Thai elementary school students' critical thinking skills in mathematics education

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Abstract. Elementary school students' critical thinking skills in mathematics education are part of 21st-century learning competencies as stated in the Basic Education Core Curriculum B.E 2551 in Thailand. The study aims to investigate the Elementary School Students' Problem Critical Thinking Skills in mathematics learning in Thailand. The subjects of this study were students of third-grade Chiang Mai Rajabhat University Demonstration School with a total of 32 students. The research instrument used the test of mathematical problems in time material and interview. The research data were analyzed qualitatively descriptive. The results showed that students' mathematical critical thinking skills were best at reading the time in the form of an analog clock that is equal to 72%; on the subject matter the difference in the time and night time marks is 63%; while the problem of drawing time and night time marks is 51%. The conclusion of this research is the mathematic problem solving skills in third-grade students in Thailand hasn’t been optimal. The results of this study provide information about the ability to solve mathematical problems in elementary schools that still need to be improved. Future research can be directed at improving the process of mathematical problem solving skills in elementary schools.

1. Introduction

The paradigm shift in education requires the skills needed in the 21st century, the abilities that need to be developed by 4C in the form of knowledge, skills and attitudes as well as mastery of information and communication technology through: (1) Critical Thinking Skills and Problem Solving Skills; (2) Communication Skills, (3) Creativity and Innovation Skills, and (4) Collaboration Skills \cite{1} \cite{2} \cite{3} In line with the Thailand Basic Education Core Curriculum curriculum BE 2551 (2008) aims to instill in students five competencies, namely: (1) Communication Ability, (2) Thinking Ability, (3) Problem Solving Ability, (4) Ability to Apply Life Skills, and (5) Ability to Apply Technology \cite{4}.

Thinking ability is part of daily activities carried out by organizing information in order to achieve a goal. Based on the revised Bloom taxonomy, students' thinking abilities are classified into 2 namely Low Order Thinking Skills (LOTS) and High Order Thinking Skills (HOTS). The cognitive abilities of the HOTS category include the ability to analyze (C4), evaluate (C5), and create (C6) \cite{5}. HOTS deals with the ability to think critically in receiving various types of information, think creatively in solving a problem using the knowledge possessed and make decisions in complex situations \cite{6}. Critical thinking skills is part of HOTS that is needed by students in the ebad 21 era. The ability to think critically is related to the ability to identify, analyze, and solve problems creatively and think logically so as to produce the right judgment and decision \cite{7} \cite{8} \cite{9}. Critical thinking skills possessed by students can help in problem solving, including problems in learning mathematics.
Learning mathematics is not just a memorization activity, but requires reasoning skills in solving problems. Learning mathematics focuses on the ability to think and reason [10] [11]. The ability to think critically in the process of solving mathematical problems is very much needed [12]. Mathematical and critical thinking skills are two inseparable things, because mathematical problems can be solved through critical thinking, and critical thinking can be trained through learning mathematics. Thus, it can be seen that critical thinking skills have an important role for students in solving mathematical problems in elementary school.

Mathematics learning at the elementary and secondary school level (below) in Thailand refers to the Basic Education Core Curriculum B.E 2551 (2008) curriculum which is oriented towards developing general skills and building students’ positive attitudes towards mathematics, as well as emphasizing the appropriate use of information technology. One of the primary goals of the mathematics curriculum is to develop creativity and the ability to think, communicate, and solve basic mathematical problems. The SD Mathematics curriculum in Thailand covers five content fields at the elementary level, consisting of: (1) numbers; (2) shape and space; (3) measurement; (4) data handling; and (5) algebra [4]. The wide flat learning learning becomes one of the spheres of mathematics learning that is studied by elementary school students, including the third grade elementary school at CMRU Demonstration School in Thailand.

Quoted from the results of achieving PISA (Program for International Student Assessment) grades that assess the extent to which students aged 15 years at the level of primary and secondary education in the ability to solve problems based on HOTS (High Order Thinking Skill) in reading, mathematics, and science [13]. From the PISA data it is known that Thailand is ranked 42 out of 72 countries tested with an average index of 405 in mathematical problem solving skills. This shows that Thailand is in the category of countries under the average The Organization for Economic Co-operation and Development (OECD). In the age range of 15 years, Thai students still have a mathematical problem solving index below the average, at the age of 15 years children are still in formal operational stages that are able to think logically and abstractly in solving problems, especially for children at the elementary school level who are still in the concrete operational stage who are starting to be able to think logically but are still concrete, will certainly be different in solving mathematical problems.

Based on observations at Chiang Mai Rajabhat University (CMRU) Demonstration School, mathematics learning in grade 3 teachers uses real learning media to arrange time for students and learning using question and answer learning methods between teachers and students. To measure learning achievement, the teacher gives three different types of questions consisting of: reading the time mark, differentiating time and night time marks, and drawing time and night time signs. This study aims to review the critical thinking skills of grade 3 students at the CMRU Demonstration School in Thailand in solving mathematics problems in time material.

