
Improving of Motivation and Learning Achievement of Mathematics by Using Missouri Mathematics Projects (MMP) of Learning Models and High Order Thinking (HOT) on Limit Trigonometric Topic

Siti Misi Akhidah, S.Si, M.Pd
Guru SMA NEGERI 3PEKANBARU
Email: Natasya.missy@gmail.com

Abstract. Motivation and student learning achievement are still low. One of the efforts taken by teacher in the 4th industrial revolution learning process is to use Missouri Mathematics Projects (MMP) of learning models and high order thinking on the topic limit trigonometric. The goal is to guide students to critical, creative, collaborative and innovative thinking skills to get the concept of limit trigonometric topic. This is a class action research on learning mathematics. The subject of this research is students of class XII IPA 2 SMA Negeri 3 Pekanbaru. The research consists of two cycles. Each cycle consists of four stages: review, development, drill, seatwork. Based on the results of the study, motivation and learning achievement can be improved by using MMP of learning models. This can be seen from the increases of learning motivation which increasing from cycle I to cycle II by 10% and result of learning increases from cycle I to cycle II equal to 27,78%. Improve of learning achievement is easy to achieve because in the use of this model students can connect, collaborate and teach each other about case limit trigonometric. The use of MMP is designed to make the student solve a lot of cases.

1. Introduction

1.1 Background

Today, the student are more complicated. The student to be born into the world with smartphone, tablets and computer. The student prefer hand on learning. They are social entrepreneur and like their learning to have meaning and purpose. The student are born into an information revolution. It is the reason that make the student have low motivation and learning achievement in the class. Because the teacher are still not open minded to the class. The teacher are not making the student practise their lesson and teach each other. So, as a teacher we have a big problem to make the student apply core skill to every day task, how to make the student approach complex challenges and approach their changing environment. The teacher need to change our style to teach. The teacher have to learn how to come in 4th industrial revolution.

In fact, the problems encountered in class XII IPA 2 SMAN 3 Pekanbaru, the motivation and learning achievement of students in the mathematics learning process are still low. Low student learning achievement can be seen in the following table:

Table 1. Average Daily Test Score for Mathematics Subjects

No	Topic	Number of Students Completed		of Students Not Completed	
		Person	%	Person	%
1	Limit Trigonometri	10	30,3	24	69,7

Table 1. The learning achievement of class XII IPA 2 are presented in mathematics with 34 students and KKM 80 in the odd semester of TP. 2018/2019 SMA 3 Pekanbaru.

As many as 69.7% of students did not complete the topics limit of trigonometric. So if it is based on complete learning standards, 90% of students 90% of competencies / objectives (Ministry of National Education, 2009), the learning achievement achieved by students of class XII IPA 2 in mathematics learning are still low. This is due to the low activity and learning achievement of mathematics in the topic limit trigonometric in that year. Therefore, the authors try to improve these conditions by making a few changes. Changes made are by using the Missouri Mathematics Project (MMP) model in the Limit trigonometric topic by incorporating aspects of critical thinking and creative thinking as indicators of higher order thinking.

1.2. Problem Identification

Based on the above problem identification, the authors can identify the problems that arise likes: Motivation learn math students not optimal, student learning achievement have not been optimal. The student are still not connect, collaborate and teach each other in the classroom, active students are few, learning model that has been applied has not been able to achieve the expected goals.

1.3. Research Objectives

The purpose of this research are improving of motivation and learning achievement of students in class XII IPA 2 of SMA Negeri 3 Pekanbaru using the Missouri Mathematics Project (MMP) model and High Order Thinking (HOT). However, this study also using critical and creative thinking as a the implementation in 4th Industrial Revolution. The Skill of student to thrive in 4th Industrial Revolution : Complex problem Solving, Critical Thinking, Creativity, People Management, Coordinating with others, Emotional Intelligence, Judgement and decision making, Service Orientation, Negotiation, Cognitive Flexibility

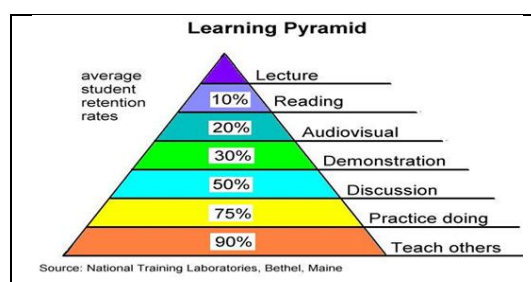
According to Siswono (2018), Critical thinking and creative thinking are representative of higher order thinking. That is because thinking ability is the highest cognitive competency that students must have in class. Thus, it can be said that higher order thinking consists of critical thinking and creative thinking.

