



# The Use of Practicum-Based Worksheets Can Improve Conceptual Understanding of Energy Material for Science Courses

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**Abstract:** This research is a research on the development of a practicum-based teaching material that aims to find out if the use of practicum-based student worksheets can increase conceptual understanding of energy material in natural science courses. Student worksheets are examples of learning media that are often used in teaching and learning activities. The method used in this research is a pre-experiment with a one-group pretest-posttest design. From the test results, the results are obtained if (1) Practicum-based Student Worksheet teaching materials have a good impact on increasing student understanding in science courses with energy material with an N-Gain score of 0.45. (2) The learning outcomes increased by 17.17 from the average pretest score of 62.7 to 80.47 at the end of the post-test results, which shows that student understanding has progressed after learning is carried out using practicum-based worksheets.

**Keywords:** Understanding Concepts; Student Worksheets; Practicum

## Introduction

The development of the world and technology has entered a new chapter called the era of the industrial revolution 4.0 or what is known as the digital era. The impact caused by this development covers many aspects of life. One of them is the aspect of education. Education in the digital era is expected to be able to produce a talented generation based on knowledge, think critically and creatively, care about the environment, and bring the values needed to live a better life and respond to challenges in the digital globalization era. Taseman & Dahlan, (2018) explained that education is one of the planned efforts so that it can realize the learning and learning process with the aim of students becoming more active and able to develop their abilities both in terms of religion, personality, noble character, and skills in the hope of being able to use for life in society, nation, and state.

Educational institutions channel and share knowledge through a process called learning. The learning process is said to be successful when, in the process students or students can experience an increase in knowledge, skills, values, and attitudes. Another indicator that becomes a benchmark for the success of the learning process is understanding the concept. (Hendriana, 2019) explained that conceptual understanding is the ability so that students can understand the meaning or concept of a situation and the facts they know. If students can understand and study concepts well, they will automatically be able to properly accept certain knowledge. Santrock in Fajarianingtyas & Herowati, (2018) also explains that the success of a student's cognitive aspects is measured by his understanding of the concepts he has. Students can elaborate on a concept to process information in depth.

Natural Science also known as science education, is one of the main subjects in the education curriculum in Indonesia and is included in important subjects. It can

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be seen that science is taught from an early age, such as at the elementary school level up to the tertiary level. This can be seen that science in general teaches us to develop reasoning abilities and demands to be able to understand concepts well.

Science education is closely related to how to systematically find out about nature, so that science is not just mastery of material or concepts. Science education is expected to be a vehicle for students to learn about themselves and their natural surroundings. Where the learning process emphasizes giving direct experience to develop competence and understand the natural world scientifically.

Sani (2016) states that student activities in science courses activities include building conceptual knowledge and conducting demonstrations or presentations. taking notes, observing objects, discussing and exploring topics, developing hypotheses, and making conclusions between findings and concepts.

From the results of the observations that have been made, it was found that in science courses for the 2020/2021 academic year, most students still conduct discussions only by rote without relating them to events in everyday life. It will be very difficult if the science learning process is only limited to memorizing theory because science is closely related to findings and experiments.

Wartono et al. (2018) argue that a lack of student understanding can occur as an understanding of the concepts that students have and believe are different from those concepts developed by experts. This student misunderstanding must be straightened out through learning related to natural phenomena that are around and followed by scientific explanations. In line with the results of the study (Ulfa et al., 2017) that student understanding can be through cognitive sharing when discussion activities form similarities and consolidate concepts. In addition, demonstration activities also cause students' logical thinking to develop through observations using practicum-based worksheets.

Frances et al. (2019) stated that one way that can be developed to improve students' science skills is to use a learning model that guides students to observe, interpret, use tools and materials, apply concepts, organize activities, communicate and ask questions.

One of the teaching materials that can be used as student media in facilitating the understanding of science subject concepts is the Student Worksheet. The use of Student worksheet is expected to be able to bridge students in discussing and conducting experiments related to a concept. As explained (Sanusi et al., 2020) so that the quality of learning can run optimally, it is necessary to have a variety that can foster critical thinking skills in mastering concepts, principles, and theories.

