

IMPLEMENTATION OF WORKSHEET BASED ON PRODUCTIVE QUESTIONS TO IMPROVE INQUIRY SKILL OF SENIOR HIGH SCHOOL STUDENTS

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Abstract This article was result of research and development (R & D) which aims to obtain profile of inquiry ability of students. Model of the tool development was based on 4-D model of Thiagarajan et al., which are consist of define, design, develop, and disseminate. In 2015, we had produced the tool, which was student worksheets, that meets validity criterion both by experts and practitioners. The model/framework of the worksheet consists of title, question of investigation, analysis questions, and question to infer. The model/framework minimized guidance statement just like as in laboratory activity guidance book (which were like “cake recipe”). Limited testing in this study was conducted in develop stage, using descriptive analysis approach. The subject of research was students of XI class consist of 30 students, at SMAN 1 Makassar in even semester of academic year 2016/2017 on heat and temperature. The results of study showed that the average of inquiry ability of students of SMA N 1 Makassar was in enough skilled categories. Learning process by using this student worksheet (LKPD) could train the inquiry ability of students because this worksheet consists of scientific activity based on science process skill. The SMA students, who were the subject of this research, were unfamiliar with independent learning, therefore the use of similar worksheet for another topic was needed. If students have familiarity with this LKPD, their inquiry ability would be getting better and better, students will be accustomed with scientific activity, and we expect that the scientific habitual will be formed and would be character.

Keywords : student worksheets, productive question, inquiry

INTRODUCTION

Physics is a highlighting science to scientific activity in laboratory which needs the operational equipment in learning process. The One of equipment is student worksheets called LKPD. The practical use of LKPD or LKS as the general known in school (which is used by a teacher) is the aggregate matter, example, and exercise numbers. It is not a small number of teachers using student worksheet/LKS as the most important part in a learning management. According to author's observation about worksheet/LKS content, it over highlights to the exercises, or it over highlights to the cognitive aspect moreover to the concept implementation. Therefore, the author states that the existing worksheet/LKS cannot accommodate the psychomotor development, the whole concept, and the skills. Thus, the existing worksheet/LKS cannot accommodate the scientific approach in curriculum in 2013.

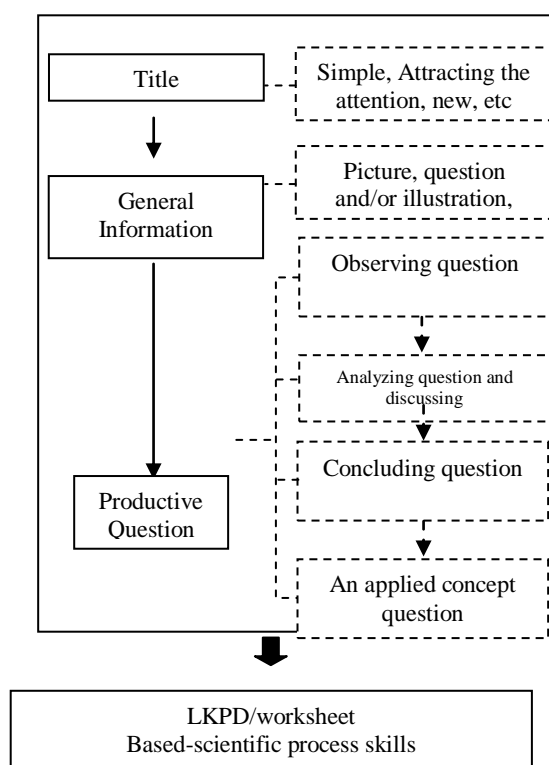
The explanation above is relevant to the result of study Wattimena, et al. 2014 which indicates the existing use of experiment instruction such as cookery book in physics experiment in some research schools. Furthermore, the result of study found by Cockman (2008) shows that in physics experiments, students need to be given a suppression consisting of skills exercise such as observing, classifying, measuring, communicating, interpreting data, and doing an experiment in a row which is based on matter characteristic. This condition needs physics teacher creativity in LKPD-developing (Experiment activity).

The role of teacher as facilitator is a successful key of the use of LKPD. In the learning process, it is recommended to do a quality Questioning and Answering (Q&A). Giving an effective question gives more potential especially for encouraging students thinking and reasoning (Kissock & Iyortsuun, 1982 on Suud Karim and co., 1994). Sheila Jelly (1985) classifies the questions to be productive questions and unproductive questions.

Meanwhile Suud Karim and co. (1994) describes how important the development of productive questions in scientific learning is. In this way, many students can be involved in productive questions, and it differs from cognitive questions answered by a small number of students who understand the concept. So, the productive questions have an important role to encourage students to answer or to express a statement, and to raise the independent learning-skills. Thus, learning a relevant science together with principle science is science as a product and science as process.

