Preliminary analysis of module development by setting arguments through the application of scientific inquiry models to improve students' scientific attitudes

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Abstract. Physics learning use scientific methods based on scientific attitudes to solve the problems they face. This study aims to conduct a needs analysis related to the application of the scientific inquiry model through the development of teaching materials in the form of modules with the help of argumentation settings to improve students' scientific attitudes in learning physics. This type of research is descriptive qualitative with a case study approach, where the research subjects are teachers and class X high school students in one of the schools located in Bima Regency. The data processed in this study are primary data analyzed from observation sheets and qualitative interviews. data analysis use Likert scale. The initial analysis carried out consisted of module analysis and analysis of students' scientific attitudes. The module analysis results that 50% learning difficulties, 83% needs, 80% performance, and 74% of graduate competency standards. The analysis results for the scientific attitude of students on average are in the good category obtained from the analysis for each indicator that is asking 76%, open thinking 71%, respecting the facts 73% and, critical thinking 75%.

1. Introduction

Today's education world emphasizes students' ability to have 21st-century skills [1,2] such as creative, initiative, adaptive, independent, and responsible [3]. Education aims to prepare students to be able to play an essential role in various environmental conditions precisely in the future. The learning process at school is a way for students to be able to form a good person according to the established educational goals. In the face of increasingly competitive global conditions, the education system helps students develop their potential optimally [1,3]. The form of the Indonesian government's efforts to produce quality students is by developing a curriculum that emphasizes the formation of students' attitudes and characters to be able to master a variety of skills [3,4]. The abilities and skills possessed by students must be in line with the life goals, attitudes, and life skills of the students themselves [1].

Physics is one of the branches of natural science that can help students develop good skills, attitudes, and thinking abilities to solve problems in everyday life [5,6]. In learning physics, it can help students to understand scientific concepts through the activities of studying theories and concepts in a structured manner [6]. Physics Learning also trains students to think logically and systematically by analyzing facts
in everyday life. Physics studies natural phenomena using scientific methods related to the ideas and concepts being studied. Studying Physics is ideal with inquiry activities that foster the ability to think, work scientifically, and be skilled in scientific processes [5,7]. Therefore, learning physics is necessary for training students to be skilled in the scientific process, then produce scientific products that ultimately foster a good scientific attitude to students.

In facing the industrial revolution 4.0 era, scientific attitude is very important to be owned by a scientist or academician [8,9]. Scientific attitude is directly related to cognitive, affective, and psychomotor aspects [10,11] such as high curiosity, honesty, objective, open thinking, caring, thorough, diligent, courageous, and polite.

Conditions in the field indicate that the Physics learning process in one of the high schools located in Bima Regency generally only instills competency and cognitive ability in the realm of memorizing and getting to know the basics of Physics material. The teaching materials used are also still very limited to textbooks and information from teachers. Teachers only explain the content based on information available in books without training students to have skills in the independent learning process. Investigation activities through the stages of practicum to the data analysis and concluding are also not widely done by the teacher. This makes students less independent and focused on high-level thinking processes that involve affective components and polite behavior in receiving subject matter in class. Students in physics are rarely to think objectively, thoroughly, honestly, and think openly in the learning process. These factors lead to low scientific attitudes of students in learning science, especially Physics.

Several innovative learning approaches and strategies can be used to motivate students to be able to think and be skilled in learning by optimizing all available sensory functions. One effective way to foster student motivation is to combine learning models that activate students' thinking and work processes with teaching materials appropriate to the level of need to improve students' scientific attitudes. Teaching materials that are complemented by stages of high-level thought processes and activities involving scientific processes are modules [12,13]. Modules are teaching materials that are designed to focus on providing opportunities for students to practice. The module also accommodates student learning difficulties by involving a series of well-coordinated activities related to the material, media, and evaluation activities [14,15]. To develop students' scientific attitudes, the Physics learning module created is formed by combining the stages of argumentation settings. The teacher does setting argumentation in an important module; argumentation involves thinking skills. Argumentation skills are important to be developed in the learning process because they can increase students' potential [16]. Developing argumentation settings in learning can help build cognitive, communicative, and critical thinking skills to support the achievement of scientific literacy in students [5,16].

