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Students' mathematical reasoning skills on number pattern using PMRI and collaborative learning approach

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Abstract

Students need to have good mathematical reasoning skills when learning number pattern material. The use of video media through the PMRI approach and collaborative learning can be applied in learning activities to have good mathematical reasoning skills. This study aims to determine mathematical reasoning skills after implementing the learning process using video media with the PMRI approach and collaborative learning on number pattern material for class VIII students. This research uses a descriptive type of research. The research subjects were students of class VIII.A, SMP Srijaya Negara Palembang, with 25 students (12 males and 13 females) out of a total of 39 students. Data collection techniques are observation, a written test consisting of two test questions, and interviews. The data analysis technique is descriptive. The results obtained from this study are the students' mathematical reasoning skills after the learning process using video media with the PMRI approach and collaborative learning on the number pattern material of grade VIII.A students of SMP Srijaya Negara Palembang are good, with an average value of 68.89. The indicator that appears the most is "submit a conjecture," while the indicator that appears the least is "draw a conclusion." Using video media through the PMRI approach and collaborative learning during learning can make students have good mathematical reasoning skills.

Keywords: collaborative learning; mathematical reasoning; PMRI; video media

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Introduction

Sari et al. (2018) state that reasoning and mathematical material are linked. Based on Permendikbud number 21 of 2016, one of the skill competencies in the 2013 curriculum is reasoning skills. The reasoning was also included in one of the National Council of Teachers of Mathematics (NCTM) process standards in 2000. Reasoning can be used to confirm or disprove conjectures (NCTM, 2000). Mathematical reasoning skills are the skills that enable one to process mathematical thinking in order to arrive at logical conclusions based on existing or suitable methods, concepts, and facts or data (Munawaroh et al., 2019). These skills are essential for students because they can help students generate new ideas, prove and conclude a statement, and solve mathematical problems (Sumartini, 2015). Cahya et al. (2021) also express the importance of mathematical reasoning skills, who state that when students are faced with complex problems, they can be solved quickly. From the explanation above, mathematical reasoning skills are needed to learn mathematics.

Through pattern learning, students can use inductive reasoning to find mathematical relationships (NCTM, 2000). Thus, students can practice their mathematical reasoning skills through learning number patterns (Sari et al., 2018). One of the competencies in learning mathematics is an explanation of patterns in real life and providing advanced assumptions from repetitive patterns (Kemendikbud, 2016). According to NCTM (2000), the two content standards in mathematics related to number patterns are content numbers and operations and algebraic content. Number pattern material is essential for students to learn because it is an essential component of success in mathematics (Diana & Fauzan, 2018). Number patterns are also included in the quantity content of PISA questions, where the questions are widely applied to real-life (Bidasari, 2017). So, it is expected that students have good mathematical reasoning skills in the number pattern material.

However, in reality, students experience difficulties determining the pattern of the questions given and formulating generalizations from number patterns (Ariyanti & Setiawan, 2019). When solving number pattern problems, students have not been able to write the formulas for the nth term, which is the basis for solving problems (Sari et al., 2018); and students also have difficulty analyzing questions (Saleh et al., 2021). One of the reasons is the teacher's learning activities, where the activities are still procedural, monotonous, and dominated by teachers (Munawaroh et al., 2019). The teacher also only uses the lecture method (Erissa et al., 2018; Saleh & Lubis, 2018), and the learning approach is still teacher-centered (Fatimah, 2016). Therefore, the need for an appropriate learning approach to learning number patterns. The learning approach in question should be contextual (Dewi & Agustika, 2020), namely by providing daily problems so that students are more interested and feel challenged.

A learning approach that emphasizes the presentation of contextual problems is Realistic Mathematics Education (RME) so that during learning activities, students will feel more fun and meaningful (Narmi et al., 2020). It is in line with the thoughts of Rahayu and Putri (2021) that the learning process carried out by involving the context makes the knowledge that students learn meaningfully. RME is known in Indonesia as "The Indonesian Realistic Mathematics Education" (PMRI). According to Meitrilova and Putri (2020), PMRI is one solution to help

students understand learning materials. The PMRI approach can make learning more interesting because it begins with a real context for students (Putri, 2015). It acts as a bridge from contextual problems to formal mathematics (Trisnawati et al., 2015). According to Zulkardi and Putri (2010), PMRI is a theory based on real problems or student experiences, emphasizing processing skills, collaborating, discussing, and sharing opinions with classmates to find their mathematical concepts to solve problems using mathematics. The principles of PMRI have guided reinvention/progressive mathematizing, didactical phenomenology, and self-developed models, while the characteristics of PMRI are using contextual problems, using models, student contributions, interactivity, and is integrated with other learning topics (Zulkardi & Putri, 2010). The PMRI approach is one of the active and innovative approaches (Salsabilla, 2020). In PMRI learning, as a result of interaction with the environment, students become individuals (subjects) who have experience and knowledge (Munir & Sholehah, 2020), while the teacher is only a guide and facilitator (Lisa, 2020).

In the 21st-century, by improving the curriculum following the demands of 21st-century competencies, education is challenged to produce human resources that can create economic and social order (Sumantri, 2019). The hope is that teachers and students have 21st-century skills, skills, and competencies: collaborative skills, critical thinking, communication skills, and creativity and innovation skills (Sumantri, 2019). According to Rahmawati (2016), through 4C, there will be an increase in the quality of Indonesian education.

One of the 4Cs, namely collaborative, is where students will be actively involved in small groups during the learning process (Septikasari & Frasandy, 2018). Collaborative learning involves two or more students who are together in groups and provide information, knowledge, ideas, and experiences to increase the understanding of all group members (Deswita & Niati, 2020). Collaborative learning activities consist of sharing and jumping lessons (Wikanta, 2017). Students who do not understand this activity must dare ask for help from friends who already understand by saying, "Please teach me" (Sato, 2014). The purpose of collaborative learning is for students to be active in groups and create student-centered learning situations (Inah & Pertiwi, 2017). Thus, the PMRI approach and collaborative learning can be applied together to create more enjoyable learning for students.

