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THE EFFECTIVENESS OF STUDENT WORKSHEETS ON HOTS IN A BILINGUAL CLASSROOM IN BANDAR LAMPUNG

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ABSTRACT

This research aims to see the effectiveness of physics worksheets on Higher Order Thinking Skills (HOTS) in bilingual classes in Bandar Lampung. The research method employed was quasi-experimental with a randomized control group pretest-posttest design. This research involved three schools, with each school having an experimental class and a control class. The independent sample t-test was performed to determine the differences in the average HOTS results of students in each class at each school. The results of the data analysis showed that there was a difference in the average HOTS of students between those who used the integrated physics worksheets in bilingual classes and the worksheets found in schools. The differences in the increased HOTS indicated that the physics worksheets in bilingual classes were effectively used.

EFEKTIFITAS LEMBAR KERJA SISWA TERHADAP HOTS DALAM KELAS BILINGUAL DI BANDAR LAMPUNG

Kata Kunci:

Efektivitas
Kemampuan berpikir tingkat tinggi
Kelas bilingual
Lembar kerja siswa

ABSTRAK

Penelitian ini bertujuan untuk melihat efektifitas lembar kerja siswa terhadap kemampuan berpikir Tingkat tinggi dalam kelas bilingual di Bandar Lampung. Metode penlitian yang digunakan ialah kuasi eksperimen dengan desain *Randomized Control Group Pretest-Posttest Design*. Penelitian ini menggunakan tiga sekolah dengan masing-masing sekolah terdapat kelas eksperimen dan kelas kontrol. Uji independent simple t-test digunakan untuk mengetahui perbedaan rerata hasil HOTS peserta didik di masing-masing kelas pada setiap sekolah. Hasil analisis data menunjukkan adanya perbedaan rerata HOTS peserta didik antara yang menggunakan lembar kerja siswa yang terintegrasi kelas bilingual dengan lembar kerja siswa yang terdapat di sekolah. Adanya perbedaan hasil peningkatan HOTS tersebut menunjukkan bahwa Lembar kerja siswa dalam kelas bilingual ini efektif digunakan.

1. INTRODUCTION

Education is a benchmark in developing human quality in the face of technological advances [1], as indicated by learning outcomes of cognitive and affective aspects [2]. Changes in the 21st century present a challenge for teachers and students [3]. In response to these demands, education must develop and invent new learning media, models, and techniques. Since the COVID-19 pandemic, online or hybrid learning policies have

emerged while prioritizing the indicators and learning objectives that have been established, despite the fact that the process is carried out online [4].

Students must master critical thinking and problem-solving skills, communication skills, creativity and innovation skills, and teamwork [5]–[7], which are all components of higher-order thinking skills (HOTS) [8]. According to Bloom's taxonomy, HOTS includes transferable skills, such as analysis, evaluation, and synthesis [9]. HOTS enables individuals to connect new information with previous knowledge and use the knowledge and skills gained [10], [11]. HOTS also teaches individuals how to process and analyze data to solve problems [12], [13]. HOTS is an important factor in developing high-quality human resources [14].

According to data from the Organization for Economic Cooperation and Development (OECD) evaluations for the 2018 Program for International Student Assessment (PISA), Indonesia ranked 72 out of 77 countries. Indonesia's average PISA score dropped across all skills [15]–[17]. According to the PISSA assessment results, 28% of countries scored higher than 500, 28% scored between 450 and 500, and 44% scored lower than 450. The statistics show that HOTS is a global educational issue, not limited to one or two countries [18].

Most schools still do not use HOTS-based assessments, and learning activities have not resulted in improved HOTS skills. Creating learning media is one method for improving HOTS [18]. Learning media used properly during learning can be a more effective and efficient support to boost students' learning motivation [19]. Student worksheets are one type of instructional media that may be used to train students. Students' HOTS can be enhanced and trained by exposing them to a challenge they have never encountered before in a lesson provided on a student worksheet [20].

