The Internalization Effort of Student Scientific Attitude through Inductive Teaching Method in Basic Physics Practical Course, Biology Study Program - PMIPA FKIP UR

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Abstract. The purpose of this study is to know the internalization improvement of scientific attitude of Biology Education Student - PMIPA FKIP UR through the application of Inductive Teaching Methods in the Basic Physics Practical course. The approach used in this study was a Classroom Action Research (CAR) with cyclic pattern which consists of planning, implementation, observation and reflection. After two time actions, the results of the assessment of the scientific attitude of the students increased from 28.46% to 51.50% in cycle 1 and to 79.96% in cycle 2. In general, the indicator scientific attitude has been quite embedded in students. Assessment of student activity increased from 12.56% to 65.50% in cycle 1 and to 78.06% in cycle 2. This result shows that the learning activity by applying the Inductive Teaching Methods has been understood by the students. Assessment on student performance in the implementation of the lab also increased, from the average of 80.55% in cycle 1 to 81.87% in cycle 2. Based on the results of the analysis, it can be concluded that through the application of inductive Teaching Methods in the Basic Physics Practical course in Biology Education Study Program PMIPA FKIP UR can escalation the internalize scientific attitude of student.

Keywords: *Internalization, Scientific attitude, Inductive Teaching Methods, Basic Physics.*

1 Introduction

The Basic Physics Practical Course is implemented in all PMIPA FKIP UR Study Programs at the first semester. As a practical course, the Basic Physics Practical course has a strategic role in fostering Scientific Attitude (scientific attitude) in students. Scientific attitude is a complex thing involving all aspects of human psychology including cognitive, affective and psychomotor. One of the problems still emerging in the Physics Basic course is the fact that many students are trapped in the technical aspects of the experiment and tend to ignore the substance of an experiment. This

Received 14th May 2017, Revised 3rd June 2017, Accepted for publication 9th June 2017
Published by FKIP University of Riau Publisher, ISBN: 2581-1657 (Print), 2581-2203 (Online)

cause the Scientific Attitude aspects cannot develop properly. This is apparent from the results of the lecture of Physics Basic Laboratory I in the Department of PMIPA FKIP UR the second semester of 2011/2012 session as shown in table 1.

Tabel 1. The practical result of PMIPA FKIP UR for Basic Physics

No	Study Program	Average Result	Practical Result
1	Biology Education	78,40	66,41
2	Physics Education	82,49	73,91
3	Chemistry Education	76,77	68,83
4	Math Education	81,83	78,19

Generally, the students have problems in the Physics Basic I course, especially in Program of Biology Education Study. Zulhelmi (2012) reported that there is no significant correlation between the ability of report preparation with the ability of Physics Basic Laboratory I in Biology Education Study Program of PMIPA FKIP UR. The reason this happens is that the students tend to work like robots, carry out the experimental steps as described in the lab manual, but when asked the basic questions about their experiments, most students cannot answer well.

Lawson (1995) mentioned that teaching science should be as science work (teach science as science is done). The result of Nurohman's research (2008) shows that through the application of Inductive Teaching Methods in Basic Physics Practical successfully internalized the scientific attitude aspect of Physics Education Faculty student of FMIPA UNY. The purpose of this study is how through the implementation of Inductive Teaching Methods in Basic Physics Practical Course can improve the internalization of Scientific Attitude students of Biology Education Studies PMIPA FKIP UR. The expected contribution from this research is the change of scientific attitude to the students of Biology Education Program of PMIPA FKIP UR in following the Basic Physics lab. The hypothesis of this study can be defined as through the implementation of Inductive Teaching Methods in Basic Physics Practicum Course can improve the internalization of Scientific Attitude students of Biology Education Studies PMIPA FKIP UR.

2. Methodology

2.1. Research Approach

The approach used in this research was classroom action research, consisting of cyclic activities: planning, implementation, observation, and reflection. The implementation of classroom action research was planned for two cycles.

