2nd International Seminar on Applied Mathematics and Mathematics Education (ISAMME) 2020

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Preface

Indonesian education system demands changes due to the dynamic challenges in human resources as the effect of the Industrial Revolution 4.0. As a result, the curriculum set into contemporary literacies: Data Literacy comprises the ability to read and analyze, Technology Literacy includes the ability to apply technology, and Human Literacy aims at creating humanists who can communicate well. This new education system requires professionals who create innovation based on research information. This notion calls for a new perspective converting challenges into opportunities. Thus, the Mathematics Education Department of IKIP Siliwangi and the Indonesian Mathematics Educator Society (I-MES) invite researchers, practitioners, and educators to participate in and contribute to The 2nd International Seminar on Applied Mathematics and Mathematics Education (ISAMME) 2020 under the theme "Issues and Challenges for Applied Mathematics and Mathematics Education in Digital Era."

This seminar has objectives to expand mathematics contribution to society, improve mathematics teaching, and solve mathematics problems. It was carried out online through the Zoom application with a capacity of 1000 people. The Zoom application is also equipped with a Zoom breakout feature to support the implementation of contribution and streaming sessions on Youtube.

The seminar's reason carried out online is that the conditions in Indonesia and other countries are still experiencing the Covid-19 pandemic, so face-to-face seminars cannot do it. Although the implementation of ISAMME 2020 is an online conference, the venue for this seminar is still being held at the campus of Institut Keguruan dan Ilmu Pendidikan Siliwangi, Cimahi, Indonesia, as a host in Zoom application.

In the implementation of the 2nd ISAMME 2020, there are still two sessions: plenary and contribution. There were six presenters from 5 countries in the Plenary Session, namely the USA, UK, Brunei Darussalam, Turkey, and Indonesia. The Plenary Session will be held from 8 am - 4 pm (Western Indonesian Time). Meanwhile, the Contribution Session was divided into 16 parallel rooms using the Zoom breakout feature, which was attended by 96 presenters.

The keynote speaker presentations are provided, mainly to show the contribution of mathematics

educators in the world of mathematics education towards research and knowledge sharing. We have six keynote speakers coming from the University of Massachusetts Lowell, MA, USA, Dr. Iman Chafik Chahine; Sultan Hassanal Bolkiah Institute of Education, Universiti Brunei Darussalam, Brunei Darussalam, Dr. Masitah Shahrill; Queen's University Belfast, UK, Dr. Erin Early; Amasya University, Turkey, Dr. Mehmet Filiz; IKIP Siliwangi, Prof. Dr. Hj. Euis Eti Rohaeti, M.Pd, and from Universitas Ahmad Dahlan, Dr. Rully Charitas Indra Prahmana.

The discussion process in the plenary session activity and contribution occurred in two directions because 1 Moderator and 1 Interpreter accompany each Session of the keynote speaker (the Plenary Session) and Presenter (the Contribution Session). So, the implementation of the discussion becomes more active.

The room of the Plenary Session contained up to 850 participants, while the contribution session reached 140 people (including 96 presenters & 44 participants) in the zoom application. Meanwhile, in the contribution session using the breakout application found in the zoom application. Thus the discussion process, the feasibility of space for Q&A, becomes more optimal, effective, and efficient. All participants in this activity came from various regions in various countries, such as USA, UK, Brunei Darussalam, Turkey, and Indonesia.

In the implementation of ISAMME 2020, the technical difficulties that occur are the internet connection, which sometimes hinders the speakers' delivery of material. However, this is not a big obstacle. During the plenary session, a streaming process was also carried out via youtube (https://www.youtube.com/watch?v=0k2oBvDQmDs), so that the Speaker at ISAMME 2020 presented all information can be seen by the wider community, especially the Mathematics Education community.

The following are figures that show the ISAMME 2020 process online.

Figure 1. Iman Chafik Chahine from University of Massachusetts Lowell delivering keynote talk

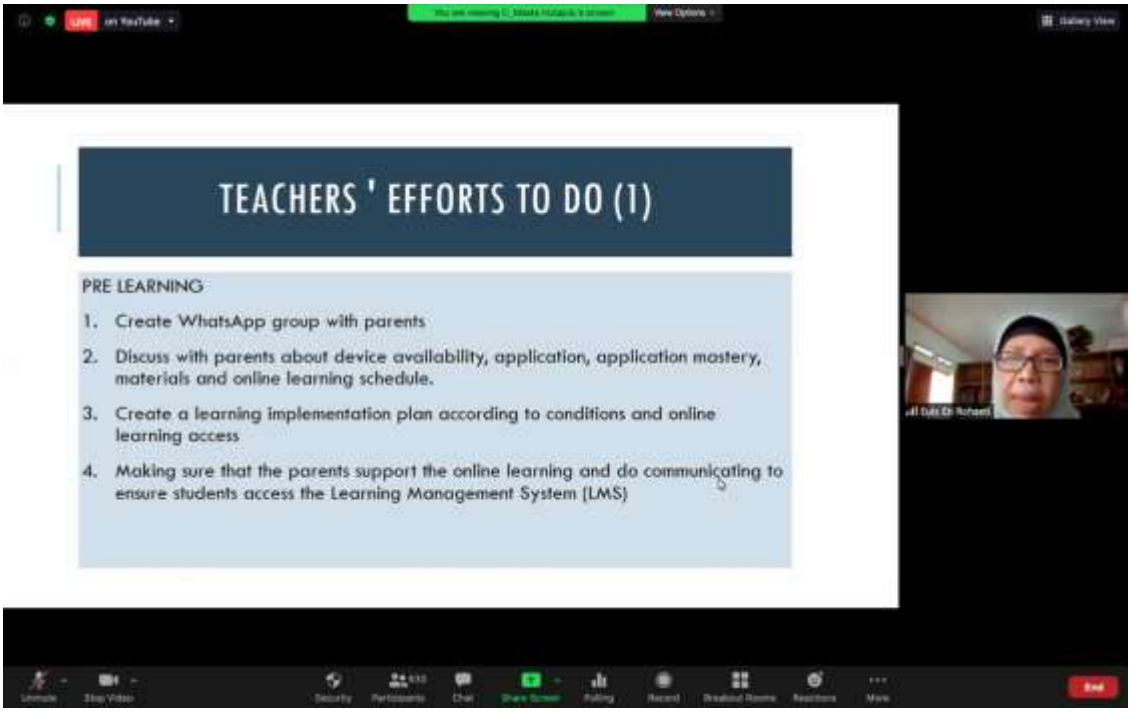

Figure 2. Euis Eti Rohaeti from Institut Keguruan dan Ilmu Pendidikan Siliwangi delivering keynote talk

