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Submission date: 17-Dec-2021 03:40AM (UTC-0800)
Submission ID: 1732726826
File name: Manuscript_Mutia_Khoirunnisa_2.pdf (643.81K)
Word count: 4459
Character count: 23527

Jurnal Elemen, 8(1), 1-9, January 2022
https:/doi.org/10.29408/jel.v8i1.XXXX

e- ISSN: 2442 - 4226

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Mathematical Reasoning Skills integer Materials using Video Media with PMRI and Collaborative Learning

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Abstract

This study to knowing the skills of mathematical reasoning after implementation of the learning process using video media with the PMRI approach and collaborative learning in class VII students with the subject matter of integers. This research is descriptive, with the research subjects being grade VII.A students of SMP Srijaya Negara Palembang with 23 students out of a total of 32 students, this study consisted of two meetings, the first meeting was the learning process using video media with PMRI and Collaborative learning and at the meeting the second is tested. This study uses observation data collection techniques, written tests and interviews and data analysis techniques used in this study are descriptive. The results obtained after doing research using video media with the PMRI approach and collaborative learning on integer material in class VII.A is found that the mathematical reasoning skills of class VII students. A SMP Srijaya Negara Palembang on integer material is good with the average score obtained is 69.61. The dominant indicator that appears in this study is the indicator of proposing allegations, while the indicator that appears very little in this study is the indicator of drawing conclusions, and the use of video media used in this study can also make students interested in following the learning process, then also make students easy understand and be clearer in receiving learning material so that it can be applied in learning.

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

Received: Date Month Year | Revised: Date Month Year | Accepted: Date Month Year | Published: Date Month Year

Introduction

In the process of learning mathematics, several abilities are needed that can support learning, one of which is the ability to reason. This is based on Permendikbud No. 21 of 2016 that in learning at the secondary school level the ability that is able to support the learning process is one of the abilities of reasoning (Permendikbud, 2016). According to Oktaviana & Indri (2021) mathematical reasoning is the ability used in stating new statements based on facts whose truth has been proven. The importance of reasoning ability is also supported by NCTM which states that one of the standard processes in learning mathematics is reasoning (NCTM, 2000).

Mathematical material whose learning requires mathematical reasoning skills, one of which is integer material (Purwanti, et al, 2020) and this material is also studied by class VII

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students in the 2013 curriculum, namely integers (Kemendikbud, 2017). Number material is material that is also important for students to learn. This is because the material is included in one of the materials tested by the Program for International Student Assessment . (PISA 2018 Draft Assessment And Analytical Frameworks, 2019). In addition, the number material was also tested in Trends in International Mathematics and Science Study (TIMSS, 2019). Students are expected to have fairly good reasoning abilities, this is because this ability is a means that can make students' thinking processes have the basis of truth in solving problems (Ramadania, 2017). This is in accordance with the opinion of Putri, et al (2019) through reasoning abilities which can be said to be classified as good, the student will be able to conclude something whose truth can be proven.

However, the results of research in the field state that students' mathematical reasoning abilities on integer material are still low. Students find it difficult to examine problems. (Rizki, et al, 2020; Sofyana & Kusuma, 2018). This is in line with previous research related to the low ability of mathematical reasoning which can be seen from the results of students' completion of which there is absolutely no explanation on the work sheet, they are used to solving problems without knowing the reasons for the answers, students tend not to think how and where the results come from. they get they only follow the teacher's way of answering sample questions (Juliawati, et al, 2016). In learning the teacher tends to only pursue the material by using the lecture method so that learning becomes boring and the teacher does not give time to students to develop their reasoning abilities (Lestari & Sardin, 2020). Because of this, there needs to be improvements related to the mathematics learning process, in order to make students more interested in learning (Munawaroh, et al, 2019). Based on Permendikbud No. 22 of 2016 which formulates the implementation learning process, which is carried out in an inspirational, interactive manner, motivates students to be active, fun and provides opportunities for students to develop creativity, independence based on interests, talents and psychological and physical development of children (Permendikbud, 2016). Based on the description, the teacher should be able to create a fun and meaningful learning proces for students. Fun learning is meaningful learning for students (Suciati, 2020). Learning mathematics will be fun and meaningful when the learning can be linked to everyday life so that student can better understand the material they are learning. In line with Rahayu & Putri (2021) that a student's knowledge he learns will be meaningful if the learning process carried out in a context. Thus, the right approach is needed for the learning process that connects to the real context (Mairing, 2016).

