Exploring Self-Regulated Learning and Their Impact on Students' Mathematical Communication Skills on the Topic of Number Patterns With the Blended Learning System

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This research aims to describe students' MCS on the topic of number patterns with a blended learning system and describe profile students' self-regulation learning (SRL) in Junior High School SMPN 8 Padang. The descriptive and qualitative method was adopted. Data were collected using questionnaires, tests, and interviews. The first step in taking the subject is the administration of an online learning SRL questionnaire through a Google form, followed by the result analysis. The second step is the administration of offline tests to class VIII students, while the third is an online interview activity through WhatsApp based on the SRL. The results showed that 40% were able to express mathematical ideas orally, in writing, and through demonstration and description. Furthermore,40% were able to explain their understanding of written mathematical presentations orally. Only 20% could communicate digitally, through the use of computer technology. The results also showed that 47.5% of students have MCS, which is in the medium category. Approximately 69% agree students enrolled in an offline course adopted self-regulated learning.

Keywords: blended learning, mathematical communication skills, SRL, number patterns

INTRODUCTION

The rapid development of science and technology has resulted in challenges in the world of education, necessitating a consistent learning system with current demands. Meanwhile, a blended learning system combines face-to-face and online learning. According to (Akkoyunlu & Soylu, 2008), face-to-face learning enables students to interact directly with educators. On the other hand, online learning is carried out anytime and anywhere with the internet (BATİLANTES, 2023; GHANI et al., 2023; Han, 2023; J. Wang et al., 2023; S. Wang, 2023; Zhang & Yang, 2023; Zhu et al., 2023). Blended learning systems have much to do with what, why, and how to appropriately combine learning (Guevara, 2021; Ohanu et al., 2022; Prafitasari et al., 2021; M. Pratiwi et al., 2022; So & Bonk, 2010). Lisa et al. (Halverson et al., 2014) stated that 48%

were related to the development of blended learning models(Darma et al., 2019; Denny et al., 2020; Jen & Hoogeveen, 2022; Klentien & Wannasawade, 2016; Lakho et al., 2022).

This learning system can improve mathematical communication skills (MCS) but various limitations have made its application not optimal (Galus et al., 2021; Juniasani et al., 2022; Tania & Siregar, 2022; Viyani et al., 2022); (Febnesia et al., 2021). However, the reality of the initial research is that the percentage of students' achievement in solving MCS is 37%, which is in the low category. Some research related to learning independence found several learning problems, including teacher-centered learning (Mulyono, 2021), limited learning resources (Hasibuan et al., 2018); (Ernawati, 2020), poor perception of mathematics (Mulyono, 2021); (Ernawati, 2020), and lack of self-awareness in terms of learning (Apriani & Khasanah, 2017). Due to a lack of motivation, students become easily bored, daydream, lazy to complete assignments, and reluctant to pay attention to the teacher (Lusidawaty et al., 2020). The phenomenon occurred from interviews with several students at Junior High School State 8 Padang and Padang Dek Private Junior High School. It was discovered that students frequently felt enthusiastic about other tasks but were less motivated by learning activities and assignments (Tam et al., 2023; Wijaya, 2018). It is anticipated that students with strong learning motivation will be able to express mathematics effectively.

Teachers require communication skills to convey ideas to students. The communication process in learning mathematics led to direct student-teacher interaction. One of the mathematical competencies required by students is the ability to communicate mathematically. This is consistent with the reports of NCTM (NCTM, 2000), Kadarisma (Kadarisma, 2016), Nugraha & Pujiastuti (Nugraha & Pujiastuti, 2019), and Wijayanti et al(Wijayanti et al., 2019) that mathematical communication is important in mathematics learning. Students' communication skills are below expectations in the field. The research from Hernawati (Hernawati et al., 2013), Hibattulloh & Sofyan (Hibattulloh & Sofyan, 2014), Maulani & Sundayana (Maulani & Sundayana, 2018), and Purnamasari & Afriansyah (Purnamasari & Afriansyah, 2021) showed that students' MCS are still low. Furthermore, (Tiffany et al., 2017) stated that their communication skills in expressing and converting images into mathematical language forms are still low.

The results of MCS in triangles and quadrilaterals were below the average (Wijayanto et al., 2018). These skills are also low in set material (S. Pratiwi et al., 2020), in presenting data (Saidah & Mardiani, 2021), in relation and function material (Yanti et al., 2019); (Setiyani et al., 2020); and absolute maximum value of a function (Sudia et al., 2020; Tang & Maitra, 2018), and there is a lack of mastery of statistical material (Niasih et al., 2019). This is also supported by the results at Junior High School State 8 Padang, which showed their skills are still relatively low. Students tend to have difficulty and make mistakes in stating problems in mathematical notation and symbols(Imelda Edo & Tasik, 2022). The result showed a low level of students' ability to understand and express situations in mathematical language. However, in this research, students' MCS were analyzed based on number patterns.