Figure 3. Masitah Shahrill from Sultan Hassanal Bolkiah Institute of Education,Universiti Brunei Darussalam delivering keynote talk

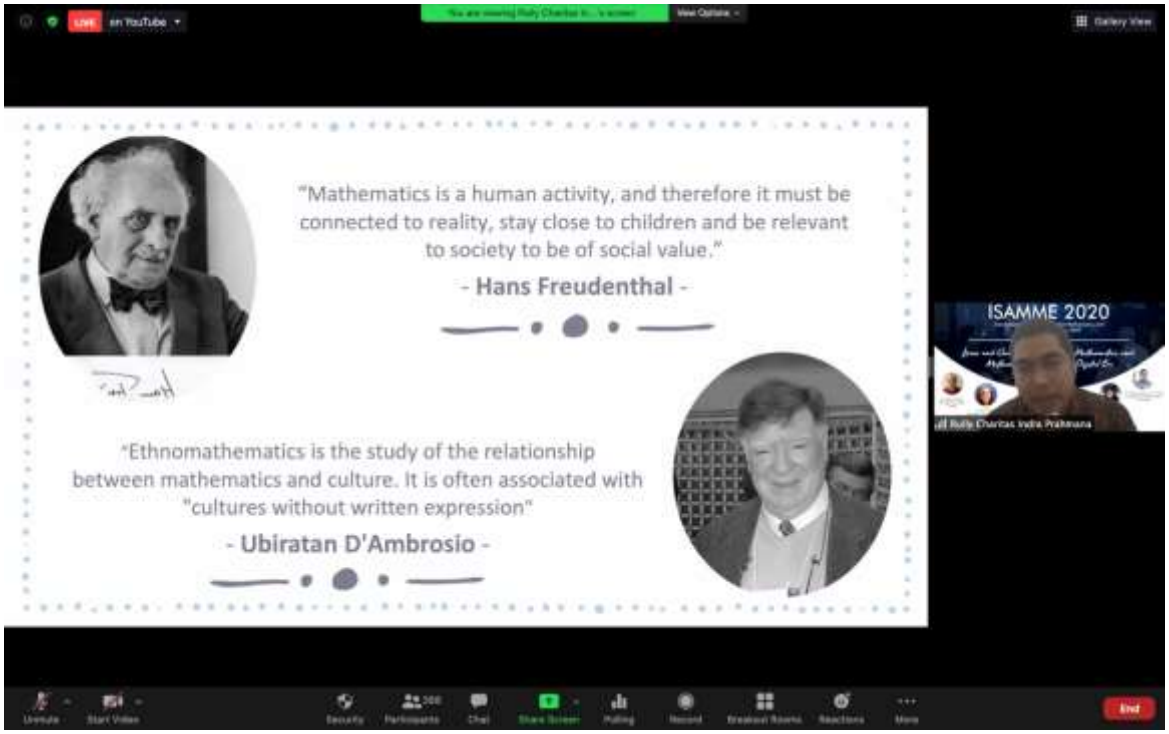

Figure 4. Rully Charitas Indra Prahmana from Universitas Ahmad Dahlan delivering keynote talk