An approach that is in line with these needs is the Indonesian realistic mathematics education approach (PMRI), this approach can help better understand the learning material (Meitrilova & Putri, 2020). The problems presented in learning using PMRI begin with a real context so that learning is more interesting (Putri, 2015). PMRI is a theory that basically refers to real problems. This problem acts as a bridge for learning mathematics from real to formal in mathematics (Trisnawati, et al, 2015). The principles of PMRI are Guided Reinvention or Progressive Mathematizing (instructions for rediscovering or progressive mathematization), Didactical Phenomenology (educational phenomena), Self Developed Models (developing their own models), while the characteristics of PMRI are using real context problems, using models, student contributions , interactivity and integrated with other learning topics (Zulkardi & Putri, 2010). The PMRI approach does not only relate to reality, but this approach also emphasizes learning that can make students imagine the problems given (Lestariningsih & Trismawati, 2020). Learning mathematics, especially integer material, is very appropriate if the PMRI approach is used, this is because integers can be linked to real things and have many examples of contextual problems (Liu, 2019; Wahyuningtyas 2016).

In order to meet the demands of the 21st century, a learning activity is needed that can shape students into critical thinkers, proficient communicators and collaborators (Ariyanti, et al, 2020). Thus, to be able to realize these learning activities, it should refer to 4 21st century

characters commonly referred to as 4Cs, namely crtical thinkng and problem solving skill, communication skills (communication skills). ,collaboration skills (skills to work together) and creativity and innovation (creativity and innovation) (As'ari, 2016). Where this collaboration requires students to help group friends who have difficulty doing their assignments, besides that each student also has to carry out individual responsibilities in his group (Maulidah, 2021). This can be applied through learning activities use the Collaborative Learning

Collaborative Learning is a learning model that involves people where they will exchange ideas, learn together and help each other to complete tasks in groups (Inah & Pertiwi, 2017). This model is designed for learning that is carried out in pairs or in small groups (Nisa, et al, 2018). Students who do not understand will ask their group friends who understand by saying "please teach me" friends who understand better must explain until the student understands, students will be given material for sharing tasks and jumping tasks (Sato, 2014). In collaborative learning using learning sharing tasks and jumping tasks, this is important to note because this is a means to develop students' potential (Asari, 2017).

In addition to the 21 century, also known as digital century led to the development of technology is progressing very large, one aspect that is involved is affected by the technological advancement of education (Muthy & Pujiastuti, 2020). Examples of the use of technological advances in the world of education namely learning media (Firmadani, 2020). Video is one example of a medium that can be used in the learning process (Furi & Mustaji, 2017). Video media is media that play a role in communicating the message or information from a study presented in audio visual so that it can be easily absorbed by the student and the student can describe an information complete and clear (Febriani, 2017). The use of video media can also support the learning process: making students interested in learning this because the presentation of images, sound and video that can be repeated many times. (Luhulima, et al, 2017). Besides video media utilizing the two senses of hearing and sight where students can easily receive and absorb information in the following study when using more than one sensory (Hidayati et al, 2019).

Many studies related to learning using the PMRI approach have been carried out but with a different focus. In Kurniawan's research (2020) using the PMRI approach through LSLC with the aspects studied, namely the ability to solve problems on straight-line gradient material and Octriana's research (2018) using the PMRI approach through LSLC with the aspect studied, namely the ability of mathematical reasoning on number pattern material. In the 21st century, which is known as the digital century, technological advances can be utilized in the world of education, one example is the use of video media used in the learning, while previous research has not used video media. Therefore, researchers are interested in researching " Mathematical Reasoning Skills integer Materials using Video Media with PMRI and *Collaborative Learning*".

Methods

In this study, the researcher used a descriptive type of research, the researcher would describe the mathematical reasoning ability of the integer material using video media through the PMRI approach and collaborative learning for class VII students. The subjects of this study were students of class VII A SMP Srijaya Negara Palembang in the odd semester of the academic year 2021/2022, totaling 32 people. Mathematical reasoning ability data can be obtained from the results of student test completion. The test questions consist of 2 items, and each question has a score. The indicators used in this study are as follows.