This research is a follow-up to the previous one, which produced a product in the form of HOTS-based student worksheets for bilingual class learning using English as the language of instruction. This research examined the effectiveness of using student worksheets to improve students' HOTS. The average students' scores at SMAN 13, SMA Muhammadiyah Bandar Lampung, and MA Al-Hikmah Way Halim Bandar Lampung were all quite poor. The lack of teaching materials, modules, and even student worksheets is a barrier to increasing students' HOTS. These schools incorporate bilingual instruction into the learning process. Students in bilingual classes have more abilities and achievements than students in regular classes.

Based on the results of pre-research at SMA Muhammadiyah Bandar Lampung, SMAN 13 Bandar Lampung, and MA Al-Hikmah Wayhalim Bandar Lampung, the HOTS of students were poor, especially in mastering thermodynamic material. This assumption was based on the alignment of students' pre-research results with HOTS criteria, which revealed that the percentage value of students' HOTS was in the poor and low categories. The percentage value of HOTS at SMAN 13 Bandar Lampung was in the poor category of 87.5% and 12.50% in the low category. At SMA Muhammadiyah Bandar Lampung, the poor category was 62%, and the low category was 38%. At MA Al-Hikmah Wayhalim Bandar Lampung, the poor category was 77%, and the low category was 23%.

So far, the learning media accessible at school has not improved, and teachers have not employed student worksheets [19], particularly during teaching and learning activities, including thermodynamic topics. Students' HOTS will improve if they use student worksheets more frequently. Therefore, the student worksheet must be thoroughly examined to determine its effectiveness in increasing HOTS. There has been extensive research on the use of student worksheets, including the effectiveness of guided inquiry worksheets to improve HOTS [10], [23] and the effectiveness of science literacy-based

student worksheets to improve science literacy skills [21]. However, there has been no research on the effectiveness of HOTS worksheets in bilingual classrooms.

The purpose of this research is to examine the effectiveness of student worksheets on HOTS in bilingual classes when students utilize English as their primary language of instruction. This research is unique in that it incorporates student worksheets with bilingual classroom instruction. Thus, researchers believe it is vital to investigate the efficacy of student worksheets on HOTS integrated with bilingual classroom learning in Bandar Lampung.

2. METHOD

This research employed a quantitative, quasi-experimental method. The research design used was a randomized control group pretest-posttest design. In this design, the behavior of the control group and experimental group is measured before and after treatment [24]. The research design is displayed in Table 1.

Table 1. Research Desain [24]

Class	Pretest	Treatment	Posttest
Experimental	T_1e	X	T_2e
Control	T_1p		T_2p

T_1e : Experimental class pretest results
T_1p : Control class pretest results
X : Learning using HOTS-based student worksheets
T_2e : Experimental class post-test results
T_2p : Control class post-test results

In a previous research published in the Journal of Scientific Education, student worksheets were designed as an effective learning instrument for enhancing students' HOTS [8]. These student worksheets were created to help students integrate HOTS concepts into their daily classroom learning. The student worksheets were developed in stages, beginning with an initial design based on the relevant curriculum and progressing to a review by educational experts and pilot testing with a small group of students [25]. The validity of the student worksheets was determined by a review of conformity with appropriate educational criteria, and their reliability was tested using the internal consistency method [26]. The results of these pilot tests and validation revealed that the student worksheets met the standards required for usage as effective learning instruments [27]. In this research, the student worksheets were adopted and utilized in a follow-up study to improve students' HOTS in a bilingual classroom in Bandar Lampung. Worksheets play an important role in education [28]. As a result, the currently developed student worksheet is not only a continuation of the previous research but also a ready-to-use instrument that has been demonstrated to be feasible in the context of bilingual instruction.

This research took place in three schools: MA Al-Hikmah Way Halim, SMA N 13 Bandar Lampung, and SMA Muhammadiyah Bandar Lampung. The research population consisted of all eleventh-grade students, with each school having two classes: experimental and control. The research instrument consisted of ten description questions, each of which carried HOTS indicators. The students' HOTS test results were determined using the following formula [8].

$$\bar{H} = \frac{obtained\ score}{maximum\ score} \times 100 \qquad (1)$$

$\bar{H}$: Students' HOTS results

Before usage, the questions were tested for validity and reliability. The analysis of prerequisite tests included normality and homogeneity tests. The hypothesis testing (t-test) was performed with SPSS version 21. To see if there was a difference in the average score between the two groups, the researchers used the independent sample t-test. The figure below illustrates the research procedure.

