



Application of Problem-Based Worksheet on Hydrocarbon Combustion Materials through E-Learning to Enhance Student's Learning Outcomes and Environmental Care Attitude

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Abstract: The purpose of this research is for investigating student's learning outcomes and environmental care attitude of hydrocarbon combustion by applying problem-based worksheet through e-learning. This research used quantitative method with one group pretest-posttest design. The sample of this research is the XI MIPA students totalling 29 students. The instrument used of this research was multiple choices test and questionnaire non-test. The data of this research were analysed by using t-test. Based on the analysis result is obtained, there is an enhancement in the average score of students' abilities from 43.10 become 71.50 and there is a significant difference of student learning outcome after applying problem-based worksheet based on the t-test result, where $t\text{-count } 25.65 > t\text{-table } 1.65$. Furthermore, there is also an enhancement on environmental care attitude from 62.54 to 79.95 with N-gain is 47.63 in the medium category. The average score of environmental care attitude for indicators, 1) the attitude towards energy has enhanced from 57.99% to 70.35% with N-gain average is 30.44% in the medium category., 2) the attitude towards humans and environment from 57.29 become 80.84% with N-gain average is 53.24% in the medium category., 3) the attitude towards water from 58.31% to 66.67% with N-gain average is 20.09 in the medium category., 4) Waste management from 54.82% to 60.99% with N-gain average 11.50% in the low medium. Consequently, based on the result is obtained, there is an enhancement of student learning outcome and environmental care attitude by applying problem-based worksheet on the hydrocarbon combustions material through e-learning.

Keywords: e-learning; Problem Based Worksheet; Learning Outcome; Environmental Care Attitude

Introduction

Corona virus disease (Covid-19) conduces several problems such as ineffectiveness of the on-going learning process (Goldscmidt, 2020). The Covid-19 transmission occurs when someone is touching everything which is contaminated virus, for minimizing that thing it is important to apply social distance to reduce interpersonal contact (Weedeen and Benjamin, 2020). This condition causes worries for both teacher and students in applying face-to-face learning (Dewi, 2020). The Indonesian Ministry of education and Culture issued Circular Letter Number 3 of 2020 concerning the

Covid-19 prevention in education units, which stated that learning process is conducted at home through distance learning for students. The result of education and culture minister decision is all the learning activities both in schools and universities are conducted at home through available online applications.

The same thing also occurs on learning system of SMA Negeri 3 Banda Aceh where the learning process is conducted at home through Microsoft office 365 online application. Free online media which has been proven effective in learning management classically include microsoft office 365 (Ngatmiyatun, 2021). Microsoft teams contained in microsoft office 365 aims to create

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distance learning is more interesting and mass-connected, such as classroom learning and enabling students and teacher keep communication (Akbar and Fajri, 2022). Teacher can check the students' progress activities from the daily learning, websites, and scoring assignment (Santoso, et.al., 2021).

Online learning can be expected make grow the environmental care attitude of students. Environmental care is an attitude and action to prevent the damage of natural environment and strive to recover it (Ismail, 2021). Nowadays, the environmental issues become extremely often heard, where many damages occur due to the excessive use of natural source (Narut et.al, 2019). Such as the use of unfriendly environment transportation, the use of fossil fuel energy, illegal logging, the conversion of forest functions into plantation land, and so on (Central Bureau of Statistics, 2014). To support that, it is necessary given understanding the importance of perserving the environment (Central Bureau of Statistics, 2014). Students are necessary to be asked for observing surrounding nature in learning process to make grow of enviromental care attitude (Shofiyah and Wulandari, 2018).

One of the lessons related to science and environment is chemistry with hydrocarbon and petroleum materials (Putri et al., 2017). Hydrocarbon and petroleum are XI IPA class material in semester 1. The basic competencies that must be had by students is identifying complete and imperfect hydrocarbon combustion reactions and the nature of combustion products (CO₂, CO, carbon particulates), develop ideas on how to overcome the effects of combustion carbon compounds on the environment and health. The chemistry branches combine subjects in the form of memorization systems, calculations, and learning concepts that must be understood and provides innovation so that students are able to solve problems and relate it in daily life (Rambe et al., 2019). However, the chemistry learning outcome generally has not been optimal, can be seen from national examination of SMA Negeri 3 Banda Aceh from the last few years from academic year 2016/2017 to 2018/2019 with the succesive percentage of 49.58; 47.79; and 48.16 % (Pusepenfik, 2016; 2017; 2018; 2019). This is in line with Ristiyane and Bahriah (2016) stated that on learning process the students face difficulties in understanding chemistry material. In order to understand the students' understanding of chemistry material that is by applying problem-based worksheets. The problem-based learning is the sequences learning activities which focus on the problem-solving process which is faced scientifically so that the students do not only listening, noting, memorizing material but also active thinking, finding information, processing data, presenting solution and conclusion. For supporting learning process, the problem-based worksheets are used as learning tools.