Teachers can develop students' scientific attitudes, especially in the realm of science learning, such as Physics subjects [17,18]. This certainly becomes the basis of the teacher's consideration to design and innovate the latest learning models and approaches to be applied according to the students' needs on the importance of having a good scientific attitude in the classroom. Having a good scientific attitude is certainly not obtained by itself by students in the learning process. Still, it needs to be trained by applying several learning models that prepare students to be active in thinking and skills in work.

One student-centered learning model that can develop students' scientific attitudes is a learning model that can improve students' abilities to think and work optimally. The experimental inquiry model is one of the learning models whose stages and flow of implementation are following scientific attitude indicators. The scientific inquiry model is designed to involve students in truly original research problems by exposing students to the field of investigation, helping students identify conceptual or methodological problems in the field, and inviting students to be able to design ways to overcome these problems [19,20,21].

Based on the description above, this important research is conducted for the initial analysis of module development by setting argumentation through the application of scientific inquiry models to improve students' scientific attitudes in learning physics.
2. Method
This research is descriptive qualitative research with a case study approach. This research focuses on intensively, in detail and depth on a variable or symptoms objectively without providing control. The data taken is primary data sourced from the results of the analysis of observation sheets on 40 high school students in class X. The research activities were carried out by conducting initial observations that distributed questionnaire sheets containing question items related to the learning process.

Data collection is done by using several instruments, namely questionnaire sheets and interview sheets. The interview sheet is filled out by the teacher while the questionnaire sheet is used for the initial analysis filled in by students who aim to get data related to responses or responses and assessment of the use of modules and the learning process.

Data analysis techniques for observation sheets used a Likert scale type. It aims to determine the extent of acceptance of teachers and students to accept or reject the question items given. The type of Likert scale used is in the form of questions that ask for agreement or rejection of the questions presented. All question items are positive in which the scale used is qualitative in Likert scale. The value for each indicator of each respondent is calculated using equation [22]:

\[
\text{Value} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%
\]

The form of conversion for assessment of questions for scientific attitudes and the use of modules by students is as in table 1.

| No | Category          | % Indicator Access |
|----|-------------------|--------------------|
| 1  | Strongly disagree | 0 - 25             |
| 2  | Disagree          | 26 - 50            |
| 3  | Agree             | 51 - 75            |
| 4  | Strongly agree    | 76 - 100           |

The results of the initial and final data analysis calculations from the use of modules and scientific attitude of students for each indicator are obtained through categories as shown in table 2.

| No  | Category       | Interval  |
|-----|----------------|-----------|
| 1   | Not good       | 0 - 20    |
| 2   | Not so good    | 21 - 40   |
| 3   | Pretty good    | 41 - 60   |
| 4   | Good           | 61 - 80   |
| 5   | Very good      | 81 - 100  |

3. Result and Discussion

3.1. Material Analysis
The results of the analysis of module development with the argumentation setting on the application of the scientific inquiry learning model consist of the study of student learning difficulties, needs analysis, performance analysis, and analysis of Graduates Competency Standards. The figure for the achievement of the percentage of each indicator for the use of the module can be seen in Figure 1.
Based on the data analysis of the use of modules with the argumentation setting through the application of the scientific inquiry model, the percentage obtained for the study of learning difficulties is 50% in the quite good category. Development of argument setting modules with experimental inquiry models to minimize the challenges of learning failure. This data also provides evidence that students have been able to adjust the learning process with the argument setting module on the application of the scientific inquiry model that can help students themselves to understand the material and theory delivered with an ongoing process.

