

[Review Article]

STUDENT WORKSHEETS OF PBL AND PROBING PROMPTING TECHNIQUE ON CRITICAL THINKING SKILLS

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ABSTRACT

In the 21st century Critical thinking skills are considered important. One of the media that can use to practice critical thinking skills is student worksheets. This study aims to discuss the design of student worksheets based on problem-based learning models assisted by probing-prompting techniques to improve critical thinking skills in physics learning. The method used in this study is a literature study as an initial stage of the development design. The results of the literacy study show that student worksheets are a companion material in the learning process that will make teacher and student interaction more effective, the material becomes easier to understand, and students are more active in critical and creative thinking so that thinking ability can be achieved. Therefore, it is advisable for subsequent researchers to try to develop again the worksheets of the students in this study and test the results of the development in physics classes.

Keywords: Student Worksheets, PBL Models, Probing-Prompting Technique, Critical Thinking Skills.

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1. INTRODUCTION

Thinking is said to be critical when the thinker analyzes information correctly and carefully, looking for valid evidence and solid conclusions to believe and do something (e.g. Emily & N.G. Holmes, 2020; N. Mafarja et al., 2021; Benson, et al., 2019). Through the process of thinking with critical, you can properly collect and find information and process it in a way that leads to credible conclusions. In an era of global competition, the ability to think critically is a very important skill for students in the hope of selecting and classifying new information that emerges daily. Therefore, critical thinking skills need to transform through the educational process (e.g. P.D.A. Putra et al., 2021; N. Mafarja et al., 2021; B. Jatmiko et al., 2018). Critical thinking skills play an important role in preparing students to become reliable problem solvers, mature decision makers, and people who never stop learning.

Physics as a branch of natural science discusses various phenomena that occur in everyday life. Physics learning in students expected not only to master concepts but also to apply concepts that they have understood in solving Physics problems. Students' ability to solve problems in learning activities is one of the competencies in achieving the 2013 curriculum issued by the Government of Indonesia through the Ministry of Education and Culture Number 81 A of 2013. With the ability to solve problems that are qualified, students will be able to think critically and creatively to solve the problems they face and are required to be independent (e.g. Marcaida et al., 2022; Rudd et al., 2021; Jess et al., 2021). Physics as knowledge that can develop the power of reason and analysis of

problems related to nature, it is necessary to strive to increase the mastery of concepts through meaningful learning. One way is to apply critical thinking skills.

Skills to think critically in their development need to train in students in order to choose the best alternative choice version of them, able to behave rationally and have the courage to account for all decisions taken. Critical thinking skills are important things that need to develop in learning activities. In everyday life in the context of learning, a student must have faced with a problem that requires students to solve the problem by choosing, making solutions, and making decisions quickly and precisely (e.g. Wan et al., 2019; N. Mafarja et al., 2021; Taufiq et al., 2019). Thus, problem solving and decision making must carry out carefully, through a mature thinking process so that it can cultivate and improve the critical thinking skills of students.

Critical thinking skills can examine problems in depth, have an open mind to the decisions and opinions of others, try to understand and validly evaluate the information received before reaching a decision and be able to connect cause and effect in finding solutions to cases encountered both in the learning process activities and in the environment of daily life. The results of previous studies showed that students' critical thinking skills during the learning process were still low. One of the reasons is that physics does not use student worksheets in the learning process that developed using a problem-based learning model as a learning resource. Learning is carrying out only from the guidebook provided by the school and there are no additional learning resources (e.g. Wan et al., 2019;

Ridha et al., 2018; Taufiq et al., 2019). As a result, students are less motivated to engage in free learning activities and lack critical thinking skills.

