S16, S17, S20 | 8 |
| | Unanswered | S2, S9, S10, S12, S13 | 5 |

Table 8 presents the students' answers to the question regarding the minute hand. As can be inferred from the table, ten students indicated the minute hand correctly, seven incorrectly, and three left this question unanswered.

**Table 8.** Answers regarding the minute hand

| Category | Code | Sample | Frequency |
|---|---|---|---|
| Minute hand | Correct | S2, S3, S7, S8, S9, S11, S13, S14, S18, S19 | 10 |
| | Incorrect | S1, S4, S5, S6, S15, S16, S17 | 7 |
| | Unanswered | S10, S12, S20 | 3 |

The researcher's dialogues with S20 and S13 regarding the hour and minute hands are given below.

- Do you know what long and short hands are called? What do we call them?
- One is hour hand but the other, I forgot.
- Is the hour hand long one or short one?
- The long one.
- And what about the short one?
- ……..(S20)
- Do you remember what we call the short hand?
- No
- What about the long one?
- Minute hand (S13)

**Table 9.** *Answers to the question about five-minute intervals*

| Category | Code | Sample | Frequency |
|---|---|---|---|
| Five-minute intervals | Correct | S1, S4, S9, S16 | 4 |
| | Incorrect | S2, S3, S6, S11, S12, S18, S19, S20 | 8 |
| | Unanswered | S5, S7, S8, S10, S13, S14, S15, S17 | 8 |

The students were asked about the functions of five-minute intervals. The answers are given in Table 9. While four students gave correct answers to this question, eight students gave incorrect answers. In addition, eight students said that they did not know. The researcher's dialogue with S12 is given below.

- You see these intervals between the numbers on the clock face. Do you know what they mean?
- To make sure they are in order.
- To make sure what is in order?
- The numbers like 1, 2.
- So you mean, these intervals are here to make sure the numbers are placed at equal intervals?
- Yes. (S12)

**Table 10.** Answers to the question, "Indicate one minute past the given time"

| Category | Code | Code | Sample | Frequency |
|---|---|---|---|---|
| 1 minute | Correct | Not exactly | S1, S16 | 2 |
| | Incorrect | | S2, S3, S4, S5, S8, S11, S12, S13, S14, S15, S17, S19, S20 | 13 |
| | I do not know | | S6, S7, S9, S10, S18 | 5 |

The students were asked to indicate one minute past the given time. The answers are given in Table 10. As can be inferred from Table 10, two students answered this question correctly, thirteen students answered incorrectly, and five students stated that they did not know the answer. The researcher's dialogue with S15 is given below.

- It is four o'clock in this drawing. How would you draw one past four?
- The short hand is on four. And the long hand is on one.
- What about twenty past four?
- We can't say twenty past four. If it is twenty past four, the long hand is on 8.
- Why 8?
- Starting from 12, we stop at eight, and we have 20 left. So the answer is eight past four.
- Excuse me?
- We stopped at 12, 13, 14, 15, 16, 17, 18, 19, 20; the long hand is on 20, and the short hand is on 4. (S15)

**Table 12.** Answers to the question, "How many minutes are there in an hour?"

| Category | Code | Sample | Frequency |
|---|---|---|---|
| How many minutes are there in an hour? | Correct | S4, S5, S16, S20 | 4 |
| | Incorrect | S1, S2, S6, S8, S15, S17 | 7 |
| | I do not know | S3, S7, S9, S10, S11, S12, S13, S14, S18, S19 | 9 |

The students were asked how many minutes there are in an hour. As can be inferred from Table 12, four students answered the question correctly, seven incorrectly, and nine left the question unanswered. The researcher's dialogue with S17 is given below.

- So how many minutes are there in one hour?
- In one hour…. our teacher taught us but, was it 12 minutes?
- I mean, how many minutes can there be in one hour?
- Our teacher taught us in the second grade but ... I think twelve minutes. (S17)

**Table 11.** Answers to the question, "How many hours are there in a day?"

| Category | Code | Sample | Frequency |
|---|---|---|---|
| How many hours are there in a day? | Correct | S1, S4, S5, S14, S16, S17, S19, S20 | 8 |
| | Incorrect | S2, S3, S6, S8, S9, S10, S12, S13, S15, S18, S7, S11 | 12 |

The students were asked how many hours there are in a day. The answers are given in Table 11. While eight students answered the question correctly, twelve answered incorrectly. The researcher's dialogue with S6 is given below.