In addition to collaborative learning, technology is also progressing very rapidly in the 21st century, so that it will be advantageous in the field of education (Isti'adah et al., 2020). It is evidenced by the increasing use of technology-based learning media to support the course of learning activities (Firmadani, 2020). One of which is video media, which includes the type of audio-visual media, namely media that uses the senses of hearing and sight, so that when participating in learning can make students do not feel bored and feel happy (Hadi, 2017). Video media can also bring up students' creative ideas because the visualization is moving images and sound (Febriani, 2017). It is not only used as a tool in learning activities but video media can also be used as a messenger or information (Aeni & Yuhandini, 2018).

When the learning process uses collaborative learning, students are formed into groups of four to complete tasks individually in groups. Then, a video media is given that contains the problems of sharing tasks and jumping tasks (Wikanta, 2017). This problem is related to real

problems, so this is in line with the understanding of PMRI, which is a theory based on real problems (Zulkardi & Putri, 2010). According to Rahayu and Putri (2021), the learning process involving the context makes students learn meaningfully. In sharing tasks and jumping tasks, students who do not understand are required to ask for help from their friends who understand by saying, "Please teach me" (Sato, 2014).

Students need to have good mathematical reasoning skills when learning number pattern material. The use of video media through the PMRI approach and collaborative learning can be applied in learning activities to have good mathematical reasoning skills. A previous study on the PMRI approach to number pattern material by Octriana et al. (2019) to see mathematical reasoning skills and research by Situmorang et al. (2020) is about the analysis of HOTS questions. However, previous studies have not used video media. Therefore, researchers are interested in researching "Students' mathematical reasoning skills on number pattern using PMRI and collaborative learning approach". This study aims to determine mathematical reasoning skills after implementing the learning process using video media with the PMRI approach and collaborative learning on number pattern material for class VIII students.

Methods

This study uses a descriptive type of research to describe the description of mathematical reasoning skills on number pattern material using video media through the PMRI approach and collaborative learning in class VIII students. The subjects of this study were students of class VIII.A of SMP Srijaya Negara Palembang in the odd semester of the 2021/2022 academic year, totaling 25 students (12 males and 13 females) out of a total of 39 students. The instruments used were an observation sheet, a written test consisting of two test questions, and an interview guide sheet. There are three indicators used in this study (see Table 1).

Table 1. Indicators of mathematical reasoning skills

Indicator	Descriptor
Submit a conjecture	Able to make assumptions about patterns that might be formed
Finding patterns or properties of mathematical phenomena to make a generalization	Able to find the right pattern to make general equations or generalizations
Draw a conclusion	Able to make conclusions that are in accordance with the problem and can be accepted by reason

In this study, there are three stages: namely: (1) the preparation stage, whereby the researcher prepares research instruments and learning tools, observes schools, validates and revises, and manages research permits; (2) the implementation stage, which consists of two meetings where the first meeting is a learning process using video media with PMRI and collaborative learning, while the second meeting is working on test questions; and (3) the last stage, where the researchers analyze the results of the data from the observation sheets, tests, and interviews. Then, the researcher will describe the data results and conclude. Finally, the researcher will prepare a written research report.

There are three data collection techniques: observation during learning, mathematical reasoning skill test questions, and interviews with students. In this study, observations were carried out by direct observation of student activities and video recordings. There are two questions in the form of descriptions for the test questions. It is easier for researchers to see indicators of students' mathematical reasoning skills that arise from their answers. One male and two females were interviewed to find out more about the students' answers from working on test questions.

The instrument validation has been carried out with the help of a Mathematics Education Lecturer at Sriwijaya University who is an expert in this research and two mathematics teachers who teach at SMP Srijaya Negara Palembang. The validation result is that there must be 2 test questions gradually from level 2 to level 3, including learning objectives. Researchers have also conducted one-to-one and small group trials to determine the practicality of the test questions.

In this study, descriptive methods were used to analyze observation data, namely describing and describing student activities during learning. To analyze student test results, researchers checked student answers by giving scores based on predetermined assessment guidelines. The following table 2 is scoring guidelines.

Table 2. Scoring guidelines

Score	Scoring Indicator
4	Perfect answer, the solution is given completely and correctly
3	The answer is correct, but the solution given has one significant error
2	The answer is almost correct, but the solution provided contains more than one significant error/shortcoming
1	Wrong answer, the solution is not completed in its entirety but contains at least one correct argument
0	Wrong answer, the solution is based on the wrong process or argument or contains no response at all

Then the score obtained will be converted into a value, and then the category of the students' mathematical reasoning skills will be determined based on the Table 3 below.

