Analysis of Students’ Incorrect Answers on the Topic of Roman Numerals in The Fourth-Grade of Primary School

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Abstract. Mathematics has an important role in solving problems related to mathematical symbols. Mathematics topics are related to the daily life of students, as well as mathematics in the primary school level. In this paper, we report the results of research that aims to understand the difficulties of primary school students towards mathematics, especially on the topic of Roman numerals. The subject of this research included 38 students of fourth grade students from a primary school in the city of Bandung. The results showed that the teacher is more likely do the learning to deliver topic directly to students, rather than having to relate the learning with a real context. In addition, after the teacher gave some exercises to students, we observed that there are some students’ answers that are unpredictable and made errors. Unexpected answers are caused by student’s unconscientious, misunderstanding, or inability to memorize in seven Roman numeral in general. The results of this analysis can be used to develop teacher competence in the teaching and learning process in the future. In this way, we expect the teacher can prepare various student responses to the given problems in the learning process.

1. Introduction

Mathematics is formed from the daily human experiences. Mathematics has an important role in solving problems related to mathematical symbols. Age of children to be the first formal education is good start in the development of numeracy person skill. The development of numeracy skills of mathematics, language, working memory is developed rapidly in the period children and formal education at primary school [1]. Mathematics skills of students at the primary school level would be an important start to be able to optimally develop their own skills. Teachers have an important role to develop students’ skills to be able to solve the problems which is related to mathematics.

There is a primary school mathematics topic that essentially can be applied to students in daily life. However, most teachers prefer teaching to deliver the topic directly to students, rather than having to relate learning with real context, for example, the topic of Roman numerals. Teachers often have difficulties in looking for context to teach this topic, because the use of Roman numerals rare, and hard to find in daily life. Whereas, students will quickly understand mathematical concepts, when learning is relevant to students in daily life [2, 3, 4]. For example, even if it is still rare to use, teachers can use a concrete to the introduction in Roman numerals, as of books or novels, clock, street names.

In addition, mathematics has rules as the meaning of the concept of the material. As well as the Roman numerals, there are rules that students need to understand when working on the problems of Roman numerals. For example, firstly students must first memorize seven Roman numerals that will
be used as the benchmark in each process. Students are also given the rules of how to write the Roman numerals two or more numbers by addition and subtraction. This will affect their way of writing. When students do not understand it, it will affect the inability to write a Roman numeral. The students are still having difficulties in using the principles correctly [4]. Most students have difficulties in applying the rules of writing a Roman numeral. The core of the problems that occur at students is not memorizing rules of writing a Roman numeral [5]. Teachers can explain the Roman numeral directly or reception learning to achieve memorization learning.

In addition, teachers must be able to plan models, approaches, methods, techniques, and strategies that suitable to facilitate and enable students to understand the Roman numerals. Then, teachers must be able to predict student incorrect answers that will appear on the students in the Roman numerals topic, so the teacher has prepared and provided appropriate action to help students misconceptions. The teacher can predict the ability of their students, and is able to give a decision in determining the approach, and what plan is suitable for students [3, 6]. Therefore, in the current study, we analyze students' incorrect answers in the Roman numerals topic, and the research questions of this study are the following: What are students' mistakes in learning the Roman numerals? What are the results of comparison between predictions of student answers and students' actual strategies? What are the factors of student mistakes?

2. Experimental Method
To address the research question, we conducted a qualitative study through classroom observation and an individual written test on Roman numerals. Data were collected through exploration ability of primary students on Roman numerals material. The subjects of the research were 38 fourth-grade students from one of primary school in the city of Bandung.

This study used a qualitative method with five procedures. First, we designed problems that would be used in the learning process. Second, we made predictions about the learning process which would be carried out by the teacher and predictions about strategies which would be used by students to answer questions from the teacher. Third, we collected data from students' responses and the learning process. Fourth, we compared between predictions and the observation results. Finally, we analyzed data and gave recommendations about the results of analysis.