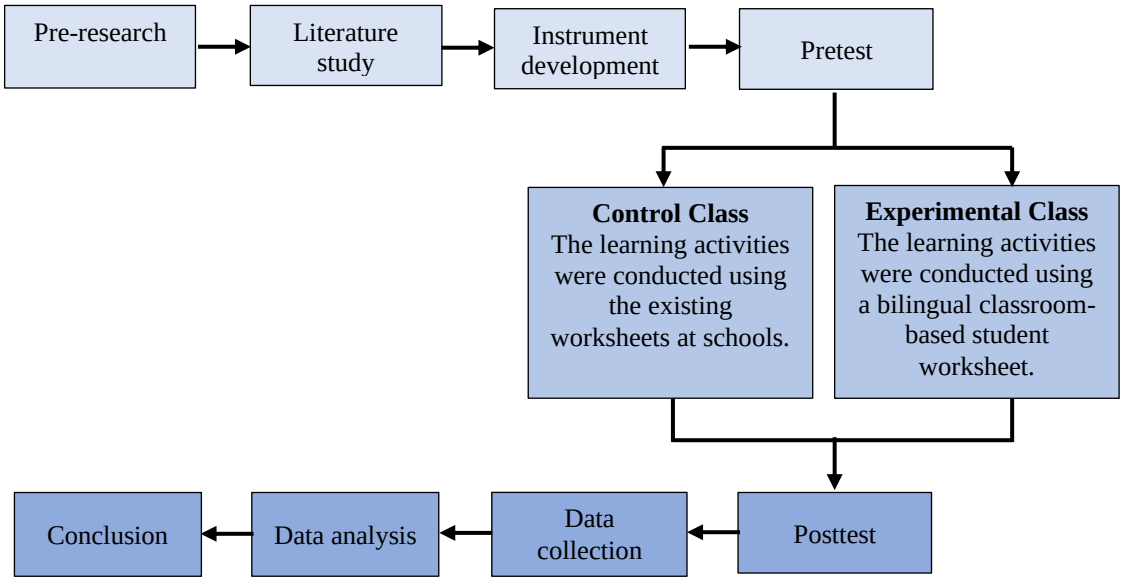


Figure 1. Research Procedure

3. RESULTS AND DISCUSSION

The questions administered on the sample classes were first tested on classes outside of the research sample. The ready-to-test questions must pass the prerequisite tests, which include the validity and reliability tests. The questions that passed the feasibility test began with 15 questions, and only 12 were declared feasible to be tested on the sample class of this research. However, only ten questions were employed as the instrument. After obtaining the research data, several stages of statistical tests were carried out to test the research hypothesis.

A pretest was used to measure students' initial ability before they received treatment utilizing student worksheets. Furthermore, the researchers conducted different treatments for each class. The control class received student worksheets that were available at school. On the other hand, the experimental class received HOTS-based student worksheets. Furthermore, a posttest was administered to assess students' abilities after the treatment. Table 2 shows the average score of HOTS of the three schools:

Table 2. Data on the Average Score of HOTS in the Three Schools

Nilai	Control Class			Experimental Class		
	1	2	3	1	2	3
Pre-test average score	65,3	65,67	65,84	65,87	65,25	65,84
Criteria	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Post-test average score	79,27	77,62	77,39	82,52	83,28	82,47
Criteria	High	High	High	Excellent	Excellent	Excellent

Based on Table 2, the average pre-test score of the three schools was included in the moderate criteria. In contrast, the average post-test score was included in the high and excellent criteria. The experimental class's average score was in the excellent criteria.