Table 3. Category of qualitative value of mathematical reasoning skills

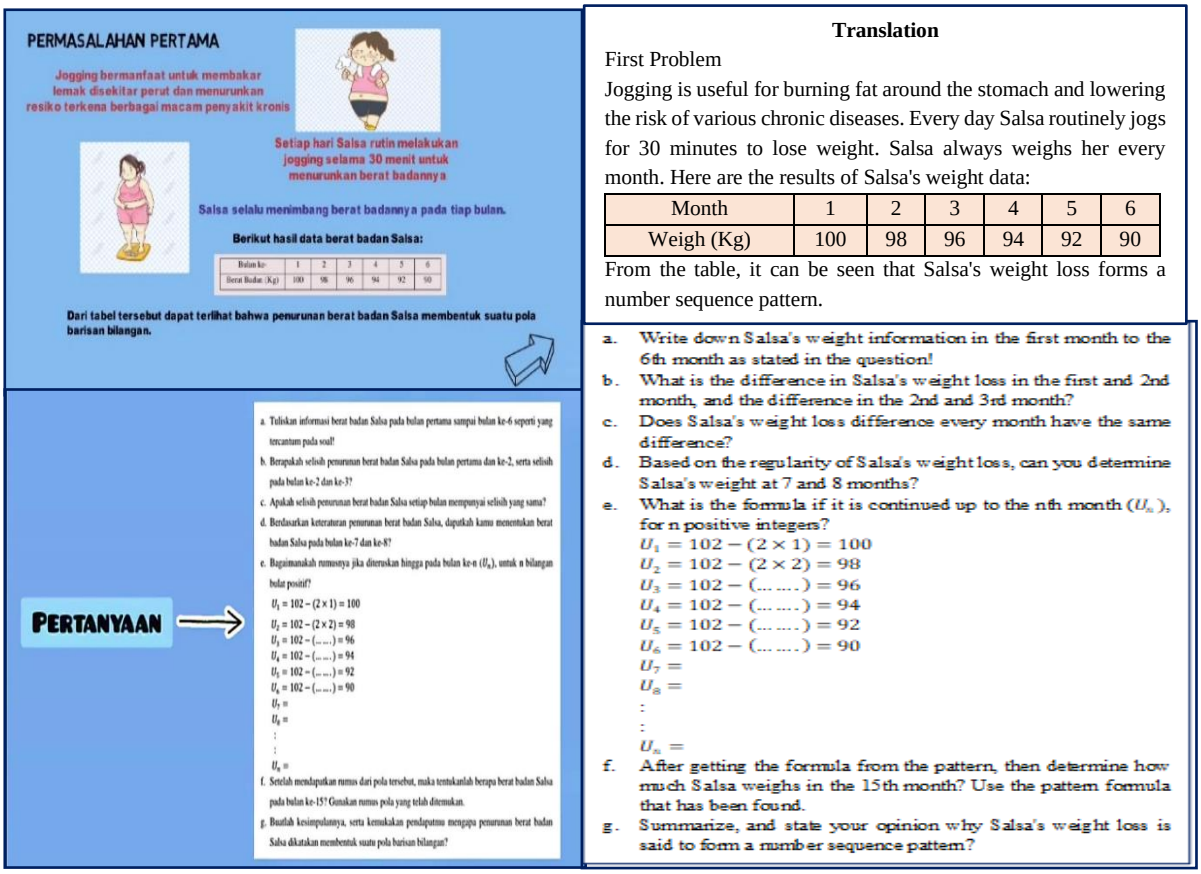
Score	Category
81-100	Very Good
61-80	Well
41-60	Enough
21-40	Not Enough
0-20	Very Less

Then, the frequency of each category of students' mathematical reasoning skills will be obtained, and the average value will be found using the formula for the average group data. The average value will be converted back to table 3 to categorize the students' mathematical reasoning skills. The results of the interview data from this study were analyzed using a descriptive method, namely changing the recorded interview results into the form of written interview transcripts.

Results

At the first meeting, students were given contextual questions (sharing task and jumping task) through video media, while at the second meeting, students were given two essay test questions.

Sharing task



Translation

First Problem

Jogging is useful for burning fat around the stomach and lowering the risk of various chronic diseases. Every day Salsa routinely jogs for 30 minutes to lose weight. Salsa always weighs her every month. Here are the results of Salsa's weight data:

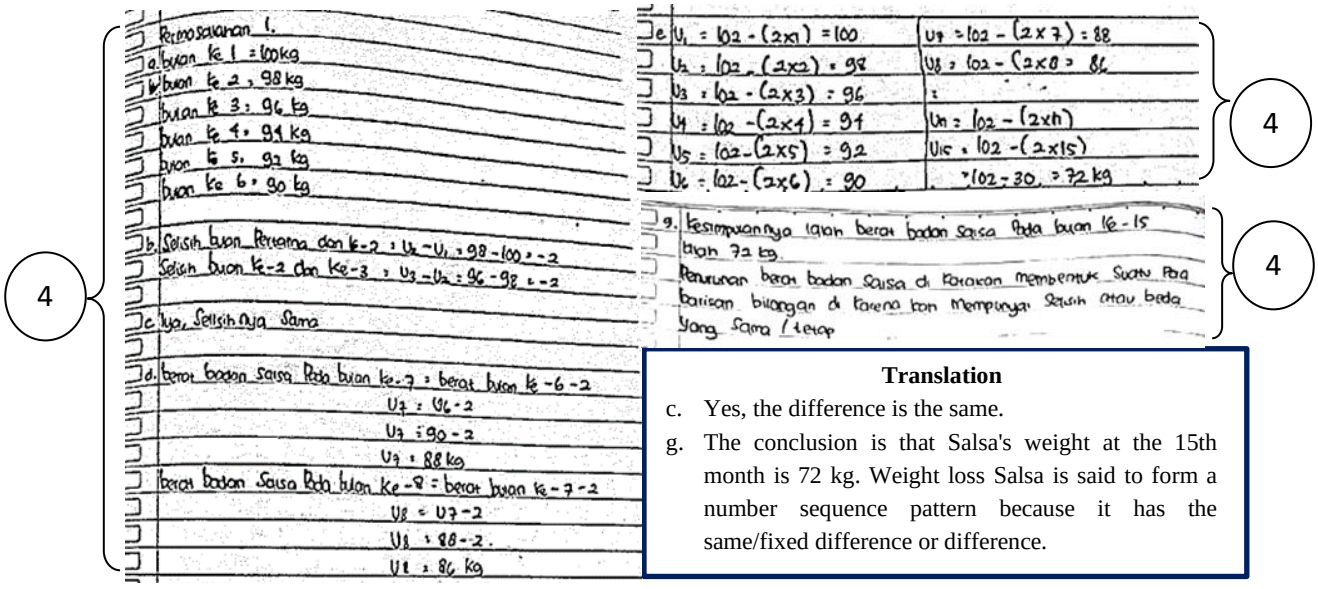
Month	1	2	3	4	5	6
Weigh (Kg)	100	98	96	94	92	90

From the table, it can be seen that Salsa's weight loss forms a number sequence pattern.