Several problem-based worksheets have been implemented and show great result in helping learning process. The study of Lipondag et al. (2016) conveyed that problem-based worksheets on hydrocarbon and petroleum material can enhance chemistry learning outcome. Moreover, the other results of Sabdaningtyas and Ambarita, (2019) showed that problem-based thematic integration student worksheet products were effectively used in the learning process of fourth grade students. Furthermore, Rahmi et al. (2019) stated that learning tools (Lesson Planning, Worksheets, and test questions) were developed based on PBL with an effective scientific approach to improve students' problem-solving abilities. Based on those descriptions can be known that the existence of problem-based learning by worksheets is effective in improving students' learning outcome. Thi is because problem-based learning stems from problem-faced in daily life directly which have an impact on improving learning outcome (Swiyadnya et al., 2021)

Based on those explanation, for overcoming the problems which have been described, the writer conducts to apply problem-based workshees on hydrocarbon combustion material through e-learning for enhancing students' learning outcome and environmental care attitude.

Method

This research is pre-experimental research with One Group Pretest-Posttest Design. The population of this research was all students of Class XI MIPA in SMA Negeri 3 Banda Aceh consisted of 7 class with total sample 229 people, where for the number of the students in each class of this research can be seen on Table 1.

Table 1. Students of class XI MIPA

Class	Number of Students
XI MIPA 1	33
XI MIPA 2	32
XI MIPA 3	33
XI MIPA 4	32
XI MIPA 5	33
XI MIPA 6	33
XI MIPA 7	33

The instrument used in this research was consisted of multiple-choice test which is used to measure students learning outcome and non test in the form of questionnaire for measuring students' environmental care attitude. Before used, the instrument was tested the validity and the reliability to determine the feasibility of the instrument.

The activities of this research were initially conducted pretest to observ the students' initial abilities. After pretest was conducted, learning will be conducted where the teacher will distribute problem-based

worksheets to students, after the learning is complete, a posttest will be carried out to see the final ability of students after learning.

The data of this research were analysed by N-gain test to investigate improvement and t-test to know the significant difference between students' learning outcome and environmental care attitude before and after learning. According to Hake (1999). Systematically N-gain score can be found based the following formula.

$$N - gain = \frac{S_{Posttest} - S_{Pretest}}{S_{mak} - S_{Pretest}} \quad (1)$$

Result and Discussion

Students' Learning Outcome

Based on the result of this study, it can be obtained that students' learning outcome before and after learning has significant score of 0.471 and 0.223, where this score is higher than significance score of $\alpha = 0,05$. This score showed that there is significant difference of students' learning outcome before and after conducted learning using problem-based worksheets, after conducting the learning, the students' learning outcome becomes significantly improve.

This improvement occurs due to e-learning by applying problem-based worksheets is interesting for students in order to be able to motivate students to have critical thinking in identifying, analysing, and problem-solving related in daily life. So tht it will be easier to understand subject provided by teacher well. This is also proven from the improvement of students' learning outcome before and after learning from 43.1 to 71.5, where this is in line with the research conducted by Mulyani, (2020) stated that problem-based learning can create students learn more actively, think critically, and have intellectual ability in solving the problems so that learning outcome can improve. Based on the hypothesis test conducted by t-test at a significance level of = 0.05, it was obtained from the test scores before and after learning as shown in Figure 1.

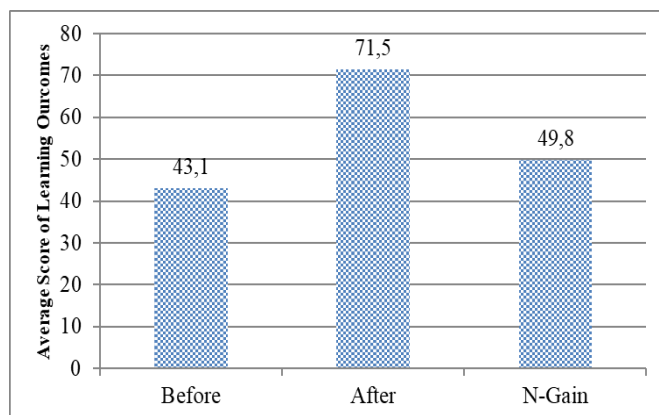


Figure 1. Average Score of Learning Outcomes

Figure 1 above showed that the average score of students' learning outcomes of 43.1 before and 71.5 after learning with the average N-gain of 49.8. Furthermore, based on t-test is obtained before and after students' learning outcomes of $t_{count} = 25.652 > t_{table} = 1.652$ with a significance score smaller than = 0.05, which is 0.000. This showed that students' learning outcomes after applying problem-based worksheets are better than before given problem-based learning worksheets, where problem-based learning is a model which appropriate for enhancing students' learning outcomes.