Most student worksheets used in schools are more general and usually only contain a summary of the material. The material presented usually directly given without a detailed explanation and there are no instructions to teachers and students on how to use the student worksheets. As a result, students lose interest in existing worksheets and are unable to improve their critical thinking skills. In addition, the packaging of material tends to be meaningless causing students only memorize the material without understanding the existing concepts so that it is easy to forget and when given a question that is correct slightly varied, students will experience confusion. The learning problems above can be overcome by using a learning model that allows students to participate in the learning process. One of the learning models is the problem-based learning model (PBL). Problem-based learning (PBL) encourages students to develop curiosity to explore their knowledge. This learning also allows students to learn independently from the questions asked (e.g. Budi et al., 2018; Mundilarto & Helmiyanto, 2017; Himawan & Heru, 2018). Students' thinking skills can develop from the process of finding and solving problems.

In the 2013 curriculum, learning activities centered on students with the application of cooperative learning and active learning methods. Problem Based Learning (PBL) is a form of learning model that centered on students. Learning activities with the application of the Problem Based Learning (PBL) are teaching and learning activities where

students given challenges in the form of problem cases that exist in the real world, so that they can solve in groups and individuals (e.g. Mundilarto & Helmiyanto, 2017; Harli Trisdiono, 2019; Halmaida et al., 2020). In learning activities by presenting problems, it can improve students' ability to think when understanding a given concept. This is in line with Yusri (2018) statement that "learning with the Problem Based Learning (PBL) model is a teaching approach that provides challenges for students to find solutions to real-world problems individually and in groups".

Research conducted by Putri (2018), regarding the influence of the Problem Based Learning model on students' critical thinking ability, showed the results that the Problem Based Learning model has an influence on students' ability to think critically. In addition, research from Nopia & Sudjana (2016), regarding the influence of the Problem Based Learning model on students' critical thinking skills, obtained results that there is a significant influence between the Problem Based Learning model and critical thinking skills in students. In this study, the Problem Based Learning (PBL) reviewed again, but the PBL model used assisted by the Probing Prompting learning technique. The Problem Based Learning (PBL) model with the Probing Prompting technique is a learning model that directed to solve a problem through a series of maps as a guide. In this study, the PBL learning model assisted by the probing prompting technique.

The probing-prompting technique is closely relate to digging questions to get deeper answers from students who intend to develop the quality of answers,

so that the following answers are more clear, accurate, and reasonable. During the process of searching and finding answers to these problems, they try to connect the knowledge and experience they already have with the questions to be answered (W. Jannah, et al., 2021; R. N Putri & T Taufiqulloh, 2020; I.K. Zakiri, et al., 2018). The question and answer process in learning is done by appointing students at random so that each student inevitably has to participate actively. Students cannot avoid the learning process, because at any time they can be involved in the question and answer process.

Student worksheet can activate and construct students' critical thinking skills by giving problems in the form of questions so that they can hone and improve students' critical thinking skills in an effective learning process (e.g. Wan et al., 2019; Dandi & Dwi, 2021; D Yulianti , 2017). The problems listed in the student worksheet relate to the real life of students. This makes it easier for students to learn and expected to master the important concepts presented in Physics learning.

In learning Physics, it is necessary to understand and master the material, especially theory. A theory confirmed by experiment, which gives the same result when repeated under the same conditions, as a more specific one. Therefore, learn Physics must be meaningful learning in the sense that every concept learned must be thoroughly understood before arriving at exercises whose applications are to material and everyday life theory (Chang, et al., 2008; Zainuddin, et al., 2019; Z C Zacharia & G Olympiou, 2011). To achieve the objectives in Physics learning, an interesting student

worksheet needed that can use as a guide in learning.

Based on the background above, it encourages researchers to examine student worksheet design based on problem based learning models assisted by probing-prompting technique learning physics. It is suggest that this worksheet can used as a learning medium for students and makes it easier to convey material.

2. METHOD

This research is a literature study with a qualitative descriptive method. This study examines the results of other research that are relevant and support the topics discussed so that it will produce a research framework.

