

# The Effectiveness Comparison of Scientific, Problem-Solving, and Open-Ended Approach of Discovery Learning Setting in Mathematics on Circle Material

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**Abstract:** *The research was an experimental research which aimed to examine: (1) The effectiveness of scientific approach of discovery learning setting in mathematics on circle material in class VIII at SMP Negeri 2 Sinjai Timur; (2) The efficiency of problem solving approach of discovery learning setting in math on circle material in class VIII at SMP Negeri 2 Sinjai Timur; (3) The efficacy of open ended approach of discovery learning setting in math on circle material in class VIII at SMP Negeri 2 Sinjai Timur; (4) whether scientific method to discovery learning setting was more effective than problem-solving approach of discovery learning setting in mathematics on circle material in class VIII at SMP Negeri 2 Sinjai Timur; (5) whether the problem-solving approach of discovery learning setting was more effective than open ended approach of discovery learning setting in mathematics on circle material in class VIII at SMP Negeri 2 Sinjai Timur. The population of the research was all of the students in class VIII at SMP Negeri 2 Sinjai Timur. The samples of study consisted of three classes, namely experiment class I taught by scientific approach of discovery learning setting, experiment class II motivated by problem solving approach of discovery learning setting, and experiment class III taught by open-ended approach of discovery learning setting, taken by employing simple random sampling technique, the data collection consisted of the students' learning achievement, the students' activity in learning and the students' response toward the device and the learning. The results of research showed that : (1) the implementation of learning it scientifically, problem-solving, and open ended approach of discovery learning setting on circle material implemented well, (2) the implementation of learning it scientific, problem-solving, and open ended approach of discovery learning setting in mathematics on circle material in class VIII at SMP negeri 2 Sinjai Timur was effective based on the aspects : (a) the students' learning achieving; (b) the students' learning activity; and (c) the students' response. The result of hypothesis test in significant level  $\alpha = 0.05$  with t-test showed that Scientific approach of discovery learning setting was more effective than Problem Solving and Open-Ended approach of discovery learning setting on circle material to class VIII students at SMP Negeri 2 Sinjai Timur.*

**Keywords:** Comparison, Effectiveness, Scientific Approach, Problem Solving Approach, Open-Ended Approach, Discovery Learning

## 1. Introduction

The development of education in Indonesia is proper. The Department of Education has implemented various policies to make improvements in all the components such as education curricula, improving the quality of teachers, as well as facilities and infrastructure that support teaching and learning activities to enhance the quality of education. However, improvements are still needed to do in the educational process to get a better quality of education.

The success of a curriculum to achieve depends on the capability of the teachers. That is, the teacher is the person who has the responsibility in the effort to reach everything that has been stated in a formal curriculum [1]. Furthermore, the learning that occurs in school or especially in the classroom, the teacher is the party most responsible for the results. The success of education is highly dependent on the teachers; the teachers are the main actors in achieving towards the quality of skilled human resources through education. One of the main tasks of teachers in learning activities in schools is creating an atmosphere of learning that motivates students to study thoroughly and excited, because this atmosphere will have a positive impact in achieving optimal learning results [2].

For the successful learning process, it would require an appropriate approach, because the learning approach is a means of interaction between teachers and students in learning activities, using less precise method can lead to boredom that students not motivated to learn. And the use of less accurate approach can impact on the low result of learning student. It proved by the average students' score of daily mathematics test at the three classes of grade VIII at SMP Negeri 2 Sinjai Timur that will examine, namely class VIII B (62.54), VIII D (58.40), class VIII E (59, 35).

The boredom of students, especially in learning mathematics is abstract, tend to be difficult to accepted and understood, it causes students to more passive and apathetic, so that study results are not optimal. In the learning process, we often encountered the tendency of students who did not want to ask the teacher, though they do not understand the material that has taught yet [3]. Teachers have made various efforts to improve students' motivation for the sake of better results.

One strategy that often used by teachers to enable students by engaging them in discussions with all students. But this approach is not very practical, though teachers are encouraging students to participate. Most students choose to be a spectator, while the discussion arena controlled by only a few students. Various approaches to learning from year to year have developed to improve the quality of education.

The studies conducted to determine how effective a learning approach to educating students learning outcomes [4].

The development of learning that needed today is innovative and creative education that provide a conducive climate to the development of reasoning power and creativity of students. Teachers' efforts to achieve the learning objectives include choosing the right approach and supporting the creation of a conducive teaching and learning activities [5][6].

There are different types of learning approaches including the Problem-Solving approach, Open-Ended, and one approach that is now the subject of conversation among teachers is aScientific approach which refers to the curriculum of 2013. But the problem is no one can guarantee that some existing methods, there will always be successful and efficient to apply to all learners and on every subject.