3.1 Normality Test

The normality test determines whether or not the sample data follows a normal distribution. The Kolmogorov-Smirnov test was performed using SPSS version 21 to conduct a normality test at a 5% significance level. If the significant value is more than 0.05, the data is normal. The following table displays the results of the normality tests.

Table 3. The Normality Test Results of the Three Schools

Schools	Class	Data	Significance	Criteria
MA Al Hikmah Way Halim	Control	Pretest	0.061	Normal
		Posttest	0.074	Normal
	Experimental	Pretest	0.066	Normal
		Posttest	0.078	Normal
SMA N 13 Bandar Lampung	Control	Pretest	0.053	Normal
		Posttest	0.062	Normal
	Experimental	Pretest	0.067	Normal
		Posttest	0.077	Normal
SMA Muhammadiyah Bandar Lampung	Control	Pretest	0.105	Normal
		Posttest	0.070	Normal
	Experimental	Pretest	0.072	Normal
		Posttest	0.078	Normal

Table 3 displays the results of the normality test for the three schools in each class of the experimental class and control class, both for the pretest and posttest. Each class shows that the significant value is higher than 0.05, which is included in normally distributed data.

3.2 Homogeneity Test

The homogeneity test seeks to identify whether the two variances of the research group are homogeneous or not. The SPSS version 21 program was used to perform a homogeneity test with a 5% significance level. The rules of the homogeneity test state that if the significant result is more than 0.05, the data is homogeneous. Table 4 displays the data of the homogeneity test.

Table 4. The Homogeneity Test Results of the Three Schools

Schools	Classes	Data	Significance	Criteria
MA Al Hikmah Way Halim	Control	Pretest	0.090	Homogeneous
		Posttest	0.100	Homogeneous
	Experimental	Pretest	0.085	Homogeneous
		Posttest	0.092	Homogeneous
SMA N 13 Bandar Lampung	Control	Pretest	0.071	Homogeneous
		Posttest	0.095	Homogeneous
	Experimental	Pretest	0.079	Homogeneous
		Posttest	0.090	Homogeneous
SMA Muhammadiyah Bandar Lampung	Control	Pretest	0.110	Homogeneous
		Posttest	0.123	Homogeneous
	Experimental	Pretest	0.089	Homogeneous
		Posttest	0.119	Homogeneous

Table 4 shows the obtained homogeneity test results for the three schools in each of the experimental and control classes, including pretest and posttest. Each class has a significant value higher than 0.05, which is homogeneously distributed data. These results signify that the samples selected for each school share the same characteristics.

3.3 Hypothesis Test

The hypothesis test was conducted following the prerequisite tests, the normality and homogeneity tests. The researchers employed the parametric test, namely the independent sample t-test when testing hypotheses. The purpose of this hypothesis test was to see if there was a difference in the average score between the experimental and control classes after the treatment. The SPSS version 21 assisted during the hypothesis test at a 5% significance level. If the significant value is greater than 0.05, H_0 is accepted, and H_a is rejected. The table below shows the t-test data.

Table 5. The Results of the t-test of the Three Schools

Schools	Data	*t-test*	Significance	Criteria	Description
MA Al Hikmah Way Halim	Pretest	-0.541	0.58	Ho is accepted, Ha is rejected	No difference
	Posttest	3.147	0.001	Ho is rejected, Ha is accepted	There is a difference
SMA N 13 Bandar Lampung	Pretest	-0.641	0.66	Ho is accepted, Ha is rejected	No difference
	Posttest	3.434	0.001	Ho is rejected, Ha is accepted	There is a difference
SMA Muhammadiyah Bandar Lampung	Pretest	-0.533	0.56	Ho is accepted, Ha is rejected	No difference
	Posttest	3.412	0.001	Ho is rejected, Ha is accepted	There is a difference

Based on table 5, the pretest data or data obtained before the treatment is higher than 0.05. Therefore, H_0 is accepted so that Ha is rejected, meaning that there was no difference between the two samples in MA Al-Hikmah Way Halim, SMA N 13 Bandar Lampung, and SMA Muhammadiyah Bandar Lampung. The post-test data or data obtained after the treatment showed that the significance value was lower than 0.05. Therefore, Ho is rejected, and Ha is accepted, meaning that there is a difference between the two samples after receiving treatment. In this research, the average data of the experimental class was higher than the control class.