2.2. Setting Research

The study was conducted on the semester of 2012/2013 in Physical Education Laboratory of PMIPA FKIP UR. The subject of this research was Biology Education Studies Program student for Class A PMIPA FKIP UR who take subjects Basic Physics Practicum as many as 36 students.

2.3. Types and Techniques of Data Collection

Data collection techniques in this research are as follows

Observation
This technique was used to determine: 1) whether the learning has taken place following Inductive Teaching Methods, 2) student activities and various phenomena that occur during the learning process, and 3) to measure the extent to which Scientific Attitude has been internalized within the students.

Performance Test

This technique was used to find out data or information about student performance in Basic Physics Practicum course.

2.4. Research Procedures

A. Cycle 1

Planning. The following works have been done in the planning stage: (1) Developing learning scenarios developed based on the learning approach of Inductive Teaching Methods. (2) Preparing observation sheet of the student learning activities. (3) Developing interview guidelines. (4) Developing assessment tools that can measure the achievement of internalization of Scientific Attitude.

Implementation. The learning scenario was designed according to the Inductive Teaching Methods in order to increase the internalization of Scientific Attitude of students. The action was done repeatedly, until the results obtained were expected, that has been internalized Scientific Attitude on the students. The steps undertaken in the implementation of this research are as the following

1. The lecturer or assistant disclose the experimental problems as per the instructions.
2. Students are guided to formulate research objectives. Each of the two groups is guided by one assistant.
3. Students conduct a study of the literature that is in the guide book of practical or other relevant physics books.
4. Students are guided to formulate hypotheses

5. Students are guided to design and implement the Basic Physics lab. The Collected experiment data was used to test the hypothesis.
6. Students make preliminary reports at the time of practicum implementation and make a complete report collected at the time of the next practicum.

Observation. Observations were made during the learning process take place. At this stage, the observer performed a systematic observation of student activities and various phenomena that developed during the learning process. Observations were made throughout the practicum implementation regarding the Scientific Attitude and student activities in accordance with the syntax of Inductive Teaching Methods. After the students finished taking the experimental data, the interviewers conducted a random observation. In the first cycle, each of two groups is observed by an observer.

Reflection. The result of observations are analyzed and used as a reflection of whether in the previous process has been in line with expectations. If not in accordance with expectations, then it needs to be pursued perfection in the next cycle.

B. Cycle 2

Planning. In cycle 2 the planning stage was not too much different from the first. The lecturer informed to student that the reason of doing the practicum is different with common practicum. The following are the other activities undertaken in the planning:

1. The addition of assistants and further guidance to the assistant
2. The observer conducts interviews more effectively to check the understanding of the practicum implementation and the hypothesis inference. In the second cycle each group is observed by one observer.

Implementation. The process of learning in second cycle was almost the same as in the first cycle, but the mentors emphasize on topics to be practiced in the next week will be more emphasized at previous meetings. The coaching for each group was also by one assistant, so it can be more optimal in guiding and serving students. At the end of the second cycle, the students accomplished a performance test on practicum activities that have been done for two cycles. Examination system was done randomly by assigning each test subject to the first cycle material and for the second cycle. The duration time for each test subject was 10 minutes. For students who were waiting for the exam, the lecturers interviewed them for more intensive of about their views on practicum activities by applying inductive teaching methods (Inductive Teaching Methods).

Observation. Observations was made by observer as in the first cycle that was about Scientific Attitude and student activity in accordance with the syntax of inductive teaching methods.
Reflection. The analysis was done based on the Scientific Attitude and student activity data that was collected from the results of performance tests and interview results. The results of this analysis were a guide in doing reflection for improvement in the next activity.

