Implemantation of Inquiry Learning Strategy in Base Microbiology Experiment on the Learning Material Optimation Growth Temperature in Order to Increase the Study Result and Activity of Students in Biology Education Program

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Abstract: This study aims to apply the inquiry model in the lecture material for bacterial growth temperature optimization, as well as prove an increase in student learning outcomes after applying the inquiry learning model. The form of this research is classroom action research (CAR). This research was carried out in two cycles, with the stages of each cycle including planning, action, observation, and reflection activities. From the results of this study can be known the percentage of classical completeness from the pre-test, cycle I, and cycle II. In the first cycle pre-test, the average score of students reached 60.4. Furthermore in the post-test cycle I increased to 79.1. This means an increase of 19 points. Then in the pre-test cycle II the average grade reached 58.8. While the post-test cycle II increased to 76.4. This means an increase of 19 points. From this explanation it can be said that the application of inquiry learning models to improve learning outcomes of bacterial growth temperature optimization material can be said to be successful because, it can exceed the achievement indicator targets previously set, namely the average grade value ≥ 65.
Keywords: Inquiry learning, student's activities, Result of Study

1.Introduction

The inquiry model is a learning process built uponquestions asked by students. Students are encouraged tocollaborate to solve problems, not just acceptdirect instruction from the teacher. Teacher's task in the learning environmentbased on this question is not to provide knowledge, howeverhelp students go through the process of discovering their own knowledgethey are looking for. The teacher functions as a facilitator and is not a source of answers.

Inquiry Based Learning is based on the thoughts of John Dewey, a personAmerican education expert, who says that learning, development, and growth of a human being will be optimal when they are faced with real and substantive problems to be solved. Hebelieve that the curriculum and instruction should be based on assignments andintegrative community-based activities that involve learners in pragmatic social actions that bring tangible benefits to world. Inquiry assumes that the school plays the best possible role facilitate self-development. Therefore that, inquiry is student-centered, determining that students participate and actively in learning. Inquiry involves a search-surprise element, and this trait makes it highly motivating to students. No there is a collection of knowledge and skills that must be learned by all. The learning

process is seen as an important outcome like the product, for example what was learned. While the teacher in the Inquiry Based Learning model acts as a facilitator who provides challenges to students by helpingthey identify questions and problems, and guide inquiry which is conducted. Thus, the inquiry approach looks at students as thinkers who actively seek, examine, process data from the environment leads to the various destinations that are best suited to mental characteristics.

According to KhoirulAnam (2015),language, inquiry comes from the inquiry word which is the word,in English which means; investigation / requesting information;free translation for this concept is "students are asked to searchand find yourself. In the context of using inquiry asteaching and learning methods, students are placed as subjectslearning, which means that students have a big share indetermine the atmosphere and learning model. In this method, everystudents are encouraged to be actively involved in the teaching and learning process,one of them is by actively asking good questionsfor every material submitted and the question is notmust always be answered by the teacher, because all students haveequal opportunity to provide answers to questionssubmitted.

Characteristics of Inquiry Based Learning Models

Characteristics of Inquiry Based Learning models by Gulo (2002, p. 95) are as follows: a. driving question or problem, b. interdisciplinary focus, c. authentic Investigation, d. production of artifacts and exhibits, e. Inquiry Based Learning collaboration organizes teaching around discovery and solving problems that are socially important and meaningful personally for students. The problem being investigated was chosen because the solution requires students to explore many subjects. Investigation authentic who try to find real solutions to real problems.Participantsstudents must analyze and determine the problem, develop hypothesis and make predictions, collect and analyze information, carry out experiments, make references, and draw conclusions.

The results of investigations in the form of products in the form of understanding withconstructing things that can explain or represent solutions. The product can take the form of a fake debate, can be shaped reports, physical models, videos, or computer programs that will later described, designed by students to demonstrate to others what they have learned and provide alternatives refreshing for compulsory papers or traditional exams. Collaboration or cooperation provides motivation for ongoing engagement in complex tasks and increasing opportunities for dialogue together, and to develop various social skills.

