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Uncovering student misconceptions: A watson's framework analysis of roman numerals problems

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Abstract
This study analyzes the errors made by second-semester students of the Elementary School Teacher Education Study Program in solving Roman numeral problems. This study uses a descriptive qualitative approach with 35 students as subjects selected through purposive sampling techniques. The research instrument used six questions to identify errors based on Watson's categories: inappropriate data, inappropriate procedures, omitted data, omitted conclusions, response level conflicts, undirected manipulation, skills hierarchy problem, and other errors (not providing answers). The analyzed data was reduced, presented, and concluded. The study's results indicate that other errors (specifically about students who did not provide answers) were the most dominant (40.41%), with details of the errors that occurred in numbers 2, 3, 4, 5, and 6, respectively, 5.48%, 4.11%, 3.42%, 13.70%, and 13.70%. Other types of errors were response-level conflicts, inappropriate procedures, undirected manipulation, omitted conclusions, and inappropriate data. The implications of this study emphasize the importance of conceptually understanding-based learning in teaching Roman numerals.

Keywords: Errors, Roman Numerals, Student, Watson's Category

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INTRODUCTION

Mathematics is one of the disciplines that plays a crucial role in forming logical, creative, critical, and systematic thinking patterns in students (Husnaidah et al., 2024; Ja'faruddin et al., 2024; Rahmaini & Chandra, 2024). Mastery of mathematical concepts is not limited to understanding arithmetic operations, algebra, and geometry, but also includes the ability to recognize and understand the number system that applies in various life contexts. One material that is often considered simple but requires precision in understanding the rules of writing and reading is Roman numerals.

Roman numerals were developed in 100 BC (Amir, 2019). Although they are not widely used in everyday mathematical calculations, they are still often found in book chapter and page numbering, as well as in the inclusion of class levels, hours, and calendars (Amir, 2019; Jusmawati, 2020). Therefore, understanding Roman numerals is an important skill that students

must master because they will find the application of Roman numerals in their lives (Hakim & Mulyatna, 2023).

However, reality shows that many students still have difficulty solving problems related to Roman numerals (Magdalena et al., 2021). This difficulty is not only shown by elementary school students but also by university students. (Oktaviani & Rijal, 2016) stated that the learning outcomes of 13 students (60% of the total number of students) on Roman numerals had not reached the minimum competency criteria. Students still have difficulty remembering the symbols of each Roman numeral. In addition, some students also do not understand addition and subtraction operations well, so they also have difficulty solving Roman numeral problems, which require skills in addition and subtraction operations. (Oktavia et al., 2018) study revealed that more than 70% of students made mistakes in writing Roman numerals, both in symbols and in converting decimal numbers to Roman numerals. These errors occurred not only due to negligence but also due to a lack of understanding of the basic rules of Roman numerals, such as IV for the number 4, not IIII, and the rules for repeating symbols, where one symbol should not be repeated more than three times in a row.

In ideal mathematics learning, understanding Roman numerals should have been mastered at the elementary school level. Children at this level are between 6 and 12 years old. They are at a stage of development called late childhood. According to developmental theory, at this time, children have a strong drive to explore the world of concepts, symbols, logic, and communication more broadly (Mifroh, 2020). This shows they are beginning to understand and use abstract symbols, including number symbols such as Roman numerals. This ability aligns with their intellectual development tasks, namely thinking more systematically, understanding rules, and using symbols to represent specific ideas or quantities.

However, the facts show that students who have passed elementary and secondary education levels still make mistakes in solving problems related to Roman numerals, translating from Hindu-Arabic numbers to Roman numerals, and vice versa. Based on the test results, it is known that the average score obtained by 35 Elementary School Teacher Education students was 11,17. The maximum score that can be obtained on this test is 24, which is determined based on the total value of the six descriptive questions. Each question is given a score range of 0–4, with assessment criteria including accuracy of the answer, completeness, and clarity of the answer description. There were approximately 45.7% of the students who had scores above the average score. A more detailed explanation of the students' scores can be seen in Table 1 below.

