Needs analysis in developing student worksheets in senior high school physics-based inquiry learning models to improve students' critical thinking capabilities

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Abstract. Teaching material is one of the learning resources that can help students in the learning process so as to improve their competence. Increased competence can be done by improving the critical thinking skills of high school students, this can be done with the help of the Student Worksheet based on model Inquiry-Based Learning. The purpose of this study is to identify the critical thinking skills of high school students using Student Worksheet based on model Inquiry-Based Learning. The type of research conducted is qualitative descriptive research. Respondents selected in this study were students of class X MIA SMA Pertiwi 2 Padang, amounting to 25 students. The instrument used is the observation sheet in the form of a questionnaire whose data are processed using a Likert scale. Based on the results of field observations obtained the evaluation questions contained in teaching materials have not been oriented to improve the ability of critical thinking. The suitability of learning models and suitable assessment into the category is very less that is 56.6% and 55.8%, this is due to the model and assessment which is used in schools is not in accordance with the model and the assessment suggested by the curriculum 2013. For good category attitudes of 78.5%, while for knowledge, competencies 58.4% and skill competencies 57% are categorized very less, it indicates the ability of learners during the learning process is still lacking. Based on the above preliminary analysis of the learners undertaken is the need for the development of Student Work Sheet Physics High School Based Model Inquiry-Based Learning to improve students' critical thinking skills.

1. Introduction
Critical thinking is a systematic, directed, and clear process used Critical thinking is a systematic, directed, and clear process used to shape and build the development of trust and take action to argue in an organized way in mental activity such as problem-solving, decision making, persuading, analyzing assumptions, and conducting research [1]. In solving the problem is able to develop the ability of critical thinking independently [2]. Critical thinking applies to learners to learn to solve and solve problems in a systematic, innovative, and the underlying solution [3]. Based on these opinions can be understood that critical thinking is needed in solving the problems at hand. The ability of critical thinking is imparted to the learners as well as possible so that learners easily understand the learning of physics.
A teacher's task in learning is to facilitate learners in learning. Teachers should be able to deliver course material in a simple, easy to understand and can help learners to work and solve problems. One of the teaching materials used to guide and help learners in learning is Student Worksheet. Student Worksheet is the learner's worksheet. Student Worksheet is an important part of the implementation of classroom learning. Student Worksheet facilitates teachers in guiding and instructing learners. [4] "The Worksheet, or Task Sheet is intended to trigger and assist learners to undertake learning work in order to master an understanding, skills, and attitude. In addition, the use of worksheets or task sheets can help guide learning so that it is more efficient and effective ". With the right Student Worksheet then learners can be helpful in understanding the material. But not all Student Worksheet developed can instill students' thinking characters such as critical thinking ability. In addition to Student Worksheet, other factors that can affect the learning process is to use the appropriate model of learning so as to instill the critical thinking skills of learners.

The standard process of core activities in the learning process should use learning models, learning methods and learning resources tailored to the characteristics of learners and subjects [5]. One of the instructional models suggested for use is Inquiry-Based Learning (IBL). Model learning based learning Inquiry is a learning that is able to involve students directly in real life by conducting an inquiry on the meaning and purpose of a learning material. Learning with model inquiry-based learning enables students to be mentally and physically active. The material given by the teacher is not simply notified and accepted by the students, but the students have endeavored in such a way that they gain experience in order to find themselves the concepts planned by the teacher [6].

Based on the results of observations and analyzes that have been done in SMA Pertiwi 2 Padang on 25 students given the questionnaire, as much as 48% that the discussion sheet used has not helped in the learning process because the exercises are done by students only by applying the concepts and principles that have been studied and have not reached the stage where learners are asked to solve a problem using the concepts and principles of physics. As a result, learners have difficulty in understanding the material. Student Worksheet used by the teacher in school from the aspect of content not seen KI, KD, indicator, material depth not yet in accordance with Student Worksheet standard, which is expected to contain a title, identity in the form of KI, KD, indicator, learning objectives, supporting information and material exposure. However, Student Worksheet used in the school directly provides learning objectives and exposure of the given material in the form of understanding and formulas. This is less suitable with the learning materials in the curriculum 2013 where the subject matter is distinguished on facts, concepts, principles and procedures. In addition, Student Worksheet used by teachers in learning is still dominated to achieve knowledge, competence has not included three competencies. Instruction Sheet given in solving problems in Student Worksheet is still short so that learners have difficulty and feel confused because of lack of sample problem. In addition, the steps in solving the problem are not explained in detail. Learners are not able to answer why doing such problem solving and is not there any other way. In order for critical thinking ability to be stimulated and well developed, the presentation of materials and learning steps must be changed.