3. Result and Discussion
3.1. Analysis Strategy
Based on observations in the classroom, the learning model used by the teacher is a classical model. The teacher thought that the classical model is easier to use in order to avoid misconceptions students' learning of mathematics. Submission of materials by teachers is a start better than the students must find and build their own understanding. This is reasonable, because skills such as the ability to compare numbers, the ability to recite the order, or the ability to recognize the number of a symbol is the development of numeracy students early [7, 8]. For that, it would be better if the material is presented by the teacher.

Furthermore, the approach which is used by teachers when learning is similar to the prediction that the expository approach. The dominance of teachers not only for delivering the material, but there are times for to ask asking questions, and giving exercises to students. Expository learning, students are not only silently listening to the teacher, but the students were given training activities and asked questions [9].

For the methods which is used by teachers during lessons based on the observation that the prediction is similar to using lectures, question and answer, and exercise. The lecture method is used when the teacher presenting the material of writing two numbers along with the rules Roman numerals. This is not an issue when the teacher is using the lecture method in the delivery of the material, because method is good if the teacher's lecture is really prepared well and understandable material by students. Furthermore, after the teacher delivering the material, the debriefing conducted between
teachers and students. It gives an opportunity for students to be active and brave in expressing their opinions. The purpose of the activities of active students is for students to be proficient in math concepts.

Lastly, the students give an exercise to find student skill. The exercise can help students in providing an understanding and students will really understand what he learned. The counting activities is early to students is very influential on the development of skills. The counting activities which is do with their training provision. The exercise is very beneficial to the students aware of the numbers, the relationship with the student materials, and other skills related to the material being studied [10, 11].

The technique which is used by teacher was the expository technique, which is also in line with the predictions which is made. In addition, the strategy which is used by teachers in learning. There is different between prediction and students’ actual strategies. Based on the prediction, researcher assumed that in explaining the Roman numerals will be easier to understand by student if the teacher which brings concrete objects, such as books or novels that the Roman numerals as the initial recognition. But, the reality showed that the teacher does not use any strategy in the classroom. Teacher is use directly material in the Roman numerals, without any concrete objects or media.

3.2. Analysis Students’ Response
Analysis the responses of the students which is earlier made is several predictions of students answers that will appear, which is then compared with the reality.

3.2.1. Analysis Problem 1
Based on observation, twenty eight students provided correct answers. Students have been corrected to writeRoman numerals 100 = C, 10 = X, and 3 = III. In addition, students have been to understand the rules subtraction that the smaller value is first written in Roman numerals. As 110, students have been to write XC, and 3 = III. So that, the answer is 93 = [100-10] + 3 = XCIII. But, more students is difficult and incorrect answers about problem 1. As an illustration, the students' answers were presented in Figure 1 below:

Figure 1 shows that more students are incorrect answers in the rules Roman numerals. Six students similar with the prediction 93 = [100-10] + 3 = CXIII. Students have been correcto writing Roman numerals that the smaller value is first written in Roman numerals. But, the students have errors in exchange number is XCIII be CXIII.
From 38 students, one student similar with prediction is $50 + 10 = 93 + 10 + 10 + 5 + 5 + 3 = LXXXVIII$. Then, one student similar with prediction is $93 = [50-10] + 50 + 3 = LXLIII$. The student have been correct to adding, but error to understand the rules five number. The teacher did not explain about the rules it.

Based on analyzed, two students did not answer with the prediction researcher. One student is answer $93 = IXXXX$. In addition, one student did not answer in problem 1.

3.2.2. Analysis Problem 2
Based on observation, twenty-six students provided correct answer. Students have been corrected to write a Roman numerals $100=C$, $10 = X$, and $9=IX$. In addition, students should understand the rules subtraction that the smaller value is first written in Roman numerals. As $99$, students have been to write $XC$, and $9 = 10-1$. So that, the answer is $99 = [100-10] + 9 = XCIX$. But, more students is difficult and incorrect answers about problem 1. As an illustration, the students' answers were presented in Figure 2 below:

![Figure 2](image)

**Figure 2.** The Example of Students’ Answer on Problem 2

Figure 2 shows that more students are incorrect answers in the rules Roman numerals. Two students similar with the prediction $99 = [100-10] +9 = CXIX$. Students have been correcto writing Roman numerals, but the student did not understand about the rules of decrease. So that, the students have errors in exchange number is XCIX be CXIX.

