The Learning of Science-Based Laboratory Experiments to Improve the Student's Scientific Attitudes on Optical Materials

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Abstract. The research on the application of lesson studies on Physics Subjects to improve the students' scientific attitudes on optical materials through the science-based learning laboratory experiments. The techniques and instruments of data collection in this study is by the observation and documentation. The application of lesson studies of each cycle consists of Plan, Do, See and redesign and all are done in three learning cycles, open class 1 the light refracting material on convex lenses. Open class 2 the reflectance material on a concave mirror. Open class 3 the light reflecting material on a convex mirror. Based on the results of the study found that the application of lesson study through science-based learning laboratory experiments is very effective to improve some indicators of students' scientific attitudes such as the attitude of asking the new things that have not been known when studying physics; Doubting the friends findings; thorough in experimenting; using the different tools in the investigation process; showing the different observation reports with friends, and cooperating and participating actively in groups. The high curiosity makes the students more severe in learning so that the sense of participation of each other in the group is active and the activities can be well exposed and increased

1. Introduction
Five factors that can facilitate the success of science learning involving laboratory activities are curriculum, resources, learning environment, teaching effectiveness, and assessment strategies. The development of these five factors will provide the characteristics of the learning model implemented in the classroom by the teacher. Whether the learning model implemented is student-centered, or vice versa, teacher-centered [1]. The science learning model which recommended by many experts is student-centered learning, which provides the opportunity for students to learn to "discover" rather than learn to "receive". The quality of physics learning process and its outcome is determined by many factors, one of which is the availability of laboratory facilities[2]. Theoretically, the existence of the laboratory is expected to support the specific skills-centered activities, including process skills, motor skills and scientific attitude formation, especially the development of interest to conduct the research and interest in studying the nature[3]. Based on the results of the interviews with the subject teachers in school, the students are still not maximized in the learning using practicum tools in laboratories,
whereas the learning in the laboratory using practicum tools has a position because the learning of the laboratory is considered to cover three domains (cognitive, affective and psychomotor).

Natural knowledge is often called by science. As a science, science has unique characteristics that distinguish it from the other sciences. The uniqueness of science is also often expressed as the essence of science. The essence of science is actually used correctly to answer the statement of what science really is. Science is the knowledge that the truth has been tested empirically through the scientific method. So the role of the scientific method of receiving a knowledge is very important. Similar to the scientific method, empirical is a special feature that becomes the identity of science”[4], [5].

Scientific attitudes in science learning are often associated with the attitudes toward science. Both are interconnected and both affect the deeds[6]. The assessment of the results of science learning is considered complete if it covers the aspects of cognitive, affective, and psychomotor[7]. The attitude is a general behavior that spreads thinly throughout the things that students do. But the attitude is also one that influences the student learning outcomes.[8] Scientific attitudes are distinguished from mere attitudes toward science, because the attitudes toward science only focus on whether students like or dislike the science learning. Of course, a positive attitude toward science learning will contribute significantly in the formation of students’ scientific attitudes but there are still the other factors that contribute significantly. The measurement of students’ scientific attitude can be based on the grouping of attitudes as the dimensions of attitude which further developed the attitude indicators for each dimension so as to facilitate the compilation of scientific attitude instruments. To make it easier to use/ attitude the dimensions [9].

Based on the above description, the study is limited by the problem of how to apply the lesson study on science learning based on experimental physics subjects, the purpose of this study is to improve the scientific attitude indicators of students learning.

2. Method
The students of Madrasah Aliyah Negeri (MAN, Islamic Senior High School) Sungai Gelam, class XI IPA1 academic year 2015/2016 which amounted to 20 students.

The type of data observed in this research is qualitative data that is data about students' learning skill during lesson study. Data collection is done by using student process skill observation sheets during learning activities and video recording during learning activities. The classroom learning applies the lesson studies with several stages, namely plan, do, see and re-design.

3. Result And Discussion
The classroom learning applies the lesson studies with several stages:

The study was conducted in 3 cycles with the stages in the cycle consisting of Plan, Do, See, and Re-Design.

3.1. Plan
At this stage, the discussion of planning lessons in class with the lesson study team, the result of the discussion is open class 1 dated September 18, 2015, on the material of refraction of light on the convex lens with the learning objectives of refracting properties on the convex lens. Open class 2 dated February 19, 2016, on the light reflecting material in concave mirrors with the learning objectives is investigating the properties of light on a concave mirror. Open class 3 dated February 20, 2016, on the light reflecting material in a convex mirror, and the learning objectives are investigating the properties of light in a convex mirror. The student learning plan will be divided into two groups, learning by doing practicum of light reflection on the concave mirror and convex mirror, before experimenting, the student will be explained about the purpose of learning, material, sheets guide lab and tools to be used in the lab. The teacher model is the teacher of physics mathematics of MAN Sungai Gelam. The observer team: researcher, one of biology teacher of MAN Sungai Gelam, two final students of Jambi University.
Here are some activities are undertaken by the lesson study team before open class:, Preparing material, Conducting practicum experiments, and Testing on practicum tools that will be used in classroom learning. The test is needed to test the feasibility of these tools to avoid the error of the observer team to understand what the students are doing later in the classroom.

3.2. Do
At this stage, the model teacher carries out the learning process while the other lesson study team as the observer observes the student activity in the learning. Here are the pictures of the implementation of the clear lesson.