Table 1. Student Scores in Solving Roman Numerals Problems

Interval Score	Frequency
2 - 5	10
6 - 9	9
10 - 13	2
14 - 17	7
18 - 21	3
22 - 25	4
Total	35

The conditions above indicate a significant gap between ideal and real conditions in the field. This condition encourages the need to conduct a more in-depth analysis of student errors in working on Roman numeral problems, so that the dominant types of errors and their root causes can be identified. Errors in solving Roman numeral problems can be categorized based on the types of errors presented by Watson. Watson's classification of error types was chosen because its framework allows researchers to systematically, deeply, and comprehensively analyze student errors. This approach identifies students' errors and explains the types and possible causes. Watson's classification of error types consists of: 1) inappropriate data; 2) inappropriate procedures; 3) missing data; 4) missing conclusions; 5) level conflict; 6) indirect manipulation; 7) skill hierarchy problems; and 8) the last category is other errors that are not included in the seven errors mentioned previously (Nurhikmah & Febrian, 2016).

Based on the problems that have been explained, this study aims to: 1) analyze the errors made by students in solving problems on Roman numerals; 2) classify the types of errors made by students in solving problems on Roman numerals; 3) find out the most dominant errors made by students in solving problems on Roman numerals.

METHOD

This research is descriptive qualitative research. The subjects of this study consisted of 35 students in the second semester of the Elementary School Teacher Education Study Program. The subjects were selected using a purposive sampling technique, considering that the second-semester students will study Roman numerals in the arithmetic course. The results of this study can be used as a basis for lecturers in charge of the course to determine students' initial knowledge before being given learning.

The instrument used in this study was a written test consisting of six descriptive questions. The questions were not designed to explore specific cognitive abilities directly, but aimed to

identify the types of errors in solving Roman numeral problems. The test instruments used in this study can be seen in Table 2.

Table 2. Test Instruments Used in the Research

Number	Test Instrument	
	Question Items	**Answer**
1.	Write the number 1987 in the Roman numeral system and explain the rules used in its construction.	1987 in Roman numerals: MCMLXXXVII Explanation: M = 1000 CM = 900 (because 1000 - 100 = 900) LXXX = 80 (because 50 + 10 + 10 + 10) VII = 7 (because 5 + 1 + 1)
2	A company uses the Roman numeral system to serial number its products. The first product is numbered CDXLV, and XXV increments each product from the previous number. Determine the serial number of the fifth product and explain the calculation process.	The first product number is CDXLV = 445 Each product increases XXV = 25 from the previous number. So, the serial number of the fifth product is as follows: 1st product: CDXLV = 445 2nd product: 445 + 25 = 470 (CDLXX) 3rd product: 470 + 25 = 495 (CDXCV) 4th product: 495 + 25 = 520 (DXX) 5th product: 520 + 25 = DXLV
3	A product serial number is written as MMMCDXXXVIIII. Is this serial number correct? Explain why and if it is incorrect, provide the correct serial number.	The number VIIII is not written correctly and should be written as IX. So the correct serial number is MMMCDXXXIX. MMMCDXXXIX = 3439 Explanation: MMM = 3000, CD = 400, XXX = 30, IX = 9
4	Write the number 1337 in the Roman numeral system and explain the rules used in its construction.	1337 in Roman numerals: MCCCXXXVII Explanation: M = 1000 CCC = 300 XXX = 30 VII = 7
5	A book has a serial number MCMXLI. If each subsequent edition increases by X, determine the serial number of the 6th edition and explain the calculation process.	The first product number is MCMXLI = 1941 Each product increases by X = 10 from the previous number. So the serial number of the sixth product is as follows: 1st product: MCMXLI = 1941 2nd product: 1941 + 10 = 1951 (MCMLI) 3rd product: 1951 + 10 = 1961 (MCMLXI) 4th product: 1961 + 10 = 1971 (MCMLXXI) 5th product: 1971 + 10 = 1981 (MCMLXXXI) 6th product: 1981 + 10 = 1991 (MCMXCI)

6	Given a year in Roman numerals, namely MDCCCXXXIV. Compare the year with MCMXX. Is MDCCCXXXIV smaller than MCMXX? Explain your reasoning!	MDCCCXXXIV = 1834 MCMXX = 1920 If compared, then: 1834 < 1920 MDCCCXXXIV < MCMXX So, it is true that MDCCCXXXIV is smaller than MCMXX.