Table 1. Indicators of mathematic reasoning skills

Indicator	Descriptor
Submit a conjecture	• Able to write down what is known and asked from the question • Able to make conjectures related to other information based on what is known from the questions
Mathematical Manipulation	• Able to solve problems by translating questions in sentence form into mathematical form
Draw a Conclusion	• Able to write conclusions that are in accordance with the problem

The research consists of three stages: (1) the preparation stage, preparing research instruments, observing schools and taking care of research correspondence , (2) implementation stages, learning consists of two meetings, the first meeting the learning process using video media through the PMRI approach and collaborative learning , then the second meeting the students were given questions about the mathematical reasoning ability test, and (3) The final stage , the researcher analyzed the data and described the research results and conclusions based on the results of tests, observations, and interviews and then compiled a research report, to determine the category of mathematical reasoning abilities. then will converted based on the category of qualitative values of mathematical reasoning abilities as follows.

Table 2. Category qualitative values mathematical reasoning skills

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

Results

In the learning process, it is carried out online (online) using GoogleMeet and WhatsApp. This research was conducted in class VII A SMP Srijaya Negara Palembang.

In the preparation stage, the researchers made learning tools and research instruments, the researchers also made observations to the Srijaya Negara Palembang Junior High School and also conducted discussions related to research. After discussing with the school and being allowed to conduct research at SMP Srijaya Negara Palembang, the researchers validated three validators, namely Prof. Dr. Ratu Ilma Indra Putri M.Si, Mrs. Lipa Meisinta, S.Pd and Mr. Drs. M. Amin, M. Si then the researcher continued the process to take care of the documents needed to carry out the research.

At the implementation stage, after the instrument was declared valid, the researcher conducted a one-to-one trial with three students of SMP Srijaya Negara Palembang from another class, namely class VII B. Then the researcher continued to conduct a small group test on six students from another class, namely class VII B. After everything is finished, there are two meetings. The first meeting conducted a learning process using video media through the PMRI approach and collaborative learning . In this learning process students learn in groups with 3-4 members and will teach each other, this is in accordance with Sato (2014) if there are

students who do not understand in the group then he is directed to ask group friends who understand more than him. , a friend who understands must teach his friend who does not understand until his friend understands. students are given the problem of Sharing Tasks and Jumping Tasks through video media, this is in accordance with Asari (2017) learning sharing tasks and jumping tasks , it is important to note because this is a means to develop student potential. Besides that, giving problems through video is used in order to make it easier for kids to comprehend the information provided and the information conveyed is clearer. This is also in accordance with Hidayati et al (2019) that video media utilizes two senses, namely hearing and sight where students will find it easier receive and absorb information in following the learning process when using more than one sense. In addition, it can make students interested in learning, because the presentation of the video can be repeated many times. (Luhulima, et al, 2017). In this learning process, the researcher asked 8 people for help to become observers in each group. In addition, the problems of sharing tasks and jumping tasks that are given are also related to daily life, this is in accordance with Zulkardi & Putri (2010) PMRI is a theory that basically refers to real problems. After the learning process was carried out at the first meeting, for the second meeting, test questions were given to students. and after getting the results of students' answers, the researchers conducted interviews with three people who were willing to be subjects according to the categories of high students, medium students, and low students.

In this final stage, analyzing observational data, analyzing test result data and analyzing interview data and then drawing conclusions for preparing reports on research. The following is a test of students' mathematical reasoning abilities.

Figure 1. Test question number 1 and 2

Description of Student Answer Result Data
a. Test Question Number 1

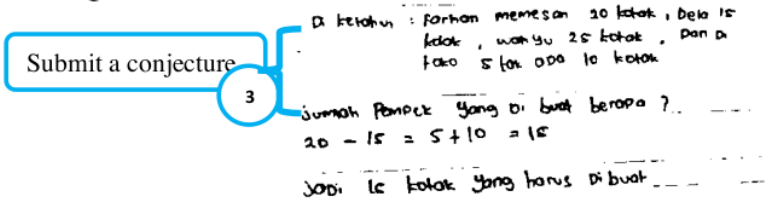

Figure 2. TZ's answer for the question number 1

Based on the results of tests and interviews, TZ students have been able to come up with indicators of submitting conjectures, namely writing down what is known and asked

completely, but TZ students do not write down other information based on what is known from the questions at the time of the interview and the student cannot answer it therefore he gets a score 3. Then it can also be seen that TZ students are not able to do the solution correctly, in this case TZ students do not show indicators of mathematical manipulation, therefore they get a score of 0, then for indicators of drawing conclusions, TZ students also look wrong in drawing conclusions. And the solution he wrote was also wrong, based on that, TZ students got a score of 0. So for question number 1, TZ students got a score of 3.