Teachers have placed less emphasis on MCS in Junior High Schools. (Rustam, 2018). This is attributed to the limitation of teachers in their ability to deliver materials using a blended learning system, resulting in weak MCS. Orally and in writing, students are less able to communicate their mathematical ideas explicitly and correctly. Therefore, it is necessary to analyze MCS with a blended learning system learning in the digital era to produce quality education.

Due to the Covid-19 pandemic, face-to-face learning between students and teachers must now be conducted online. According to Muntazhimah (Muntazhimah et al., 2020), online learning is an alternative to education during this pandemic(Paudel, 2020; Reeves, 2000). This attitude of independent learning of students is expected to develop along with the development of the world of information technology with the needs of modern humans who are demanded creative and innovative. Based on the problems caused by the independent learning of students (Agustina & Fajar, 2019; Kamalia & Andriansyah, 2021; Novantri et al., 2020; Nuris & Istyaningputri, 2021; Sari & Zamroni, 2019; Sarsekeyeva et al., 2019). Independence is one of the most important factors affecting student academic success (Prayekti, 2015); (Ismail et al., 2021). Further, according to (Fauzan & Yerizon, 2013), there is an interaction between the learning approach and learning independence in influencing students' reasoning abilities. In this case, the RME approach has a better effect on improving the reasoning abilities of students with moderate and low self-regulated learning (SRL). In several studies that have been carried out, SRL is useful in improving academic performance.

Learning based on self-regulation is an individual's effort to self-regulate in learning by involving metacognitive abilities, motivation, and behavior (Kuo et al., 2013)

Self-regulated learning also affects students' ability to develop their MCS. Consequently, teachers must exert efforts to arouse enthusiasm and rebuild students' desire to hone their skills. One of the methods to improve students' skills is blended learning. (Rizqi, 2016) showed that problem-solving-based blended learning can develop MCS because it emphasizes active learning techniques. Therefore, this research aims to analyze students' MCS on the topic of number patterns with a blended learning system. and describe profile students' self-regulation in online mathematics learning in Junior High School SMPN 8 Padang.

Mathematical Communication Skills

Mathematical communication can be interpreted as a process of conveying ideas and knowledge both orally and in writing, but also includes media or without using media and is multi-directional in a dynamic, developing, and sustainable manner (Dewi, 2014; Nasruddin & Jahring, 2019; Sherawat & Punia, 2022; Tahir, 2021). While mathematical communication skills are the ability to convey mathematical ideas/ideas both orally and in writing as well as the ability to understand and accept mathematical ideas/ideas, as well in the form of diagrams and pictures, carefully, analytically, critically, and evaluatively to deepen understanding (Yudhanegara & Lestari, 2017): (Noor & Ranti, 2019; Sundayana et al., 2017) also expressed his opinion that mathematical communication is the main strength for students in formulating mathematical concepts, strategies and is a capital and one of the factors that contribute to determining student success in learning mathematics(Haryani & Hamidah, 2022; M. Pratiwi et al., 2022; Putra Wijaya et al., 2022; Wibawa et al., 2022). The importance of communication is also expressed by Kadarisma (Kadarisma, 2016) stating that communication is a very important ability for students to have in learning mathematics. General Education Curriculum states that mathematics is taught to develop eights core competencies (Peraturan Menteri Pendidikan Dan Kebudayaan Tentang Kurikulum 2013 Sekolah Menengah Pertama/Madrasah Tsanawiyah, 2014). Preparing students for junior high school mathematics requires mathematical modeling, problem-solving, communication, and tool-use skills(Kamal et al., 2022). Some of the modified indicators MCS proposed by Soemarmo (Hendriana et al., 2017) include:

a. Declare real objects, situations, and daily events in the form of mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions.
b. Explain in writing their understanding of mathematical presentation
c. Making assumptions, compiling arguments, and formulating definitions and generalizations.
d. Express mathematical ideas orally, in writing, in a visual demonstration, and illustration.

The results from (Yang et al., 2016) indicate that pupils utilize computer-supported reciprocal peer tutoring to improve their ability to communicate in mathematics. To support in improving pupils' mathematical communication abilities through computer-supported reciprocal peer tutoring.

Blended Learning Systems

Blended Learning is a "mixture, together to improve quality so that it gets better" ("Collins Dictionaries," 2013), or the formula of a combination or combination alignment (Thomas, 1896) (Heinze & Procter, 2006), (Mosa, 2006) said that what is mixed is two elements the main, namely learning in class (classroom lesson) with online learning. Another term that is often used is Hybrid Course (hybrid = mixture/combination, course = courses). In general, blended learning refers to learning that combines or mixes face-to-face learning (face-to-face = f2f) and computer-based learning (online and offline). Learning with a learning technology approach with a combination of face-to-face learning resources with teachers and those contained in other electronic media. Previous research was reviewed from the combination of face-to-face learning with online learning (Kenney & Newcombe, 2011); (So & Bonk, 2010) ; (Julie et al., 2014)

In blended learning classes, students meet face-to-face, creating the opportunity to communicate through open dialogue, critical debate, and group discussions to broaden their learning experience. Blended learning media is one of the learning media designed and created to learn mathematics in the era of development in facilitating students' mathematical communication skills (Hamid et al., 2020). Students in class VIII at SMPN 8 Padang had never learned in blended learning using Padang G School in their previous using features in it will make students interested in the mathematics learning process.