- How many hours are there in a day?
- In one day...
- Yes, one day. For example, in the morning, we wake up and go to school. In the evening, we have dinner and go to bed. Then, it is morning again. So, how many hours?
- 2 hours
- So you think a day lasts 2 hours, that is, there are 2 hours in one day?
- No, 3 hours.
- Sorry, did you say 3 hours?
- Yes. (S6)

**Table 12.** Answers to the question, "Why are there 12 numbers on a clock?

| Category | Code | Sample | Frequency |
|---|---|---|---|
| 12 numbers on a clock | Correct | S1, S5, S14, S16, S18, S19, S20 | 7 |
| | Incorrect | S2, S6, S15, S17 | 4 |
| | I do not know | S3, S4, S7, S8, S9, S10, S11, S12, S13 | 9 |

Answers to the question, 'Why are there 12 numbers on a clock?' are given in Table 12. As can be inferred from Table 12, four students answered the question incorrectly, seven correctly, and nine said they did not know.

- Why are there 12 numbers on a clock? Why are these numbers from 1 to 12?
- Because the last number is 12.
- So?
- …….(S6)

## DISCUSSION and CONCLUSIONS

Making sense of time through traditional timekeeping devices such as clocks and calendars is an important goal for all primary school children (Burny, Valcke, & Desoete, 2012). The ability to tell the time is an important skill that children develop in preschool years and use throughout their lives (Freedman & Laycock, 1989). The results reported by experimental studies (Case, Sandieson, & Dennis, 1986; Friedman & Laycock, 1989) show that analog clock reading skills develop based on the age of the child. Children's ability to perceive time does not develop as an isolated cognitive competence; this ability is developed based on arithmetic, literacy, memory, and spatial skills (Foreman et al., 2007).

Our findings indicate that the means of the scores of children with and without dyscalculia risk from the 28-item analog clock reading test were 5.45 and 11, respectively. It can be said that the means of the scores of both groups are low. However, the fact that children who are at risk of dyscalculia could answer only approximately 6 items out of 28 items suggests their inability to read clocks. On the other hand, the low scores obtained by both groups from the clock reading test are consistent with the studies reporting how difficult it is for children to develop clock reading skills (McGuire, 2007;

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Harris, 2008; Anderson, 2008; Burny, Valcke & Desoete, 2012; Van Steenbrugge, Valcke and Desoete, 2010).

In the study, we found a significant difference between boys' and girls' scores from the clock reading test, which was in favor of boys. In contrast, Vakali (1991) reported no difference between boys and girls in terms of clock reading skills. This inconsistency between the findings may be attributed to the difference in the samples included in the studies.

Also, we obtained a moderate relationship (.56) between mathematics achievement test scores and clock reading test scores and determined that the ability to read analog clocks explains 31% of the total variance in mathematics achievement. Although there is a significant correlation between students' mathematics performance and clock reading skills in every grade of primary school, this correlation is only at a moderate level. Especially when first- and second-grade children are taught how to read analog clocks (whole hours, half-hours, and quarter-hours), the correlation between clock reading skills and mathematics achievement becomes quite weak (Burny, Valcke & Desoete, 2012).

Findings reported by Andersson (2008) indicate that dyscalculic children have significant problems with reading clocks. Similarly, Burny, Valcke, & Desoete (2012) have reported difficulties in reading clocks experienced by dyscalculic children. In the current research, during the interviews with 20 children at risk of dyscalculia, the majority of children (13) were able to draw an analog clock but only 50% of the children were able to draw the given time correctly on the clock. It was also found that most of the children (12) confused hour and minute hands and could not tell why there are 12 numbers on an analog clock while there are 24 hours in a day (average number of correct answers 8). Besides, only four students gave correct answers to the question regarding five-minute intervals. A sequence of time acquisition was proposed based on Case's theory of cognitive development (1985, 1992 cited in Boulton-Lewis, Wills, & Mutch, 1997). This was hour, half-hour, quarter-hour, five-minute, and minute times. This sequence may explain why dyscalculic children perform less successfully in minute times. Considering that dyscalculic children have problems with counting, calculating, conceptual knowledge, and spatial competencies, which are needed to develop clock reading skills (Geary, 2006; Sharma, 2015; Shalev et al., 2001); Sharma, 2015; Shalev et al., 2001), the reasons for dyscalculic children's inability to reading clocks become clear.