Open class 1 the learning is carried out in the laboratory room of MAN Sungai Gelam, the learning begins by greeting, praying, perception to the students and giving an explanation of material before doing a practicum. The model teacher explains the equipment to be used in the lab; the students pay close attention while reading the work sheets that have been given. After the explanation of the teacher, the students experiment the practicum of refraction on the convex lens to know the nature of refraction of light on the convex lens. During the learning process students seem to feel the high curiosity of learning activities, the students do practicum activities while discussing with each other about the tools to be used and work together to assemble tools, and an obsession team consisting of researchers, one biology teacher and two junior high school students observing student activities in conducting lab. Activities and learning processes like this will be the same done on open class 2, and open class 3, which distinguishes is there will be some improvements made by the findings that existed during the discussion after the open class

3.3. See
At the seed stage, a discussion activity led by observer lecturer, the first opportunity given to the model teacher to convey the self-reflection which includes expression of feeling, review of the process/learning path, and review the achievement of lecture objectives. Furthermore, the other observers expressed the results of his observations on lectures based on facts, not just theories/opinions for the improvement of the next lesson plans or open lesson.

Based on the open class 1 that has been done, the model teacher conveyed the obstacles encountered while teaching the material, the students have not much to give a good response to the tools used because students have never known the equipment, there are doubts or concerns of students about the tool will be broken or damaged so that many students who have not dared to touch the tool. The solution which is the result of the team discussion is to try to introduce more practicum tools to the students in learning.

In open class 2 and open class 3, the students have started to actively use the tools in the implementation of the lab, in the involvement and how to use the equipment has begun to increase. From the observer himself, more to say about the intrusion and the sense of want to know the tools very well, the cooperation among students in the group is well preserved, the careful in using tools is very good, and so is in conclusion after the lab in groups.

3.4. Re-design
At this stage of the reflection results, obtained some improvements in subsequent the learning including teacher models and teachers who become observers that will try to add media or practicum in science learning. In the next learning, the students will be invited to discuss, so it is expected to improve the ability to ask questions and to give the opinions.

In picture 1 below is the data of the student number who carry out the indicators of scientific attitude during the learning process at open class 1, 2, and 3. The Student's scientific attitude indicators observed by the observer consists of 14 indicators that are 1) Asking the new things which are not yet known when studying physics, 2) Enthusiastic to seek the information from various sources, 3) Enthusiastic looking for the answers, 4) Conduct the investigation through observation / experiment seriously, 5) Doubt the others findings/friends, 6) Thorough in the measurement/experiment, 7) Does
not ignore the data through small, 8) Make the conclusions based on data and facts of the experimental observations, 9) Use the different tools in the investigation process, 10) Show the different observation reports with other people / friends, 11) Accepting and respecting the opinions of others / friends, 12) Not feeling that he is always right, 13) Assuming every conclusion which is tentative, 14) Cooperating and participating actively in groups.

In the bar chart can be explained that the number of students who perform indicators of scientific attitude in learning using a practicum of physics tools for some indicators is increased. However, on indicator 13) Assuming each conclusion is tentative in the student's decline, this is because at the time of student discussion directly draw/write conclusions based on the discussion together, it could be the result of discussion of some students there "A" then other students tend to write "A" as well, so that can be seen between indicators 5, 9, and 13 are interrelated. Because of the same opinion of the students in the group, so that few of the students who doubt the findings of other students. In the case of trying the different tools in the lab also a little, so the conclusions obtained from students will be the same and no longer tentative.

The following is the result of the group discussion after the practicum, the visible image refraction of light in the convex mirror; there are still some mistakes of students in understanding the concept of refraction of light.

**Figure 1.** Graphs of the student number performing scientific attitude indicators [10]

![Figure 1](image1.png)

Figure 2a. The concept of refracting light

![Figure 2a](image2a.png)

**Figure 2b.** The Results of group discussion 2

**Figure 2c.** The Results of group discussion 1
In Figure 2b the result of the group discussion one, it appears that the drawing (red circle) of the students has not understood the concept of refraction of light when it concerns the transparent object, so that this group can not explain with what images occur in light when through a convex mirror, the visible light lines coming off in a convex mirror. Figure 2c of the second group discussion shows that the group of students has understood the concept of refraction of light in a convex mirror when it is about a clear object, so that this group can describe a line in the mirror, in the picture there are red and blue, the red means that the rays coming into the mirror are described by the students less carefully to be observed when after out of the mirror, while the right blue color

4. Conclusion
From the results of the study showed that the lesson study in the physics lessons at Madrasah Aliyah Negeri (MAN) Sungai Gelam expertly applied in an effort to improve the students' scientific attitude although not maximal, but from open lesson 1, 2 and 3 have started to look at some indicators of students' scientific attitudes are very significant improvement: asking new things that have not been known when studying physics, for this indicator, the students are very active to ask new things either to the other students during lab work or the physics teacher in class; the investigation through the observation/experiment with severe and high enthusiasm leads to the high spirit and seriousness to do practical activities, this is seen in students during the practicum during open lesson 1, 2 and 3; accept and value the opinions of others/friends; cooperate and participate actively in groups, this indicator continues to increase during open lesson 1,2 and 3. The high curiosity makes the students more severe in learning so that the sense of participation of each other in the group is active and the activities can be well exposed and increased

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