Based on Karim et al (1994) , the productive question has a strong role to create a bravery of answering or expressing a statement because the productive questions get more students involved to answer, and it differs from the cognitive questions used to be answered by a small number of students who understand the concept. The questions used in Natural Science learning must be able to create a courage activity for students in scientific work. According to Jelly 1985, a productive question is a stimulating question to productive activity or scientific activity, while an unproductive question needs an answer from secondary source such as books. A scientific process is developed and trained through the use of process skills approach or scientific process skills. If the teacher presents a planned-productive question, the students will get an example directly regarding to the questions. The students' curious feeling can be also expressed in a question that aims at doing an investigation to the observation within productive question. The productive question is a series of including questions in worksheet that needs a series of scientific activities in order to find out the answers. Scientific activity conducted in this worksheet uses the approach of scientific process skills.

One of efforts providing Physics as a product, a process, and a behavior is by learning the model based-inquiry. Gulo in Trianto, 2009 states that inquiry strategy is a series of learning activity involving all of students' ability to find out and to investigate systematically, critically, logically, analytically, so they are able to formulate their discoveries or their inventions strongly. By Learning model based on inquiry, the students' inquiry ability is wished to grow and to develop. The Inquiry ability is a capable of getting information through observation or experiment to solve a problem using critical thinking and logical thinking which consists of stating problems, formulating a hypothesis, designing an experiment, collecting, interpreting, and concluding the data. So, the use of LKPD based-productive questions taught of scientific process skills is relevant to the inquiry learning. This approach is developed to facilitate the teacher teaching science (Physics) with the use of inquiry in some relevant stages to students' thinking capability stages (Wenning, 2010). Levels of inquiry are divided into five levels, such as discovery learning, interactive demonstration, inquiry lesson, inquiry lab, and hypothetical inquiry. In this study, researcher will analyze inquiry capability only into interactive demonstration, discovery learning, inquiry lab, and hypothetical inquiry level.



(resource:herman, 2015)

Figure 1. LKPD/worksheet based-scientific process skills framework

In 2005, researcher has made an effective worksheet/LKPD to get tested for massive subject numbers. This is based on the result of assessment by the expert and the practitioner and also the result of limited testing to see the effectiveness and the implementation of equipment. According to the result of literature studies (Guilford, 1988; Reif, 1995; McDermott, 2010; Santyasa, 2003; Etkina, 2005; Popper, 2005; Wenning, 2006; Brewster, et al. 2009; Abrahams & Milar, 2008; Danielson, 2011; Nivalainen, et al. 2013; Putra, 2013), it shows the information of student worksheet characteristic based-scientific process skills which has framework that consists of several processes, such as (1) A containing identity of title with characteristic like more specific, brief, clear, and the attractive attention (2) A general information like figure and/or descriptive narration: (3) the productive questions consisting of observing question, analyzing question and discussing, concluding question and applied concept question like on figure 1.

So that, the objectives of study are to (1) know students' capability of physics inquiry profile through the use of delivered LKPD, (2) produce a LKPD prepared that is used widely.

THE RESEARCH METHOD

This study is a result of research and development (R&D) referring to the research and development design of Tiagarajan, semmel, and he is known of 4-D, the acronyms of define, design, develop, and disseminate. In 2015, the researcher has produced the learning equipment of worksheet based-productive question. The validity result by the expert and the practitioner shows that the produced equipment is very effective to get a limited testing. (Herman, 2015). This produced worksheet according to the researcher needs to be tested more widely before distributing. This is to get a good result.

The plot of research implementation is given into Figure 2.