a. Write down Salsa's weight information in the first month to the 6th month as stated in the question!
b. What is the difference in Salsa's weight loss in the first and 2nd month, and the difference in the 2nd and 3rd month?
c. Does Salsa's weight loss difference every month have the same difference?
d. Based on the regularity of Salsa's weight loss, can you determine Salsa's weight at 7 and 8 months?
e. What is the formula if it is continued up to the nth month (U_n), for n positive integers?
$U_1 = 102 - (2 \times 1) = 100$
$U_2 = 102 - (2 \times 2) = 98$
$U_3 = 102 - (\ldots\ldots) = 96$
$U_4 = 102 - (\ldots\ldots) = 94$
$U_5 = 102 - (\ldots\ldots) = 92$
$U_6 = 102 - (\ldots\ldots) = 90$
$U_7 =$
$U_8 =$
$U_n =$
f. After getting the formula from the pattern, then determine how much Salsa weighs in the 15th month? Use the pattern formula that has been found.
g. Summarize, and state your opinion why Salsa's weight loss is said to form a number sequence pattern?

Figure 1. First problem (sharing task)

The context used in task sharing is closely related to real life, namely the context of weight loss. In this problem, students are given tier questions so that it is easier for them to solve. The following is the answer of one of the students from group 3.



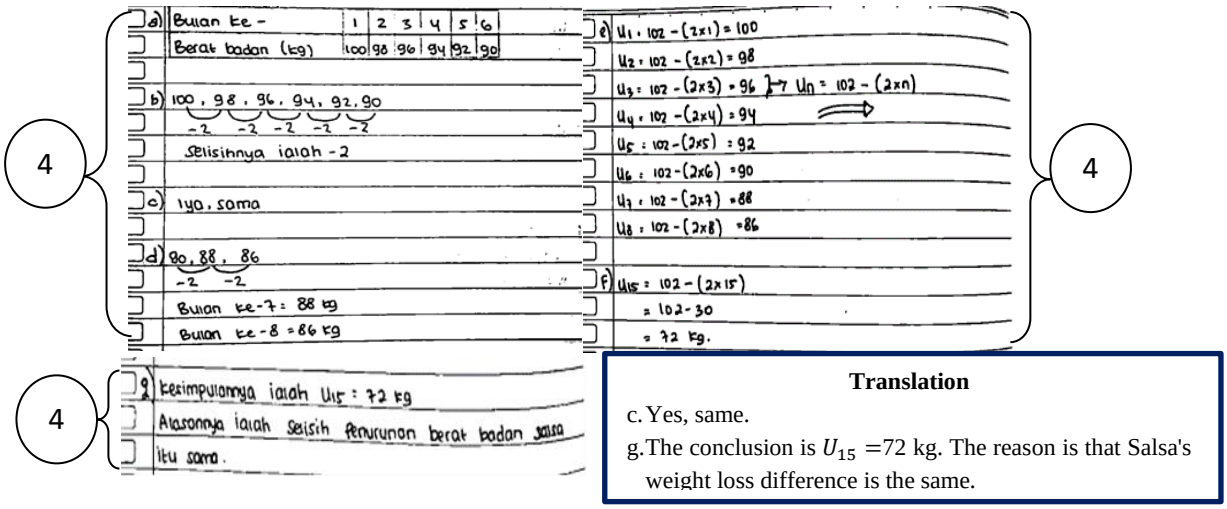
Translation

c. Yes, the difference is the same.

g. The conclusion is that Salsa's weight at the 15th month is 72 kg. Weight loss Salsa is said to form a number sequence pattern because it has the same/fixed difference or difference.

Figure 2. Answer sharing task (group 3)

The student has brought up the three indicators of mathematical reasoning skills perfectly, so that he gets a score of 4 on each indicator. So, the student gets a maximum score of 12. The method used by group 3 to determine the difference is not the same as that of group 6, but the difference obtained remains the same. Here's the answer:



Translation

c. Yes, same.

g. The conclusion is U_{15} =72 kg. The reason is that Salsa's weight loss difference is the same.

Figure 3. Answer sharing task (group 6)

From the student's answer, it can be seen that she has brought up all three indicators of mathematical reasoning skills perfectly, so that he gets a score of 4 on each indicator. So, the maximum score is 12.

Jumping task

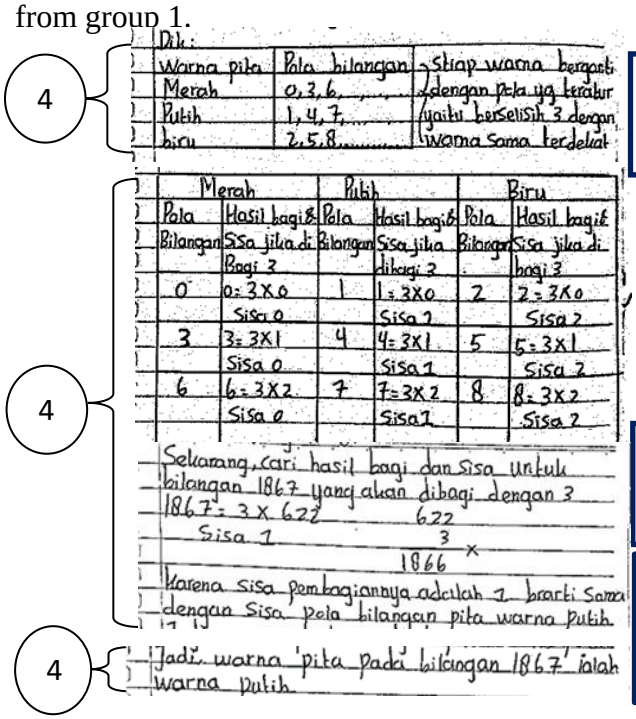
Translation

Second Problem

This picture is a picture of Intan's tricolor number row ribbon. The ribbon consists of three colors, namely red, white, and blue. The band can be extended with the formed pattern. What color is the band in the number 1867?