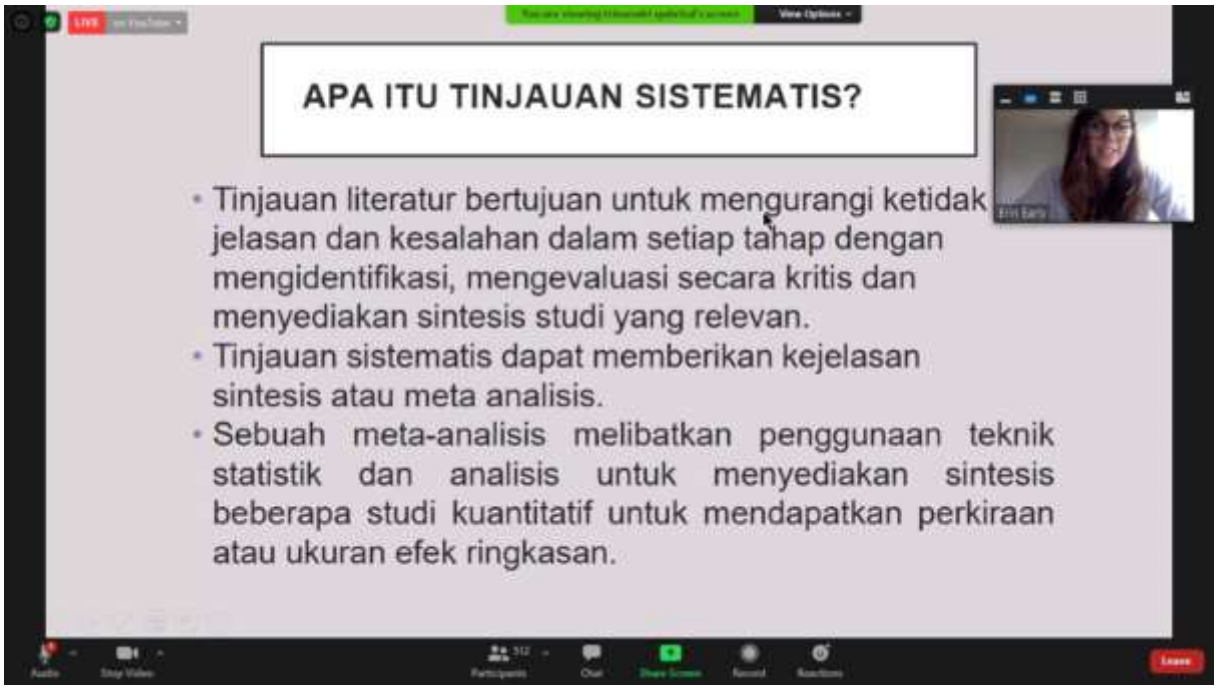

Figure 5. Erin Early from Queen's University Belfast delivering keynote talk with the presentation has been translated to Bahasa by Translator in this talk