Based on the background stated above, the problem statements in this research are:

- 1) Is the implementation of ascientific approach to discovery learning setting useful in mathematics on circle material in class VIII at SMP Negeri 2 SinjaiTimur?
- 2) Is the implementation of theproblem-solving approach of discovery learning setting useful in mathematics on circle material in class VIII at SMP Negeri 2 SinjaiTimur?
- 3) Is the implementation of theopen-ended approach of discovery learning setting useful in mathematics on circle material in class VIII at SMP Negeri 2 SinjaiTimur?
- 4) Is there any difference of the effective implementation of thescientific approach, problem-solving and open-ended of discovery learning setting in mathematics on circle material in class VIII at SMP Negeri 2 SinjaiTimur?

## 2. Literature Review

### 2.1. Learning Mathematics

The process of change in a person can say to learn, the changes as result of the learning process can demonstrate in a variety of forms of knowledge, changing attitudes and behavior, skills, aptitude, habits, and change other aspects that exist in every individual.

The learning math is to learn about the concepts and structures of mathematics contained in the material learned and look for relationships between ideas and the mathematical structure. From this view illustrates that higher mental activity in learning math desperately need appropriate learning strategies applied by the teacher,so the students achieve a good quality learning outcomes in mathematics [7].

### 2.2. Scientific approach

Application of Scientific approach in learning, involves the process skills, such as observing, classifying, measuring, predicting, explaining, and concluding[8].

The step-by-step of scientific approach in the learning process at all levels of the curriculum in 2013 to implemented by using a scientific method, include: gathering information, observing, questioning, experimenting, and then processing the data or information, presenting data, or information, followed by analyzing, associating, concluding, then creating and establishing a network.

### 2.3. Problem Solving Approach

The emergence of Problem Solving learning theory based on the assumption of constructivism principle that students should build their knowledge so that they experienced meaningful learning[9].

### 2.4. Discovery Learning Model

Discovery is a learning model which was developed based on constructivism' view. These models emphasize the importance of understanding the structure or important ideas to a scientific discipline, through the involvement of students actively in the learning process. According to[10]-[11], students encouraged to learn mostly through active participation in their concepts and principles, and teachers encourage students to have the experience and conduct experiments which allowed them to find laws for themselves.

It also expressed by[12], that the Discovery Learning is a learning model that encourages students to ask questions and Draw conclusions from the general principles of practical examples of experience. Operational Implementation Steps in Learning Process.

Steps of Discovery Learning strategy preparations:

- 1) Determining the purpose of learning.
- 2) Identifying the characteristics of learners (prior knowledge, interests, learning styles, and so on).
- 3) Choosing the subject matter to learned.
- 4) Determining the topics to studied inductively by the learners (of examples of generalization)
- 5) Developing training materials in the form of models, illustrations, tasks, and so on to learnfrom the learners.
- 6) Set the lesson topics from simple to complex, from the concrete to the summary, or from stage enactive, iconic to symbolic.
- 7) Assess the process and learning outcomes for the students.

## 3. Method

### 3.1 Research Methodology and Design

The methodology of this research is quasi-experiment. The design of this study can explain as follows: Three experimental class, each class, acquire learning through Scientific Approach, Problem-Solving, and Open-Ended on circle material. The results of this treatment are the effectiveness viewed through observing. Observations willbe made in the form of watching the response of students, observation of student's activity, observation of the teacher's

ability to manage the learning activities, and assessment of learning outcomes of students.

### 3.2 Research Variables

The independent variables in this study is a learning approach that consists of three procedures namely Scientific Approach, Problem-Solving, and Open-Ended. The dependent variable in this study is learning Effectiveness of students learning outcomes, student activities, and student responses.

### 3.3 Population and Sample

Purposive sampling technique did sampling. According to [13], that in purposive sampling, the researcher selects individual cases to included in the sample based on the peculiarities of the assessment.

The population of this research is class VIII student of SMP Negeri 2 Sinjai Timur 2014/2015 academic year which consist of six classes. The sampling technique that chose three experimental courses of six levels, with the number of students on average 22 students.

### 3.4 Research Instruments

Instruments used in this research is a test as a measure of the ability of student mathematics, observation sheet of teachers' ability to manage the learning process, student activity observation sheet, student questionnaire responses to learning.

### 3.5 Research Procedures

The procedures performed in this research divided into two phases: the preparation phase and implementation phase.