2. Method
This research uses a qualitative approach with descriptive type. This type of research seeks to describe a symptom or condition systematically so that the object of research can be explained and understood[14]. This study aims to describe the students’ critical thinking skills in solving time mathematical problem material. Subjects were involved as many as 32 3rd grade students at Chiang Mai Rajabhat University Demonstration School. Data collection techniques using tests and interviews. The test technique uses a problem solving test sheet to determine the ability of reasoning, the ability to interpret data, and the ability to analyze data. The test instrument was developed by the teacher by referring to three indicators consisting of reading the time and night time signals, matching time signals, and drawing time and night time signals. The interview is used to reveal the ability to explain so that it can be seen what considerations are selected when students provide answers on the test sheet. The collected data is then analyzed descriptively and content analysis.
3. Results and Discussion
Mathematics learning in class 3 on time material refers to three indicators consisting of reading the time and night time markings, matching time marks, and drawing the time and night time signs correctly. This learning is very important to be mastered for students to help them in doing daily activities about time. In order to measure student learning outcomes, the teacher provides an evaluation consisting of three types of tests (reading time and night time signals, matching time signs, and drawing time and night time signals). Measurement of learning outcomes of 32 students in the time material is presented in table 1.

| Interval | Limit          | Xi  | F  | Cumulative Frequency | Relative Frequency |
|----------|----------------|-----|----|----------------------|--------------------|
| 57-63    | 56.5-63.5      | 60  | 3  | 3                    | 9.38               |
| 64-72    | 63.5-73.5      | 67  | 8  | 11                   | 25.00              |
| 73-79    | 72.5-79.5      | 76  | 11 | 22                   | 34.38              |
| 80-85    | 79.5-86.5      | 83  | 3  | 25                   | 9.38               |
| 87-93    | 86.5-93.5      | 90  | 4  | 29                   | 12.50              |
| 94-100   | 93.5-100.5     | 97  | 3  | 32                   | 9.38               |

| Mean     | 77             |
| Minimum score | 57             |
| Maximum score | 97             |

In Table 1 it can be seen that in general students' problem solving abilities in learning mathematics problem time at Chiang Mai Rajabhat University Demonstration School are good enough. The measurement results of the mathematical problem-solving ability of the concept of the time sign include consisting of reading the time mark, matching the time mark, and drawing a time mark.

3.1. Critical Thinking in Reading Time Sign of Day and Night
The first type of questions aims to measure students' critical thinking skills in reading the time and night signals. In this type of problem, students must be able to read the time mark and be able to distinguish when writing them according to the use of daytime and nighttime situations. The following are some of the responses of students in answering the first type of questions.
Figure 1 is the response of one of the students who was answered equally by most students in the class. In Figure 1 it is known that students already have good reasoning skills. The ability of students to know the position of numbers as markers of hours and position of numbers as markers of minutes reaches 72%. The ability to interpret data has also been good, students are able to distinguish the function of the clock mark and the needle for the minute markers. Nevertheless, the analysis of students is still not good. This is indicated by the students’ mistakes in distinguishing the time marks for the day and night. The following are students’ responses in answering the time and night signals.

![Figure 1](image1.png)

**Figure 2.** Student responses to the test reading the time clock hours day and night

Figure 2 indicates the weakness of student analysis to distinguish time from day and night. The answer to question number 2 shows that students still cannot write the time mark for midnight. As for problem number 3, it shows the reasoning ability that is not good. Students only write numbers as they are pointed to by long needles that function as minute markers. Students answer the number 9 which should be correctly read 45 minutes. The interview results reveal that students only add up morning time with 12 numbers to find out the time of night. The results of the low analytical skills in critical thinking are not only found in elementary students in Thailand. Previous research found that analytical skills were poor in elementary students in Indonesia [15] [16].

3.2. Critical Thinking in Choosing Time Sign of Day and Night

The second type of problem is to choose the correct day and night time mark. This type of question is included in the simple category because students only choose the correct time mark according to the provisions in the problem. The thing most needed in solving this problem is the ability of reasoning, that is, students are able to distinguish correctly between hours and minutes. In this type of type most students (63%) have answered correctly as can be seen in Figure 3.

![Figure 3](image2.png)

**Figure 3.** Students’ responses in choosing the time mark day and night
Nevertheless, there are still students who experience problems with critical thinking skills in the aspect of analysis. Students are still experiencing problems in identifying the use of night time signals. The results of the interview revealed that the students had difficulty in converting the time stamp from the night time signal to the afternoon time.

3.3. Critical Thinking in Drawing Time Sign of Day and Night
The third type of problem is describing the time and night sign. If students were previously assigned to read the time mark, then this type of question aims to make students able to describe the time sign. The ability of reasoning and analysis becomes the main provision to work on this problem. The following are the responses of students' answers in drawing time marks.

![Student responses in drawing time marks](image)

Looking at Figure 4 indicates that students' critical thinking skills in drawing time are not satisfactory. Students still do not differentiate between the hour hand and the minute hand. Problem number 4 is answered with the position of the two needles correct, but students are not correct in using the hour and minute time mark. In question number 5, students ignore the direction of the short needle that should be close to number 3. In the questions number 6 and 7 students still do not give a difference in the function of using the long needle and short needle. The results of the interview showed that students claimed to be easier in reading time than drawing it. Achievement of the ability of students to draw time marks is measured at 51%. Students still have difficulty in placing the position of the short needle if the minutes already show more than 30 minutes. These results are in accordance with previous research which revealed the weaknesses of elementary students' critical thinking in mathematics [15] [16].

4. Conclusion
The results showed that students' mathematical critical thinking skills were best at reading the time in the form of an analog clock that is equal to 72%; on the subject matter the difference in the time and night time marks is 63%; while the problem of drawing time and night time marks is 51%. The conclusion of this research is the mathematic problem solving-skills in third-grade students in Thailand hasn’t been optimal. The results of this study provide information about the ability to solve mathematical problems in elementary schools that still need to be improved. Future research can be directed at improving the process of mathematical problem solving skills in elementary schools.

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