Siswono (2018) explains too that critical thinking is a process of using thinking skills effectively to help someone make something, evaluate, and apply decisions according to what is believed or done. Some skills related to critical thinking are comparing, distinguishing, estimating, drawing conclusions, influencing, generalizing, specializing, classifying, classifying, sorting, predicting, validating, proving, connecting, analyzing, evaluating patterns."

Creative thinking is a series of actions taken by people using their intellect to create new ideas from a collection of memories that contain various ideas, information, concepts, experiences, and knowledge.

This understanding shows that creative thinking is marked by the creation of something new from the results of various ideas, information, concepts, experiences, and knowledge that exists in those mind.

The choice of MMP learning model is because this model has several advantages such as: the topic received by students are more than the time to explaining the topic is 50% of the total allocation of learning time. This time is used to obtain more topic. In addition, students can also develop topic of limit trigonometric from questions presented during the learning process. Another advantage can make students skilled in solving the problems. Project assignment learning takes the form of exercise to ask students are complete it. During the question activity, students help each other and exchange the ideas to solve the problem that given. Its equal with the learning pyramid that student teaching each other is the main goal. The practice of exercises and sharing the problem solving processes make students skilled in working on various existing problems.



So it is clear that the use of the Missouri Mathematics Project (MMP) learning model will create classrooms in which students will be active participants not just passive observers, and responsible for their learning. The application of the Missouri Mathematics Project (MMP) learning model will greatly help teachers to make students more confident in overcoming various problems that arise because students get used to dealing with various problems.

2. Methodology

2.1. Form of Research

This research is a class action wherein this classroom action research is a practical research that aims to improve and to overcome the weaknesses in learning in the classroom. By implementing this activity is expected to find a solution that can solve the problems that exist in learning in the classroom.

2.2. The Missouri Mathematics Project (MMP) Learning Model

The Missouri Mathematics Project (MMP) learning model is one of the learning models that is oriented to problem solving. Learning activities facilitate students to understand various mathematical problems that are solved individually and in groups.

2.3. Characteristics of the MMP Learning Model

According to Tiasto and Arliani (2015: 1192) the characteristics of the MMP learning model are the existence of project assignments. This is indicated by the presentation of a math project assignment sheet containing practice questions applying the mathematical topic that must be completed by students. The project work is carried out in groups. This group learning activity enables to emergence some of various ideas and opinions of students, in developing topic through mathematical problems.

The hope of developing topic through these problems is to make students more skilled in solving mathematical problems. This activity becomes the experience of students in exchanging ideas and training to work on various forms of mathematical problems. The results of the group study are applied in other math problems that are done individually. It aims to better understand the concept of mathematical topic in every student. Students can self-correct about the topics that has been understood and not understood.

2.4. Syntax of the MMP Learning Model

The MMP learning model has several stages of learning, as follows (Tiaso and Arliani, 2015)

a. Introduction / Review

Learning begins with recalling the previous topic related to the one that will be discuss. Previous topic was a prerequisite for working on new practice questions. Motivation at the beginning of learning can arouse students' enthusiasm to carry out learning activities and solve practice questions. Motivation is done by opening up insights on the importance of teaching topics in life.

b. Development

The development stage is the learning phase to develop previous topic in order to obtain new topic. Learning is done by a process of explanation and discussion. An explanation process where students get new topic used in the discussion process of the question exercise.

c. Training with Teacher guidance / Cooperative work

Students are presented a project sheet that must be completed in groups. The project worksheet contains a series of questions based on topic that students have obtained in the previous stage. The teacher monitors and guides group activities to avoid misconceptions.

d. Seatwork / Independent Work

After students have done the group activities to complete the set of questions, the students then develop the topic by completing the problem exercises independently or individually. Students apply topic that has been understood from the process of explanation and group discussion. Because the process of repeating the completion of various kinds of problems makes students become trained so that they can increase the speed in solving the next questions. This is very useful for students in the future when undergoing the National Examination or college entrance test because at that time students are required not only to answer but also must have speed in completing various questions given.