Inquiry Based Learning Principles

Sagala (2009, p. 69) states that the principles of learning are used to experience changes in the old way approach to new ways, because this approach puts forward psychological studies. This approach refers to the condition and situation of students in the process learning, inquiry approaches put forward the study of psychology and refer to the conditions and situation of students in the process learning. Along with the times, approaches learning has undergone many changes. In this case Sagala (200 9, p. 69) identifies several principlesin the approach from the old way to the new way as follows:

a. The application of straightforward and straightforward teaching and learning principlesplanned.
b. Refers to the development aspects according to the level of participants Student

c. In the learning process respect individual students.
d. Paying attention to the individual objective conditions with a starting point onpersonal development of students.
e. Using teaching methods and techniques that are appropriatesubject matter.
f. Describe the concept of the problem with discipline.
g. Using standardized learning measurements and evaluationsmeasure learning ability.
h. Use of audio visual equipment by utilizing facilitiesand optimally available equipment.

The steps of Inquiry Learning

a. Orientation

The orientation step is a step to foster an atmosphere or climate responsive learning. In this step the teacher conditions so students are ready to carry out the learning process. Teacher stimulates and invite students to think about solving problems. Step orientation is a very important step. Success this strategy is very dependent on students' willingness to move using his ability to solve problems, without willingness and ability the learning process will not running smoothly.

b. Formulating Problems

Formulating a problem is a step to bring students to somethingproblems that contain puzzles. The problem presented is a problem that challenges students to think about solving the puzzle. It is said that the puzzle is in the formulation of the problem you want
assessed because the problem is of course there is an answer, and students encouraged to find the right answer. The process of finding answers that is very important in the inquiry strategy, therefore through this process students will gain experience very valuable as an effort to develop mentally through the process think.

c. Formulating Hypotheses

The hypothesis is a temporary answer to a problembeing studied. As a temporary answer, the hypothesis needs to be tested the truth. Estimates are not arbitrary hypotheses
estimates, but must have a solid foundation of thinking, so that the hypothesis raised is rational and logical.The ability to think logically itself will be greatly influenced bythe depth of insight possessed and the breadth of experience. Thus, every individual who lacks insight it will be difficult to develop a rational and logical hypothesis.

d. Collecting data

Collecting data is an activity that captures information needed to test the proposed hypothesis. In inquiry learning, collecting data is a mental process which is very important in intellectual development. Process Data collection does not only require strong motivation in learning, but also requires perseverance and ability to use his thinking potential.

e. Test the hypothesis

Testing the hypothesis is determining the answer that is consideredreceived according to the data or information obtained based on data collection. Testing hypotheses also means develop rational thinking skills. That is, truth the answer given is not only based on argumentation, it will but must be supported by data found and can accounted for.

f. Formulate conclusions

Formulating conclusions is the process of describing the findingsobtained based on the results of testing hypotheses. To achieveAccurate conclusions the teacher should be able to show onwhich student data is relevant.

Inquiry learning in Experiment activity of Biology Education

Studies in biology cover various aspects related to living things and their environment. One branch in Biology is microbiology, namely the branch of biology that studies microscopic organisms such as bacteria, viruses, protists and so on. In lectures at Higher Education, microbiology becomes one of the subjects taught. This course requires prospective teacher students to be able to understand aspects of microorganisms and their use that can be taught in the world of school. The function of this course is to develop knowledge, values, attitudes, and student skills in overcoming problems caused by microorganisms and able to utilize their potential in daily life

Lectures Basic microbiology is carried out in an integrated manner between theory and practicum so that students can directly apply the basic microbiological sciences that have been studied in order to improve their skills in the laboratory. Therefore learning performance is assessed from performances, products and portfolios.

Practicum in the Basic Microbiology course is very important because students are trained to develop experimental abilities by practicing their ability to observe carefully, measure accurately with simple or more sophisticated measuring instruments, use and handle tools safely, design, perform and interpret experiments . To realize this, one of the lecture strategies used is based on inquiry.

Practicum is an activity carried out by students and is an integral part of lecture activities. Practicum is very important because: (1) practicum generates motivation to learn science. Learning is influenced by motivation. Through practicum activities, students are given the opportunity to fulfill the urge of curiosity and want to be able to. This principle will support practical activities where students find knowledge through exploration of nature; (2) Practicum develops basic skills in conducting experiments. Conducting experiments is an activity that is widely carried out by scientists. To do experiments, some basic skills are needed such as observing, estimating, measuring, and manipulating science equipment. With practicum activities, students are trained to develop experimental abilities by practicing their ability to observe carefully, measure accurately with simple or more sophisticated measuring instruments, use and handle tools safely, design, conduct and interpret experiments; (3) Practicum becomes a vehicle for learning scientific approaches.