From 38 students, four students are similar with prediction, such as $99 = [50-10] +50 + 9 = LXLIX$. On observation, the teacher give to symbol that the answer is incorrect. However, the students areincorrectas the rules in Roman numerals. The rules in Roman numerals is $X$ can be used to decrease
L and C. So, the student can be decreased by 50 or 100. But, the teacher explained about the rules V, L, D only be 1x written. So that, the teacher must explicate about the rules in Roman numerals.

In addition, one student response is similar to prediction, i.e., $99 = 9 + 9 = IXIX$. The student did not understand about $99 = 90 + 9$, so the student answers $9 = IX$ with $9 = IX$. Other responses, two students is answer $99 = [100-1] = IC$. Based on analysis, the students did not understand the rules who is explained by the teacher about decrease V and X. So that, C or 100 can not to subtraction by 1.

Problem 2, there is one student who did not answer.

Other responses, one student produced $99 = LXXXVVIX$. Student is correct to write Roman numerals $LXXXVVIX = 50 + 10 + 10 + 10 + 5 + 5 + 9$. But, the answer is a longer than the teacher answer $99 = [100-10] + 9 = XCIX$.

Based on the analysis, one student did not answer according the prediction of researchers. One student answered $90 = 90 + 9 = [9 + 10] + 9 = IXXIX$.

4. Conclusion

Based on the analysis between the predictions and observations, the teacher used a classical model and the expository learning method. However, the teacher does not bring concrete objects that can help students to understand and the benefits in learning Roman numerals. In addition, we found that some predictions are similar to student answers. Therefore, for the learning processes, we suggest the teacher not only prepare the planning models/approaches/methods/techniques/learning strategies, but also to predict the responses of students.

5. References

[1] Cirino P T 2011 Journal of Experimental Child Psychology 108 pp713-33
[2] Hudojo H 2003 Common Textbook: Pengembangan Kurikulum dan Pembelajaran Matematika (Malang: UM Press) p 83
[3] Haylock and Fiona 2007 Key Concepts in Teaching Primary Mathematics (SAGE Publications) p 20
[4] Kusmaryono I and Hardi S 2016 The Effect of Constructivist Learning Using Scientific Approach on Mathematical Power and Conceptual Understanding of Students Grade IV Journal of Physics J. Phys.: Conf. Ser. 693 012019
[5] Wardono, S B Waluya, Scolastika M and Candra D 2016 Mathematics Literacy on Problem Based Learning with Indonesian Realistic Mathematics Education Approach Assisted E-Learning Edmodo Journal of Physics J. Phys.: Conf. Ser. 693 012014
[6] Blongkod S 2014 Analisis Kesalahan Mengubah Bilangan As like Bilangan Romawi pada Siswa Kelas IV (Gorontalo: Skripsi Universitas Negeri Gorontalo)
[7] Sumiaty E dan Endang D 2015 Proc. Int. Seminar on Mathematics, Science, and Computer Science Education(Bandung) (Bandung: FPMIPA UPI) p. 78-83.
[8] Desoete, A, CeulemansA, De Weerdt F and Pieters S2012 British Journal of Educational Psychology 82 p64-81
[9] Tim MKPBM Jurusan Pendidikan Matematika 2001 Common Text book Strategi Pembelajaran Matematika Kontemporer (Bandung: JICA UniversitasPendidikan Indonesia) p 171
[10] Barth H, La Mont K, Lipton J, Dehaene S, Kanwisher N and Spelke E2006 International Journal of Cognitive Science 98 pp199-222
[11] Andersson U and Lyxell B 2007 Journal of Experimental Child Psychology 96 p 197-228

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