The Activity on the Number Patterns Topic in SRL

Self-regulated learning (SRL) refers to the process of students' activation and maintenance of cognition, emotion, and behavior to achieve personal goals (Zimmerman & Schunk, 2011). There are two matters to describe in number patterns in each SRL activity: Activity 1 (determine the pattern of odd, even, square, rectangle, triangle, Pascal's triangle, and Fibonacci). Activity 2 (configuring objects from odd, even, square, rectangle, triangle, Pascal's triangle, and Fibonacci number patterns). Self-regulated learning is a broad framework that encompasses motivational, metacognitive, cognitive, affective, and behavioral aspects of learning (Panadero, 2017). Students start with the forethought phase where they are involved with task analysis and self-motivation beliefs. They set goals and make plans before embarking on a learning task. Self-motivation beliefs influence these goals and plans. After the forethought phase, students proceed to the performance phase where they carry out their plans by exercising self-control and self-observation. To effectively learn, students manage their time, structure their environment, and apply useful learning strategies. In addition, they monitor their learning progress

METHOD

This is descriptive and qualitative research describing the conditions that occurred in the process (Sugiyono, 2013). It aims to analyze and describe the MCS of Junior High School students in solving problems related to number patterns. The sample comprises 32 randomly selected Class VIII students at Junior High School State 8 Padang. The first step in taking the subject was to administer a learning motivation questionnaire in online mathematics learning through Google form to obtain five motivation profiles, namely high cluster, moderately high, medium, rather low, and low motivation (Ismail et al., 2021). In the second stage, students were given a preliminary online test on their knowledge of the material studied during class VII. After, an offline test was given on MCS on number pattern material. The third step is online interviews using Zoom meetings and WhatsApp with five selected students based on learning motivation profiles.

The instrument used was a multiple-choice test for early mathematical abilities in class VII material, namely numbers, sets, linear equations, and flat shapes. It also includes an essay test for MCS on number pattern material with 4 items. Questions were compiled based on the MCS indicator (Sumarmo, 2015), which is the number pattern from the class VIII first semester and math book of the 2013 Revised 2017 curriculum, to obtain data from the MCS test. The validity of the essay questions was tested, and all of them were valid.

The MCS test questions consist of four essays to be completed in 60 minutes. Documentation techniques were used to collect data that could not be obtained through written tests or interviews. The results were obtained from photos of student answers during the written test. The results of the interview test were determined by evaluating the students' responses to the five motivational clusters' questions and initial ability test scores. Meanwhile, interviews are important for gaining an explicit and in-depth understanding of any information not gathered while constructing the test questions. Data collection was carried out for two days. The participants' answers were assessed based on the rubric for determining MCS, adapted from (Mathematics et al., 2015), with each question having a score of 0, 1, 2, 3, and 4. The percentage technique was used to analyze the students' MCS scores according to (Sumarmo, 2015).

TABLE 1
CATEGORIES OF EARLY MATHEMATICS SKILLS

Achievement of Early Mathematics Skills	Category
≤ 40 %	Very low
40 % < EMS ≤ 55%	Low
55< EMS ≤ 70 %	Average
70 < EMS ≤85 %	High
> 85 %	Very high

TABLE 2
SCORING GUIDELINES FOR ASSESSING THE MCS TEST

Score	Indicator of MCS test
4	Complete and clear responses, no hesitation, complete diagrams, efficient communication, logical presentation, accompanied by examples.
3	Correct responses, complete and clear diagrams, efficient communication, and complete presentation but not accompanied by examples.
2	The correct response, complete and clear, complete diagram, incomplete communication, and presentation, not accompanied by examples.
1	The response is correct but incomplete/clear. The diagram, communication, and presentation are incomplete and not accompanied by examples.
0	Response, inefficient communication, misinterpretation (no answer/blank answer sheet)

Table 2: Guidelines for Scoring MCS
Based on the scoring guidelines, the results of student activities were accurately evaluated.