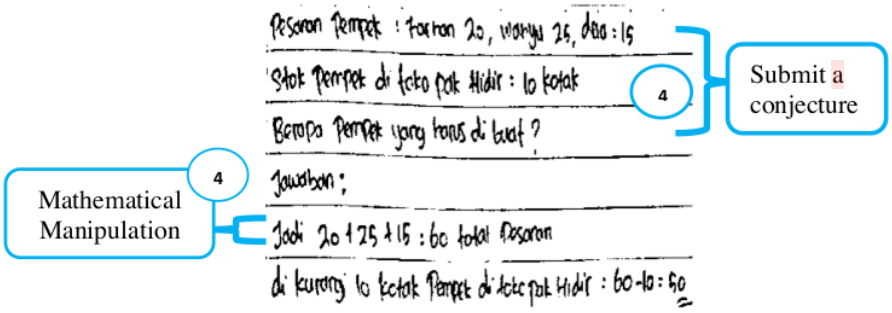

Figure 3. PA's answer for the question number 1

Based on the results of the PA students' tests during interviews and the test results, it can be seen that PA students also understand question number 1 and can solve it. PA students bring up the indicators of submitting conjectures perfectly so that they get a score of 4, PA students can also solve problems by translating questions in sentence form into mathematical forms completely and correctly, therefore for indicators of mathematical manipulation PA students get a score of 4, but PA students do not make conclusions on the answer sheet therefore PA students get a score of 0. So the total score of PA students is 8.

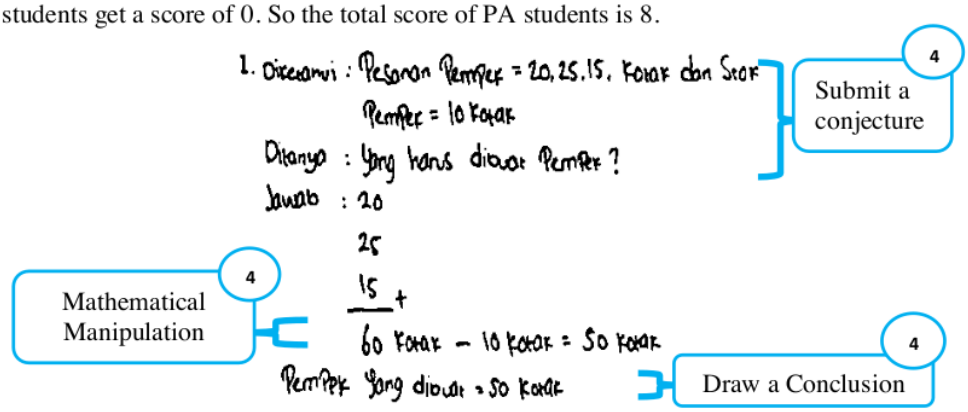

Figure 4. ZR's answer for the question number 1

It was seen that ZR students understood the questions and could answer them. So the ZR student raises the indicator of proposing the conjecture perfectly so that he gets a score of 4, the ZR student can also solve the problem by translating the problem in sentence form into a complete and correct mathematical form, therefore for the mathematical manipulation indicator ZR student gets a score of 4, then the ZR student is also able to draw conclusions appropriately so as to obtain a score of 4. so the student's total score on the test item number ZR 1 which is 12.