### 3.6 Data Analysis Techniques

All data analyzed using descriptive statistics and inferential statistics. Descriptive statistics used to describe the level of student response, student activities, teachers' ability to manage the learning process, and student learning outcomes based on learning with Scientific Approach, Problem-Solving Approach, and Open-Ended Approach. Inferential statistics used to test research hypotheses that have formulated.

## 4. Result and Discussions

### 4.1. Implementation of Learning

#### 1) Implementation of Learning with Scientific Approach to Discovery Learning Setting.

Based on observations on the implementation of the approach: meeting I, II, and III show that learning is done well, and at the meeting, IV, V, and VI in the category very successfully. Overall for the sixth meeting of the implementation of the learning approach can say to be performing well. The indicated by the average score of application of the method of the first session until the

meeting VI of 4.4.

#### 2) Implementation of Learning with Problem Solving Approach Discovery Learning Setting

Based on observations on the implementation of the approaching meeting I, II, and III show that learning is done well and at the conference, IV, V, and VI in the category very successfully. Overall for the sixth meeting of the implementation of the learning approach can say to be performing well. The indicated by the average score of the application of the plan of the first meeting until the meeting VI of 4.38.

#### 3) Implementation of Learning Approach Open Ended setting Discovery Learning

Based on observations on the implementation of the approach: At the first meeting, it appears that the application of learning approach implemented well enough, stood at 3.22 so that only its appropriateness in the category is quite accomplished. At the meeting II, III, IV, and V in the group of good and at the reception VI are in the excellent team. Overall for the sixth meeting of the implementation of the learning approach can say to be performing well. The indicated by the average score of the meeting II implementation approach to meeting VI of 4.35.

### 4.2. Analysis of Effectiveness at First experimental classes that implement Scientific Approach Discovery Learning Setting Descriptive Analysis Results.

#### 1) The learning achievement of students who taught by Scientific approach Discovery Learning Setting.

Based on students' achievement that taught by Scientific Approach Discovery Learning Setting: The percentage of students who pass classically by  $100% > 85%$ , descriptively, the students' mathematics achievement in experimental class students I meet the criteria of effectiveness.

#### 2) Scientific Approach Discovery Learning Setting teach activities of Students

Based on the recapitulation of the students' activity observation who taught by setting Scientific Approach Setting Discovery Learning then: Category minimum of students' activity is in the category of good. It can conclude that the actions of students in the experimental class I with Scientific Approach Discovery Learning Setting descriptively meet the criteria of effectiveness.

#### 3) The response of students who taught by Scientific Approach Discovery Learning Setting.

Based on the student's response to learning by Scientific Approach Discovery Learning Setting is positive. Thus, descriptively effectiveness criteria fulfilled. Based on the results of the descriptive analysis described above, it appears that the effectiveness criteria met by the learning with Scientific Approach Discovery Learning Setting in the experimental class I are students' achievement, students' activities and students' responses. Because classical completeness of students achieved thus, it can conclude that learning by Scientific Approach Discovery Learning

Efficiently Setting applied in grade VIII SMP Negeri 2 Sinjai Timur on circle material.

#### 4) Inferential Analysis Results

Based on the average test scores of students' post-test, the mediocre test results normalized gain, classical completeness testing of students done by using the proportion test, then: The proportion of students who achieve 73 of completeness criteria (KKM) of more than 85%, thus can concluded that inferentially mathematics achievement of students in the classes taught by the application of Scientific Approach Discovery Learning Setting meets the criteria of effectiveness.

#### 5) Learning Effectiveness Analysis Results

Based on the analysis of the effectiveness level of mathematics learning material circle in grade VIII SMP Negeri 2 Sinjai Timur is in the category of Effective enough.

#### 6) Hypothesis Testing Results

Based on the analysis of descriptive and inferential analysis that has described previously, it appears that the scientific approach discovery setting has met the criteria of effectiveness, both in students' achievement, students' activities, and students' response. Therefore, one primary hypothesis verified. Thus it can conclude that learning with scientific approach discovery settings is adequate to apply in grade VIII SMP Negeri 2 Sinjai Timur on the material circle.

### 4.3. Analysis of Effectiveness in the Third Experiments Class that Implements the Open-Ended Approach Discovery Learning

#### 1) The learning achievement of students who taught by Open-Ended approach Discovery Learning setting

Based on the observation of the implementation of the approach: Indicates the percentage of students who completed classically at  $90.91\% > 85\%$ . Based on the description above, it can conclude that the descriptively the mathematics learning achievement of the students of experimental class III meets the criteria of effectiveness.

#### 2) Activities of Students that taught by using Open-Ended Approach Discovery Learning Setting

Based on the recapitulation Observations Results in Students' activities In Experimental Class III. It appears that the minimum category of student activity in the right category. It can conclude that the actions of students in the experimental class III with open-ended approach Discovery Learning Setting descriptively meet the criteria of effectiveness.