2.5. Data analysis

Data in this research was analyzed descriptively using percentage technique include: a. Scientific attitude of student, b student activity, c. Absorption (performance test results). The assessment of each component is done under the following conditions:

Student Score = 100% x (Obtained score) / (maximum score)

The criteria for making a decision, scientific attitude and absorption ability of students are (Table 2):

Tabel 2. Marking criteria for *scientific attitude*, activities, student absorption

No	Range Value (%)	Category
1	85 – 100	Very Good
2	70 – 84	Good
3	50 – 69	Good Enough
4	0 - 49	Not Good

3. Results and Discussion

A. The results of cycle 1

Planning. The activities that are conducted in the Cycle 1 are:

1. Preparing the practical manuals that correlates Inductive Teaching Methods.
2. Developing lecture unit (SAP) that is developed based on Inductive Teaching Methods principles.
3. Developing a data collection instruments, includes: a) Observation sheets of learning activities. b) Assessment tools that is capable for measuring the achievement of internalization Scientific Attitude. c) The performance test is to determine the students' ability in performing the practicum activities that have been trained.

Implementation. The specific activities have been planned through Inductive Teaching Methods in the Physics Basic Practicum course as following: 1) Delivery of experimental problems. 2) Information gathering (discussion or literature review). 3) Hypothesis preparation, 4) Preparation of experimental design, 5) Conducting the experiment, 6) Collecting and analyzing data, and 7) Drawing conclusions (contained in the practice report).

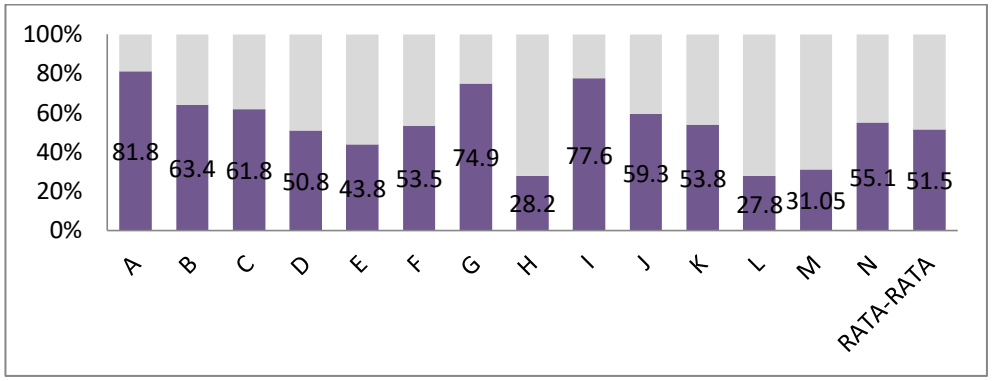
Observation. Observation is done to observe 1) whether the learning is in accordance to the steps of Inductive Teaching Methods, and 2) is the implementation of the Basic Physics Practicum through the implementation of Inductive Teaching Methods steps are able to improve the scientific attitude?
The observation result of the implementation of the action cycle 1 can be described as follows:

1). Observation of learning activities.

Based on the observation, observed learning activities with the following steps: a). The assistant reveals the experiment problems in accordance to the practicum guide book, the students are required to convey the purpose of practicum and formulate the hypothesis, b) The students read the literature review through the experimental principles that are in the practical guidebook as well as through other basic physics books. c) The students discussed the experiments design to test the hypothesis. d) The students doing basic physics activities according to the design that they created under the direction of the assistant. e) The student made the interim report and showed the observation data to the assistant, the assistant to sign for the agreed Data.

2). Assessment of scientific attitude

The result of scientific attitude assessment is shown in Figure 1.



A = Curiosity
B = Open minded
C = Critics
D = Believing on interaction
E = Thinking logically
F = Emphasizing on the fact
G = Reviewing data
H = Self protecting from blind believing
I = Intellectual honesty
J = Decision based on eligible data
K = Objective
L = Able to make unbiased decision
M = Able to distinguish between fact & hypothesis
N = Action and voice are real

Figure 1. Analysis result of *Scientific Attitude* in Cycle 1

The average attitude of the student is good enough in the Cycle 1

3). Activity Rating

Observation of student activity through the application of inductive method (Inductive Teaching Methods) in practicum of Basic Physics can be seen in Table 4.