One of the materials that is often done with practicum in basic microbiology courses is the practicum of bacterial growth temperature optimization. It is known that temperature has a significant influence on bacterial growth. Temperature is an environmental factor that affects the biodegradation of hydrocarbon compounds. Especially for metabolic processes and bacterial growth rates. In general, an increase in temperature affects enzyme activity. Outside the optimum temperature bacterial growth becomes slow or no growth (Silvia, 2010). Temperature is one of the most important environmental factors that affect the growth of organisms. According to Abrar (2013) Temperature can affect microorganisms in two ways, namely when the temperature rises, the speed of the metabolism also decreases and growth is slowed.

This practicum has become one of the basic practicums in microbiology with the aim of studying the effect of temperature in bacterial growth. This practice requires good observation and good laboratory skills from students. The problem that often occurs in this bacterial temperature optimization practicum is that the material is fairly difficult to master and the practicum procedures are indeed many, ranging from sample dilution, isolation, purification to entering the optimization stage. This causes students to have difficulty understanding this material directly have an impact on learning activities that are sluggish and have low learning outcomes. For that, an appropriate learning strategy is needed that can increase student activity and learning outcomes in this material.

Difficulties in understanding this practicum make learning outcomes and student activities in doing so decrease. According to Silvi et.al (2015), the activities of students can be in the form of viewing activities (visual activities), activities in speaking (oral activities), activities in writing (writing activities), activities in listening (listening activities), activities in drawing (drawing activities), activities in motion (motor activities), activities in attitude (mental activities), and activities in emotions (emotional activities). According to Hamalik (1999) there are several benefits of learning activities. First, students have the opportunity to seek their own experience and experience it themselves. Then, students can work and learn based on their interests and abilities so that they are useful in the service of individual differences. The benefits of other learning activities are learning and learning activities carried out realistically and concretely which can develop students' critical thinking so that learning activities become more lively.

One alternative that can be developed to increase practical activities is the inquiry learning strategy. According to Sagala (2004) inquiry is a learning strategy that seeks to instill the basics of scientific thinking in students so that in the learning process, students learn more themselves, develop creativity in solving problems. Furthermore Haury (1993) stated that inquiry requires active involvement of students in learning. Garton (2005) the inquiry method has 5 common components namely Question, Student Engangement, Cooperative Interaction, Performance Evaluation, and Variety of Resouce.

In practicum activities students are required to formulate problems, design experiments, assemble tools, make careful measurements, interpret acquisition data, and communicate it through reports that must be made. Inquiry learning strategies can be developed for all courses including the Basic Microbiology course. Therefore in this study will be carried out "Implementation of Inquiry-Based Learning Strategies in the Implementation of Basic Microbiology Practicum Optimization of Bacterial Growth Temperature to Increase Student Activity and Learning Outcomes in Biology Education Study Program"

2. Methodology

The research method used is Classroom Action Research (CAR) with Pre-Experimental Design with the design of One-Group Pretest-Postest Design. This study uses the initial test given before the treatment and the final test given after treatment. Learning strategies implemented based on inquiry, with the following steps: (1). Introduction: Provide prerequisites before the learning process begins, Convey learning objectives; (2) Core Activities: delivering problem-oriented information; organize students to learn and share MFIs to be solved in groups so that students find hypotheses; guiding students to collect data, analyze and conclude the results of problem solving, students present the results of problem solving, lecturers together with

students analyze and evaluate the problem solving process; (3) Closing: students together with lecturers conclude lecture material. The sample selection used in the study is purposive sampling technique or sample determination technique with certain considerations (Sugiyono, 2013). These considerations are made based on the characteristics or characteristics of the population that have been known beforehand and based on the results of the student quiz achievement. Based on the results of these considerations, the researcher chose Basic B Microbiology class totaling 30 people.

The parameters measured are student learning activities and learning outcomes. Student activities include scientific activities (process skills) in the inquiry including: Observation (Observation); Asking (Questioning), Submitting allegations (Hyphotesis); Data collection (Data gathering); Conclusion / conclusion (Conclusions) and learning outcomes are values at the end of each cycle.