Figure 4. Second problem (jumping task)

For the jumping task, there is one problem with the context of the three-colored ribbon that needs to be solved. The second problem (jumping task) is a problem with a higher level of difficulty than the first problem (sharing task). There are only 2 groups who can answer correctly on the second problem (jumping task). The following is the answer of one student from group 1.



Translation

Each color alternates with a regular pattern that is 3 different from the nearest same color.

Translation

Now, find the quotient and remainder for the number 1867 to divide by 3.

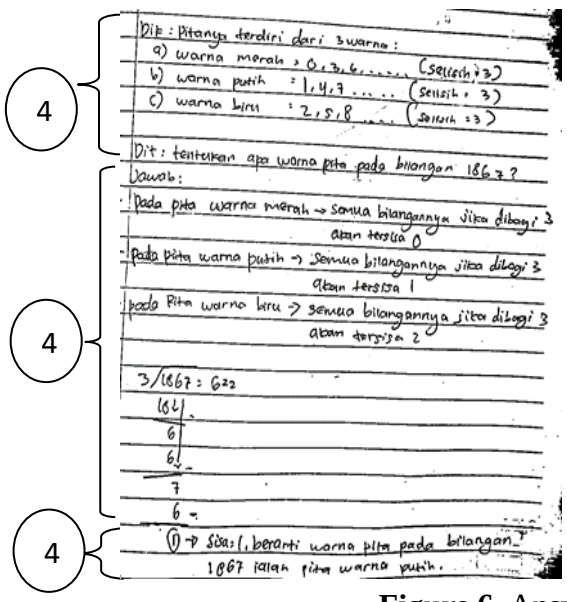
Translation

Because the remainder of the division is 1, it is the same as the remainder of the white band number pattern.

So, the color of the ribbon in the number 1867 is white.

Figure 5. Answer jumping task (group 1)

The student has brought up the three indicators of mathematical reasoning skills perfectly to get a score of 4 on each indicator. So, the student gets a maximum score of 12. The steps used in group 1 were not the same as in group 3, but they still got the same answer. Here is the answer (Figure 6).



Translation

Known: the ribbon is in 3 colors:
a) red = 0, 3, 6, ... (difference = 3)
b) white = 1, 4, 7, ... (difference = 3)
c) blue = 2, 5, 8, ... (difference = 3)
Asked: what color is the band in the number 1867?
Answer:
On the red ribbon = all the numbers if divided by 3 will remain 0.
On the white ribbon = all the numbers if divided by 3 will remain 1.
On the blue ribbon = all the numbers if divided by 3 will remain 2.

Translation

Remainder = 1, it means that the color of the band in the number 1867 is a white band.

Figure 6. Answer jumping task (group 3)

From the student's answer, it can be seen that she has brought up all three indicators of mathematical reasoning skills perfectly, so that he gets a score of 4 on each indicator. So, his score is 12.

Test question number 1

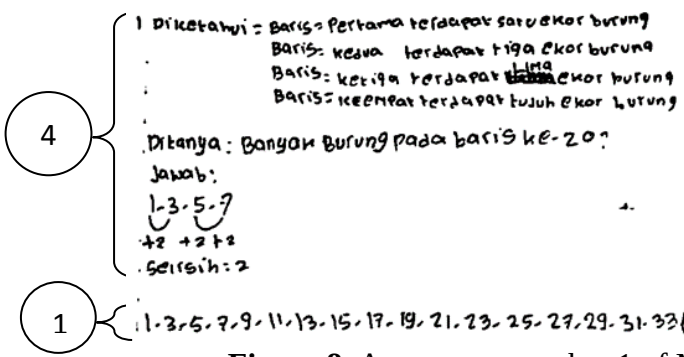
1) Migrasi burung merupakan pergerakan populasi burung yang terjadi pada waktu tertentu setiap tahun, dari tempat berbiak menuju tempat mencari makan selama iklim di tempat berbiaknya itu tidak memungkinkan.
Seorang peneliti migrasi burung yang bernama Alex mencatat pergerakan burung seperti berikut ini: baris pertama terdapat satu ekor burung, baris kedua terdapat tiga ekor burung, baris ketiga terdapat lima ekor burung, baris keempat terdapat tujuh ekor burung, dan seterusnya dengan pola yang sama.
Tentukan berapa banyak burung pada baris ke-20!

Translation

Bird migration is the movement of bird populations that occur at certain times of the year, from breeding sites to foraging areas as long as the climate in their breeding areas does not allow. A bird migration researcher named Alex recorded bird movements as follows: in the first row there was one bird, the second row had three birds, the third row had five birds, the fourth row had seven birds, and so on in the same pattern. Determine how many birds are in the 20th row!

Figure 7. Test question number 1

For the first test question, where students are asked to determine the number of birds in the 20th row. The answers from the three students regarding question number 1 are as follows in Figure 8.



Translate

Known: the first row there was one bird
the second row had three birds
the third row had five birds
the fourth row had seven birds
Asked: Many birds in the 20th row?

Figure 8. Answers to number 1 of MF students' test questions

Based on the results of MF students' answers, he has submitted a conjecture to get a score of 4 on this indicator. However, he is still not quite right on the indicator of finding patterns or properties of mathematical phenomena to generalize. He gets answers is 35 while the correct answers are 39, so he gets a score of 1. It is supported when interviewed, and he also admitted that he was wrong in writing answers because the time was limited. Then the MF students did not come up with indicators to conclude. So, MF students only got a score of 5 for test question number 1.

