Preliminary study in the student worksheet development using inquiry based learning model with science process skills approach for physics learning of second grade high school

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Abstract. Physics learning is expected to involve direct activity of students in the investigation process to build their knowledge. But in fact, learning is still teacher centered and the involvement of students in the learning process is still low. To solve that problem, need to use teaching materials in the form of student worksheet to guide students to developing and implementing the concept independently. The research aims to describe the preliminary study of student worksheet development. This research includes descriptive research and instrument used are questionnaire and interview sheet. Research subjects are physics teacher and students of second grade high school 2, 3, and 7 Padang, West Sumatera. And then, the results of the preliminary study described. First, the competence of knowledge and skill students needs improvement. Second, the use of learning models and approaches that involve students direct activities have not been optimally carried out by the teacher. Third, the available student worksheet have not optimally to guided students in developing and implementing the concept independently. This preliminary study describes the need for the development of student worksheet using the inquiry based learning model with science process skills approach for physics learning of second grade high school.

1. Introduction
Physics is a science discipline that can be predict natural phenomena. In this case to obtain physics knowledge using a scientific process. As a scientific process of learning, physics in schools should be carried out by involving the active participation of students in building their knowledge. Direct involvement of these students can develop all aspects in him such as attitudes, knowledge, and skills.

In facts based on interviews with five physics teachers and direct observation of second grade high school 2, 3 and 7 Padang, West Sumatera showed that physics learning was not optimal involving active participation of students. In this case, learning that involves students direct activities often has difficulties because students are still difficult in developing and implementing the concept independently. This happens because the variety of learning models and approaches by teachers has not varied. Besides that, the existing teaching materials have not optimally guided and motivated students to learn independently, actively, and creatively.
To solve this problem in the learning need to use teaching materials in the form of student worksheet to guide students to develop and implement the concept independently. Student worksheet is a sheet containing tasks that must be done by students [1]. The use of student worksheet is during the learning process to guide students to gaining knowledge. In accordance with this, there should be steps in the student worksheet scientific process that can guide students. In this case, the teacher as a mentor is expected to be able to connect the experiences of students with the problems of daily life related to learning. If students realize the relationship between what is learned with the real world is an important problem for them, then the learning motivation will be increase.

One of the real world context based learning models is the Inquiry Based Learning (IBL) model. This model makes students active in building knowledge based on their experience in gaining that knowledge. Real world phenomena become a reference to attract students attention related to learning. The use of IBL can create more meaningful and permanent knowledge in students. Students in the IBL model are directly involved in building their knowledge by conducting experiments [2].

Five phases in IBL model [3]. First, the orientation phase focuses on attracting students interest and curiosity regarding the problem at hand. Learning topics are introduced based on the surrounding environment. Second, the conceptualization phase is the process of understanding the concepts of the problem to produce a research problem formula. Third, the investigation phase to find solutions a problem. Fourth, the conclusion phase is to conclude the results of the investigation. Fifth, the discussion phase is communicating and reflecting all the process that have been carried out.

The use of the IBL model is in accordance with the science process skills approach. The importance of using the process skills approach in learning is that it can teach ways to achieve knowledge [4]. The combination of the IBL model with the science process skills approach makes students to understand the concept of science, especially physics in the problem solving process. Student worksheets using the IBL model with a science process skills approach can make physics learning more meaningful so as to improve student competence.

The research aims to describe the preliminary study of student worksheet development using IBL model with science process skills approach for physics learning of second grade high school.

2. Method
This research uses a descriptive method. Descriptive research to describe, interpret and describe or explain what it is about a variable or state [5]. The research aims to describe the preliminary study of student worksheet development. The stages of descriptive research include planning, designing and developing instruments, collecting data. Data that has been collected is analyzed and continued by describing the data that has been obtained.

Research subjects are physics teachers and students of second grade high school 2, 3 and 7 Padang, West Sumatera. The sampling technique is probability sampling. In this case each member of the population can be a sample [6]. Probability sampling technique used simple random sampling.

The data used in this study are primary data obtained directly from the sample through questionnaires and interview sheets. Questionnaire data collection techniques using a Likert scale. Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group of social phenomena [6]. The Likert scale procedure is to determine the score on each question in the distributed questionnaire [7]. Respondents answers are divided into the following four assessment categories: 1 = less; 2 = enough; 3 = good; and 4 = very good.

Data analysis techniques used are quantitative techniques using descriptive statistics. Descriptive statistics are statistics used to analyze data by describing data that has been collected as it is without intending to make a generalized conclusion [6]. The questionnaire results are obtained by calculating the score of each indicator given by the respondent. Calculation of values in each indicator using the formula:

\[ S_k = \frac{\sum x_i}{x_{max}} \times 100\% \]  

(1)
Which, Sk is the score obtained, Xi is the score of each respondent, and Xmax is the maximum score of the questionnaire for each indicator. Furthermore, to determine the criteria for each indicator classification is used in Table 1.

| Interval     | Category  |
|--------------|-----------|
| ≤60          | Very Less |
| 60 < value ≤75 | Less     |
| 75 < value ≤90 | Good     |
| 90 < value ≤100 | Very Good |

### 3. Result and Discussion

The research data was obtained from the answers to questionnaires filled out by respondents. The data obtained are needs analysis and students analysis.

#### 3.1. Result of Needs Analysis

Needs analysis conducted include performance analysis, graduation standard analysis and analysis of learning difficulties. Performance analysis consists of teacher identification and completeness of facilities and infrastructure.