Student activities during practicum activities are measured using the following formula:
P = F / N X 100%
Information :
P = The percentage percentage of student activity
F = Frequency of activity that appears
N = Number of students
(Sudijono, 2008)

Student activity is determined based on the following criteria

Table 1. Categories of student activities in lectures

No	Interval	Kategori
1	85 – 100	Very Good
2	71 – 84	Good
3	65 – 70	Enough
4	<65	Fail

(source ;Depdiknas, 2007)

Student learning outcomes are measured by the value of each cycle end. The success criteria are determined from the value interval that refers to the normal reference (PAN) issued by the University of Riau based on the Rector's Decree.

Tabel 2. Interval of value

Value Alphabet	ammount	value	predicate
A	4,00	>85	Very good
A-	3,75	81 – 85	Very good
B+	3,5	76 – 80	Very good
B	3,00	71 – 75	good
B-	2,75	66 – 70	good
C+	2,5	61 – 65	enough
C	2,00	51 – 60	enough
D	1,00	45 – 50	less
E	0	<45	fail

3. Result and Discussion

Learning outcomes

The results of the study by applying guided inquiry learning models to solve the problem of low student learning outcomes in the material of bacterial growth temperature optimization in class B Basic Microbiology Biology Education Study Program FKIP UR 2017/2018 school year with a total of 30 female students17. Learning outcome tests are conducted to find out the improvement of student learning outcomes that are carried out at the end of each cycle. According to Sudjana (2014: 39), learning outcomes are abilities that students have after receiving learning experiences.Students' understanding of the optimization material of bacterial growth in guided inquiry learning can be seen from student learning outcomes in cycle one and cycle two, to be more clearly seen in the percentage of student learning completeness in Table 1.

Table 1. Frequency distribution of average scores of students at pretest cycle 1

Interval	Frequence (f1)	Middle value (x1)	F1.x1
50 – 55	7	52,5	367,5
56 – 61	5	58,5	292,5
62 – 67	4	64,5	258
68 – 73	4	70,5	282
74 – 79	8	76,5	614
80 – 85	0	82,5	0
Nilai rata - rata			60.4

Value data in this study is the data of pre-test and post-test values in cycle I and cycle II. In the first cycle pre-test, only 8 students or 26.6% of the 30 students reached the achievement indicator while the average student score only reached 60.4. The average class value in the first cycle pre-test can be seen in table 1. Data from table 1 obtained the average value of the first cycle pre-test results before the action was only reached 60.4. From this it can be said that the level of completeness in the optimization material of bacterial growth is still low.

Furthermore, in the post-test cycle I the number of students who achieved the indicators of success (range of values> 65) increased to 25 students or 83.3% of students. While the average value increased to 79.1. This means that the average class value has increased by 19.1. The average value in the post-test activity of cycle I can be seen in table 2.

Table 2. Frequency distribution of the average score of students in post test cycle 1

Interval	Frequence (f1)	median (x1)	F1.x1
55 – 61	3	58	174
62 – 68	2	65	130
69 – 75	9	72	718
76 – 82	8	79	642
83 – 89	5	86	430
90 – 96	3	93	279
Nilai rata - rata			79,1

Then in the pre-test cycle II shows from a total of 30 students only 8 students or equal to 26.6% of students who scored above the Minimum Completeness Criteria. While the average value class only reached 58.13. Class average values can be seen in table 3

Table 3. Frequency distribution - average value of students in the pre test cycle 2.

Interval	Frequence (f1)	median (x1)	F1.x1
40 - 46	7	43	301
47 – 53	4	50	200
54 – 60	7	57	349
61 – 67	2	64	128
68 – 74	2	71	142
75 – 81	8	78	624
Average			58,13

In the post-test cycle II the number of students who achieved the achievement indicator increased toincreased to 28 students or 93.3%. While the average grade value increased to 76.4. This means an increase of 18.3. The average value of the second cycle posttest activity class can be seen in table 4.

Table 4. Frequency distribution of the average value of students in the post test cycle 2.

Interval	Frequence (f1)	median (x1)	F1.x1
65 – 70	2	67,5	135
71 – 76	9	73,5	661,5
77 – 82	9	79,5	715,5
83 – 88	7	85,5	598,5
89 – 94	2	91,5	183
95 – 100	0	97,5	0
Average			76.4

From the explanation above it can be said that the application of inquiry learning models to improve learning outcomes maintains optimization of the growth temperature of hydrocarbonoclastic bacteria can be said to be successful because it can exceed the achievement indicators set previously.