Table 4. Results of Student Activity Analysis for Cycle 1

No.	Indicator of Activities	Score (%)
1.	Delivering question	62,0
2.	Collecting information	66,2
3.	Defining Hypothesis	61,6
4.	Performing Experiment	68,2
5.	Analyzing Data	70,0
6.	Obtaining Conclusion	67,5
	Average	65,5

Average value for each activity of the student in Cycle 1 is good enough.

4). Performance Appraisal

Table 5 shows the result of absorption analysis based on the student performance evaluation in the Basic Physics practicum through the application of Inductive Teaching Methods in Cycle 1.

Table 5. Results of Data Absorption Ability Data Ability Student Practicum In Cycle 1

No.	Interval (%)	Absorption Category	Number of Student (%)
1.	85 – 100	Very good	27,78
2.	70 – 84	Good	52,78
3	50 – 69	Good enough	19,44
4	0 – 49	Not good	-
Average (%)		80,55	
Category		Good	

Table 5 shows the students' basic physics performance with average of 80,55%.

Reflection. The result of observation on the basic physics practice learning activity in cycle 1 has followed all the learning syntax of Inductive Teaching Methods. The students are still facing some obstacles to define practical goals, hypotheses and set experimental procedure. Students are also still lack in manipulative some variables and response of the experiment, analyzing experimental data, plot the graph of relationships between variables and interpret the graph, drawing conclusions from an experiment.

The result of scientific attitude assessment indicates not quite satisfactory. There are some indicators of the scientific attitude that is still weakly embedded in students, especially the ability to think logically, emphasis on real evidence, keeping away from blind trust, the ability to make unbiased decisions, the ability to distinguish between hypotheses and reality. The average scientific attitude ability of students in the cycle 1 is 51.5 with the category of quite good.

Assessment of student activity shows that there are some indicators that are still need to be addressed. The indicator is the activity of asking questions and formulating hypotheses. The rate for this indicator is 65.5% with category of quite good.

The performance tests shows that the student absorption in cycle 1 is 80.55% with category good, but there are still 19.44% of students who have absorption rate just good enough.

Reflection for the observation result has been done at the end of cycle 1. The main problem need to be studied is why some obstacles still experienced by student in conducting of basic physics. Some things that emerged are 1) students not yet accustomed to follow the steps of Inductive Teaching Methods in lab, 2) the assistants also have not understood their

role in the guidance of students in particular, 3) the lecturer should provide direction and be involved in more intensive laboratory activities.

Based on the analysis and reflection have been done at the end of cycle 1, there are some considerations for the planning on the action cycle 2. 1) The lecturer needs to convey the reason on why the practicum activities are carried out differently with most other labs. The practicum implemented applying the procedure of Inductive Teaching Methods that aims to internalization of the scientific attitude. 2) Assistants need to be added and give more intensive training in order to guide the students better, especially in setting the experimental goals, formulating the hypotheses and determining the procedure of the experiment, 3) Lecturers / assistants have to test the understanding of students after practicum by asking them to give an example on how to analyze the data, plot a graph relationships between variables and draw conclusions from the experimental results.