Data analysis begins with collecting various relevant and supportive sources used as a reference for the study. Scientific articles used as reference sources selected by researchers based on their closeness to the topics discussed. The method used in writing this article begins by selecting keywords for reference searches on Google Scholar. The keywords in the search for articles used were "student worksheets, problem based learning model, probing prompting technique, and critical thinking skills". The inclusion criteria were student worksheets based on problem based learning model assisted by probing prompting technique, and critical thinking. The search for reference articles are limit to the last 10 years and were journal articles that met the inclusion criteria.

Data collected and interpreted in tabular form and analyzed descriptively. The results of data analysis are in the form of

a descriptive study regarding the design of student worksheet based on problem based learning models assisted by probing-prompting techniques to Improve critical thinking skills in learning Physics. In section of discussion, the researcher explains how the relationship between the results of this study and the results of previous research, how to design a students worksheet based on problem based learning model assisted by probing-prompting techniques to improve critical thinking skills in physics learning, and explain the advantages and disadvantages of student worksheet. In general, the procedures performed by researchers in this systematic literature review were (Jesson et al., 2011):

a. Read related scientific writings

In this section, the author looks at the structure and text such as table of contents, abstract, headings and sub-headings, to see if the text is appropriate for your purposes. If the text seems fit for purpose, then read it in more detail to look for specific research that would support the Literature Review. This technique makes it possible to identify suitable material by reading widely and to gain a general understanding of the literature to study.

b. Evaluate all scientific writings read

Quality scientific writings are electronic journals and databases. Be careful when doing a Google search that produces unqualified site and make sure the research comes from. Things that must considered in evaluating scientific writing: accuracy, objectivity, up to date and coverage.

c. Summarizing these publications

Make notes when reading literature about: the main theory or problem in the text, summarizing the main points proposed by the author, and other things that considered important.

d. Combine into one complete scientific story about a problem.

3. RESULT AND DISCUSSION

Problem-Based Learning with Probing Prompting is a real-world problem oriented learning model that helps students develop thinking and problem solving skills combined with questioning to explore, and direct students to acquire information and knowledge. Problem-based learning with Probing Prompting technique can also motivate students to deepen their understanding of a problem and students can get the intended answers to achieve their learning goals. Students' physics learning becomes more interesting and challenging, because learning physics by applying problem-based learning model with Probing Prompting technique requires student's concentration and activity in the classroom. Problem based learning model assisted by probing prompting technique is characterized by 1) posing problems to everyday life, 2) providing questions that explore knowledge and guide students to find solutions, 3) provide students with opportunities to work together and conduct investigations, and 4) opportunities for students to report the results of discussions to find solutions of problems

The Problem Based Learning model with the Probing Prompting technique is useful for developing students' ability to solve problems by exploring and connecting

what is learned with the problems given in the learning process. Thus, students gain the ability to solve problems and understand the relationship between the physics concepts studied and the realities they face in everyday life. The Problem Based Learning model combined with the Probing Prompting technique in its application also has several advantages. The advantages of the Problem Based Learning Model using the Probing Prompting technique are 1) increasing students' attention and focus on learning activities, because students must always be ready to answer questions asked by the teacher during the learning process, 2) increasing active student participation in learning, especially in formulating problems and looking for solutions to the problems given, 3) increasing students' creativity in answering questions and finding solutions to the problems posed, 4) increasing the quality and quantity of student answers in answering questions and solving a problem, 5) growing student motivation in understanding a problem more fully through the provision of questions, so as to be able to achieve the intended answer.

Physics learning experienced by students also becomes more interesting and challenging, because through the application of the Problem Based Learning model with the Probing Prompting technique, it demands concentration and student activity in the learning process. This creates meaning and increases students' understanding of the topic. The learning process that students go through has a positive impact on both the development and physics critical thinking skills of students. Therefore, this study aims to explore students' critical thinking skills during the learning process using problem based learning model assisted by probing prompting technique.