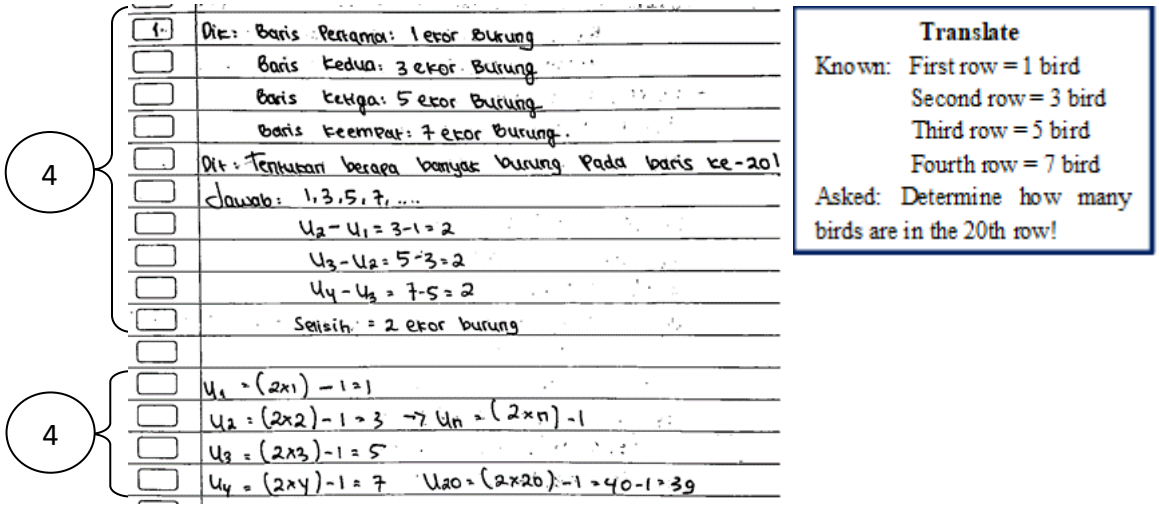


Figure 9. Answers to number 1 VA student test questions

Based on these answers, it can be seen that the VA students already understand and can solve problem number 1. It's just that he forgot to write the conclusions because of the limited time given to do it. So, VA students get a score of 8.

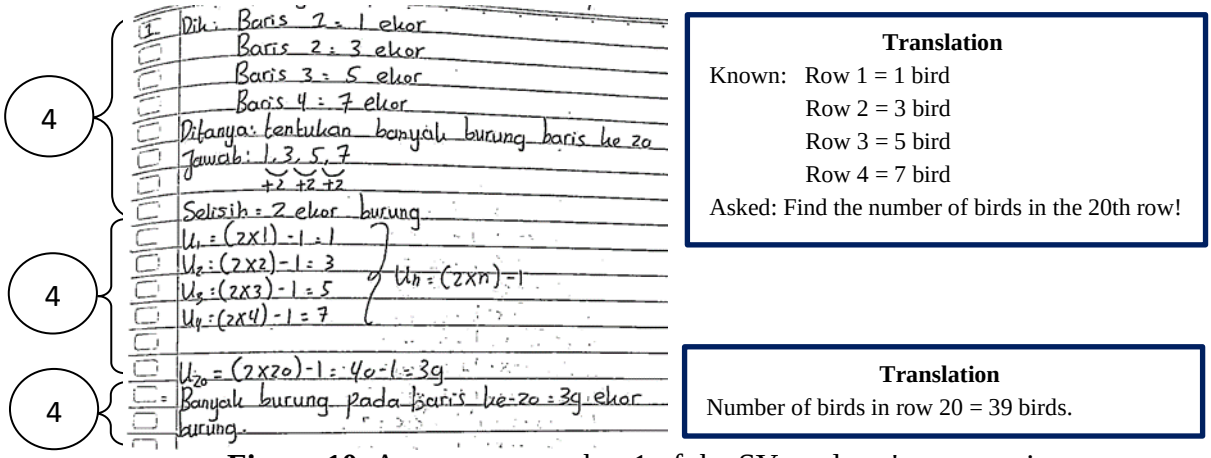


Figure 10. Answers to number 1 of the SY students' test questions

When interviewed, SY students seemed to have understood question number 1 and could solve it correctly. SY students have brought up the three indicators of mathematical reasoning skills perfectly. So, SY students get the maximum score for the number one test question, which is 12.

Test question number 2

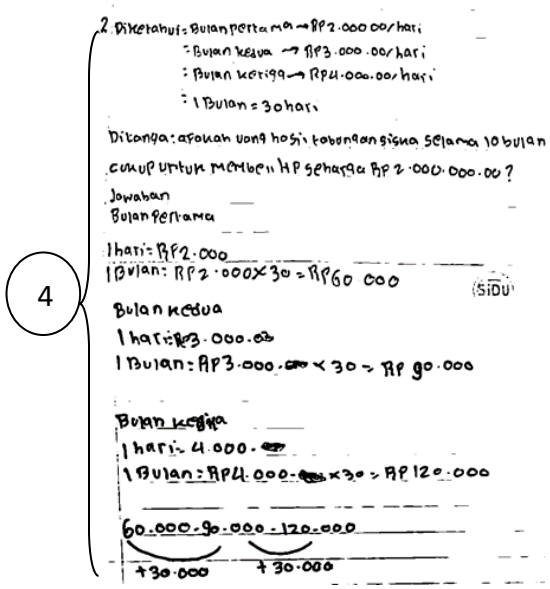
2) Setiap hari Siska diberi uang jajan oleh Ayahnya dan ia selalu menyisihkan uangnya untuk membeli sebuah *handphone*. Pada bulan pertama ia menyisihkan uangnya sebesar Rp 2.000,00/hari, pada bulan kedua ia menyisihkan uangnya sebesar Rp 3.000,00/hari, pada bulan ketiga ia menyisihkan uangnya sebesar Rp 4.000,00/hari, dan seterusnya sampai 10 bulan (dengan perhitungan 1 bulan = 30 hari). Apakah uang hasil tabungan Siska selama 10 bulan cukup untuk membeli *handphone* seharga Rp 2.000.000,00?

Translate

Every day Siska is given pocket money by her father and she always sets aside money to buy a cellphone. In the first month he sets aside Rp. 2,000.00/day, in the second month he sets aside Rp. 3,000.00/day, in the third month he sets aside Rp. 4,000.00/day, and so on for up to 10 months (by calculating 1 month = 30 days). Is the money that Siska saved for 10 months is enough to buy a cellphone for Rp. 2,000,000.00?