The data collection technique was carried out by implementing tests in class that the researcher directly supervised to ensure the authenticity of the students' work. The students' answers were then carefully analyzed to identify errors based on Watson's categories. The data analysis technique in this study used three main stages: data reduction, data presentation, and concluding. This model was chosen because it follows the study's objectives, which focus on identifying and classifying students' errors in solving Roman numeral problems, not quantitative measurements of their abilities.

The first stage is data reduction, which involves sorting and simplifying raw data from students' test results. In the context of this study, the data analyzed were students' written answers to six questions about Roman numerals. The researcher identified parts of the answers that showed errors, then grouped the data into segments relevant to the study's focus, namely, based on the type of error according to Watson's classification. The second stage is data presentation, where the reduced data is arranged in a table to make it easier to understand the error patterns that occur. In this study, data presentation was carried out using a frequency table that shows the number of students who made each type of error. This presentation helps researchers to see the tendency of the most dominant types of errors and how often they occur in the group of subjects studied. The final stage is concluding. Conclusions are made based on patterns that emerge from the data that has been presented. For example, suppose most students make mistakes in the category of " inappropriate procedures". In that case, the researcher concludes that students have not mastered the rules for compiling Roman numerals involving addition and subtraction concepts. More details of this research procedure are presented in Figure 1.

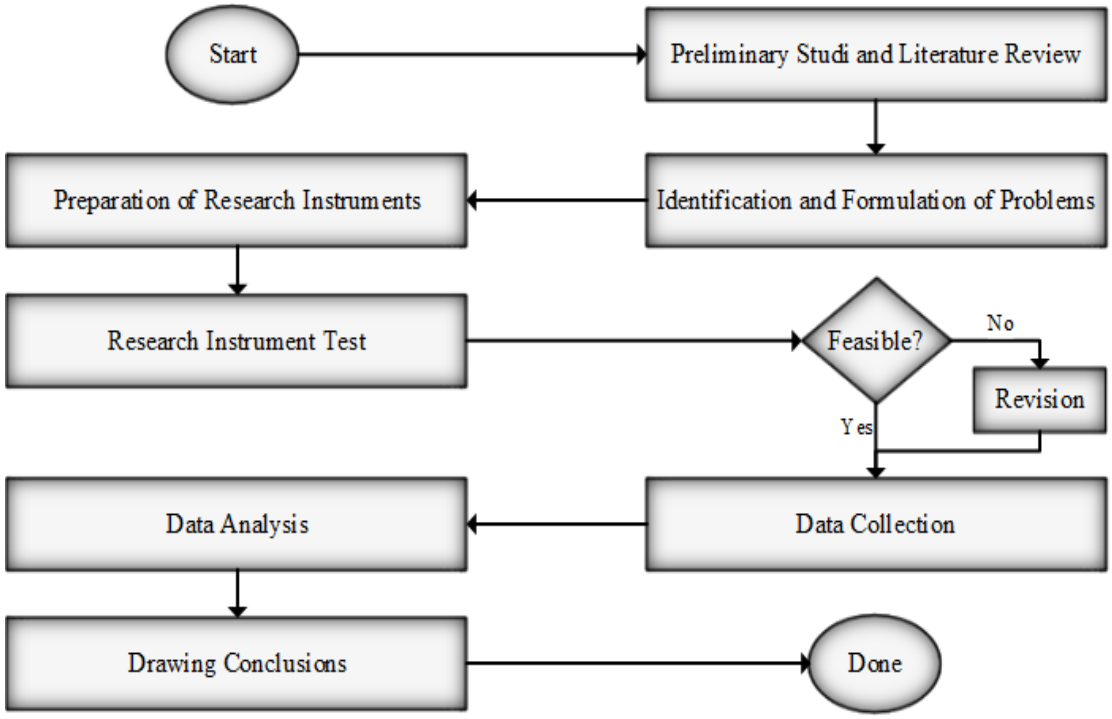

Figure 1. Research Procedures

RESULTS AND DISCUSSION

In general, out of 35 students who took the test, only 8.57% could answer all the questions correctly. Most students, or around 91.43%, made mistakes in answering the questions. There are various types of mistakes made by students. The error analysis for each question is as follows:

Analysis of Answers for Question Number 1

In this question, twenty-one students made mistakes in solving the question. The mistakes made were:

1. Inappropriate data: Three students wrote incorrect data. An example of the mistake that the student made is writing M (1000) + CM (900) + L (50) + XX (20) + VII (7). The question asked him to write the year 1987 in Roman numerals, so he should have written M (1000) + CM (900) + L (50) + XXX (30) + VII (7).
2. Inappropriate procedure: One student wrote the wrong Roman numerals when performing a calculation operation. He wrote 900 = (1000 – 100) = M – C = MC.
3. Response level conflict: Ten students wrote answers without steps to compile them, so they made mistakes. They wrote 1987 in Roman numerals as MCVXXIIIXII. They did not write down the steps of this arrangement. This shows that students only guess the answer and do

not understand the questions given.

4. Undirected manipulation: Seven students carried out an illogical process. For example, some students wrote 1900 as MX, 80 as VM, and 7 as VII.

Analysis of Answers for Question Number 2

In this question, twenty-nine students made mistakes in solving the question. The mistakes made were:

1. Inappropriate data: Two students wrote incorrect data. For example, a student entered the first product serial number as 645 when it should be 445.
2. Inappropriate procedure: Seven students made mistakes in performing calculation operations. To find the fifth product serial number, they should have performed a multiplication operation of $25 \times 4 = 100$, which was then added to the first product serial number, but all students who made this type of error performed a multiplication operation of $25 \times 5 = 125$, so the final result was incorrect.
3. Omitted conclusion: Three students have done the calculation operation but did not write the conclusion, or some have obtained the conclusion but added one line of work that they should not have written. For example, a student has obtained the answer that the serial number of the fifth product is 545, but he did not write the Roman numeral. Another student made a mistake by continuing to calculate the serial number of the sixth product, DLXX, and did not conclude which answer was correct.
4. Response level conflict: Seven students only wrote answers by guessing. Students did not seem to understand the questions given. This can be seen from the answers that did not have a basis for work, such as a student writing the answer 360 = CCCLX. Other students who made this mistake also wrote the answers DC, 500, MMCDX, etc.
5. Undirected manipulation: Two students carried out an illogical process. For example, students wrote:

   CDXLV

   = 100, 500, 10, 50, 5

   = (100 + 500 – 10 + 50 – 1)

   = 639
6. Other errors: Eight students did not provide an answer.

Analysis of Answers for Question Number 3

In this question, twenty-five students made mistakes in solving the question. The mistakes made were:

1. Omitted conclusion: Eight students stated that the writing of the Roman numerals MMMCDXXXVIIII is wrong because I is repeated 4 times, where it should be written a maximum of 3 times. However, students who made this mistake did not write the correct Roman numerals. Their answers only stopped at the statement that the writing was wrong.
2. Response level conflict: Nine students only wrote the answer by guessing. For example, some students only wrote the word wrong as the answer. Some students wrote the answer correctly, but did not provide a reason for the answer given. The other students said the serial number was wrong because VIII cannot be more than 3. V should not have been included because it was not repeated three times.
3. Undirected manipulation: Two students carried out an illogical process. For example, students write: The correct Roman numerals are MMMCDXXXIV = 3000 + 400 + 30 + 4 = 3434, even though the product serial number asked in the question is MMMCDXXXVIIII.
4. Other errors: Six students did not provide an answer.