b. Test Question Number 2

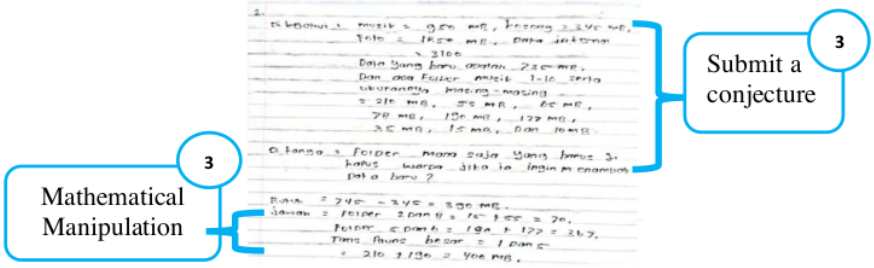

Figure 5. TZ's answer from the question number 2

TZ students have been able to come up with indicators of proposing allegations, namely writing down what is known and asked but not yet complete and when interviewed, TZ students could not answer, so the indicator put forward a guess he got a score of 3. Then, based on the findings of the interviews, it can be seen that TZ pupils were able to write down the solution but when interviewed he could not answer the researcher's questions so on the indicator of mathematical manipulation he got a score of 3, then for the indicator of drawing conclusions the TZ students did not write it down and when interviewed he also could not answer the researcher's questions so he got a score of 0 on the indicator of drawing conclusions. So TZ makes a total score of 6.

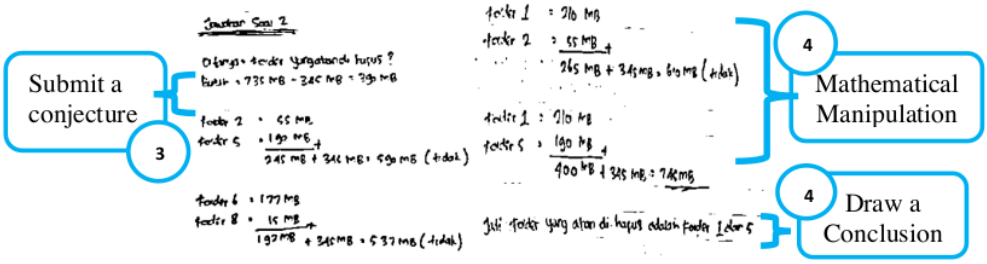

Figure 6. PA's answer from the question number 2

Based on the results of the PA test at the time of the interview, it can be seen that the PA students raised the indicators for submitting the guess correctly but did not write them down on the answer sheet for fear of running out of time so that he got a score of 3, PA students can also solve problems by translating the questions in sentence form into complete mathematical form. and true, therefore for the indicator of mathematical manipulation, PA students get a score of 4, then PA students also make conclusions on the answer sheet correctly so that for indicators of drawing conclusions, PA students get a score of 4. So PA gets a total score of 11.

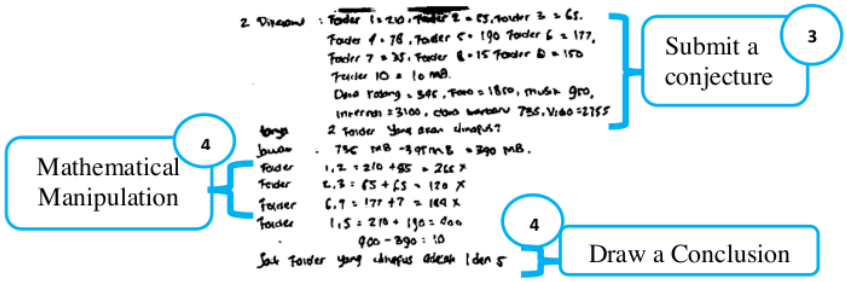

Figure 7. ZR's Answer from the question number 2

When interviewed, it was seen that ZR students understood the question and could answer it. Student ZR raises an indicator of proposing a guess even though it is not perfect because he misreads the problem so that what is written in the section it is known that there is a slight error so he gets a score of 3, ZR student can also solve the problem by translating the problem in sentence form into a complete and correct mathematical form because For the indicator of mathematical manipulation, ZR students get a score of 4, besides that ZR students are also able to draw conclusions correctly so that they get a score of 4. So the total score of ZR students on test number 1 is 11.

Table 3. The origin of mathematical reasoning skills indicators

Indicator	Total Eligible Students	
	Question test number 1	Question test number 2
Submit a Conjecture	23	20
Mathematical Manipulation	21	21
Drawing Conclusion	18	16

Table 4. The qualitative value of mathematical reasoning skills

Score	f_1	f_2	f_{tot}
81-100	11	5	16
61-80	9	9	18
41-60	1	6	7
21-40	2	2	4
0-20	-	1	1

Information:
f_1: Number of students in question number 1
f_2: Number of students in question number 2
f_{tot}: $f_1 + f_2$

Table 5. Students average mathematical reasoning skills

Score	f_{tot}	x_i	$f_{tot}. x_i$	Rata-Rata
81-100	16	90,5	1448	69,61
61-80	18	70,5	1269	
41-60	7	50,5	353,5	
21-40	4	30,5	122	
0-20	1	10	10	
Total	46		3202,5	

Based on table 5, the average mathematical reasoning ability of class VII.A SMP Srijaya Negara Palembang after the implementation of learning using video media through the PMRI approach and collaborative learning on integer material shows the category of mathematical reasoning abilities that are classified as good.