Figure 11. Test question number 2

For the second test item where students are asked to find out whether the money Siska has saved for 10 months is enough to buy a cellphone for Rp. 2,000,000.00. The answers from the three students regarding question number 2 are as follows (see Figure 12).



Translate

Known: First month = Rp. 2,000.00/day
Second month = Rp. 3,000.00/day
Third month = Rp. 4,000.00/day
1 month = 30 days

Asked: Is the money that Siska saved for 10 months is enough to buy a cellphone for Rp. 2,000,000.00?

Answer:

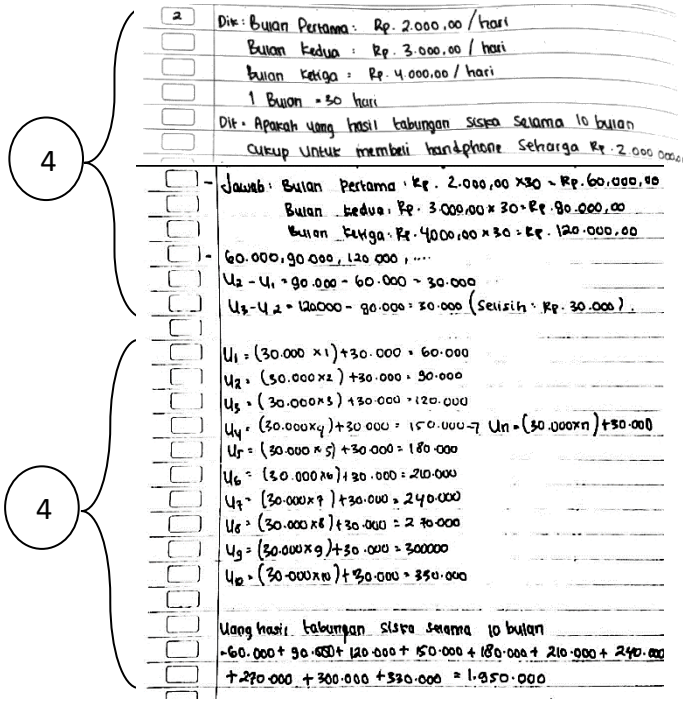
First month
1 day = Rp. 2,000.00
1 month = Rp. 2,000.00 × 30 = Rp. 60,000.00

Second Month
1 day = Rp. 3,000.00
1 month = Rp. 3,000.00 × 30 = Rp. 90,000.00

Third month
1 day = Rp. 4,000.00
1 month = Rp. 4,000.00 × 30 = Rp. 120,000.00

Figure 12. Answers to number 2 of MF students' test questions

When interviewed, MF students said that not complete it because they did not have enough time to do it. However, MF students have come up with indicators of making conjectures ideally, so they get a score of 4. So, MF students only get a score of 4 for test question number two.



Translation

Known: First month = Rp. 2,000.00/day
Second month = Rp. 3,000.00/day
Third month = Rp. 4,000.00/day
1 month = 30 days

Asked: Is the money that Siska saved for 10 months is enough to buy a cellphone for Rp. 2,000,000.00?

Answer:

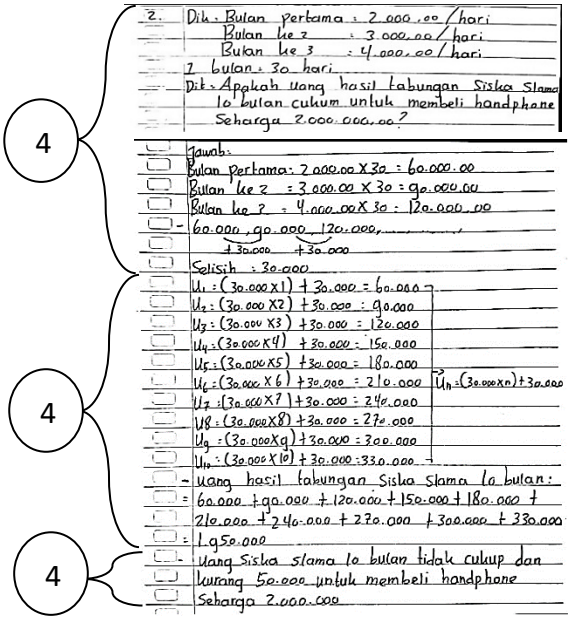
First month = Rp. 2,000.00 × 30 = Rp. 60,000.00
Second month = Rp. 3,000.00 × 30 = Rp. 90,000.00
Third month = Rp. 4,000.00 × 30 = Rp. 120,000.00

Translation

Siska's savings for 10 months = 60,000 + 90,000 + 120,000 + 150,000 + 180,000 + 210,000 + 240,000 + 270,000 + 300,000 + 330,000 = 1,950,000

Figure 13. Answers to number 2 of VA students' test questions

Based on these answers, it can be seen that the VA students already understand and can solve problem number 2. It's just that he forgot to write the conclusions because of the limited time given to do it. So, VA students get a score of 8.



Translation

Known: First month = Rp. 2,000.00/day
2nd month = Rp. 3,000.00/day
3rd month = Rp. 4,000.00/day
1 month = 30 days

Asked: Is the money that Siska saved for 10 months is enough to buy a cellphone for Rp. 2,000,000.00?

Answer:

First month = Rp. 2,000.00 × 30 = Rp. 60,000.00
2nd month = Rp. 3,000.00 × 30 = Rp. 90,000.00
3rd month = Rp. 4,000.00 × 30 = Rp. 120,000.00

Translation

Siska's savings for 10 months = 60,000 + 90,000 + 120,000 + 150,000 + 180,000 + 210,000 + 240,000 + 270,000 + 300,000 + 330,000 = 1,950,000.