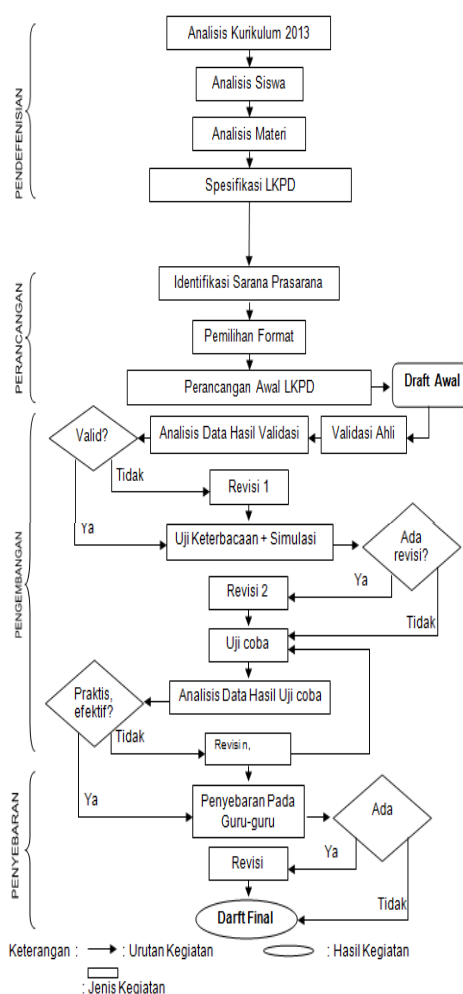


Figure 2. The plot of research implementation.

The limited testing in this study is in the stage of develop, and the use of approach method is descriptive analysis method. This method is used to getting the students' profile of inquiry capability in SMAN 1 Makassar. The subject is students of X1 class in SMAN 1 Makassar consisting of 30 students. In academic year 2016/2017 even semester, the matter is Temperature and Heat. The collecting data method uses authentic assessment with the observation worksheet which has assessment criteria within to measure inquiry ability in the learning process focusing on level of discovery learning, interactive demonstration, inquiry lab and hypothetical inquiry.

The assessment of inquiry ability for each student is done by observer. Students' inquiry is known of Grade point group (GPG) measurement that bases on students' score existed in observation worksheet of inquiry ability with formulation as $GPG = (x/IS) \times 100\%$, where x is the average score of students' inquiry ability in a observed group, and IS is an Ideal score (Maximum score). The interpretation of inquiry ability according to the criteria is shown in table 1.

Tabel 1. Grade Point Group (GPG) Categories

<i>No</i>	<i>GPG Categories (%)</i>	<i>Interpretation</i>
1	0 – 20,00	<i>Very less capable</i>
2	20,01-40,00	<i>Less capable</i>
3	40,01 -60,00	<i>Capable enough</i>
4	60,01-80,00	<i>Capable</i>
5	80,01-100	<i>Very Capable</i>

THE RESULT AND DISCUSSION

Based on the obtained data, the students' inquiry ability of X1 class in SMAN 1 Makassar for each levels is shown in table 2. The students' inquiry ability based-levels of inquiry is only given into level of discovery learning,, interactive demonstration, inquiry lab, and hypothetical inquiry. This is because the author's assumption that the provided students worksheet/LKPD has contained of inquiry lesson.

Table 2. Grade Point Group (GPG) categories

<i>Level of Inquiry</i>	<i>Inquiry Ability (GPG)</i>
<i>Discovery learning</i>	60,50 (<i>Capable</i>)
<i>Interactive demonstration</i>	62,42(<i>Capable</i>)
<i>Inquiry lab</i>	43,20 (<i>Enough</i>)
<i>Hypothetical Inquiry</i>	56,50 (<i>Enough</i>)
<i>Rata-rata</i>	55,66 (<i>Enough</i>)

Students' inquiry ability in discovery learning level has the highest GPG score of Inquiry ability, and this is caused by students in discovery learning level who have understood regarding direction of the existing question in student worksheet/LKPD. The teacher does not need to give more explanation/guidance on how to construct students' knowledge. While students' inquiry ability in inquiry lab level shows the lowest GPG score of inquiry ability because of students basic capability in the use of measuring instrument such as ammeter, stopwatch, and voltmeter. The difficulty of observing activity implementation is to measure the current and volt flowing in the filament within the using calorimeter joule. Besides in inquiry lab level, the students' inquiry ability in hypothetical inquiry level is also capable enough because students are not used to formulating the hypothetical statements. The information obtained by the researcher, the student never does an experiment activity/observation involving a hypothetical inquiry activity within, so the researcher gives a brief explanation regarding the right hypothetical statements before doing an experiment.

Based on the analysis result, the researcher states that the implementation of student worksheet/LKPD based-productive question is useful to know the inquiry ability of students. The student worksheet/LKPD made by the researcher is able to implement, although the analysis result shows that GPG score is different in Capable enough category, but this result is not very bad where students of X1 class SMAN 1 Makassar are not used to using a difference student worksheet/LKPD provided by the researcher and the result of GPG score is going to be capable enough. For all this time, the student worksheet/LKPD is a guidance like book recipe or a series of matter and exercise contents only.

The obtained result is relevant to the study result from Sitti S and co; 2013, Heni; 2013 state that the implementation of productive question can increase student understanding to the concept of plant and animal tissue structure. The students love to do an experiment. The existing-productive questions in student worksheet guide students to observe everything in experiment that is possible be. The way of team work in this experiment method gives much love to students because it can train students working in team. The analysis result of teacher

questionnaire shows that the containing student worksheet about the productive questions can aim students doing a relevant attempt, so the student will be focused on what should they do.