The analysis phase is the process of identifying the problems faced by the students. Outputs to be generated are the characteristics of learners, gap identification, needs identification and detailed task analysis based on needs. There are several stages done in this analysis that is needs analysis and learners. [7] This step is a process of description of what will be taught and forms the basis of all other steps. In this step, the designer determines the need and the difference between attitude, knowledge, and skill. The system is analyzed and the root of the problem is explained. Constraints are determined and perhaps the solution to the problem is found. Needs analysis is a necessary analysis in developing a product. In developing Student Worksheet needs analysis in the form of performance analysis, analysis of graduation standards, and analysis of learning difficulties. Performance analysis is intended to obtain a picture of what performance should be mastered by learners after following the learning process. Figure 1, Performance analysis produces a set of practical skills that learners must master so that learners become competent graduates [8]. In a performance analysis an identification, analysis of
existing gaps exists. To determine the factors that cause a gap and understanding can be done with the identification of teachers, supporting facilities and infrastructure, school policy, social and psychological climate [9]. Needs analysis relating to the profile of graduate students based on the underlying elements in the material and the learning model, the analysis of learning difficulties related to the factors that study the learning (motivation, methods, media and teaching materials). The method used at this stage includes field observation using an observation questionnaire.

Student analysis is conducted for the study of development goals, the analysis of learners is a study of the characteristics of learners in accordance with the design of Student Worksheet development based on model Inquiry-Based Learning To improve students' critical thinking skills.

2. Methods

This research method included in the qualitative descriptive research. [10] Descriptive research is not intended to examine a certain hypothesis, but only to describe a variable or state. One of the categories of descriptive research is survey research. In the survey research required an instrument to survey the preliminary study.

The technique of collecting data by using a questionnaire (questionnaire). [11] The questionnaire is an efficient data collection technique if the researcher knows with certainty the variables to be measured and knows what is expected from the respondents. The answer of each instrument item has a very negative degrade until it is very positive, is less, quite, well, and very good.

The type of data in this study is primary data, is data taken directly from the results of observation of questionnaires to learners. The data collection instrument is a questionnaire for the analysis of learners. Field trials were conducted at SMA Pertiwi 2 Padang class X MIA, amounting to 25 students.

Data analysis techniques for questionnaire needs analysis, student analysis using the Likert scale. It aims to know the extent to which teachers and learners accept or reject the given statement. [12] Likert scale is a statement whose answer is a scale of approval or rejection of a given statement or question. The form of the statement is made in a positive form. So the answer in accordance with the expectations of researchers. The scale of respondents' answers that are qualitative in nature is converted to ordinal scale. The terms convert for the statement, expressed by 4 options of scale with the format:

- Strongly disagree (STS)
- Disagree (TS)
- Agree (S)
- Strongly Agree (SS)

Category of needs analysis and analysis of the characteristics of learners obtained by calculating the scores obtained from each respondent. The score of each respondent is obtained using equation 1.

$$S_k = \frac{\sum X_i}{X_{\text{max}}x_{\text{max}} x 100}$$  \hspace{1cm} (1)

Description:

- $S_k$ = score obtained
- $X_i$ = score of each respondent
- $X_{\text{max}}$ = maximum score from questionnaire each indicator

Data analysis to assess the needs analysis of each indicator using the provisions on Table 1

| No | Score Observation Results | Category       |
|----|----------------------------|----------------|
| 1  | 90$>$ Score $\leq$ 100    | Very Good (A)  |
| 2  | 75 $<$B $\leq$ 90        | Good (B)       |
| 3  | 60$>$ C $\leq$ 75        | Poorly (C)     |
| 4  | $\leq$ 60               | Very Less (D)  |
The results of the needs analysis of learners in the development of Student Worksheet Physics SMA based Model Inquiry Based learning to improve students' critical thinking skills obtained will be displayed in graphical form.

3. Results and Discussion
The analysis is done that was needed analysis and learners. Needs analysis includes performance analysis, SKL analysis, needs analysis and learning difficulties analysis of learners. Meanwhile, for the analysis of learners include the competence of attitudes, knowledge, and skills.

The results of performance analysis include teacher identification, supporting facilities, and facilities, as well as social and psychological climate, can be seen in Figure 1.

![Figure 1. Performance Analysis](image1)

Figure 1 shows that teacher identification is not good category 61.5%, facility of infrastructure 72.4%, while the social psychological climate is in good category 81.5%.

The result of graduate competency standard analysis includes spiritual attitudes, social attitudes, knowledge and skills can be seen in Figure 2.

![Figure 2. Analysis of Graduate Competency Standards (SKL)](image2)

Figure 2 shows that students' spiritual attitudes are very good 90.2% This indicates students behave in accordance with the teachings adopted, but the social attitude, competence shows very less 56.2 %, the competence of knowledge included in the category of less good 58.4%, and skill 57%.