Discussion

In this study aimed to determine the students' mathematical reasoning abilities after the implementation of learning using video media through PMRI approach and *collaborative learning* on the material integers in class VII. mathematical reasoning is the ability to declare a

new statement is based on the fact that the truth has been proved (Oktaviana & Indri, 2021). The data from this study were taken from the results of the answers to the tests of mathematical reasoning abilities made at the next meeting after the implementation of the learning process. Problem numbering two, were made by adjusting the characteristics of PMRI approach and indicators of bringing alleged, mathematical manipulations and draw conclusions.

The learning process that has been carried out is in accordance with the principles of the PMRI approach. In addition, the learning carried out is also based on the characteristics PMRI and this learning is also in accordance with *collaborative learning* where students are divided into 3-4 people in one group and given the problem of *sharing tasks* and *jumping tasks* and they are asked to solve them individually in their groups. there are students who do not understand then he is directed to ask his friends who are a group who understand more than him, friends who understand must teach their friends who do not understand until their friends understand (Sato, 2014) In addition, the learning process carried out also uses PMRI, this is because PMRI can help students to better understand the learning material (Meitrilova & Putri, 2020) besides that the learning is carried out according to the principles of PMRI namely *Guided Reinvention* or *Progressive Mathematizing* (instructions to rediscover or progressive mathematization), *Didactical Phenomenolog* (educational phenomena), *Self Developed Models* (developing their own model) (Zulkardi & Putri, 2010). The problem of *sharing tasks* and *jumping tasks* given is also related to daily life, this is in accordance with Zulkardi & Putri (2010). The problems used in this study refer to real problems, this is also in accordance with the characteristics of PMRI, namely using real context problems, using models, student contributions, interactivity and integrated with other learning topics (Zulkardi & Putri, 2010). In line with Rahayu & Putri (2021) If a student's learning is done in a context, the knowledge he gains will be meaningful. The problems presented in learning using PMRI begin with a real context so that learning is more interesting (Putri, 2015). PMRI is a theory that basically refers to real problems. This problem acts as a bridge for learning mathematics from *real* to formal in mathematics (Trisnawati, et al, 2015). So based on this, the problems used in the learning process use a context where the problem of *sharing task is the* context of temperature and the *jumping task is the* context of cake. The problem of *sharing tasks* and *jumping tasks* used will be displayed through video media. The use of video can make it easier for students to understand the information provided and the information conveyed will be clearer. This is in accordance with Hidayati, et al (2019) video media utilizes two senses, namely hearing and sight where students will more easily receive and absorb information in following the learning process when using more than one sense. In addition, it can make students interested in learning, because the presentation of the video can be repeated many times. (Luhulima, et al, 2017).

After the learning process is held, at the next meeting students are given questions about the mathematical reasoning ability test, It can be seen from the research that has been carried out showing that by applying learning using video media through the PMRI approach and *collaborative learning,* mathematical reasoning abilities are classified as good, although not all indicators of mathematical reasoning abilities are perfect. By using video media through the PMRI approach and *collaborative learning* , it can indirectly generate student interest in

learning, so that learning using video media through the PMRI approach and *collaborative learning* can be applied in schools.

Conclusion

Mathematical reasoning ability in integer material using video media through the PMRI approach and collaborative learning in class VII.A SMP Srijaya Negara Palembang is good with the indicator that most often appears is proposing conjectures and the one that rarely appears is drawing conclusions and using this video media. can make students interested, easy to understand and clearer in receiving learning material so that it can be applied in learning.

Acknowledgment

This article is part of a research project funded by a professional research grant from the Universitas Sriwijaya with the letter number of the Chancellor's letter number 0014/UN9/SK.LP2M.PT/2021.With the research contract number 0127/UN9/SB3.LP2M.PT/2021

Conflicts of Interest

The authors state that there are no conflicts of interest in the publishing of this work. Furthermore, plagiarism, misconduct, data fabrication and/or falsification, multiple publication and/or submission, and redundancy have all been thoroughly addressed by the authors.

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