Based on Figure 1 in general the performance of the teachers in preparing learning equipment have been good and accordance with the curriculum 2013. Curriculum 2013 aims to produce students who are productive, creative, innovative and active through strengthening attitudes, skills, and knowledge [8]. However, teachers are still difficult in implementing learning models and approaches that can activate student in physics learning. In addition, the teachers uses a textbook and student worksheet that self-designed in learning. Constraints in using student worksheet are not all students trying to experiment, generally students tend to only record the results of having friends. This indicates that the motivation of students in learning is less and the student worksheet used is considered less attractive. Facilities and infrastructure in schools for physics learning activities have been good but laboratory activities have not been optimally utilized in learning.

Furthermore, graduation standard analysis with aspects of assessment of spiritual, social, knowledge and skills attitudes. The results of the graduation standard analysis can be seen in Figure 2.
Figure 2 shows that the aspects of the spiritual and social attitudes of students are good. Students behave well in accordance with the teachings of their religion, active in spiritual activities, and respect diversity and interact with all those in the school environment. But for knowledge, students are still unable to link facts with learning. In general, conceptual, principle and procedural understanding of students towards learning material is still less and difficulties in solving problems in learning. The skills of students in the laboratory are still not optimal because rarely learning activities in the laboratory, so that the students understanding of learning is still less. This can be improved if the teacher uses the IBL model and process skills approach that can involve the students direct activities to build their knowledge by experimenting and increasing students understanding in accordance with Bayram [2] and Simsek's opinions [9].

After that, analysis of learning difficulties with aspects of student worksheet assessment, learning models, and learning approaches. The results of the analysis of learning difficulties can be seen in Figure 3.

Figure 3 illustrates that the student worksheet available in schools has not made it easy for students to understand physics lessons and carry out practical activities. The available student worksheet has not optimally motivated students to build their knowledge. Supposedly, the use of student worksheet can minimize the role of teacher, but more enable students [10]. After that, the learning model is generally in accordance with the curriculum 2013 recommendations, but its implementation in the learning process is not optimal. The approach used in learning is the student center, but its implementation often experiences obstacles such as the difficulty of students conducting investigations to solve problems. This causes learning to tend to focus on the teacher in providing knowledge. Students direct experience in building their knowledge is still lacking so learning becomes less meaningful.

3.2. Results of Student Analysis
Student questionnaire consists of six indicators, interest, learning motivation, learning style, attitude, knowledge, and skills. The analysis results of students can be seen in Figure 4.

![Student Analysis](image)

Based on Figure 4, the following information is obtained. First, the interest and motivation of students towards physics learning is less. Constraints faced by students are the difficulty of finding solutions in solving problems or tasks given in the learning process. The IBL model influences student motivation in learning and scientific process skills [2]. Second, the learning style that students like is practicum, because they are directly involved in building knowledge and implementing the concepts obtained. Third, the spiritual and social attitudes of students are good. Fourth, the knowledge of students is very less. The reason is that students find it difficult to understand physics material and it is difficult to explain the material again. Learning is not optimal yet facilitates students to build their knowledge through direct activities. Fifth, during practicum activities students do not fully understand the practical steps and are less motivated to implement them.

4. Conclusion
The results of the preliminary study show that students attitude competence in physics learning are good but for competence knowledge and skills need to be improvement. This is because the use of learning models and approaches by teachers that involve direct activities of students is not yet optimal. The structure, content, and graphics of the student worksheet that are used still need to be considered again to motivate students to learn independently. This preliminary study describes the need to develop student worksheet using IBL model with a science process skills approach.

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References
[1] Depdiknas. (2008). Panduan Pengembangan Bahan Ajar. Jakarta : Direktorat Pembinaan Sekolah Menengah Atas.
[2] Bayram, Zeki., Oskay, Ozge Ozyalcin., Erdem, Emine., Ozgur, Sinem Dincol., Sen, Senol. (2013). Effect of inquiry based learning method on student’s motivation. Procedia-Social and Behavioral Science, 106, 988-996.
[3] Pedaste, Margus., Macots, Mario., Siiman, Leo A., Jong, Ton de., Riesesn, Siswa A.N., Kamp, Ellen T., Manoli, Constantinos C., Zacharia, Zacharias C., dan Tsourlidaki, Eleftheria. (2015). Phases of inquiry based learning: definition an the inquiry cycle. Educational Research Review, 14, 47-61.
[4] Shahali, Edi Hafizan Mohd dan Halim, Lilia. (2010). Development and validation of a test of integrated science process skills. Procedia Social and Behavioral Sciences, 9, 142–146.
[5] Sukardi. (2007). *Evaluasi Pendidikan*. Jakarta: Bumi Aksara.
[6] Sugiyono. (2012). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alpabetha.
[7] Supriyanto, Sani A. dan Masyhuri Machfudz. (2010). *Metodologi Riset: Manajemen Sumberdaya Manusia*. Malang: UIN-Maliki Press.
[8] Mulyasa. (2014). *Pengembangan dan Implementasi Kurikulum 2013*. Bandung: PT. Remaja Rosdakarya.
[9] Simsek, Pinar dan Kabapinar, Filiz. (2010). The effect of Inquiry based learning on elementary student’s conceptual understanding of mater, scientific procces skills and science attitudes. *Procedia-Social and Behavioral Science*, 2, 1190-1194.
[10] Prastowo, Andi. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.