At this stage the author gives students the freedom to search for themselves the questions related to limit trigonometric both from textbooks or searching the internet but prioritizing HOTS questions. This is done so that after this learning finished, students know that wherever they find questions related to the topic being studied they can solve those questions, so that confidence is expected to emerge in the topic that has been learned.

e. Cover

In the final stage of learning, students make a summary of the topic that they have obtained from various activities. In addition, students are given assignment projects to do at home if needed.

2.2. Location and Subject Research

This research was carried out in class XII IPA 2 of SMA Negeri 3 Pekanbaru. This research was conducted in the odd semester of 2019/2020 on the subjects of mathematics, which implemented in line with the implementation of learning in the classroom. The subjects of this study were the students of class XII IPA 2 of SMAN 3 Pekanbaru, amounting to 36 students.

2.3. Research Cycle

Planning Stage consists of creating a Lesson Plan (RPP), learning motivation indicators, an observation sheet of learning activities, and an observation sheet on the ability of students in solving the given problem. The action stage consists of review, development, drill, and seatwork. Observations made was the observation process of the implementation of mathematics learning using Missouri Mathematics Project (MMP) learning model. Media of teaching using observation sheet, activity and student motivation sheet. After the data is collected in cycle I, the data was analyzed by the researcher along with the observer, the weaknesses that occur in cycle I set the actions to overcome these deficiencies for the next cycle.

2.4. Research Instruments

Instruments in this class action research are as follows: Lesson Plan (RPP), students' paper test, Observation sheet, teacher activity sheet, field note sheets.

2.5 Data analysis technique

Data Analysis Techniques Motivation and Student Learning achievement:

Average value = (number of observed values) / (ideal number of values) x 100%

Information :

76% - 100% = High Once

56% - 75% = Height

26% - 55% = Low

0% - 25% = Low Once

3. Research and Development Results

3.1. Research Results

Based on the problems in learning, an action has been planned consist of planning, implementation, observation, and reflection, so that students can improve motivation and learning achievement.

3.1.1. Description of Cycle I

All topics and methods that have been used in the work must be stated clearly and subtitles should be used when necessary.

a. The first meeting

The first meeting was held on Friday, Juli 19 2019. At the beginning of learning the teacher conveyed the learning objectives on the subject limit trigonometric so that students can solve problems related to limit trigonometric.

As an apperception at the beginning of the review stage, the teacher gave several questions related to the concept limit trigonometric. At the development stage, the teacher formed students' learning groups into 5 groups where each group consists of 6 students. Each group was given questions and each group worked on the problems by first doing a literacy process related to the questions given. Literacy can be as diverse as book literacy or website literacy by searching on the internet using each student's mobile phone. The teacher acts as a facilitator in learning activities and monitors the discussion. The teacher provides guidance to groups who had difficulty in carrying out procedures for solved the given problem.

After completing the questions the students are directed to arrange each answer about the questions given and present the results of group work in front of the class. The presentations were conducted by several groups and the teacher acts as a facilitator if there are mistakes in the concepts conveyed by students.

After completing the questions in groups, the teacher gives seatwork to students in the form of questions to be done individually as a stabilization for students in working on various kinds of problems related to limit trigonometric. The teacher provides guidance to students in order to build discipline in working on problems individually.

In the closing stage, students were asked to summarize and make important notes of learning activities and the teacher provides exercises to do at home so that students understanding the subject matter that is given.

b. Second meeting

The second meeting was held on Thursday, July25, 2019. At the beginning of the meeting the teacher said that students would learn about solving the problem of the limit trigonometric and learning objectives on that day. As an apperception, the teacher appoints several students to make the homework results that have been given.

c. Student Learning Achievement

Student learning achievement in this study can be seen from the score of understanding of mathematical concepts in the test carried out at the end of the first cycle, the assessment was carried out in accordance with the criteria and scale specified. Learning achievement of students in the first cycle can be seen in the table below:

Table 2. Student Learning Achievement in Mathematics Learning Using MMP Model Cycle 1

Kategori	Jumlah Siswa	Persentase	Ketuntasan
Nilai \geq 80	17	47,22	Tuntas
Nilai $<$ 80	19	52,77	Tidak Tuntas

d. Reflection

In the reflection stage, various obstacles and problems encountered during the first cycle were collected, the alleged causes of the obstacles were then analyzed and the solution was found so that improvements were made in cycle 2.