According to the findings, several critical stages were involved in developing HOTS-based student worksheets integrated with bilingual classroom instruction. These stages include potential and problem identification, data collection, product design, design validation, design revision, product trial, and product revision [8].

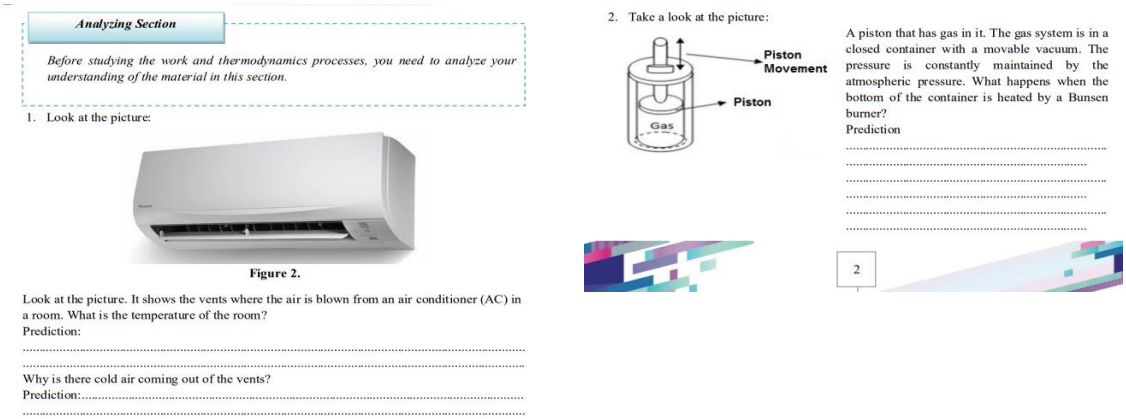
New study findings in the sample class, as well as statistical analysis, allow us to better understand the influence of employing student worksheets on students' HOTS. The research included pretests and posttests on experimental and control classes from three different schools to compare the difference in HOTS before and after the use of HOTS-based student worksheets [29]. The new data also has a significant impact on the readiness and obstacles to implementing online learning during the COVID-19 pandemic. In this context, concerns about limited student participation during the online learning process, school readiness for online learning, and technical constraints like internet access must be addressed in the development and implementation of HOTS-based student worksheets.

According to the research, learning utilizing student worksheets has limited impact, particularly at SMAN 13 Bandar Lampung. Although the hypothesis test results by assessing the pretest and posttest scores across the two study sample classes show a difference in the acquired significant value of pretest (0.66) and posttest (0.001), the researchers provide reasons for the statement. First, SMAN 13 Bandar Lampung, SMA Muhammadiyah Bandar Lampung, and MA Al-Hikmah Way Halim were schools that had just implemented the student worksheets, and the learning was carried out online through smartphone applications. Therefore, the students were not accustomed to it, and they were not ready. Second, the success of the research to measure students' HOTS in this research cannot be determined just by the results of pretests and posttests because, in distance or online learning, the researchers can only examine objective results. Third, the researchers' limitation in monitoring the learning process since learning was done online, which is heavily reliant on the restrictions of the internet network. For these three reasons, the researchers claimed that learning with the developed student worksheet improved students' HOTS, although there were challenges in implementing it. As a result, the researchers suggest that future studies should directly apply student worksheets face-to-face or through offline instruction.

Because of the circumstances and situations surrounding the COVID-19 pandemic, online learning made the student workbook less effective. Another barrier to implementing online learning was a lack of maximal student participation during the learning process [1]. This research began with the identification of two sample classes: experimental and control. In the experimental and control classes, a learning platform based on student worksheets was implemented via WhatsApp groups. During the learning process, three treatments were conducted to discuss the material contained in the student worksheet, which was divided into multiple periods.