TABLE 3
GUIDELINES FOR ACHIEVEMENT OF MCS

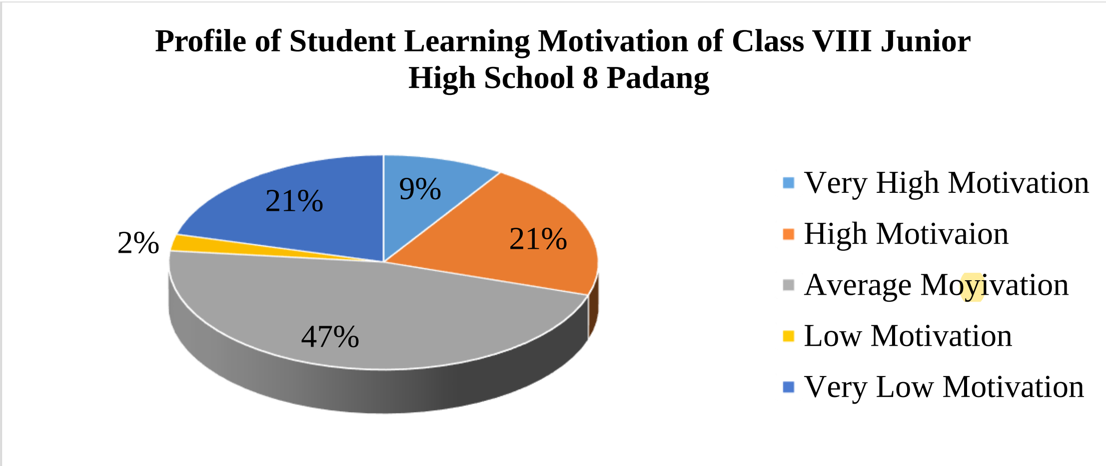
Achievement of Mathematical Communication Skills	Category
MCS ≤ 33 %	Low
33 % < MCS ≤ 66%	Currently
MCS > 66 %	High

RESULTS

Student Regulated Learning (SRL)

After the teaching unit was offline learning class VIII Junior High School 8 Padang, a questionnaire on motivation learning activity and intrinsic learning motivation was administered. The results indicate that teaching skills should be fostered to enhance teacher’s in asking questions and providing feedback. Figure 1 shows the frequency of course activities in the profile of student learning motivation of class VIII Junior High School 8 Padang. Students have an average motivation of 47%. The percentage of students’ learning motivation profiles from the questionnaire is shown in Figure 1:

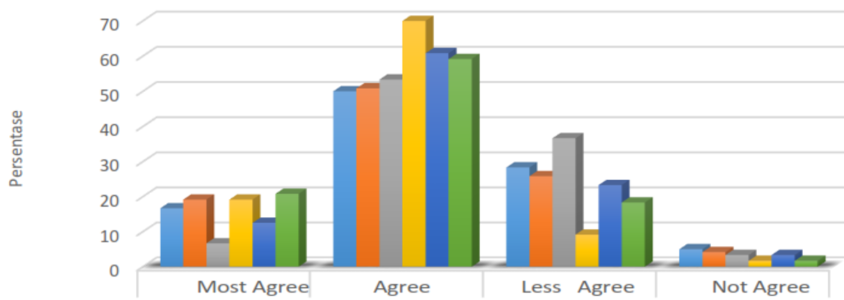
FIGURE 1
PROFILE OF STUDENT LEARNING MOTIVATION OF CLASS VIII JUNIOR HIGH SCHOOL 8 PADANG



This learning motivation consists of motivation from the student and outside the student's self. Based on Figure 1. The results showed that the learning motivation of students in the same percentage is not relatively good by being able to achieve four indicators of learning motivation in limited offline and online learning. The high percentage (47%) is in average motivation. Male subjects in school are known for their friendly, active, and communicative students. In teaching and learning activities, male subjects do not hesitate to ask the teacher about material that is not yet understood. The learning motivation of female students in limited online and offline learning is poor, indeed badly influenced by extrinsic factors of the subject when participating in the limited offline number pattern learning process. Students' great intrinsic motivation (high motivation with 21%) can make them always consistent with their tasks and diligent when participating in teaching and learning activities. In addition, students also have a high sense of self-confidence and discipline. Students, which 9% in very high motivation provide with multiple opportunities for engagement through synchronous and asynchronous tools, which are crucial to promoting student motivation, learning, and course success.

The results of the questionnaire on student self-regulation profiles in online mathematics learning are viewed from the SRL indicator in Figure 2.

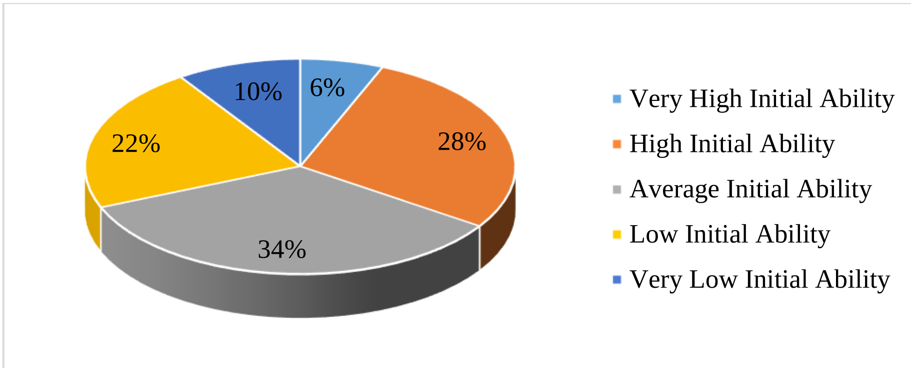
FIGURE 2
PROFILE OF SELF-REGULATED LEARNING OF CLASS VIII JUNIOR HIGH SCHOOL 8 PADANG



We obtained a six-cluster learning profile solution. Approximately 69% agree students enrolled in an offline course adopted self-regulated learning. Profile adoption depended on whether a student was considering online or offline learning

The category of test achievement is obtained from the results of the initial ability test, as shown in Figure 3.