3.1.2. Description of cycle II

To carry out learning that has been prepared, it is necessary to pay attention to the presentation of topic that is appropriate to student development. The implementation in cycle II corrects the weaknesses and shortcomings that occur in cycle I. In the implementation of this cycle II, the activities that are focused on are carrying out preliminary activities, core activities that are in accordance with the MMP model and closing activities. The ar of activities was more focused on improvements to the weaknesses identified in cycle I. Cycle II consisted of two meetings, after two meetings a cycle II test was held.

a. The first meeting

The first meeting in the second cycle was held on Thursday, Agustus1, 2019. At this meeting the teacher reminded that the learning to be carried out that took place was still using the MMP model and asked students to concentrate and discipline in carrying out learning activities.

b. Second meeting

The second meeting was held on Friday, Agustus9, 2019. Based on observations at the second meeting, the teacher's activities applying the MMP model by incorporating elements of high order thinking were carried out according to plan. Activities of students in the question and answer experience increased because students have understood the topic provided through the method used. For the activities of practicing the steps MMP has increased and the presentation of the work by students has increased because students have begun to get used to the methods and concepts applied.

c. Student Learning Achievement

Table 3. Student Learning Achievement in Mathematics Learning Using MMP Cycle II Model

Kategori	Jumlah Siswa	Persentase	Ketuntasan
Nilai \geq 80	27	75	Tuntas
Nilai < 80	9	25	Tidak Tuntas

During the second cycle of learning, gradually the level of understanding of students' concepts increases marked by an increase in the ability of students to analyze the concepts of limit trigonometrics.

d. Reflection

In the reflection stage, various obstacles and problems encountered during the second cycle were collected, the alleged causes of the obstacles were then analyzed and the solution was found. When reflecting, the researcher uses the reflection guidelines as listed in the appendix. From the results of the study, it can be concluded that the motivation and learning achievement of students have increased. Activities and learning achievement of students have reached the criteria determined in this study so that research can be stopped.

As one of the learning models of the many existing learning models the Missouri Mathematics Project (MMP) model places the teacher as a facilitator, the teacher guides students which needed. In this method students were encouraged to solve their own problems, analyze themselves so they can find a concept and solve problems that have been given by the teacher individually or in groups.

The teacher as a facilitator helps students to have the character of discipline to think at a high level, namely to think critically and creatively in order to understand the concepts and skills that students have previously had to gain new knowledge. Thus increasing learning activities and is expected to ultimately improve student learning achievement.

3.2 Discussion

a. Student Learning Activities

Increased student activity in cycles I and II can be seen in the following table:

Table 4. Comparison of Student Activities in the Learning Process with MMP Model Cycle I and Cycle II

No	Aktivitas Yang Diamati	Siklus I (%)	Siklus II (%)	Peningkatan (%)
1	Tanya jawab antar peserta didik dan antara peserta didik dengan guru	64	76	12
2	Mengerjakan dan mendiskusikan LKS yang diberikan dalam kelompok	80	84	4
3	Mempraktekkan langkah-langkah model MMP sesuai petunjuk pada LKS	86	90	4
4	Menyajikan hasil kerja kelompok di depan kelas	80	100	20
5	Mengerjakan soal-soal secara mandiri dengan kedisiplinan	60	70	10
6	Menyimpulkan materi pelajaran	84	90	6

In the activity concluded the subject matter with the teacher during the learning process continued to increase. Even at the end of learning using the MMP model, almost all students were involved in inferring the topic.

b. Student Learning Achievement

In addition to knowing the increase in learning activities of students, in this research also saw an increase in student learning achievement seen from the ability to understand mathematical concepts of students. Following this, a discussion of student learning achievement, carried out in cycles I and II.

Table 5. Comparison of Student Learning Achievement in the Learning Process with MMP Model Cycle I and Cycle II

Kategori	Jumlah Siswa		Persentase		Ketuntasan
	Siklus I	Siklus II	Siklus I	Siklus II	
Nilai \geq 80	17	27	47,22	75	Tuntas
Nilai <80	19	9	52,77	25	Tidak Tuntas

In accordance with the appendix about the recapitulation of student learning achievement, it is also known that the learning achievement of students in the first cycle reached an average of 47,22 and in the second cycle reached 75. This illustrates that most of the students have obtained learning achievement above the KKM. Improved learning achievement can also be seen from the following graph:

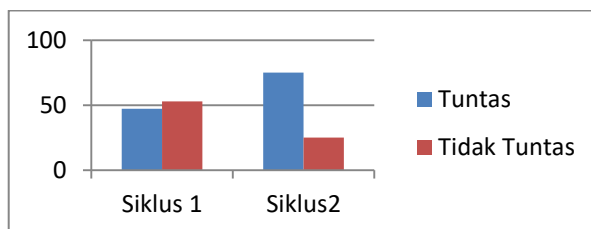


Figure 2. Percentage of Student Learning Achievement

Increased student learning achievement, seen from the better ability of students to define, identify concepts, recognize the correct calculation procedures and draw conclusions from the results of group work. However, the ability of students according to the criteria for understanding the concept is still sharpened again so that students are accustomed to understanding the concepts of mathematics.

4. Conclusion

4.1 Conclusion

The result of research by applying high order thinking skills using the Missouri Mathematics Project (MMP) model in the mathematics subject limit trigonometric in class XII IPA 2 SMA NEGERI 3 PEKANBARU TP. 2019/2020, the following conclusions are obtained.

- a. The application of the Missouri Mathematics Project (MMP) Model by high order thinking can improve the learning activities of students in class XII IPA 2 of SMA NEGERI 3 PEKANBARU on the topic limit trigonometric. Student activities have increased from cycle I to cycle II. on the six indicators observed namely working on and discussing HOT questions, practicing the steps of the MMP model, presenting the results, working on the questions individually, concluding the topic with the teacher.
- b. The application of the MMP model and high order thinking can improve the learning achievement of students in class XII IPA 2 SMA NEGERI 3 PEKANBARU on the topic limit trigonometric. In the first cycle, the number of students who completed reached 17 people or 47.22 percent, and in the second cycle the number of students who completed increased to 27 people or 75 percents.

4.2. Suggestions

Based on the results of research conducted in class XII IPA 2 SMA NEGERI 3 PEKANBARU on TP. 2019/2020, suggestions can be made as follows:

1. In applying learning with the MMP model by high order thinking, teachers should make careful planning so that learning runs systematically. Careful planning makes effective use of time.

-
2. To guide students to make discoveries, teachers are advised to make questions that require students to think at a high order thinking (HOT) to lure students to find the right answer.

References

- Adisusilo, Sutarjo. 2017. *Pembelajaran nilai karakter*. Jakarta. PT. Raja Grafindo Persada
- Danoebroto, S.W. 2015 Teori Belajar Konstruktivistik Piaget dan Vygotsky. *Indonesian Digital Journal of Mathematics and Education*.
- Hamdayana, J. 2014. *Model dan metode Pembelajaran Kreatif dan Berkarakter*. Bogor: Ghalia Indonesia.
- Isrok'atun, Amelia. 2018. Model-model Pembelajaran Matematika. Jakarta; Bumi Aksara
- North, Alfred, 2018. *The aims of Education*. New York. The free Press a Division of Macmillan Publishing Co, Inc.
- Rochani, A. 2016. "Keefektifan Pembelajaran Matematika Berbasis Masalah dan Penemuan Terbimbing Ditinjau dari Hasil Belajar kognitif Kemampuan Berfikir Kreatif". *Jurnal Riset Pendidikan Matematika*.
- Rusman. 2017. *Model-model pembelajaran Mengembangkan profesional guru edisi kedua*. Jakarta: PT. Raja Grafindo Persada.
- Sadewo, Sri. 2016. *Meneliti itu mudah*. Surabaya. Unesa University Press Sadiman, Arif, dkk. 2011. *Mediependidikan*. Jakarta: PT Raja Grafindo Persada.
- Sardiman, A.M. 2010. *Interaksi dan Motivasi Belajar Mengajar*. Jakarta: PT. Raja Grafindo Persada
- Siswono, Tatag Y.E. 2018. *Pembelajaran Matematika Berbasis Pengajaran dan Pemecahan Masalah*. Bandung: PT Remaja Rosdakarya.
- Trianto, 2009. *Model-model pembelajaran Inovatif Progresif*. Surabaya: Kencana Prenada Media Group.
- Vlassi, M. Dan Karaliota A. 2013. The Comparison Between Guided Inquiry and Traditional Teaching Method. *Acasestudy for the Teaching of The Structure of Matter to 8th Grade Greek Student*". *Jurnal: Social and Behavioral Sciences*.