Siska's money for 10 months is not enough and less than 50,000 to buy a cellphone for 2,000,000

Figure 14. Answers to number 2 of the SY students' test question

When interviewed, SY students seemed to have understood question number 2 and were able to solve it correctly. SY students have brought up the three indicators of mathematical reasoning skills perfectly. So, SY students get the maximum score for the number two test question, which is 12.

Table 4. The emergence of indicators of mathematical reasoning skills

Indicator	Total Eligible Students	
	Test Question Number 1	Test Question Number 2
Submit a conjecture	25	23
Finding patterns or properties of mathematical phenomena to make a generalization	22	20
Draw a conclusion	18	18

Table 5. Qualitative value of mathematical reasoning skills

Score	f_1	f_2	f_{tot}
81-100	8	5	13
61-80	12	13	25
41-60	4	4	8
21-40	1	2	3
0-20	-	1	1

Note:

f_1: The number of students in test number 1

f_2: The number of students in test number 2

f_{tot}: $f_1 + f_2$

Table 6. Average students' mathematical reasoning skills

Score	f_{tot}	x_i	$f_{tot}. x_i$	Average
81-100	13	90,5	1176,5	68,89
61-80	25	70,5	1762,5	
41-60	8	50,5	404	
21-40	3	30,5	91,5	
0-20	1	10	10	
Total	**50**		**3444,5**	

Based on the table above, the average mathematical reasoning skills after the implementation of the learning process using video media with the PMRI approach and collaborative learning on number pattern material for class VIII.A SMP Srijaya Negara Palembang is categorized as good.

Discussion

The implementation of this learning process has used video media and has been adapted to the principles and characteristics of PMRI and collaborative learning. According to Meitrilova and Putri (2020), PMRI is one solution to help students understand learning materials. The PMRI approach can make learning more interesting because learning begins with a real context for students (Putri, 2015). It acts as a bridge from contextual problem to formal mathematic (Trisnawati et al., 2015). The principles of PMRI have guided reinvention/progressive mathematizing, didactical phenomenology, and self-developed models; while the characteristics of PMRI are using contextual problems, using models, student contributions, interactivity, and is integrated with other learning topics (Zulkardi & Putri, 2010). In

collaborative learning, students are formed into several groups, with each member consisting of four people. Then, a video media is given that contains the problem of sharing tasks and jumping tasks (Wikanta, 2017). The problem is related to real problems following PMRI, a theory based on real problems (Zulkardi & Putri, 2010). According to Rahayu and Putri (2021), the learning process involving the context makes students learn meaningfully. Students who do not understand this activity must dare ask for help from friends who already understand by saying, "Please teach me" (Sato, 2014). Giving problems through this video media can make students not feel bored and feel happy, this is because video media is included in the type of audio-visual media, namely media that uses the senses of hearing and sight, so when participating in learning can make students not feel bored and feel happy (Hadi, 2017).

Furthermore, students are given mathematical reasoning skills test questions at the next meeting. Mathematical reasoning skills are the skills to process mathematical thinking to get logical conclusions based on existing or appropriate methods, concepts, and facts or data (Munawaroh et al., 2019). The test questions that have been made have been adjusted to the indicators of mathematical reasoning skills, which consist of submitting a conjecture, finding patterns or properties of mathematical phenomena to generalize, and drawing a conclusion. Based on the results of the research findings described above, the indicators of students' mathematical reasoning skills that appear after learning using video media through the PMRI approach and collaborative learning will be explained in more detail as follows:

Submit a conjecture

Based on the student's answer test results, it can be seen that the most indicator that appears is the indicator of proposing allegations, namely that all students who take the test, 25 students, can bring up this indicator for test number one. In contrast, for test question number two, there are 23 students. According to Jannah et al. (2020), proposing an allegation is a student's effort to propose an allegation of the possibilities to obtain a solution to the given problem. It means that the student's efforts to make assumptions to get a solution have been good.

Finding patterns or properties of mathematical phenomena to make a generalization

For this second indicator, quite many students can bring up this indicator, namely 22 students for test question number one and 20 students for test question number two. Because of the limited time given to do it, many students have not come up with this second indicator ideally. According to Melani and Sutirna (2019), finding patterns or properties of mathematical phenomena to generalize is a skill that students have in finding patterns to be developed into mathematical sentences.

Draw a conclusion

For indicators that rarely appear are indicators of concluding, whereas, for test questions numbers 1 and 2, only 18 students bring up this indicator. However, VA students have been able to conclude completely and correctly based on the results of the interviews. However, VA

students forget to write conclusions on the answer sheet due to the limited processing time given. VA students do not come up with indicators for concluding. Students are said to be able to bring up indicators of concluding if they produce new statements based on existing statements so that they can make conclusions following the question, following Afandi's (2016) statement.

It can be seen that after the learning process was carried out using video media with the PMRI approach and collaborative learning, it was found that the students' mathematical reasoning skills were classified as good. However, there were still students who did not display their mathematical reasoning skills indicators perfectly.

Conclusion

The mathematical reasoning skills of class VIII students on number pattern material after learning using video media through the PMRI approach and collaborative learning are classified as good with the indicator of submitting a conjecture as to the indicator that appears the most, is based on the research result. The indicator that appears the least in this study is to conclude because students still forget to write conclusions. After all, the time given is limited. Using video media through the PMRI approach and collaborative learning during learning can make students have good mathematical reasoning skills. However, the research conducted still has shortcomings, namely the weakness in contextual problems (sharing task) created by researchers in weight loss. Namely, if the pattern continues, it will become a problem. Therefore, it is better to set a target or normal weight limit so that the activity can be used properly. In addition, the limited time to work on the questions given by the researchers made students less than optimal at solving them.

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Conflicts of Interest

The authors declare that the publication of this manuscript does not constitute a conflict of interest. In addition, everything has been borne by the author, namely ethical issues, including, plagiarism, errors, falsification and/or falsification of data, publication and/or duplicate submissions, and redundancy.

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