FIGURE 3
NUMBER OF STUDENTS ON THE EARLY MATHEMATICAL SKILLS TEST



Based on Figures 1, 2, and 3 students were randomly selected with different motivational profiles, SRL, and initial abilities in the same category. The results of the MCS test are shown in Figure 4

FIGURE 4
DATA ON STUDENTS' MCS SCORES

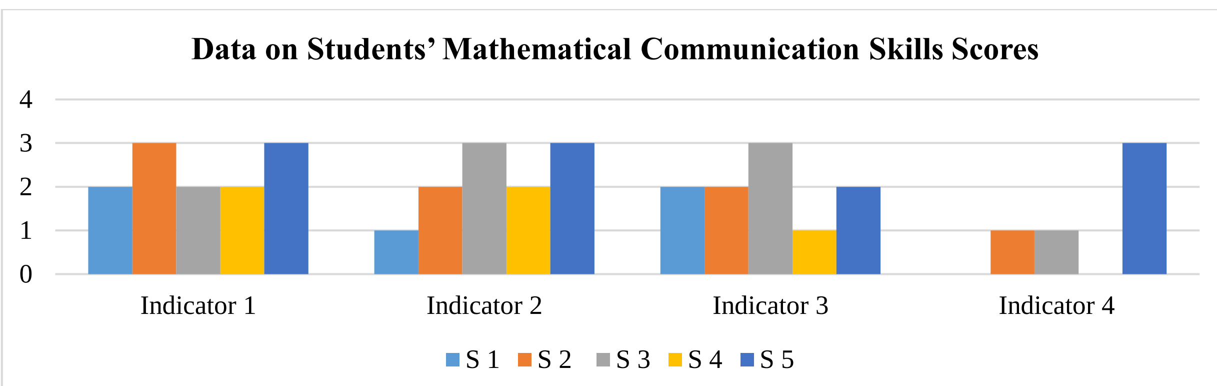


Figure 4 shows the scores of students' MCS. The result showed that question 1, with 48% for indicators, states real objects, situations, and daily events in mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions. In addition, question 2, with 44%, states daily events in the mathematical model. In the third question, 40% make conjectures, and co-arguments, and formulate definitions and generalizations. The fourth, with 20%, express mathematical ideas orally, in writing, and by visual descriptions and demonstrations. Tables 4 and 5 show the acquisition of students' answer scores on the MCS test with a numbers pattern

TABLE 4
GUIDELINES FOR SCORING MCS

Indicator	High Category	Medium Category		Low Category	
	ST 5	**ST 2**	**ST3**	**ST1**	**ST4**
States real objects, situations,	V	V	V	V	V
Daily events in mathematical models	V	V	V	V	V
Make conjectures, and co-arguments, and formulate definitions and generalizations	V	V	V	-	-
Expresses mathematical ideas orally, in writing, and by visual descriptions	V	-	-	-	-
Category	Good	Sufficient		Less	

Table 4 gives information on the category of students with high, medium, and low abilities. High-ability students can fulfill all indicators. In good category. moderate abilities students and fewer abilities have been able two indicators.

TABLE 5
SCORES AND PERCENTAGES OF STUDENTS' ANSWERS IN THE MATHEMATICAL COMMUNICATION SKILLS TEST

Name/ Category	Indicator Score to-				Total Score	Percentage of Total Score
	1	2	3	4		
ST 1 (L)	2	1	2	0	5	31.25
ST 2 (M)	3	2	2	1	8	50.00
ST 3 (M)	2	3	3	1	9	56.25
ST 4 (L)	2	2	1	0	5	31.25
ST 5 (H)	3	3	2	3	11	68.75

From Table 4 above, the skills based on the indicators above show that 47.5% of the students were in the medium category of MCS.

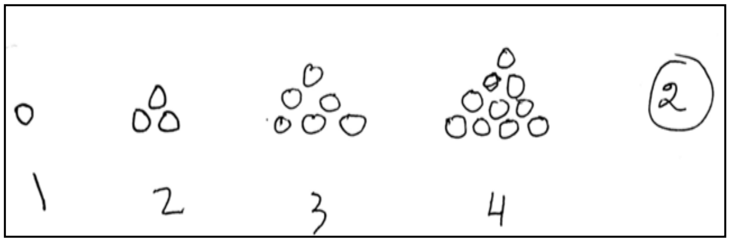
The assessment results of answers were converted into percentages and concluded based on the categorization of students' MCS. Based on the tests and interview data, MCS was divided into three levels according to the indicators, namely high, medium, and low. A summary of the test results and interviews with mathematical communication skills was obtained.