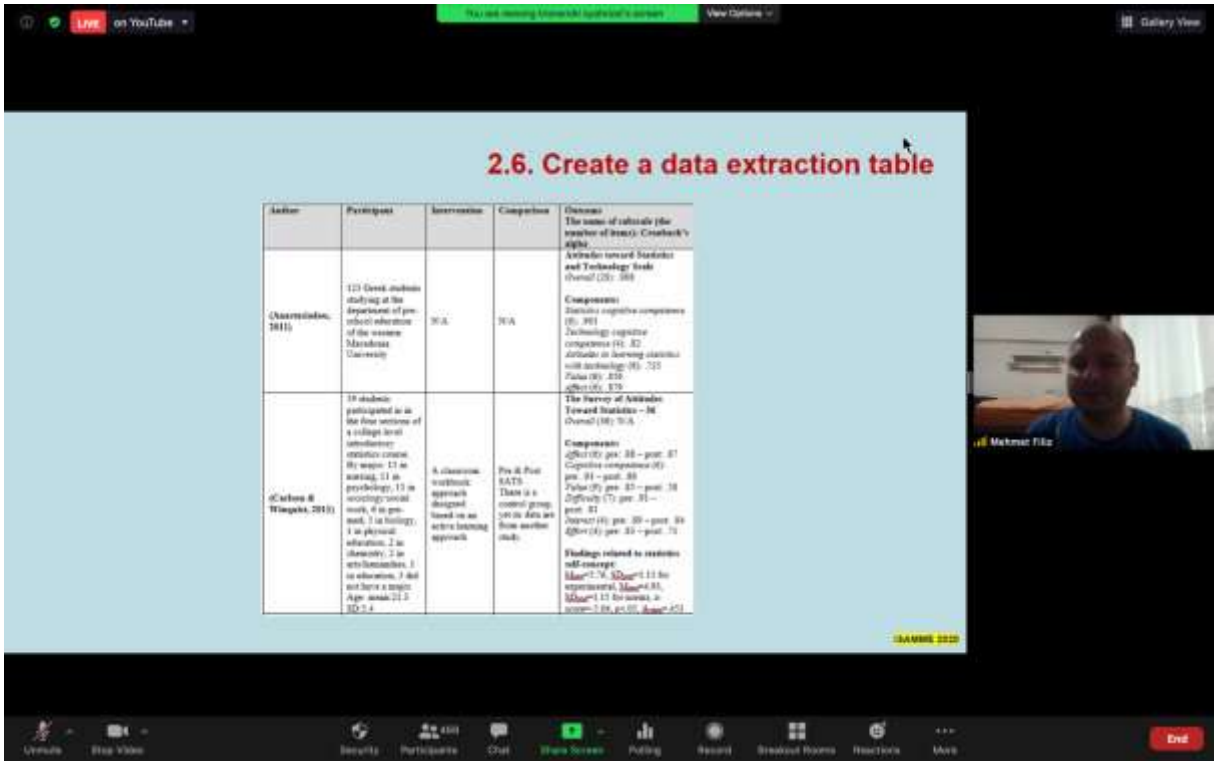

Figure 6. Mehmet Filiz from Amasya University delivering keynote talk

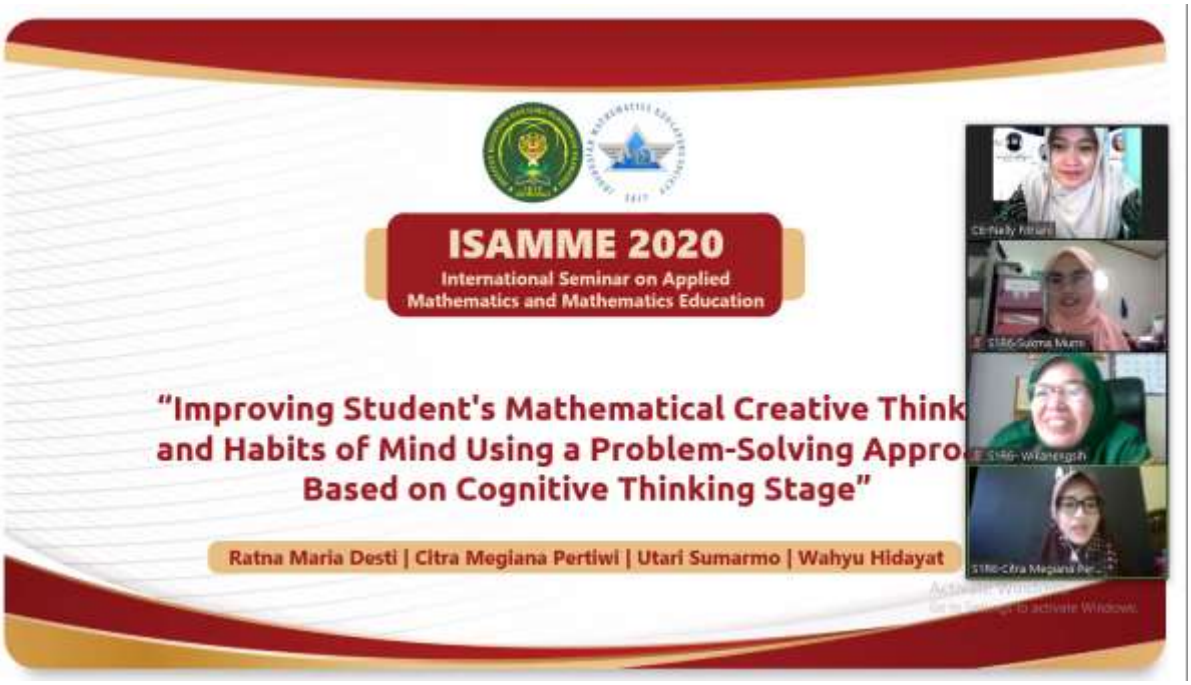

Figure 7. One of the participants delivering her talk in parallel session

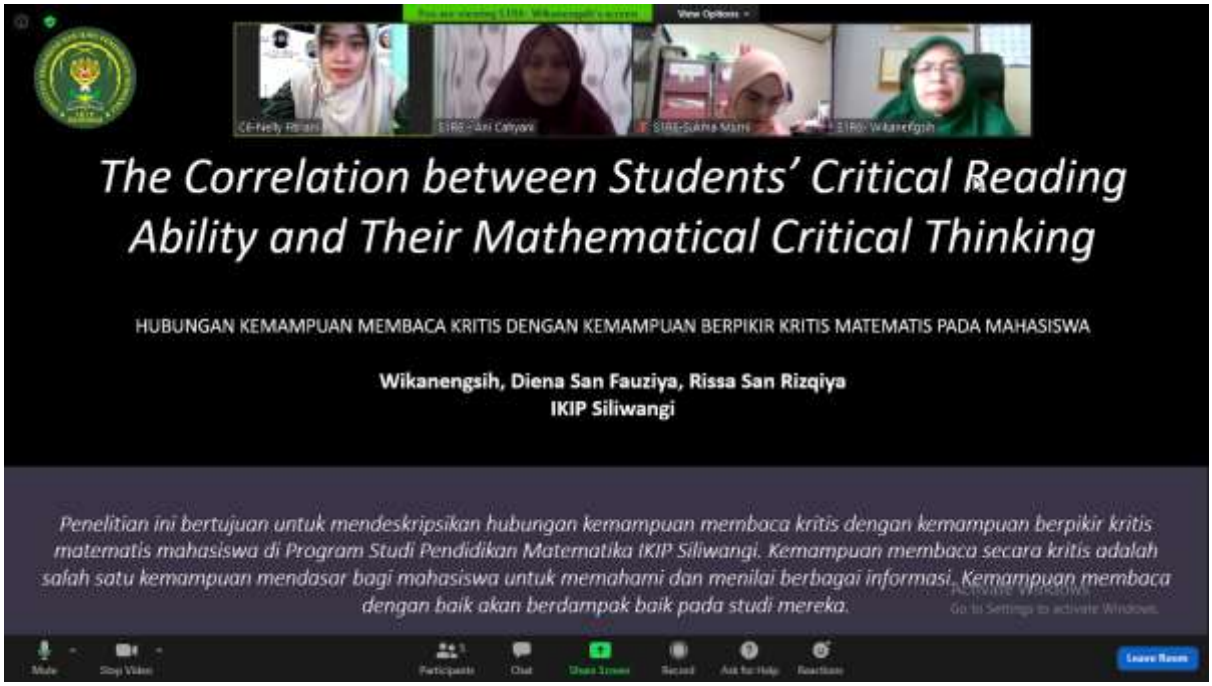

Figure 8. One of the participants delivering her talk in parallel session

Figure 9. One of the participants delivering her talk in parallel session

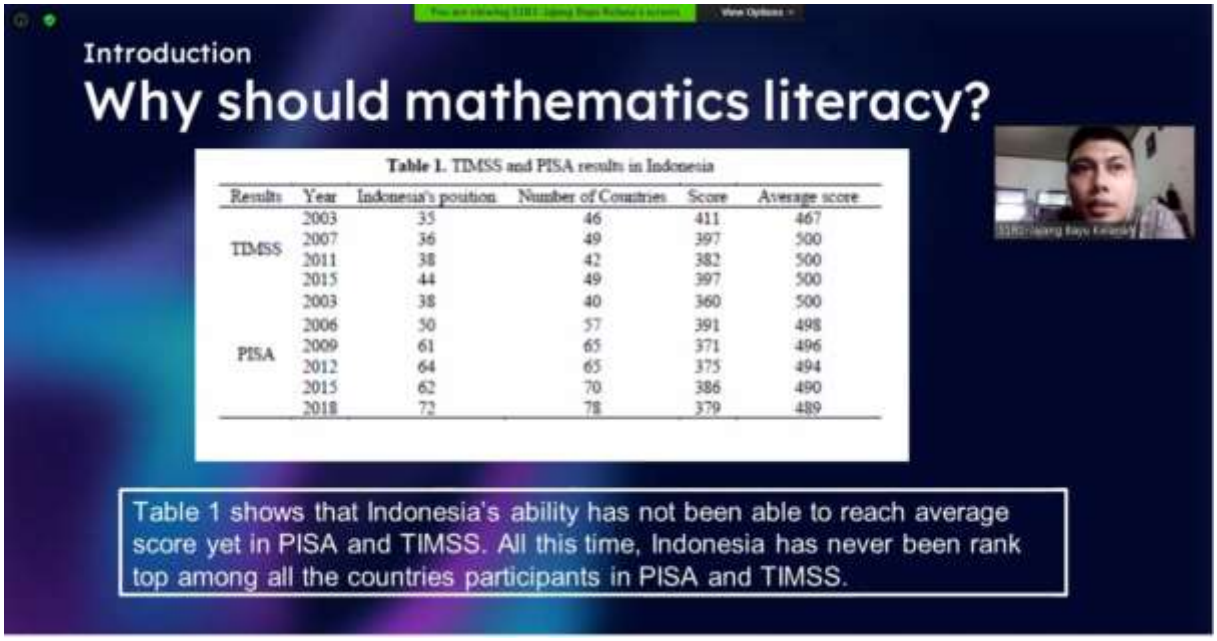

Figure 10. One of the participants delivering her talk in parallel session

On this seminar implementation, from one hundred and sixty-two presenter registers, ninety-six presenters were declared qualified. We trust that all the participants found their involvement in the seminar, both valuable and rewarding. Our wish is that all participants would enjoy this seminar, improve their knowledge and experiences.

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The 5E learning cycle model in an effort to foster students' mathematical communication skills viewed from academic level

The 5E learning cycle model in an effort to foster students' mathematical communication skills viewed from academic level

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Abstract. This study aims to analyze the effectiveness of the 5E Learning Cycle model in developing mathematical communication skill of junior high school students. This research is Quasi Experiment. The design of this study is nonequivalent control group design. The population of this research is all eighth grade students of SMP Negeri 5 Pekanbaru. Samples were selected using purposive sampling. Class VIII.2 as an experimental class with 36 students and class VIII.1 as a control class with 36 students. Data collection instruments are tests and observation sheets. The test is used to see the score of students' mathematical communication skills to be analyzed with descriptive statistics and inferential analysis. Observation is used to see the implementation of the 5E Learning Cycle model on teacher and student activities. The data analysis technique uses percentages and t-test, and the observations are analyzed in percentages and categorized qualitatively. The findings showed that there is a significant effect of the LC 5E model on the mathematical communication skills of Grade VIII students of SMP Negeri 5 Pekanbaru. Especially for high academic level, there is no significant effect of the 5E Learning Cycle model on the mathematical communication skill.

1. Introduction

Mathematics is an invaluable tool for communicating ideas clearly, precisely and concisely. Basically, it is not a difficult subject if it is studied systematically and understood every step. This subject seems difficult because the teacher does not guide students in understanding the lesson, the teacher only requires students to be able to solve the problems given [1,2].

Basically a teacher is a communicator [3]. The learning process that takes place in the classroom is a communication process. In the context of educational communication, a teacher fulfills all the prerequisites for effective communication in delivering lessons. Otherwise, the learning process will be difficult to achieve maximum results.

Mathematical communication is the ability to express mathematical ideas coherently to friends, teachers, and others through spoken and written language [4]. Communication about mathematics refers to how students are able to understand the concepts of mathematics, communication in mathematics means writing symbols that can be understood from mathematics, and communication with mathematics is verbal communication, explain what is perceived about the concept of mathematics itself [5]. Furthermore, mathematical communication is the ability to communicate which includes the activities of using the skills of reading, writing, listening, studying, interpreting, and evaluating ideas, symbols, terms, and mathematical information observed through the process of listening, presenting, and