Analysis of Answers for Question Number 4

In this question, seventeen students made mistakes in solving the question. The mistakes made were:

1. Inappropriate data: Two students wrote incorrect data. An example of a mistake made was a student writing:

   1337

   1 = I

   3 = III

   3 = III

   7 = VIII

   The student wrote Roman numerals without paying attention to their placeholders. The Roman numerals symbols he entered were incorrect, 1000 should be expressed as M, 300 should be CCC, 30 should be XXX, and 7 should be VII.
2. Inappropriate procedure: Two students used incorrect arithmetic operation signs and symbols for Roman numerals. For example, students wrote the following answers:

   1337 = (1 × 1000 – 3 × 100 – 3 × 10 – 7 × 1)

   C = 1000

   D = 100 × 3

   X = 10 × 3

   VIII = 7

1337 = DDDXXXVII

3. Response level conflict: Four students wrote answers without steps in compiling them. For example, a student wrote the answer MCCXXXVII correctly, but did not include his steps to get it. Other students wrote incorrect answers, such as MMVII, MCCDVII, and MMIVII.
4. Undirected manipulation: Four students carried out an illogical process. For example, students wrote:

   1337 = MDCCLXXVII

   1000 = M

   300 = D – CC (500 – 200)

   30 = L – XX (50 – 20)

   7 = VII
5. Other errors: Five students did not provide an answer.

Analysis of Answers for Question Number 5

In this question, thirty students made mistakes in solving the question. The mistakes made were:

1. Inappropriate procedure: Five students made mistakes in performing calculation operations. For example, students wrote the following answer:

   Serial number = 1941

   Each serial number increases by 10, so the sixth serial number is added by 10 × 6 = 60. So, the sixth serial number is 2001 (MMI). It should be enough to add 50, not 60, to get the sixth serial number.
2. Omitted conclusion: One student performed the calculation operation correctly and got the answer for the sixth serial number, 1991, but he did not continue writing the serial number in Roman numerals.
3. Response level conflict: Three students wrote answers without logical reasons and produced incorrect answers. They wrote the answers CXLVI, MCMXLI, and MCMXLXI.
4. Undirected manipulation: One student carried out an illogical process. For example, students wrote:

   MCMXLI, if added, becomes MCMXLIX

   The serial number of the 6th edition is MMCXLIXX.
5. Other errors: Twenty students did not provide an answer.

Analysis of Answers for Question Number 6

In this question, twenty-four students made mistakes in solving the problem. The mistakes

made were:

1. Inappropriate procedure: Three students made mistakes in understanding the Roman numeral symbols given. For example, a student wrote MDCCCXXXIV = 1934
   MCMXX = 1920
   DCCC should be the Roman numerals for 800, not 900, so he mistakenly concluded that MDCCCXXXIV is greater than MCMXX.
2. Response-level conflict: One student only wrote the answer by guessing. For example, a student only wrote "accurate" as the answer. There was no process of working on the problem that he did, so the answer was incorrect.
3. Other errors: Twenty students did not provide an answer.

Table 3. Recapitulation of Error Types Based on Watson Categories

Error Categories	Number 1		Number 2		Number 3		Number 4		Number 5		Number 6	
	Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%	Number of Cases	%
Inappropriate data	3	8.57	2	5.71	-	-	2	5.71	-	-	-	-
Inappropriate procedures	1	2.86	7	20	-	-	2	5.71	5	14.29	3	8.57
Omitted data	-	-	-	-	-	-	-	-	-	-	-	-
Omitted conclusion	-	-	3	8.57	8	22.86	-	-	1	2.86	-	-
Response level conflict	10	28.57	7	20	9	25.71	4	11.43	3	8.57	1	2.86
Undirected manipulation	7	20	2	5.71	2	5.71	4	11.43	1	2.86	-	-
Skills hierarchy problem	-	-	-	-	-	-	-		-		-	-
Other errors	-	-	8	22.86	6	17.14	5	14.29	20	57.14	20	57.14
Total	21	60%	29	82.85%	25	71.42%	17	48.57%	30	85.72%	24	68.57%

Based on Table 3, it can be concluded that other error categories that specifically occurred in this study were when students did not provide answers (other mistakes), ranked first (40.41%) in the errors most often made by students in solving Roman numeral problems. In second and third place, the most common errors were response level conflicts (23.29%) and inappropriate procedures (12.33%).