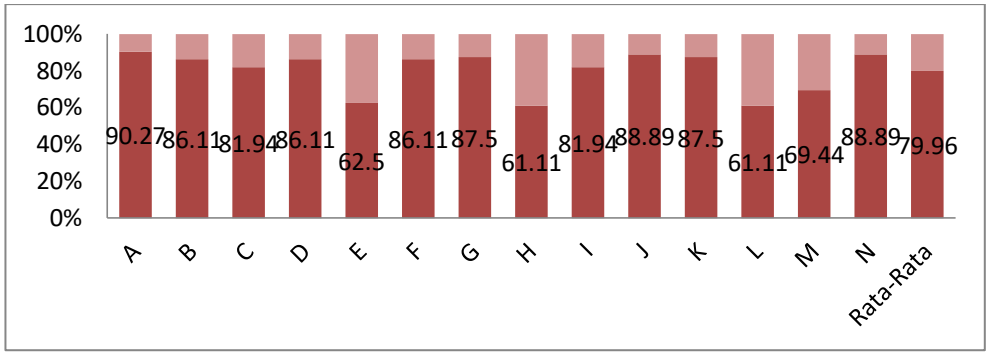
B. Results in Cycle 2

Planning. Planning that has been done: 1) preparing the learning scenario using the syntax of Inductive Teaching Methods. The implementation of learning in cycle two is planned to be almost the same as in cycle 1, but the lecturers at the beginning provide practical direction so that students should really follow the learning procedure of Inductive Teaching Methods so that it can be embedded scientific attitude to the student. 2) The assistant is trained to make the High level question or guiding students to ask high-level questions. Assistants are asked to emphasize on topics to be practiced in the next week at the previous meeting. The goal is to allow students in learning more about the topic of the lab. 3) Counseling for each group is done by an assistant, so it can be more optimal in guiding and serving students. 4) Preparation of additional observers and train observers to operate the scientific attitude observation sheets,

Implementation. The implementation of the Basic Physics Learning Activity in action Cycle 2 follows the Inductive Teaching Methods syntax including 1) asking questions, 2) gathering information, formulating hypotheses, 4) conducting experiments, 5) analyzing data, and 6) drawing conclusions. Lecturers monitor and provide guidance during practicum so that all students are involved in practicum and discussion.

Observation. Observations are made as same as in the cycle 1 that follow to Inductive Teaching Methods syntax. The observation of each group in the action of cycle 2 was performed by an observer who had previously been trained. The learning steps that are carried out are similar to those of cycle 1, It's just that the emphasis on the topic that will be practiced by each group on the previous practicum that is emphasized by the assistant, so that the students are prepared better, especially in formulating the hypothesis and

designing the experimental procedure to be performed. The results of observation in the action of cycle 2 can be described as follows:



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I = Intellectual honesty
J = Decision based on eligible data
K = Objective
L = Able to make unbiased decision
M = Able to distinguish between fact and hypothesis
N = Action and voice are real

Figure 2. Average of scientific attitude of the student in cycle 1.

3). Activity assessment. The assessment result in cycle 2 can be found in table 7.

Table 7. The assessment result of student activity in cycle 2.

No.	Activity Indicator	Score (%)
1.	Deliver question	73,26
2.	Collecting information	78,82
3.	Defining Hypothesis	67,71
4.	Performing experiment	86,81
5.	Analyzing Data	79,86
6.	Inverting Conclusion	81,94
	Average	78,06

4). Performance assessment of cycle 2 is shown in Table 8.

Table 8. The absorption rate of student in cycle 2

No.	Interval (%)	Absorption category	No of student (%)
1.	85 – 100	Very Good	38,89
2.	70 – 84	Good	38,89
3	50 – 69	Fair Good	22,22
4	0 – 49	Not Good	-
	Average (%)	81,87	
	Category	Good	

The data in Table 8 shows the students' basic physics performance which the average of absorption is 81.87%,

Reflection. The improvement learning that is done on the cycle 2 is an improvement effort from the action of cycle 1 in the Physics Basic activity through the application of Inductive Teaching Methods. The improvement steps taken are 1) The lecturers emphasis to the students why in the activities of the Basic Physics practicum applying an Inductive Teaching Methods. And also the reasons students should be able to instill a scientific attitude in them. 2) increase the number of assistants into each group and guide them by one assistant and train how to guide students according to Inductive Teaching Methods pattern. 3) Increase the number of observers for each group into one observer, so that the observation of scientific attitude and student activity more observed accurately. Some of the improvement of the learning step that is done in the implementation of Cycle 2 is done by the lecturer / assistant to each student after practicum activity to see the extent of their understanding of the practicum activity that they have done and also to give assistance if they have difficulties in data analyzing, creating and interpreting of graphs or draw conclusions. Based on the improvement of learning that is done on the action of cycle 2, it shows satisfactory results.

Learning activities undertaken in order to prove the hypothesis of action have been made by two classroom action cycles. The first action is an improvement of the traditional practicum activities that emphasize the technical aspects of experiment by presenting the task of prescription to students, without demanding creativity from within the students themselves so that not embedded Scientific Attitude in students. The action of the second cycle is a refinement of the first cycle action in order to obtain more satisfactory results.