The results of the needs analysis of learners include the suitability of indicators, learning device compliance, suitability of learning materials, suitability of learning models and conformity assessment, can be seen in Figure 3.
Figure 3. Needs Analysis

Figure 3 shows that the conformity of the indicators included in the categories of good 78.3%, suitability of learning tools including good category 77.8%, suitability of learning materials, including poor category 69.4%, and suitability of learning models included in the category very less 56.6% and the appropriateness of the assessment included in the category is very less 55.8%.

The results of the analysis of learning difficulties of learners include motivation to follow the learning, motivation to read the source of learning, difficulty in doing the problem can be seen in Figure 4.

Figure 4. Learning Difficulties Analysis Students

Figure 4 shows that the motivation of learners to take lessons on the category less 64.5%, the motivation to read the source of the lesson 63%, and the difficulty of learners in working on the problem 67.2%.

The results of the analysis of learners include attitude indicators, knowledge indicators and skills indicators can be seen in Figure 5.

Figure 5 shows that the results of the learner's analysis of the indicators of attitudes included in the category of either 78.5%, knowledge indicator included in the category is very less 58.4% and skill entry in the category is very less 57%.

The results of the initial analysis of students that have been done in SMA 2 Padang indicate that the analysis of teacher identification performance in the category of less good 61.5%. Performa teachers in preparing learning tools are good, teachers also have good at mastering the learning. But teachers are still lacking in using varied learning models. The exercises given by teachers have not been able to motivate learners to think critically. Teachers rarely develop their own Student Worksheet that can be used in the learning process. Facilities and infrastructure are in a good category of 72.4%, the school has a classroom equipped with a complete set, the library is available well, has a laboratory and a complete laboratory computer. The psychological, social climate is categorized as good 81.5%
because it shows good social relation in all aspects of school life.

![Figure 5. Student Analysis](image)

Analysis of Competency Standards of graduation shows that students' spiritual attitudes are very good, as seen from the results obtained reach 90.2% this shows learners behave in accordance with the teachings adopted, but on a social attitude, competence shows 56.2%. In the knowledge, competence included in the category of less good 58.4%. This is because the students have difficulties in understanding the concept of physics. In the skills, competence is also included in 57% less good category, due to the rare practicum for material that can be practiced.

In the requirement analysis of conformity of indicators included in good category 78.3%, suitability of learning device including good category 77.8%, suitability of instructional material, including bad category 69.4%, suitability of learning model included in category less good 56.6%, this is because the learning model used is less varied and the form of assessment 55.8%, because the assessment used is not in accordance with the assessment of the curriculum 2013.

In the analysis of learning difficulties learners seen that the motivation of students, 64.5% to follow the learning and reading the source of learning still less 63%. This is because learning resources such as Student Worksheet not yet available with the maximum and yet can help learners in following the learning process. Difficulties learners in working on the problem 67.2%.

In the learner attitude indicator analysis has shown good behavior 78.5%, mean learners have to behave according to expected character values. But on knowledge, competence 58.4% and skill 57% still less good. Because the learning roses are done still give the formulas and less relate the material with daily life, so that learners difficult to improve the ability of critical thinking in formulating the issues, determine the consequences of a provision taken, expressing the definition in the solution of the problem as well evaluate the relevant argument in solving a problem.

Teachers need to develop teaching materials in the form of the Student Worksheet to improve students' critical thinking skills in schools, based on problems encountered in school. Student Worksheet used does not support the attainment of competency attitudes, knowledge, and skills of learners. Problems on Student Worksheet that is used has not supported the critical thinking ability of the learners. [14] The problem of critical thinking is a matter involving the analysis, synthesis, and evaluation of a physics concept. Critical thinking skills include: (1) Ability to identify assumptions given; (2) Ability to formulate the main issues; (3) The ability to determine the consequences of a given provision; (4) The ability to detect the existence of bias based on different viewpoints; (5) Ability to disclose data / definition / theorem in solving the problem; (6) The ability to evaluate relevant arguments in the resolution of a problem. Student Worksheet contains the work steps, creativity, and independence of learners to discover the concepts, principles, rules, and laws of Physics. The advantage of LKPD for teachers is to facilitate the implementation of learning and for learners is to help learn independently to understand and carry out activities or written tasks and improve the ability of critical thinking learners.
4. Conclusion

After analyzing the needs of learners, the results obtained show that the competence of knowledge and skills of students is still low. This is because the learning model used is less varied, the problems contained in teaching materials have not been oriented to improve students' critical thinking skills. Student Worksheet used to support the learning process is not yet available properly. Therefore, it is necessary to develop the Student Work Sheet Lecture High School Based Physics Model Inquiry-Based Learning to Improve Student Critical Thinking Ability.

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