The results of the research on the observation of student activities have increased. seen from a number of 30 students in observing student activity in the first cycle there were 25 or equal to 83.3% of students who achieved predetermined indicators of achievement and included in the good category. The results are then corrected in cycle II because they have not met the indicators of achievement that have been previously determined. In observing student activity in the second cycle, the number of students achieving achievement indicators increased to 93.3%. From these results it can be said that observations of student activities have reached predetermined indicators of achievement, namely ≥ 75% of the number of students achieving good categories. Student learning outcomes are depicted in graph 1.

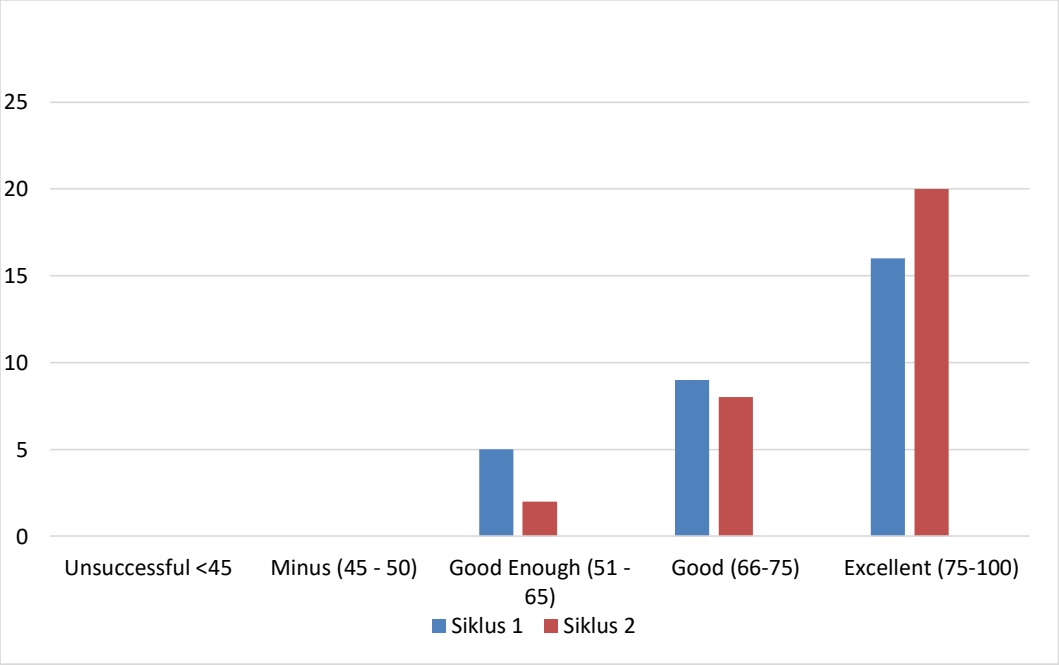

Figure 1 : Study result from Biology education students in experiment of optimation of bacterial growth temperature after the implementation of inquiry learning

The effectiveness of inquiry learning, students get a real orientation towards a problem and find their own problem solving through a series of activities and investigations, namely by conducting scientific investigations in the laboratory. This is in accordance with the opinion of Piaget in Ibrahim (2004) that knowledge is not passively obtained by someone, but through action. In addition, when discussing students look more active and do good cooperation in learning so that they get good learning outcomes as well

Learning Activities

Learning activity is a series of physical or physical or mental or spiritual activities that are interrelated so as to create optimal learning. In this learning activity students must actively dominate in following the teaching and learning process so as to develop the potential that exists in them. In other words, in activities, students not only listen and record as found in schools that conduct conventional learning.

Inquiry-based learning in Biology Basic Biology practicum activities carried out on the topic Optimization of bacterial growth temperature Students are required to find the optimum temperature in the growth of baktei by testing growth at various different temperature levels. develop their creativity in groups to be able to raise problems, make hypotheses, experiment, observe and make conclusions. To ensure understanding of the material concept, each group was asked to report in front of the class the results of the discussion.

The results of the measurement of student activities in the practicum activities of Microbiology courses through inquiry-based active learning are shown in Figure 2.