The study showed that second-semester students experienced various errors in solving Roman numeral problems. Another category of errors, where students did not provide answers, occupied the highest proportion of errors. This type of error often occurs in the last numbers, such as question number 5 and question number 6. This happens because students take too long to solve the previous questions. Most students who did not provide answers to questions 5 and 6 also had difficulty working on the questions in the previous numbers. They seemed not to

understand the questions well and did not master the Roman numerals material. (Amalia, 2017) stated that various causes of errors can occur, including not understanding the questions, not mastering the material, running out of time, being less careful, rushing in working on questions, and not being used to writing conclusions. This statement is also supported by (Pamungkas & Wicaksono, 2019), who state that the causes of errors are being less careful, rushing, and running out of time to work on questions.

The second most common type of error is response level conflict. This error occurs because students do not understand the questions given, so they write answers without being based on logical reasons or steps. Examples of mistakes that students make are as follows.

Figure 2. Example of Response Level Conflict Error in Question Number 1

Figure 2 shows that the student cannot write 1987 in Roman numerals. The student only guesses the answer and produces an incorrect answer. This type of error also occurs when solving question number 5. The student should have calculated first to find the serial number of the 6th edition book. However, without doing the calculation, the student immediately stated that the serial number was MCMXLXI, which is an incorrect answer. The student's answer can be seen in Figure 3.

Figure 3. Example of Response Level Conflict Error in Question Number 5

Mistakes often occur due to missing steps when working on problems (Ong et al., 2019). Students cannot write down these steps because they cannot understand their problems. (Tias & Wutsqa, 2015). They also do not understand the mathematical symbols used (in this case, the symbols used in Roman numerals), so errors occur when solving problems (Mujib, 2019; Putri & Dewi, 2020).

The third type of error that is most often made is inappropriate procedures. This error occurs because students incorrectly perform operations requiring calculations or misuse Roman numeral symbols. Examples of errors that students make are as follows.

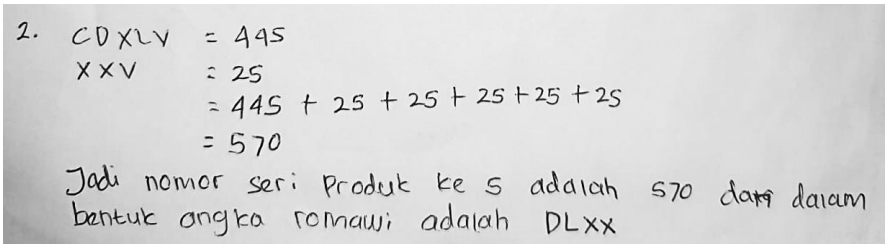

Figure 4. Example of Inappropriate Procedure Error in Question Number 2

Figure 4 shows that the student correctly interpreted the first serial number, CDXLV = 445. He also understood the serial number would increase by XXV = 25 for the following product. However, in the subsequent calculation operation, he made a mistake. He performed an addition operation to find the serial number of the sixth product, even though what was asked was the serial number of the fifth product. So, the final answer produced was incorrect.

This type of error also occurred while working on question number 5. The student mistakenly understood the XL symbol as 6, which should be the Roman numeral symbol for 40. Then, he also made a mistake when performing the calculation operation. The student only added the first serial number with 10, even though what was asked was the serial number of the 6th edition, not the 2nd edition. More details about this error can be seen in Figure 5.

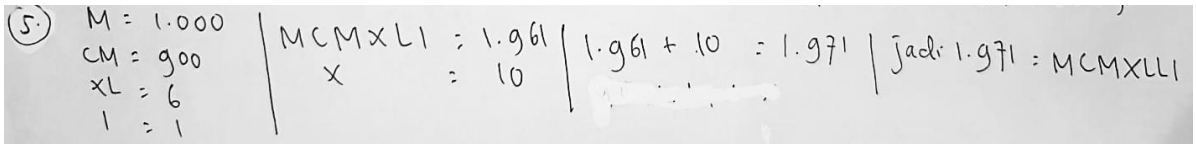

Figure 5. Example of Inappropriate Procedure Error in Question Number 5

(Rosyidah et al., 2020) stated that many students still make mistakes when performing basic arithmetic operations. Students' carelessness in working on questions also exacerbates the mistakes. (Novianti, 2015) stated that 48% of students made mistakes in using symbols or signs because they were not careful or less careful in working on the questions given.