The action is done only in two cycles, because the proposed action hypothesis can be achieved. This is shown from the results of data analysis that has been done on the scientific attitude, activity and student performance in the Basic Physical Activity learning through the application of Inductive Teaching Methods that shows better results between the actions of cycle 1 with the action cycle 2. Assessment of the student scientific attitude shows the increase value of 28.46% from the average class 51.50% in cycle 1 to 79.96% in cycle 2. In general, scientific attitude indicator has been quite embedded in students. Assessment of student activity is increased from 12.56% to 65.50% on cycle 1 and to 78.06 in cycle 2. This shows that the learning activity by applying the steps of Inductive Teaching Methods has been understood by the students. Assessment of student performance in the implementation of the lab also increased, from the average absorption of 80.55% in cycle 1 to 81.87% in cycle 2. The results obtained in this study in accordance with the study theory. Theoretically, the

application of Inductive Teaching Methods can foster and internalize the scientific attitude in students.

Based on interviews that were conducted to students about their responses on the implementation of the Basic Physics activity by applying the steps of Inductive Teaching Methods, it is showing very positive response. Some of the advantages they feel in this lesson are a). Creativity is more honed and developing, b) students can learn more independently, c) practice is more interesting and challenged because the trial procedure does not exist, d) broader student insight in knowing one experiment because they have to learn in advance about the trial procedure to be conducted at the next meeting from various resources (books, internet, tutorials etc.), e) group discussions are more diligent and warm, as each group member obtains preliminary information from various sources. While the weaknesses that they feel are a) require them to prepare more time independently in searching for references about the material of the Basic Physics practicum that will be done, b) Time to practice is longer if they not studied first, c) the implementation of Physics Basic laboratory from 16.00 - 18.00 WIB feels very pressed and cause a sense of haste in students, d) experiments on alternating currents are difficult for students because the tools used are still foreign (oscilloscopes) and other, too much in developing formulas, while they not been studied theoretically in class activities. The results of interviews by assistant revealed that the advantages of the application of Inductive Teaching Methods in the Physics Basic lab are as following: a) the students are more focused on the practicum that will be done, b) the preparation of students more mature, because they have studied in advance, c) The results of the responses are better, the students are more responsive and enthusiastic, d) the students are more familiar with the experiments they are doing, e) the assistant feels more familiar because the student response is very good, f) the assistant is encouraged to prepare the questions in order to ask the students and ask them Hypothesized. The weaknesses of the assistant are a) if the students are not ready before they enter they will be overwhelmed and confused during the lab, b) the lab time is longer because the assistant should ask about the purpose of the lab and ask the students to have a hypothesize and ask them also the next procedure that they will do according to the referral they learn, c) assistants are a little overwhelmed because they have to focus more on serving each student.

4. Conclusion

A. Assessment of the scientific attitude of students is increased from 28.46% to 51.50% in cycle 1 and 79.96% in cycle 2. In general, indicators of scientific attitude have been quite embedded in students.

B. Assessment of student activity is increased from 12.56% to 65.50% in cycle 1 and to 78.06 in cycle 2. This shows that student learning activity increase.
C. Assessment on student performance in doing a practicum is also increased, from 80.55% of absorption rate in cycle 1 to 81.87% in cycle 2.

From the above findings it can be concluded that through the application of inductive Teaching Methods in the Physics Basic in Biology Education PMIPA FKIP UR can internalize the scientific attitude of the students.

Suggestions
Basic Physics lab equipment in the Physics Education Study Program of PMIPA FKIP UR should be added as soon as possible so that students in doing practicum at the same time is the same topic. Similar research can be done by taking into account the characteristics of students, the characteristics of the material being practiced and the facilities that exist in a laboratory. Assistants and observers need to be trained first so that the implementation of the research can really follow the steps of Inductive Teaching Methods and an observation on the scientific attitude is done effectively. The further research can be done in the form of research development to develop a guidance of Basic Physics practicum which can guarantee to grow and develop scientific attitude of student.

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