Achievement data for the analysis of student needs are in the first category, with a percentage of 83%. This shows that the module used has been able to facilitate the characteristics and conditions of students in meeting work needs in competencies expected in educational goals as well. It also indicates that the argument setting module is in accordance with the profile of the students in meeting the global work needs for graduates who will be produced later. Furthermore, the results of performance data for performance analysis are at 80% with a good category. The results of this performance achievement analysis can be understood that the teacher has designed and prepared teaching materials in the form of modules with argumentation settings using scientific inquiry learning models by the 2013 curriculum. In this study, there are some things that still need to be considered in the achievements to fulfill aspects of performance in accordance with the 2013 curriculum that is the use of active learning media based on computers or IT is still an obstacle for some schools that do not yet have adequate facilities such as computer equipment and networks. The computer-based learning media still cannot be used optimally by the teacher considering that in the application of the scientific inquiry learning model is still based on investigation activities that utilize practicum activity in the laboratory. However, the existence of a module that is combined with the argumentation setting is very helpful for students to understand the material well because the module presents a clear and simple concept and theory with communicative language.

The results of data analysis for the achievement of the percentage of graduate competency standards are at a score of 74% with functional categories. This data shows that the use of modules with the argumentation setting through the scientific inquiry model can help the condition and profile of students in meeting the criteria set out in the 2013 curriculum in terms of emotional, character, intellectual and spiritual.

3.2. Analysis of Student Scientific Attitudes
The results of data analysis on students’ scientific attitudes are obtained from 4 indicators, namely asking questions, thinking critically, respecting facts, and thinking critically. Achievement data for each indicator can be seen in Figure 2.

Figure 1. Analysis of the use of argument setting modules with the scientific inquiry model

Figure 2. Results of Analysis of Student Scientific Attitudes
Based on the data analysis results in Figure 2 shows that the achievement of the percentage of indicators asking questions by 76% which indicates that students are active in asking questions caused by the teacher in learning scientific inquiry always gives problems related to the concept of physics to students to be solved. The questioning activity becomes more communicative because students are asked to discuss with classmates to analyze the facts they get from the information presented by the teacher through inquiry activities [5,6]. The open thinking indicator is at 71%. This happens because students enthusiastically listen to information from the teacher and from group discussion friends during the learning process. Students also want to hear responses and instructions from the teacher and classmates during the presentation of the material takes place.

Achievement data for indicators respecting facts are in the good category with a score of 73%. This shows that students are able to gather information based on investigation activities and the facts they get. Facts and concepts are obtained by students through scientific inquiry activities that pass the systematic analysis stage. Finally, the data for the results of the analysis of the achievement of critical thinking indicators are in the good category with a score of 75%. Investigation activities in the scientific inquiry model with the help of the argument setting module encourage students to be active in observing knowledge through experimental activities or scientific inquiry that can help improve critical thinking skills. [2,4,19]. This is what is able to foster an independent attitude on students which then influences the improvement of students’ scientific attitudes.

4. Conclusion
The initial analysis is needed to determine the extent of the problem of implementation of learning in schools. This is the basis for the development of modules and the selection of effective learning models in improving students' scientific skills and attitudes. Based on the analysis conducted, it was concluded that for the analysis of the use of modules on each indicator, namely the analysis of learning difficulties got a value of 50% with a pretty good category, needs analysis with a value of 83% with a very good category, performance analysis got a value of 80% with a good category and standard analysis competence of graduates with a value of 74% with a good category. Then for the results of analysis of scientific attitudes of students on each indicator that is asking, open-minded, respecting facts and critical thinking are in the good category. The results of the attainment of the scientific attitudes of students are the lowest, that is the aspect of open thinking caused by students being still low on motivation to read the information presented through the module completely but are more active when hearing explanations from the teacher or getting information from facts obtained through practicum or videos and attractive image display. Seeing the results of the above achievements, it is necessary to develop teaching materials by selecting interactive learning models that can be analyzed for other variables such as scientific and digital literacy skills in students.

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