Based on the findings of various types of errors made by students, there are several important implications for learning Roman numerals in higher education:

1. Emphasis on conceptual principles rather than memorization

   Teaching Roman numerals should not only emphasize memorizing significant numbers such as I = 1, V = 5, X = 10, and so on. However, it should also teach basic principles, such as when to use the concepts of subtraction and addition.

   For example, the addition operation is used when there are small Roman numerals after a larger one.

For example:

VI (6) = V (5) + I (1)

XV (15) = X (10) + V (5)

Meanwhile, the subtraction operation is used when there is a smaller Roman numeral before a larger one.

For example:

IV ⟶ I (1) written before V (5) means 5 – 1 = 4

IX ⟶ I (1) written before X (10) means 10 – 1 = 9

2. Use of visual media

Figure 6. Roman Numerals 49 Visualization Concept Map

Visualizations, such as conversion tables or Roman numerals hierarchy diagrams, can help students better understand the structure of numbers. For example, 49 is 50 minus 1 (XLIX) through the concept map presented in Figure 6.

3. Problem-Based Learning Strategy

Students must be given exploratory questions, not memorization questions, to internalize Roman numerals patterns.

4. Gradual Training

The material can be divided into stages, starting from small numbers, tens, hundreds, to thousands, while scaffolding can be applied to help students understand the concept gradually.

5. Diagnostic Feedback

   It is important to provide feedback that states whether an answer is right or wrong and explains why the answer is wrong and how to improve it.

Although this research has been conducted systematically, there are several limitations. These limitations include: 1) the limited number of questions (only six questions were used in the instrument, so it may not have covered all variations of Roman numeral complexity); 2) subject homogeneity (all subjects came from the same study program and the same batch). The description of these limitations is expected to be a consideration for further, more comprehensive research development.

CONCLUSION

Based on the research and discussion results, several important things can be concluded as follows: 1) the errors made by students in solving problems on Roman numerals include students not understanding the information given in the problem so that the data used to solve the problem is not correct, students do not understand the symbols used in Roman numerals, the procedure for working on the problem is not appropriate, the work on the problem is not complete so that no conclusion is obtained for the problem given, and students do not work on the problem given; 2) the types of errors made by students in solving problems on Roman numerals based on Watson's categories are inappropriate data (errors of 4.79%), inappropriate procedures (errors of 12.33%), omitted conclusion (errors of 8.22%%), response level conflict (errors of 23.29%), undirected manipulation (errors of 10.96%), and other errors specifically about students who did not provide answers (errors of 40.41%); 3) the most dominant type of error is other types of errors; in this case, students do not provide answers (errors of 40.41%). This happens because students take too long to complete the previous questions, so they run out of time and do not have time to work on the last questions; 4) the level of complexity of the questions given can affect the errors made by students. The bigger and more complicated the problem whose answer must be written in Roman numerals, the more complex the structure that students must understand, which in turn increases the possibility of various types of errors; 5) the need for a Roman numeral learning approach that is not just memorization, but emphasizes more on understanding the concept.

REFERENCES

Amalia, S. R. (2017). Analisis Kesalahan Berdasarkan Prosedur Newman dalam Menyelesaikan Soal Cerita Ditinjau dari Gaya Kognitif Mahasiswa. *Aksioma*, *8*(1), 17–30.

Amir, M. (2019). *Buku Ajar Mata Kuliah Bilangan untuk Guru Sekolah Dasar: Suatu Pendekatan Konseptual*. UMSIDA Press.

Hakim, A. R., & Mulyatna, F. (2023). Sejarah Matematika: Perkembangan Bilangan Matematika Empiris. *Prosiding Diskusi Panel Nasional Pendidikan Matematika Universitas Indraprasta PGRI Jakarta*, 471–478.

Husnaidah, M., Hrp, M. S., & Sofiyah, K. (2024). Konsep Dasar Matematika Fondasi untuk Berpikir Logis. *Jurnal Ilmiah Multidisiplin Terpadu*, *8*(12), 41–47.