discussing [6]. Through these mathematical communication skills students can develop mathematical understanding when using the correct mathematical language to write about mathematics, clarify ideas and learn to make arguments and present mathematical ideas verbally, pictures and symbols.

Mathematical communication skill is the ability to convey mathematical ideas both verbally and written [5]. Mathematical communication skill can be developed through the learning process at school, one of which is through learning mathematics. This occurs because one of the elements of mathematics is the science of logic that is able to develop students' thinking abilities. Thus, mathematics has an important role in the development of mathematical communication skills.

Mathematical communication needs to be focused in mathematics learning, because through communication, students can organize and consolidate their mathematical thinking and students can explore mathematical ideas [7]. Communication becomes an integral part of human life. Most of human life is filled with communication, where humans can exchange information, share, develop themselves, etc.

Communication ability is considered necessary in our real life, as many misleading incidents are often caused by miscommunication or misinterpretation of received information. Look at this simple incident as example. When someone tells us that certain area has been under fire and then we directly call the fire brigade without further clarification, we may end up in trouble as the fire fighters have come for nothing. For this reason, information should be received properly and then reacted accurately. Similarly, this communication skill is also essential in mathematics learning. Misinterpretation of mathematical information, either in oral or written form, may lead to misleading results. Therefore, communication ability is urgently needed in all aspects of life, particularly in the process of mathematics learning [8].

In this study, researchers did not use all indicators of communication skills. The indicators of mathematical communication skill discussed by researchers are: 1) Explaining ideas, situations, and mathematical relations in line or writing with real objects, pictures, graphics or algebraic forms; 2) Stating daily events in mathematical language or symbols; 3) Read the written mathematical presentation and arrange relevant questions.

Based on the information from mathematics teachers at SMP Negeri 5 Pekanbaru, the mathematical communication skill of Grade VIII students is still relatively low. Students still have difficulty in conveying mathematical ideas both orally/written from contextual events. Then the ability of students to use symbols / notations and mathematical language and the ability of students to read written mathematical presentations and arrange relevant questions.

The 5E Learning Cycle Model (5E LC) is a model that can make students participate actively in mastering and achieving competence because this model is student-centered [9]. The 5E model consists of several steps. First, the teacher tries to arouse interest in students' curiosity about the topic being taught. Second, students are invited to explore about the learning topics that will be discussed. Third, students explain a concept with their own sentences / thoughts. Fourth, students apply the concepts they have learned in new situations. Fifth, evaluating.