In line with Sanusi et al., (2020) research also explained that guided practicum instructions would have a positive impact on students. Research conducted by (Payudi et al., 2017) concluded that Student Worksheets developed were effective in improving student learning outcomes in science process skills.

Hanafita (2012) in his research revealed that Student worksheet can optimize the understanding of concepts in science learning. This is supported by the results of his research which show that worksheets that are integrated with the experimental method help students make sense of learning. Students become trained in conducting experiments so that their abilities increase.

Student worksheets are a type of printed teaching material that can activate students in the learning process (Wahyuni & Kurniawan, 2019). The worksheets that are made are worksheets that help students find concepts that convey student understanding in independent learning (Silalahi, 2022).

In general, the Student Worksheet contains a summary of the material; questions; tasks, and instructions that must be carried out by students in activities according to basic competencies and refer to the goals to be achieved. In line with Sadia (2014) who argues that a practicum guide aims to train students' abilities in carrying out observations or research, explaining a phenomenon, knowing the meaning of each problem, and solving it independently.

Energy is one of the natural science materials related to daily activities. This material is suitable to be taught in practicum using worksheets, where students will form groups and discuss with their groups to then conclude from the results of the activity. Thus, mastery of the concept will be better and maximized.

Based on the above problems, a formulation of the problem was developed, namely How Using Practicum-Based Student Worksheets Can Increase Conceptual Understanding of Energy Materials in Science Courses? The main objective of this research is to improve conceptual understanding of energy material for science courses through practicum-based student activity sheets.

## Method

In this study, researchers used pre-experiments, which were used to look for the impact of this treatment on others under controlled conditions (Sugiyono, 2016). The design in this experimental research is the One-Group Pretest-Posttest Design. The use of this type is expected to obtain accurate results, due to comparing the results of research before and after being given treatment. The research sample consisted of 30 students at PGRI Yogyakarta University.

**Table 1.** One-Group Pretest-Posttest Research Design

Pretest	Treatment	Posttest
O <sub>1</sub>	X	O <sub>2</sub>

Note:

O<sub>1</sub> = Pretest value before being given treatment

O<sub>2</sub> = Posttest value after receiving treatment

X = Treatment using the practicum-based worksheet

Meanwhile, to find out the increase in student understanding after using the worksheet obtained from the GainScore, with equation 1.

$$g = \frac{S_{Post} - S_{Pre}}{S_{Max} - S_{Pre}} \quad (1)$$

Note:

S<sub>post</sub> = Post-test score

S<sub>pre</sub> = Pre-test score

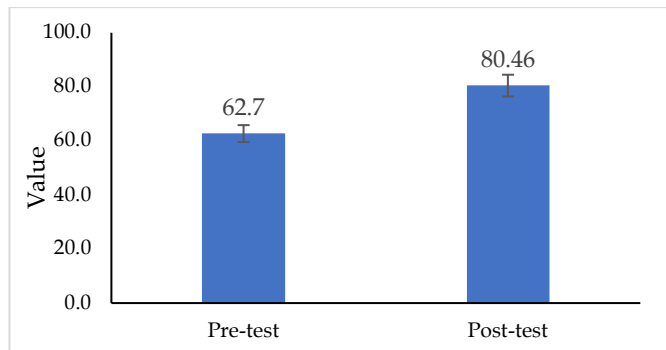
S<sub>max</sub> = Ideal maximum score

**Table 2.** N-Gain Score Category

N-gain	Category
$g > 0,7$	Hight
$0,3 \leq g \leq 0,7$	Midle
$g < 0,3$	Low

## Result and Discussion

In this sub-chapter, the researcher will review the results of the research data that has been obtained and try to link the results to the hypotheses that have been set by previous researchers. From the test results, the results obtained if the average value of the N-Gain score is 0.45, it is included in the medium category as seen in Table 2. This means that there is an increase in understanding of the concept of energy material through the use of practicum-based worksheets, although there are still some students who don't understand. Students' Pretest and Posttest scores also show that using Practicum-Based Worksheets can improve understanding in studying the material.



**Figure 2.** Graph of Student Learning Outcomes

Based on Figure 2 we can see if there is an increase in value. In the pretest value that was carried out at the

beginning of the learning activity, an average value of 62.7 was obtained. There are still many students who do not understand the material well. When implementing the use of practicum-based worksheets and holding a final assessment or posttest, student scores increased with an average of 80.47.