Ja'faruddin, Zaki, A., Rahman, A., Sidjara, S., & Nyulle, R. (2024). Program Kelas Cermat Mahasiswa Matematika KKNT 2023 Sebagai Upaya Meningkatkan Pengetahuan Dasar Matematika Siswa SD Inpres 4/82 Jompie. *Panrannuangku Jurnal Pengabdian Masyarakat*, *4*(2), 55–58. https://doi.org/10.35877/panrannuangku2576.

Jusmawati. (2020). *Makalah Bilangan Romawi*. Universitas Megarezky.

Magdalena, I., Anggraini, I. A., & Khoiriah, S. (2021). Analisis Daya Pembeda dan Taraf Kesukaran Pada Soal Bilangan Romawi Kelas 4 SDN Tobat 1 Balaraja. *Jurnal Pendidikan Dan Ilmu Sosial*, *3*(1), 151–158. https://ejournal.stitpn.ac.id/index.php/nusantara.

Mifroh, N. (2020). Teori Perkembangan Kognitif Jean Piaget dan Implementasinya dalam Pembelajaran di SD/MI. *JPT: Jurnal Pendidikan Tematik*, *3*, 253–263.

Mujib, A. (2019). Kesulitan Mahasiswa Dalam Pembuktian Matematis: Problem Matematika Diskrit. *Jurnal MathEducation Nusantara*, *2*(1), 51–57.

Novianti, D. E. (2015). Analisis Kesalahan dalam Mengerjakan Soal Materi Logika Matematika Mahasiswa Prodi Pendidikan Matematika IKIP PGRI Bojonegoro. *Jurnal Pendidikan dan Pembelajaran Matematika (JP2M)*, *1*(1).

Nurhikmah, S., & Febrian. (2016). Analisis Kesalahan Siswa dalam Menyelesaikan Permasalahan Integral Tak Tentu. *JURNAL TATSQIF*, *14*(2), 218–237. https://doi.org/10.20414/j-tatsqif.v14i2.1074.

Oktavia, Y., Yensy, N. A., & Syafdi, M. (2018). *Analisis Kesalahan Siswa dalam Menyelesaikan Soal Materi Bilangan Romawi di Kelas V SD Negeri 69 Kota Bengkulu*. Universitas Bengkulu.

Oktaviani, R., & Rijal, R. (2016). Penerapa Metode Kumon untuk Meningkatkan Hasil Belajar Matematika Pada Materi Bilangan Romawi. *PRIMARY*, *8*(1), 75–92.

Ong, Hananta, F. I., & Ratu, N. (2019). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Logaritma. *Jurnal Pendidikan Matematika Indonesia*, *4*(1), 29–35.

Pamungkas, M. D., & Wicaksono, A. B. (2019, March 27). Analisis Kesalahan Mahasiswa dalam Menyelesaikan Soal Geometri Bidang Berdasarkan Teori Newman. *Konferensi Nasional Penelitian Matematika Dan Pembelajarannya (KNPMP) IV*.

Putri, L. A., & Dewi, P. S. (2020). Media Pembelajaran Menggunakan Video Atraktif pada Materi Garis Singgung Lingkaran. *MATHEMA JOURNAL*, *2*(1), 32–39.

Rahmaini, N., & Chandra, S. O. (2024). Pentingnya Berpikir Kritis dalam Pembelajaran Matematika. *Griya Journal of Mathematics Education and Application*, *4*(1). https://mathjournal.unram.ac.id/index.php/Griya/indexGriya.

Rosyidah, A. N. K., Maulyda, M. A., & Oktaviyanti, I. (2020). Miskonsepsi Matematika Mahasiswa PGSD pada Penyelesaian Operasi Hitung Bilangan Bulat. *Jurnal Ilmiah KONTEKSTUAL*, *2*(01), 15–21. https://doi.org/10.46772/kontekstual.v2i01.24.4

Tias, A. A. W., & Wutsqa, D. U. (2015). Analisis Kesulitan Siswa SMA dalam Pemecahan Masalah Matematika Kelas XII IPA di Kota Yogyakarta. *Jurnal Riset Pendidikan Matematika*, *2*(1), 28–39. https://doi.org/10.21831/jrpm.v2i1.7148.