5E LC model is a learning model with a constructivism approach [10]. The learning cycle in the constructivism approach consists of three stages: exploration, concept introduction, concept application. In the next process, the three stages of the cycle undergo development. The three cycles are developed into five stages consisting of: engagement, exploration, explanation, elaboration / extension, and evaluation [11]. After the implementation of the 5E LC model, it is expected that it can improve students' mathematical communication because learners are actively involved in the learning process. Students are able to express mathematical ideas verbally/written, and be able to demonstrate and visualize. Based on the steps of the 5E LC model in mathematical communication skill, students' mathematical communication skills are verbally optimized at the exploration and explanation stages. As for writing, it is optimized at the elaboration stage. The other study results of [5] communication skills developed through problem-based learning models and research results of [12] communication skills that cannot be improved through Geogebra-assisted direct learning.

Mathematical communication needs to be the focus of attention in Mathematics learning, because through communication, students can organize and consolidate their mathematical thinking. In addition, students can explore mathematical ideas [13]. Communication skills need to be acquired by students to improve students' understanding of the usefulness of mathematics itself [14]. The low mathematical communication skills of a student is very important to note. Because of the importance of these

mathematical communication skills, an educator must understand mathematical communication and know the aspects or indicators of mathematical communication [8]. Therefore, the aim of the study to analyze the effectiveness of the 5E Learning Cycle model in developing mathematical communication skill of junior high school students, overall and based on academic level.

2. Method

This research was conducted at SMP Negeri 5 Pekanbaru in the even semester of the 2018/2019 academic year, starting on February 19, 2019 until March 13, 2019. The research was Quasi Experiment using Nonequivalent Control Group Design. The population in this study were all eighth grade students of SMP Negeri 5 Pekanbaru in the 2018/2019 academic year. The sampling technique used in this study was purposive sampling techniques based on certain considerations and certain characteristics [15]. The experimental class is class VIII.2 consisting of 36 students and the control class is class VIII.1 consisting of 36 students. The instrument of this study was the test and observation sheet. Data analysis techniques are descriptive analysis and inferential analysis. There are three stages carried out by researchers, namely: normality test, homogeneity test, and average test of mathematical communication skills (t-test).

3. Result and Discussion

3.1. Result

Before testing the difference in pretest data for the experimental class and the control class, the normality and homogeneity tests are first performed. From the results of the normality test it was found that the two classes were normally distributed, then the homogeneity test obtained the variance of both homogeneous classes. Because the pretest data meets normality and homogeneity, the parametric test used is the t-test, the result is $t_{calculate} < t_{table}$ then the conclusion H_0 is accepted. This means that there is no difference between the mean score of students in experimental class and control class before the treatment is given.

Same with the pretest data, for the posttest data also before the pretest data difference test is performed for the experimental class and the control class, then the normality test and homogeneity test are performed first. From the results of the normality test and the homogeneity test it is found that both classes are normally distributed and the variance of both classes is homogeneous. Because the pretest data meets normality and homogeneity, the parametric test is used t-test (Table 1.)

Table 1. T-test Data of Post-test in Experimental and Control Classes.

Classes	N	$(\bar{x})$	S_{gab}	$t_{calculate}$	t_{table}	Conclusion
Experiment	36	72,56	12,32	2,049	1,667	H_0 rejected
Control	36	66,61				

Based on Table 1, it can be seen that $t_{calculate} > t_{table}$, therefore H_0 is rejected and H_1 is accepted. So it can be said that the mean score of the experimental class using the 5E LC model is better than the mean score of the control class using conventional learning model. So, it can be concluded that there is an influence of students' mathematical communication skills after applying the 5E LC model. Next, to see the effect of the 5E LC model for each student's academic level, namely high, medium and low academic levels, a t-test is performed for each academic level. The results can be seen in the Table 2.

Table 2. T-test Data of the Post-test In Experimental and Control Classes for All Academic Levels

Classes	**Academic Levels**	**N**	$(\bar{x})$	S_{gab}	$t_{calculate}$	t_{table}	**Conclusion**
Experiment	High	11	86,45	6,24	1,969	2,073	H_0 accepted
Control		11	81,18				
Experiment	Medium	14	72,42	3,77	5,414	2,048	H_0 rejected
Control		14	64,71				
Experiment	Low	11	58,81	6,40	2,929	2,073	H_0 rejected
Control		11	50,81				

Table 2 shows that $t_{calculate} < t_{table}$ for high academic level. Therefore, H_0 is accepted. This means that there is no difference in the mean score of students between the experimental class and the control class, while for medium and low academic levels, $t_{calculate} > t_{table}$. Therefore, H_0 is rejected. This means that there are differences in the average mathematical communication skills of students between the experimental class and the control class.

3.2. Discussion

The results of the mathematical communication skills of the experimental class and control class students before conducting the study were still relatively low. This happens because the learning process is still teacher-centered, in other words the teacher delivers the material directly. Consequently, students feel difficult to convey their mathematical ideas during the learning process. The learning model used by researchers as an alternative in learning is the 5E LC model.

The learning process using the 5E LC model was carried out in the experimental class. For each meetings, the researcher asked students to solve the problems in students' worksheet by discussing in groups using mathematical language and their own ideas. So learning becomes more meaningful. The following illustrates the students' answers in solving a problem.