Furthermore, the study result of Purwanto and co; 2013 also concludes that by using a level of inquiry learning method, it can develop inquiry ability of students, the students' learning outcomes in the affective part and the psychomotor part. While according to Winny L and co; 2014 states that inquiry ability of students in secondary school has less capable of doing an experiment, the students in high school has a good capable of doing an experiment and so do the students in vocational school. The learning process of levels of inquiry model can train the students' inquiry ability even though the students in secondary school are classified into the low category. The secondary schools student as a subject of study is less to do an independent learning (Inquiry) than High school and vocational school students. Therefore, the use of levels of inquiry model needs students to be trained and the students will be used to inquiring themselves which affects to the inquiry ability. The result of straight investigation to the learning implementation and analysis outcomes towards student worksheet contained by the students shows that the most of them are still extraneous with scientific process skills term, so the teacher gets difficulties to serve their questions. Questioning activity, the curious feeling grown is absolutely caused of the existing questions in student worksheet which is not usual to answer, if they do not do a measurement activity (scientific activity).

Therefore, the researcher illustrates that if the learning process is the use of student worksheet/LKPD to support inquiry ability, the student will be used to working scientifically, so scientific behavior will be formed and wished to be a character. Thus, the direction and purpose of curriculum in 2013 is able to be purposed and to be reached out.

The specific discovery

The result of contained worksheet/LKPD in productive question, especially in formulating problems and hypothesis, shows that the most of students only formulate the question, but not in a good problem statement category. This is caused by the ability of students that is not usual to formulate the investigated problem. The result of contained student worksheet regarding to discussing and concluding question shows that the student still needs a specific guidance to plug the worksheets, this is caused by the student who does not understand about the procedure and the purpose, yet the student does not have a very good-basic concept operationally, which is conducted to logical discovery of physics concept. They just measure and analyze it relevant to the guidance, but getting a concept through the experiment is not well-trained at all. So, the teacher needs to be more proactive in giving the information. Once, this can be happened by the less-known experiment activity of students.

The relevant case shown by Brewe et al. (2009) describes that scientific method used by the university student in the interpretation of experiment result always be the significant obstacle because of less-thorough in some of unknown variables identification. Thus, there are some of university students achieving a very good work in concept implementation content. This can be happened of conducted activity which aims them to the concept understanding comprehension. This statement is relevant to Santyasa (2003) that explains the physics concept understanding through experiment that can exist when they can run the scientific process as knowledge regarding to error analyzing and interpreting the data. The same discovery stated by Popper (2005) states that the students will be able to do an investigation and interpretation of theory optimally, if they realize about the problem. So, it could be said that the students' preparation to analyze the relation between experimental physics concepts is run very well.

Another analysis figures the existing mistakes of students to structure the experimental design, this shows that the conducting student worksheet starts to train them in experimental designing even though the mistake is still exist, so scientific activity needs sustainable training. The result of straight investigation towards the learning implementation and analysis outcome to contained worksheet/LKPD by the student shows that the most of students feel extraneous with scientific process skills term, so the teacher sometimes be bothered to serve their questions. Questioning activity, the curious feeling grown is caused of the unusual question in worksheet without doing a measurement activity (scientific activity). Therefore, the researcher states that if the learning process used to using a supporting worksheet of students' inquiry ability, the student will get used to working scientifically, so the scientific behavior is formed and wished to be a character. Thus, the direction and purpose of curriculum in 2013 is able to be purposed and to be reached out.

CONCLUSION

Based on the conducted result, it can be conclude that the inquiry ability average of students in SMAN 1 Makassar is capable enough. The learning process that uses student worksheet based-productive question are able to train the students' inquiry ability because the student worksheet contains the scientific activity based-scientific process skills. The High school student been subject in the study is not usual to learn independently, so the use of suitable student worksheet/LKPD with the other main topic/ matters needs to be trained to the student because the learning process that uses student worksheet/LKPD supporting the students' inquiry ability will help them to get used to working scientifically, and the scientific behavior is formed and wished to be a character. This is relevant to curriculum in 2013.

Acknowledges

The researcher thanks to Dra. Arum Condrowaty, M.Pd., as the physics teacher of SMAN 1 Makassar, Zainal bakri, and all of fundamental physics laboratory assistants for helping the researcher to implement the study. Therefore, the researcher would like to thank to the donor for giving a help of donation (funded by DIPA UNM 2016).

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