In addition, considering that difficulties in reading clocks in early classes can be an early indicator of dyscalculia, classroom teachers may need to pay close attention to the difficulties experienced by six- and seven-year-old children (Burny et al., 2012). In addition, considering the procedural, semantic, and spatial difficulties experienced by dyscalculic children, certain adaptations can be made to make it easier for them to learn to read clocks.

In primary school mathematics education, teachers and students in almost every grade of primary school (Van Steenbrugge, Valcke, & Desoete, 2010) perceive the subject of 'clock reading' as a difficult subject. Therefore, further research is needed to reveal the difficulties experienced by both teachers and students in the subject of clock reading.

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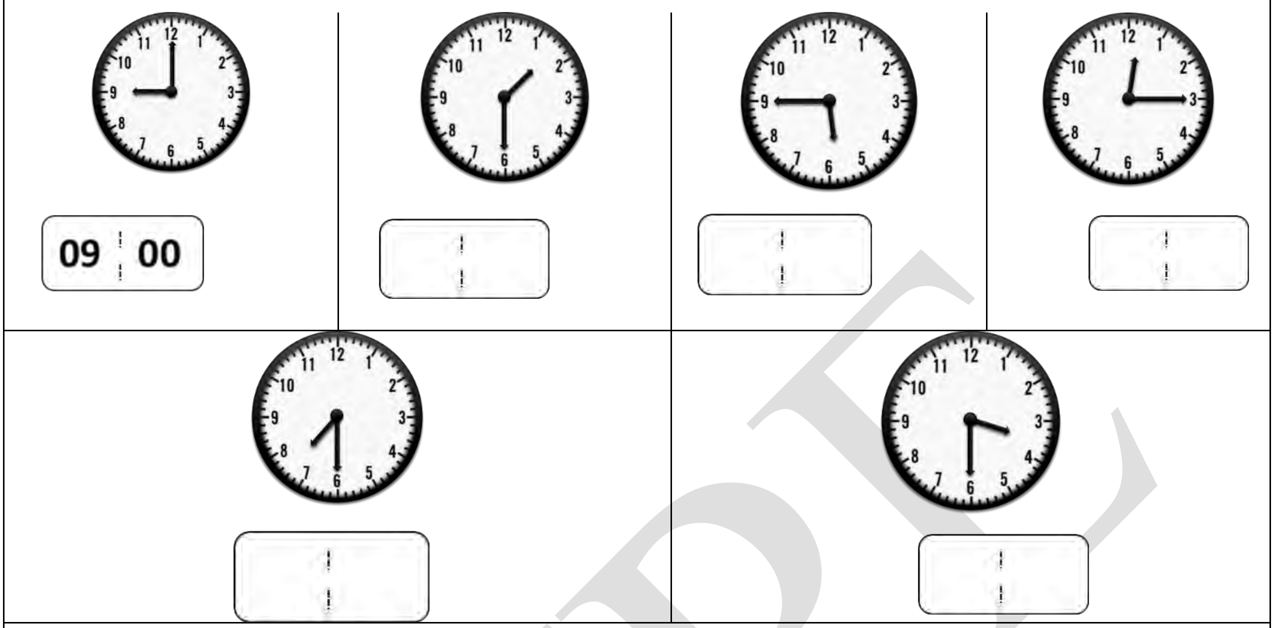
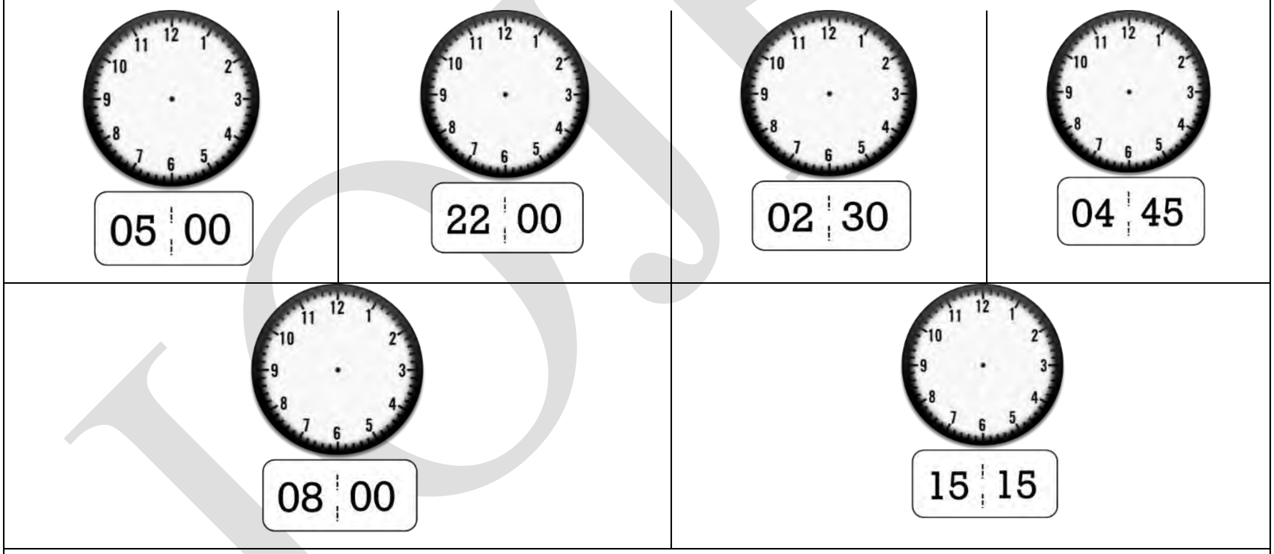
Annex 1. Clock Reading Test