This increase in results occurs because students get new experiences with practicum and joint discussions so that students can understand the concept of material better. Because building directly through observation will create an impression that is easy to remember (Fajarianingtyas & Herowati, 2018). Practicum activities can spur students to hold discussions with group mates and to be more active and enthusiastic in attending lectures. The same thing was also expressed (Susanti, 2013) in research that said interesting learning could make students more enthusiastic and motivated.

Activities using the practicum method can foster curiosity from within students so that students will try to find and analyze. If students succeed in finding the information or knowledge they are looking for, satisfaction will arise from within them. The practicum-based worksheet can also be used as a determinant of effectiveness, students are not only required to complete practicum activities but also answer questions in the pretest and posttest, as well as discuss in making conclusions from the concepts being studied.

There was an increase in learning outcomes of 17.77 and an N-Gain value of 0.45 (included in the moderate category) occurred because the activities that the researchers designed in the Worksheet were able to make students active and think critically and be able to solve problems related to everyday life. day. Santrock (2008) says that one of the efforts that can help students form a concept is to invite students to associate the concept with other concepts.

The use of Student Worksheet media in Science courses with Energy material contains several learning activities related to daily life, so students do not just memorize theory but emphasize the process of understanding, so they know applications and examples in life. Efuansyah & Wahyuni (2019) in their research also stated that the worksheet was very appropriate to use in line with the research (Wirda et al., 2018) because student learning outcomes had increased compared to the previous pretest scores, and students gave fairly good responses. Agree with Wirda, Sukmawati et al. (2020) in his research emphasized that the worksheet was effectively used because it was able to provide a level of completeness of understanding of the concept of 77.14% and problem-solving of 71.43%. Scientific method-based worksheets need to be implemented in other relevant scientific material so students are accustomed to solving scientific problems scientifically (Indayati, 2020). The results of the study (Hasanah et al., 2019) are in line with Octavihari et al. (2019) also

explained that the application of student worksheets was able to improve student's communication skills and understanding of concepts. In line with research (Imamah, 2020) that worksheets are applied in learning and can improve students' understanding of concepts.

The worksheet is one of the learning resource materials that can be used by teaching staff in learning activities. The worksheet is also a learning medium because it can be used simultaneously with other learning resources. The role of worksheets is very much, namely worksheets that can guide students in the learning process and develop their scientific work abilities, so practicum-based worksheets are created or developed in which there are experimental and discussion activities.

Student worksheets that are made, are designed with the following characteristics: (1) Contains practicum activities related to the concept of energy in life; (2) Explain the achievements of learning activities so that they can guide students in carrying out problem-solving activities; (3) Worksheets are prepared with projects that require discussions to solve problems individually or in groups.

Each activity listed in the student worksheet teaches students to make observation plans, carry out observation activities, analyze data, make conclusions and make presentations on the results of discussions orally. Following research (Yusuf & Adeoye, 2012) to train students' communication abilities and skills, it would be nice for lecturers or teaching staff to facilitate activities that allow students to have discussions and oral presentations, this is also able to increase students' understanding of the concepts being studied.

Slavin (2006) explains that an effective teaching process requires an understanding of how to make information accessible to students so that they can relate it to other information, think about it, and implement it outside of teaching and learning activities in everyday life. The positive response given by students to learning and materials is a very important factor to note because good teaching materials must be based on the needs and interests of students. The 80% response given by the students indicated that the Worksheet used was classified as successful.

## Conclusion

Practicum-based student worksheets can improve understanding of concepts in natural science subject matter. This can be seen by the N-Gain Score of 0.45. Learning outcomes also increased by 17.77 which shows that students' understanding progressed after learning was carried out using practicum-based worksheets. As for suggestions that can be recommended from the results of this study, namely the practicum-based science worksheets developed in this study are suggested to be

used in science learning at the tertiary level with student abilities and it needs to be emphasized again for practicum methods that can be used in science learning. Experimental activities developed in student worksheets are made more innovative, easy to do, close to everyday life, and even more interesting for students.

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