#### 3) Response of students who taught by the Open-Ended Approach Discovery Learning Setting

Based on the results of the descriptive analysis previously described, it appears that the effectiveness criteria met by learning to open-ended approach Discovery Learning Setting in the experimental class II are students' achievement, students' activities, and students' response.

Because the classical completeness of students achieved so that it can conclude that learning process through the open-ended approach with Discovery Learning Setting expertly applied in grade VIII SMP Negeri 2 Sinjai Timur on the material circle.

#### 4) Inferential Analysis Results

Inferentially mathematics learning achievement of students in classes that taught through the implementation of open-ended approach Discovery Learning Setting meets the criteria of effectiveness.

#### 5) Learning Effectiveness Analysis Results

The effectiveness of the problem-solving approach in mathematics learning circle material at a grade VIII SMP Negeri 2 Sinjai Timur is in the category of Effective enough.

#### 6) Hypothesis Testing Results

Based on the analysis of descriptive and inferential analysis that has described previously, it appears that the open-ended approach to setting discovery has met the criteria of effectiveness, either in students' achievement, students' activities, and students' response. Therefore, the third primary hypothesis verified, so that it can conclude that the learning by open-ended approach discovery setting applied expertly in grade VIII SMP Negeri 2 Sinjai Timur on the material circle.

### 4.4. Results of Comparative Analysis of the Effectiveness of Learning with Scientific Approach and Problem-Solving Approach Discovery Learning Setting

Based on the descriptive analysis and inferential analysis results, a scientific approach discovery learning setting is more than learning with problem-solving approach discovery learning setting, both in students' achievement, students' activities, and students' responses.

### 4.4. Results Analysis of Comparison of the effectiveness of Learning with Problem Solving Approach Discovery Learning Setting and Open-Ended Discovery Learning Setting.

Based on the descriptive analysis and results of the inferential study, problem-solving approach discovery learning setting is more than teaching with open-ended approach discovery learning setting, either from students' achievement, students' activities, and students' responses.

Based on the research that has described previously, hence at the discussion of the results of the study include discussion of descriptive analysis results and review of inferential analyzes results. The descriptive analysis contains students' activities, students' response, the implementation learning approach, and students' achievement. While the results of inferential analysis include students' achievement.

To realize learning activities, human beings need strength or encouragement. The power or impetus caused by a need is called motivation. Motivation is necessary, someone who has no motivation in learning, is not possible to do learning

activities, one of them by directing students to think creatively in obtaining ideas about what learned for problem-solving[14]. According to [3], that Mathematical problem can be a source of motivation for students when issues involve aspirations and student interests

Since then, Japanese teachers have developed many open-ended problems and lesson plans using Open-Ended issues. These issues handled in mathematics lessons elementary through high school grades and the experiences are called the Open-Ended Problem Solving now[15]. Open-Ended problems are also used as assessment tasks because in responding to such (Open-Ended) items, students are often asked not only to show their work but also to explain how they got their answers or why they chose the method they did[16].

## 5. Conclusions

Based on the results of research and discussion, the conclusions in this study are as follows:

- a) Learning by using Scientific approach Discovery Learning setting is adequate to implement in grade VIII SMPNegeri 2 Sinjai Timuron the material circle.
- b) Learning by using the Problem-Solving Approach Discovery Learning setting is useful to apply in grade VIII SMPNegeri 2 Sinjai Timuron the material circle.
- c) Learning by using Open-Ended Approach Discovery Learning setting is useful to apply in grade VIII SMPNegeri 2 Sinjai Timuron the material circle.
- d) There are differences in average students' achievement in Scientific Approach, Problem Solving, and Open-Ended Discovery Learning setting. The average results of student's achievement consecutive 85.05, 80.17, and 77.41, and the standard deviation of the post-test respectively 6.39, 5.94, and 6.96. Thus, regarding students' achievement, application of scientific approach is superior to the other two methods.

Based on the conclusions above, the researcher suggested several things to note:

- a) Although the sample in this study is the eighth-grade students of SMPNegeri 2 Sinjai Timuron the material circle, for teachers of mathematics, can apply the above approach to learning in different populations so that they can create active learners and achievement.
- b) This study has revealed the existence of differences in the effectiveness of Scientific Approach, Problem Solving, and Open-Ended Discovery Learning setting. In this is, the mathematics teachers who want to apply one of the Scientific Approach, Problem Solving, or Open-Ended, it suggested to refer to different materials.
- c) For researchers who are interested in continuing this research, it suggested examining all the limitations of this study. Thus, the results obtained will be better.

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