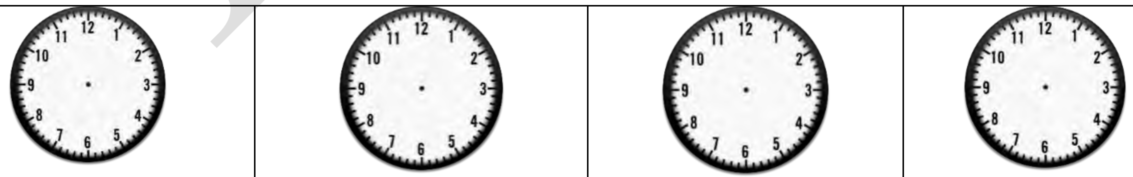
**1.** Write the time under each clock as shown in the example.




**2.** Draw the hands on each clock according to the given times.




**3.** Draw the hands on each clock according to the times given in words.



It is a quarter to nine o'clock. | It is three o’clock. | It is half past four. | It is a quarter past six.

**4.** Write in words the times given in each clock.

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| | |
|---|---|
|  …………………………………….. | 18 : 15 ………………………………… |
|  ……………………………………. | 09 : 30 ………………………………… |
|  ……………………………………. | 15 : 45 ………………………………… |

**5.**What time is it in the first clock? In the second clock, draw the hands according to 2 hours past the time given in the first clock.

**First Clock**  **Second Clock** 

**6.** What time is it in the first clock? In the second clock, draw the hands according to 3 hours to the time given in the first clock.

**FirstClock**  **Second Clock** 

**7.** A football match that started at 09.00 lasted 3 hours. What time did the match finish?

Write your answer in the box.

**8.** A movie started at 21:00 and lasted 2 hours. What time did the movie finish?

**9.** A play started at 13:30 and finished at 15:15. How long did the play last?

| |
|---|
| **10.** If the hour hand is close to 7 and the minute hand is on 9, what time is it? |
| **11.** Yusuf sleeps 9 hours a day. What time does he need to go to bed to get up at 6 o'clock in the morning? |

**Annex 2. Interview Questions**

| Item | Question |
|---|---|
| **1** | Can you draw an analog clock? |
| **2** | Which one is the hour hand? |
| **3** | Which one is the minute hand? |
| **4** | Five minute intervals |
| **5** | Indicate one minute past the given time |
| **6** | How many hours are there in a day? |
| **7** | How many minutes are there in an hour? |
| **8** | Why are there 12 numbers on a clock? |