Furthermore, the scores were categorized based on the criteria table. Two students had low MCS, two had moderate, and one had high. In connection with this, students with low MCS can solve only question 1 but cannot apply the knowledge to contextual problems. Those in the moderate category were quite good at solving the three questions. However, they were less careful in writing down the patterns' meanings. The following is a display of student questions and answers.

Question 1, with indicators that state real objects, situations, and everyday events in the form of mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions: **"A fruit trader wants to make a triangular arrangement of citrus. One orange was used in the first arrangement, while 3 were used in the second, forming a triangle, 6 in the third, and so on. Draw an arrangement of oranges forming a triangle up to the 6th arrangement!"**

Question no. 1: the students were asked to state everyday situations and events in the form of mathematical models like pictures with a percentage of 48%. Below are examples of incomplete student work in progress.

FIGURE 5
REPLICA OF STUDENT ANSWERS FOR QUESTION NUMBER 1

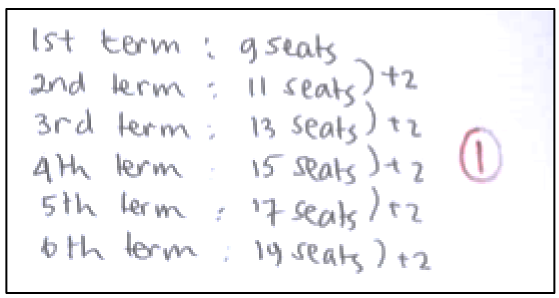


Question 2: the indicator is to state daily events in a mathematical model. **"The arrangement of seats in a meeting hall with 9** seats **in the front row, 11 in the second, and 13 in the third. Suppose there are seats up to the sixth row in the building, then by arranging the chairs into a mathematical model, determine the number of seats in the meeting hall!"**

Question no. 2: students were asked to explain daily events in a mathematical model. Their score percentage was 44%, as shown in Figure 3.

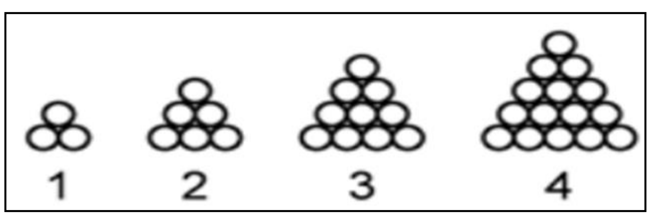
Examples of student work that experienced errors in the process.

FIGURE 6
REPLICA OF STUDENT ANSWERS FOR QUESTION NUMBER 2



Question 3 with indicators, namely making conjectures, compiling arguments, and formulating definitions and generalizations. **"Consider the following number pattern".**

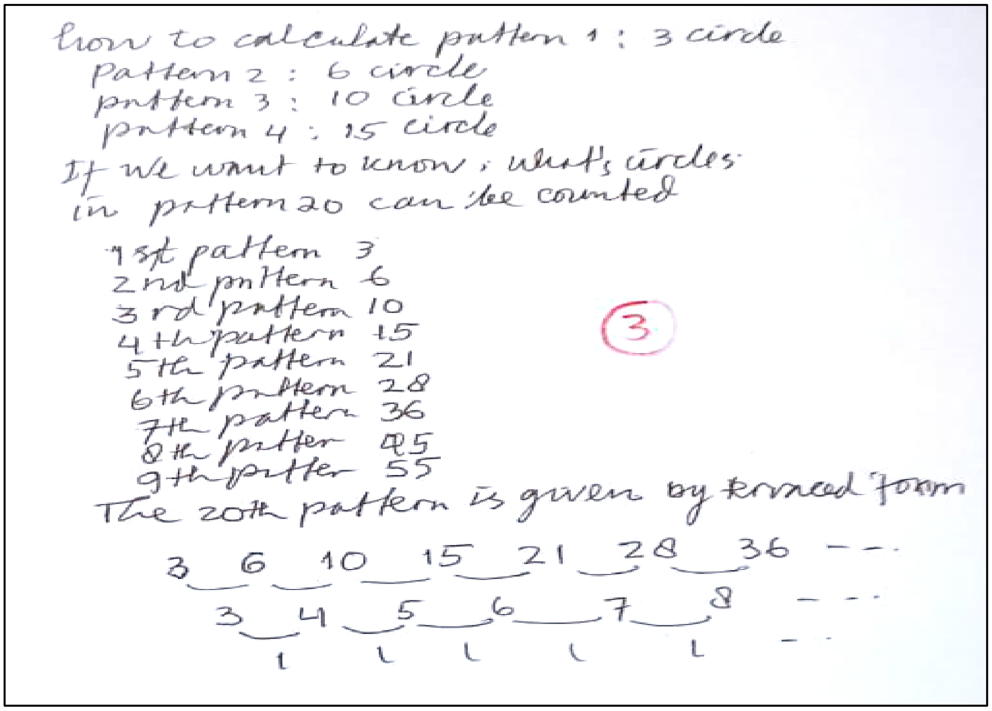
FIGURE 7
QUESTION NUMBER 3



"Suppose the circles are arranged up to the 20th pattern, then how does the formula determine the total number in the 20th pattern?"