Student worksheets are design to resemble teaching materials in Physics learning. This worksheet designed by the author to help teachers in the learning process and as a learning resource for students both in class and at home. The following are the characteristics of student worksheet based on Problem Based Learning Models Assisted by probing-prompting technique:

Table 1 Characteristics of student worksheets based on PBL models assisted by probing-prompting technique

Aspect	Information
Content	The contents of the student worksheets are: <ul style="list-style-type: none"> • Have operational learning goals • Accuracy of serving order • The sub-topics on the student worksheets are sorted • Evaluation accuracy • The practice questions are in accordance with the specified indicators and the practice questions aim to train critical thinking skills • The practice questions must act as a guide that can explore the thoughts of students
Construct	The preparation of student worksheets refers to the characteristics of FRISCO critical thinking skills, namely: <ul style="list-style-type: none"> • Focus The questions on the student worksheets are designed so that students focus first on the questions to be able to answer the questions

Aspect	Information
	<ul style="list-style-type: none"> • Reason The questions on the student worksheets are designed for students to state the reasons for their answers • Inference The questions on the student worksheets are designed so that students conclude their answers after doing the analysis • Situation The situation of the question or the core of the question can be understood by students • Clarity The questions made must require students to make clear and correct conclusions about the problem • Overview (Overall inspection) Questions designed on studentworksheets must haveinstructions for students to re-check their answers so that they are sure of what they conclude
Language	<ul style="list-style-type: none"> • The formulation of the sentence mustbe communicative • The sentences in student worksheets must use good and correct language,and according to EYD • The formulation of the sentence does not cause double interpretation or misunderstanding

Based on table 1 above, it shows that student worksheets based on the PBL model assisted by the probing prompting technique must designed in such a way as to be attractive in terms of content, construction and language. First, in the content section, student worksheets based on the PBL model with the help of probing prompting techniques must include clear competency standards, and learning objectives based on teaching materials. The preparation of student worksheets also needs to consider in the correct order of writing. Student worksheets in this study are identical to problem-based questions that will lead students to think critically in finding and finding solutions to problems that occur in everyday life related to the material beingstudying. The questions displayed in this student worksheet are used as a guide for students to improve their understanding of the material being studied, and can stimulate them to think deeply (critically) in analyzing

and evaluating the problems presented in the student worksheets. Therefore, the important point of the contents of this student worksheet is to contain problems related to teaching materials in the form of questions that can improve students' critical thinking skills.

Second, in the construction section, the student worksheet design must refer to the goals achieved. Base on the goal the questions on student worksheets designed so that students focus first on questions to be able to find answers, questions on student worksheets designed for students to express reasons from the answer and then conclude the answer after doing the analysis. The design of the questions in the student worksheets is also easy to understand so that it requires students to make conclusions from the problems presented. At the end, students accept instructions to re-check their answers so that they are sure of what they

conclude. Therefore, the important point in the construction section of this student worksheet is that the design of this student worksheet must base on indicators of critical thinking skills, namely: interpretation, analysis, evaluation, inference, explication, and self-regulation.

Third, the language section explains that the preparation of this worksheet must use communicative and clear sentence formulations so that students can understand the contents of the student worksheets and can work on the instructions in the student worksheets and achieve the desired goals. The use of sentences in student worksheets must be in accordance with a good and correct improved spelling so that it does not cause double interpretation or misunderstanding.

If the three important elements in the student worksheets mentioned above are met, student worksheets based on PBL model with the help of probing-prompting technique can be said to be effective in improving students' critical thinking skills in Physics learning.

4. CONCLUSION

In designing a PBL model based student worksheet with the help of the probing prompting technique, they must pay attention to the content, construction, and language of the worksheet. These three elements have a very important role to improve students' critical thinkingskills. The content section of this worksheet contains problems related to teaching materials in the form of questions that can improve students' critical thinking skills. Student worksheet construction must base on indicators of critical thinking skills,

namely: interpretation, analysis, evaluation, inference, explication, and self-regulation.

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