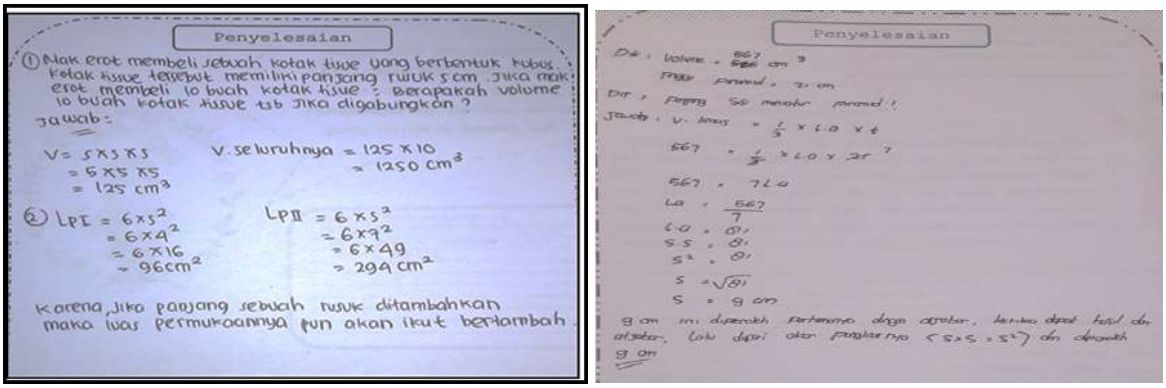

Figure 1. Student answers on cube and pyramid material

Based on Figure 1, the cube material shows students' answers during elaboration activity, where students have applied new concepts they have learned. In solving the problems, students can follow the activities given in their worksheets so that students do not experience difficulties. Students are able to arrange relevant questions and explain ideas in writing. While the pyramid material presents the answers of students who have followed the procedure and can choose the concepts appropriately in solving problems in the elaboration activity. Then students are able to explain conclusions based on mathematical ideas in writing exactly as the questions require.

Figures 2 illustrates the students' answers in high academic level in experimental class and control class. Based on the answers of these students, the experimental class and control class students did not have a significant difference, this shows that the students' mathematical communication skills between the experimental class and the control class did not differ. In question no.1, the indicator that students must achieve is to explain ideas, situations, and mathematical relationships verbally or in writing with real objects, pictures, graphics or algebraic forms. The students are to meet the indicators of mathematical communication skill.

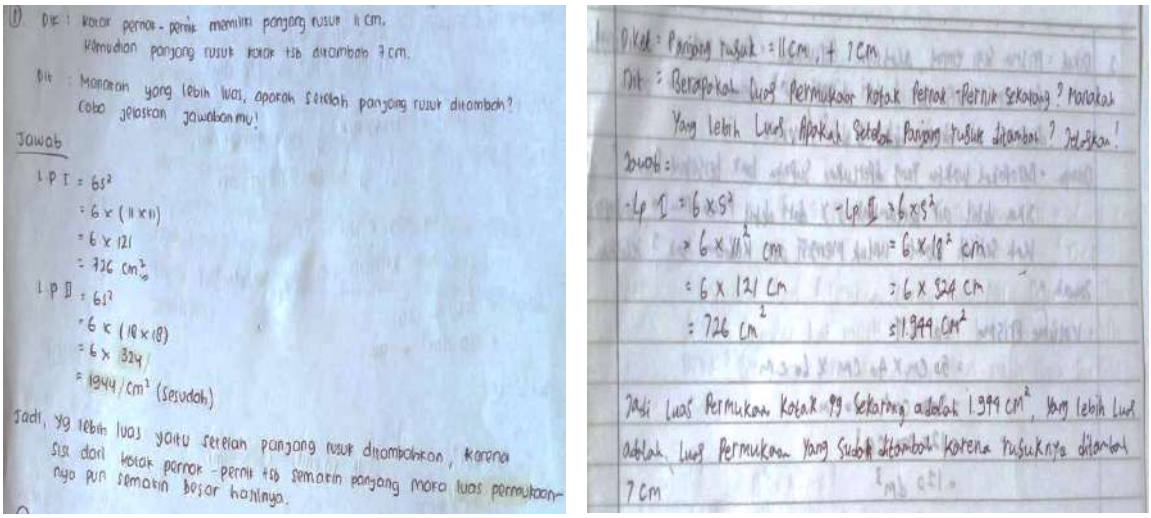

Figure 2. High level experimental and control class students' answers to question no. 1 to describes ideas, situations, and mathematical relations verbally or in writing with real objects, pictures, graphics or algebraic forms.

Figure 3 presents the students' answers in medium academic level in experimental class and control class. Based on the answers of these students, there were differences in the experimental class and the control class. In the experimental class, the students were able to solve the given problem, but there were still some shortcomings. For example, finding the initial time before adding debit. As for the control class, students are right in answering the question, but the student is only looking for the initial time without looking for the difference requested by the problem. Both the experimental class students and the control class students have met the mathematical communication ability indicators so that it shows that the students' mathematical communication skills in the experimental class are better than the control class students.

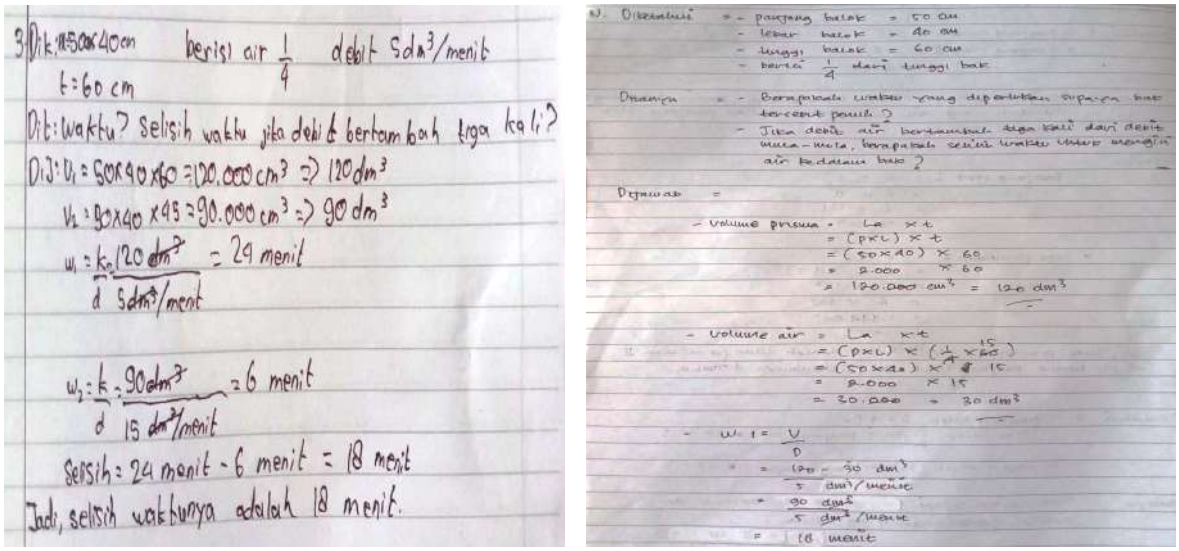

Figure 3. Medium level experimental and control class students' answers to question no. 3 on the indicator stating daily events in mathematical language or symbols