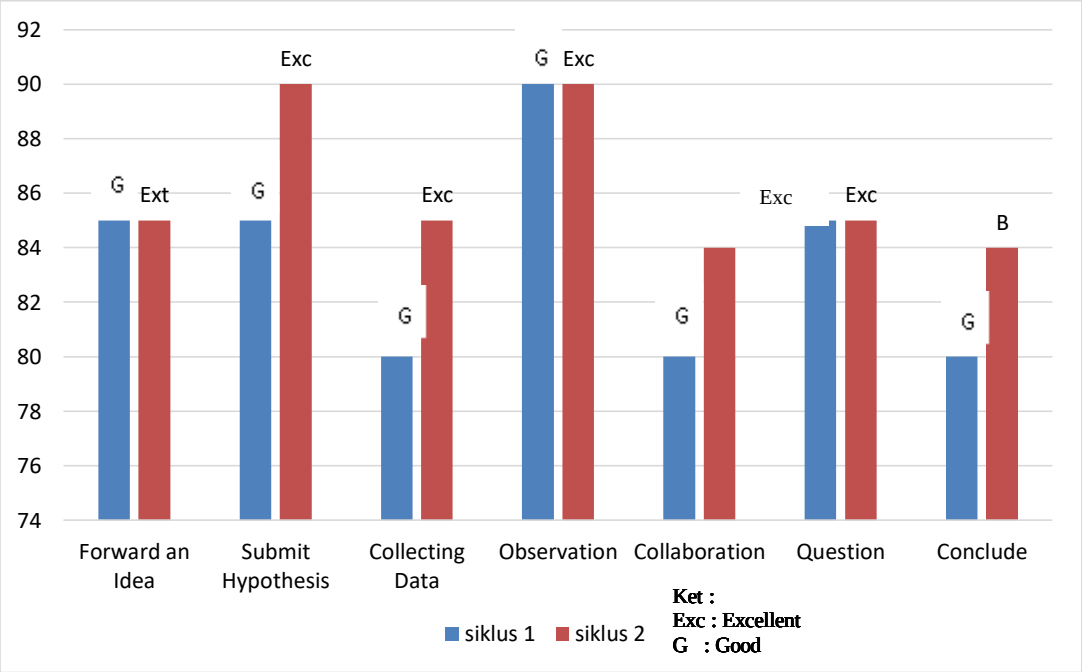

Figure 2. The student activities in the experiment of optimation oh bacterial's growth temperature in 2 cycle

From the picture above it can be concluded that the implementation of inquiry-based learning in practicum activities can improve student learning activities. Student learning activities increased from cycle 1 to cycle 2. All categories measured in both cycles showed good to very good categories. In cycle 1, in terms of collecting data / conducting practicum activities, working together and concluding shows good categories, then in terms of submitting ideas, submitting hypotheses, observing and asking questions shows a very good category. Furthermore, in cycle 2 in terms of working together and concluding, showing good categories, and in terms of submitting ideas, submitting hypotheses, observing, collecting data and asking questions, the categories are very good.

During practicum activities, students look more active, passionate and more critical thinking because they have to find their own problems to solve. In addition, students can also adapt well to their groups, can develop social attitudes, communicate with friends in learning and work in groups. This makes the practicum atmosphere more active and run smoothly because students can cooperate well in their respective groups.

In cycle 1, students seem to have difficulty in collecting data due to practical procedures which are fairly complicated and require high practicum skills. All students have tried to do the laboratory temperature optimization practicum which is determining the optimal temperature where bacterial growth can run well. In this case it is done by testing the incubation temperature with 4 different temperature variations. Some groups can do it smoothly but there are some other groups that have difficulty collecting data so that activities for this field are in good category. Then with motivation and guidance carried out by the lecturer, in cycle 2 students look more understanding and smart in practicing procedures or collecting data so that their activities are in a very good category. In cycle 2 also only activities to work together and conclude that are in good categories, other than that other activities are in very good category.

4.Conclusion

Based on the discussion of research results that have been carried out, it can be concluded as follows.

1. Implementation of inquiry-based learning strategies can improve student learning outcomes and learning activities. Learning outcomes of students who get very good categories are more than others, namely 16 people or 53.3% in cycle 1, and 20 people or 66.6% in cycle 2.
2. Student learning activities increase in implementation in two cycles.

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