Question no. 3: students were asked to make formulations and generalizations. It can be seen that the percentage is 40%. One student's work resulted in a mistake in calculating the pattern work and did not continue even though the idea was correct.

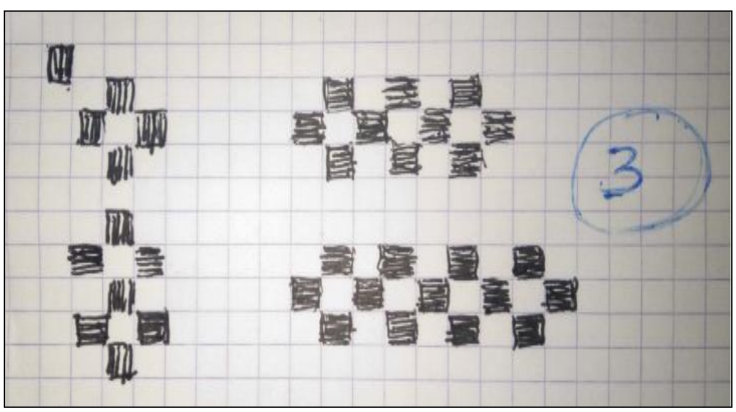
FIGURE 8
REPLICA OF STUDENT ANSWERS FOR QUESTION NUMBER 3


how to calculate pattern 1 : 3 circle
pattern 2 : 6 circle
pattern 3 : 10 circle
pattern 4 : 15 circle
If we want to know ; what's circles
in pattern 20 can be counted
1st pattern 3
2nd pattern 6
3rd pattern 10
4th pattern 15
5th pattern 21
6th pattern 28
7th patter 36
8th patter 45
9th patter 55
The 20th pattern is given by known form
3 6 10 15 21 28 36 ---
3 4 5 6 7 8 ---
1 1 1 1 1 ---

3

Question 4, with indicators, namely express mathematical ideas verbally, in writing, and by visual description and demonstration. **"It is known that a number sequence is 1, 4, 7, 10, 13. Determine the pattern by making a design according to Ananda's creativity".** Question no. 4: students were asked to visually demonstrate and describe pictures. From Figure 3, it is known that the percentage is 20%. The results of creative student work in the process.

FIGURE 9
REPLICA OF STUDENT ANSWERS FOR QUESTION NUMBER 4



The three selected subjects will be further analyzed with three categories. The following is a description of the test results for each object, namely:

Low Category

Based on the results of the analysis of the mathematical communication ability tests that were previously described in the first indicator, ST1 and ST4 can directly mention the classifications included in the number pattern. The second indicator, ST1 was unable to complete correctly and clearly, so by reading the low group's answer sheets, we can find all the information and objectives to be achieved from the problems given. The third indicator, ST 1 was able to write down the information needed to solve this problem. However, ST4 made a mistake in solving the problem by writing the wrong number which is very important in working on the problem so that the pattern you get is wrong. Meanwhile, based on the results of the low group interviews, they said that they only understood a little information on the questions so in working on the questions they were not optimal and did not fulfill the answers they wanted to achieve.

Middle Category

Based on the results of the analysis of the mathematical communication ability test that was previously described, on the first indicator, ST2 was able to write down the information contained in the questions. However, ST3's answer still contains errors. The second indicator, ST3 can answer the number pattern according to the intent of the question so that the answers obtained are correct and correct. The third indicator, ST3 seemed to master the intent of the questions and was able to use patterns in working on the questions so that the results obtained were correct. Whereas in the results of the interview subject, ST2 said that there were confusing questions.

High Category

Based on the results of the analysis of the communication skills test that has been described previously, on the first indicator, the ST5 subject was able to write down the classification directly included in the number pattern. The second indicator, they are also able to answer questions using number patterns and can write them correctly and completely so that the answers they get are correct. The third indicator, ST5 was unable to write down how to work out the number pattern formula to produce the most appropriate answer. Meanwhile, at the time of the interview, ST5 also felt that some of the questions were difficult so ST5 worked on the easy questions first, subject ST5 was able to do the questions very well.

Based on the results described above, the results of the mathematical communication ability test and interviews with high group subjects achieved 4 indicators with a score of 3, medium-ability subjects achieved two indicators with a score of 2 and low-ability subjects also achieved 1 indicator with a score of 0 but there was an error when working on the questions. wrong. This is following Baroody's statement (2017) stating that the importance of mathematical communication skills as an essential language is not only a tool for thinking, solving problems, finding formulas, or making conclusions, but mathematics also has value for expressing various ideas clearly, thoroughly, and precisely.