Figure 4 shows the answers for the students with low academic level in experimental class and control class. Based on their answers, there were differences in the experimental class and the control class. In the experimental class, the students were less able to complete the questions given, so they did not match the indicators requested by the questions. But the formula to find the surface area of the field is right. It's just that the student is not right to analyze the questions. As for students in the control class, these students are less precise in using the formula so that the questions are not solved in accordance with the requested procedure. So, it shows that the mathematical communication skill of students in the experimental class is better than the control class.

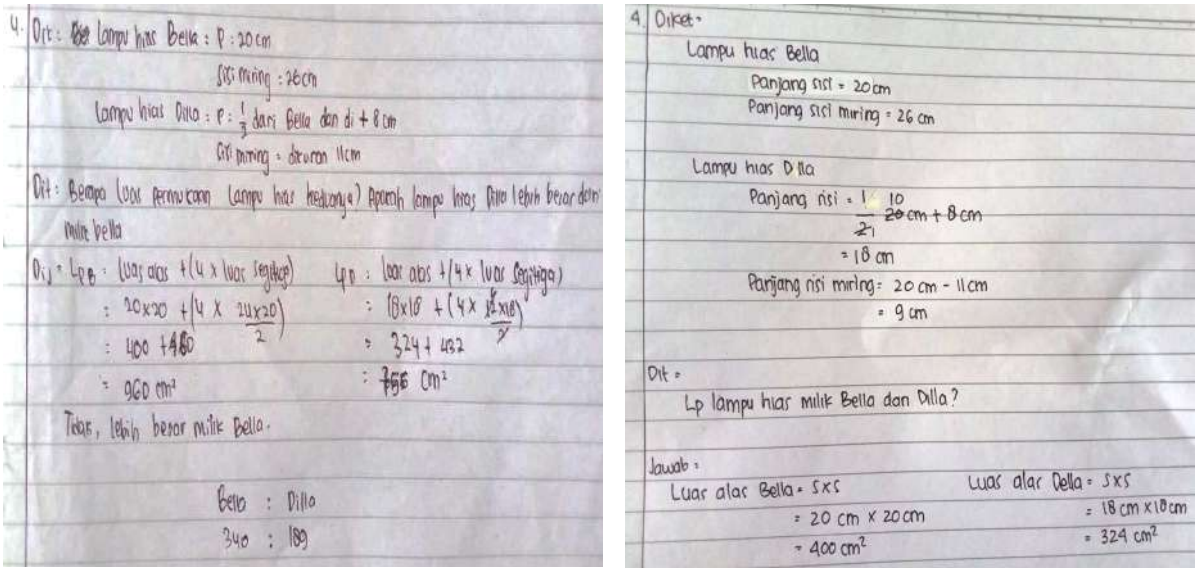

Figure 4. Low level experimental and control class students' answers to question no. 4 on the indicator stating daily events in mathematical language or symbols.

Based on the results of data analysis, it can be seen that the mean score of experimental class students is 72.56. While the mean score of mathematical communication skills of control class students is 66.61. From the results it can be concluded that the mean score of the experimental class students is higher than that of control class students. This is in line with the results of hypothesis testing where H_1 is accepted. The hypothesis H_1 is the mean score of the experimental class is better than the control class. Therefore, the 5E LC model can improve mathematical communication skill.

The research findings coincide with the study on 5E LC model. There was an improvement of students' mathematical communication after the model was implemented. The 5E LC model is better than conventional learning because the students' mathematical communication skill increases [16]. Then, it is also in line with this study that using the 5E LC model can improve students' mathematical communication skills, because the application of the 5E LC model in the experimental class helps students to build their own knowledge and communicate what they have acquired [17]. The research result of [18] that there is an increase in mathematical communication skills of students whose learning with a scientific approach through the 5E LC model is better than that through the direct learning model. According to Sumarmo [19] in the learning process through the 5E LC model with a scientific approach, students are more active and think critically in solving contextual problems in daily life related to statistical material. In this case the teacher is only as a facilitator in providing assistance (scaffolding) to students when experiencing difficulties.

In terms of the students' academic level, the 5E LC model does not have a significant influence on students' mathematical communication skill for high academic level. In other words, the 5E LC model has higher influence on students at low and medium levels. It shows that the mathematical communication for high level students doesn't quite improve with the LC 5E model because it is more

suitable for written communication. Usually high level students aren't careful and like to rush in writing the answers so that the results are wrong. However, for oral communication, students from high level have better communication than students from medium and low levels. It was observed during the learning process, high level students dominate learning when asked to explain the material. Meanwhile, medium and low level students listen more and take notes. This is supported by the study conducted by [18] that the mean score of oral communication in the high academic level is higher than the low level.

From the result of data analysis, it is accepted that there is a significant effect of the 5E Learning Cycle model on the mathematical communication skills of Grade VIII students of SMP Negeri 5 Pekanbaru.

4. Conclusion

The mathematical communication skill of students using the 5E LC model is better than using conventional learning. It can be concluded that there is a significant effect of the LC 5E model on the mathematical communication skills of Grade VIII students of SMP Negeri 5 Pekanbaru. Especially for high academic level, there is no significant effect of the 5E Learning Cycle model on the mathematical communication skill.

5. Acknowledgments

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