The learning model is one of ways used by teacher in establishing relationship with the students during learning process, so that the role of learning model is as tool to create learning process. Problem-based learning model is learning form which requires students to learn independently with the group and individually in solving the problems presented by the teacher by using several teaching methods, including the lecture method, group discussion, question and answer as well as assignment. This is in line with Sani, (2015) stated that students who work together to solve the task in group is really helping them, where they will realize that they have weakness and strength, and help each other.

There are activities which create students active in learning will cause high sense of curiosity, where this is certainty impact on the achievement of students' learning outcomes. The students would be provided worksheet where there wer problems which would be found the fact by discussing with fellow group members. The students felt challenged to gather the informations from learning used lecturer mehod (Trianto, 2009). Liliyana et al., (2021), explained that by using problem-based learning model through e-learning can enhance students' learning outcomes.

Students' Enviromental Care

Based on the result showed that from 22 enviromental care attitude items, most of them showed an average of strongly agree, agree and doubt. Furthermore, based on analysis the achievements per indicator of environmental care attitudes, it can be seen in Table 2.

Table 2. Per indicator of environmental care attitudes

Environmental care attitude indicator	Average score before learning	Average score after learning	N-gain
Attitude to energy	57.99	70.35	30.44
Attitude towards human and environment	57.29	80.84	53.24
Attitude towards water, air, land	58.31	66.67	20.24
Trash management	54.82	60.99	11.50

Based on Table 2 above, it is found that the students' learning outcomes in SMA Negeri 3 Banda Aceh have the best environmental care attitude on indicator of human and environment, the test result is obtained the average of N-gain 53.24 with medium criteria. The attitude indicator towards energy is obtained the average of N-gain 30.44 with medium criteria. The attitude indicator towards water, air, and land is obtained the average of N-gain 20.24 with medium criteria, and the trash management indicator can be seen on Figure 2.

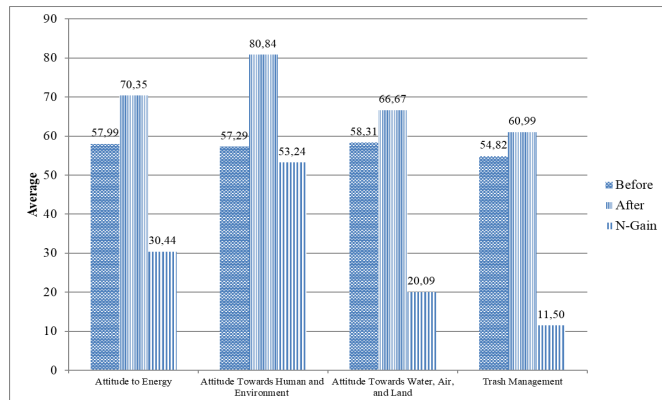


Figure 2. Graph of the average achievement of students' environmental care indicators before and after learning

The formation of attitude is basically the result of person's socialization and interaction with the environment which is embodiment of thought, someone's feeling and the value of object which is based on knowledge, understanding, opinion, believe in order to produce a tendency to act (Arofah and Pujilestari, 2020).

Attitude is grown and learnt throughout students' development of relation to certain object. Thing that can be conducted by education is developing environmental awareness of students. The environmental awareness of students can be built through learning, one of which is through chemistry subject (Putri et al, 2017). Chemical is the most pollutant in environment which comes from carbon compounds. For examples are plastic trash, gas fuel, fuel oil, air conditioners and household cleaning materials. In learning, attitudes are closely related to the knowledge and skills which is had by students. This is important because the environmental knowledge information obtained from learning will be processed through analysis, synthesis and evaluation activities so as to produce values that are contained in the form of attitudes. Teachers must be able to integrate environmental problems that occur in daily life by providing simple examples so that they are easily understood by students (Istiqomah, 2019).

Based on the average score of environmental care attitude of students before and after learning is obtained the average score is 62.54, whereas after learning is 79.95

with good category. The data showed that environmental care attitude of students after learning have an improvement greater than before learning. Moreover, there is also significant difference of environmental care attitude of students before and after learning which is reflected from t-test score obtained, where $t_{count} = 41.383 > t_{table} = 1.652$ which indicated that students' environmental care attitude after learning is better than before learning.

Conclusion

Based on the finding of the research and discussion which is described in the previous chapter, it can be concluded that the students' learning outcomes have improvement with applying problem-based worksheets. The environmental care attitude is also better than before applying problem-based worksheets through e-learning. Furthermore, there is significant positive relation between learning outcomes and environmental care attitude of students after applying problem-based worksheets through e-learning.

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