The results are still classified as moderate based on the analysis carried out in solving MCS problems. This is evident in the percentage of item analysis results for question 1, 48%, with indicators stating real objects, situations, and daily events in mathematical forms, such as pictures, tables, diagrams, graphs, and algebraic expressions. Question 2 is 44% with indicators, namely stating daily events in mathematical models. Question 3 is 40% with indicators, namely making conjectures, formulating arguments, formulating definitions, and generalizations. The fourth question is 20%, with indicators expressing mathematical ideas orally, in writing, in the visual instruct description, and demonstration. The results above are consistent with the results of (Niasih et al., 2019); (and Romlah et al., 2017). It is also consistent with the report of (Pujiastuti et al., 2020) that students who are not trained to understand the flow of contextual problems tend to have low MCS. Furthermore, low-skilled students are still in the poor category because they only meet the indicators of using their language to explain the completion of an image. This is consistent with (Arifin et al., 2016; Purba, J., Maimunah., and Roza, 2020).

Based on the indicators above, it can be concluded that 47.5% of students have medium MCS. Furthermore, the moderately skilled students are still in the sufficient category because they meet only indicators 1 and 2. This is also supported by the results of (Arifin et al., 2016; Purba, J., Maimunah., Roza, 2020) that "moderately capable students can meet two MCS indicators in the sufficient category".

Furthermore, the weakness of moderately skilled students is that they lack understanding of the problem and do not write down the complete steps. This result is consistent with (Andriani & Rasto, 2019) reports that learning motivation has a positive and significant effect on student learning outcomes. It is also consistent with (Purwaningsih, 2016), which stated that learning motivation positively affects MCS.

DISCUSSION

The result of student learning motivation shows the frequency of course activities in the profile of student learning motivation of class VIII Junior High School 8 Padang. Students have an average motivation of 47%. In this discussion, the relationship between research results and existing theories, expert opinions, or research results that are related and relevant to this research will be discussed. The following discusses the results of research on mathematical communication skills in solving number pattern problems in class VIII students of SMPN 8 Padang. Based on the results of the written test and the results of the interviews, it was shown that students with high abilities were able to fulfill all indicators of mathematical communication ability based on Ennis' theory. High-ability students (ST5) can fulfill the MCS indicators because they can understand the intent of the questions so they can state real objects, situations, and everyday events in the form of mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions. ST5 is also able to fulfill o state daily events indicators in a mathematical model so that ST5 can solve the number pattern problem correctly. ST5 also seems capable of fulfilling the indicators namely making conjectures, compiling arguments, and formulating definitions and generalizations, this can be seen in the interview process where it can check and prove again that the formulas used are correct. Furthermore, the subject of medium ability with the results of the written test and interview results showed that ST2 and ST3 had not been able to fulfill all the indicators of mathematical communication ability. ST3 was only able to meet the indicators Explain in writing their understanding of mathematical presentation and Making assumptions, compiling arguments, and formulating definitions and generalizations, this was seen in the interview process where they were able to explain and prove again that the formula used was correct. So it can be concluded that ST2 and ST3 are classified as communicative in solving mathematical problems. This research is in line with research conducted by Finally, the low-ability subject with the results of the written test and interview results showed that ST1 and ST4 were not able to meet all indicators of mathematical communication ability. This is because they are unable to find the right method or formula and are unable to use the information in the questions correctly so ST1 is unable to solve the math problem. ST4 also tends not to understand the terms contained in the questions, this can be seen in the interview process where ST4 is not able to express mathematical ideas verbally, in writing, and by visual description and demonstration. So it can be concluded that ST1 and ST4 are classified as having no mathematical communication skills in solving mathematical problems.

The results showed that two students could express real objects, situations, and daily events as mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions. Furthermore, two students could verbally re-explain their understanding of writing mathematical presentations, make conjectures, as well as formulate arguments, definitions, and generalizations. Only one student can express mathematical ideas orally, in writing, and give a visual description and demonstration. The percentage for question 1 is 48%, with indicators that state real objects, situations, and daily events in the form of mathematical models, such as pictures, tables, diagrams, graphs, and algebraic expressions. In addition, question 2 is 44%, with an indicator that states daily events in the language of mathematics. The third is 40% and the indicators include making conjectures, compiling arguments, and formulating definitions and generalizations. The fourth question is 20%, with indicators expressing mathematical ideas orally, in writing, and through visual description and demonstration. Based on the indicators above, it was found that 47.5% of Class VIII Junior High School 8 Padang students had MCS in the medium category.

CONCLUSIONS

The qualitative research established that there was a direct and indirect effect between research components and respondents' MCS. The specific approach of this study has implications for two research fields. First, it specified that MCS can be beneficial to enhance self-regulated learning (SRL). Findings indicate the motivational and self-regulated learning profiles that mathematics students adopt in several patterns, why they do so, and what profile adoption means for learning. Our findings can guide instructors in providing motivational beliefs and self-regulated learning scaffolds in the classroom. The analysis has shown the direct effect of achievement MCS and the indirect influence of SRL and a blended learning system on participants' academic accomplishment. Additionally, the analysis of direct and indirect results indicated the explorer of SRL on achievement MCS and learning systems. The above findings were similar to the existing literature on SRL, achievement MCS, and learning systems about the student's academic achievement. Second, the study provides more insight into emerging research.

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