In this research, the researchers also paid attention to the rules for implementing learning policies during the Covid-19 pandemic based on an excerpt from the circular letter of the Minister of Education and Culture, which says that online/distance learning is used to provide meaningful learning experiences without being burdened by the demands to complete all curriculum achievements. Online learning can be focused on life skills education, and learning activities and tasks can vary. Before beginning the treatment, a pretest was administered to determine students' initial ability. After completing the treatment, a posttest was administered to assess the level of HOTS on the specified material, namely thermodynamics.

The worksheet was developed using HOTS indicators, such as analyzing, organizing, connecting, evaluating, and producing. The student worksheet was organized into three levels or tasks that students can complete to improve their HOTS. The first level is the Analyzing Section, which requires students to assess their understanding of the Zeroth Law of Thermodynamics to answer questions based on the phenomena shown on the student worksheet. The Analyzing Section teaches students how to divide material into sections and organize knowledge into parts that are related to one another [20], [30]. The Analyzing Section is also crucial for teaching students how to understand and describe problems [9] through activities that identify phenomena [23].



Analyzing Section

Before studying the work and thermodynamics processes, you need to analyze your understanding of the material in this section.

1. Look at the picture:

Figure 2.

Look at the picture. It shows the vents where the air is blown from an air conditioner (AC) in a room. What is the temperature of the room?
Prediction:
.....
.....
Why is there cold air coming out of the vents?
Prediction:.....
.....

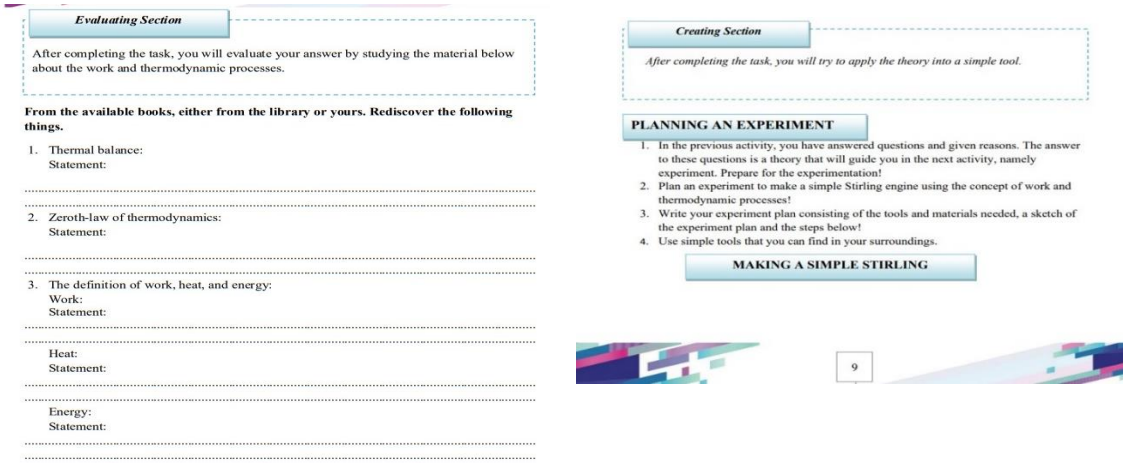
2. Take a look at the picture:

A piston that has gas in it. The gas system is in a closed container with a movable vacuum. The pressure is constantly maintained by the atmospheric pressure. What happens when the bottom of the container is heated by a Bunsen burner?
Prediction
.....
.....
.....
.....
.....
.....

2

Figure 2. Worksheet's Analyzing Section

The second stage is the Evaluating Section, in which learners will evaluate their responses by reviewing the material from available books, either from the library or their books. The Evaluating Section step evaluates a solution, idea, or viewpoint using common criteria, such as checking or criticizing [20], [23], [30]. The third stage is the Creating Section, in which students are directed to apply the concepts to a simple tool. The Creating Section stage requires students to design ideas that will form a coherent whole when making conclusions using a simple tool and theory [20], [23], [30].



Evaluating Section

After completing the task, you will evaluate your answer by studying the material below about the work and thermodynamic processes.

From the available books, either from the library or yours. Rediscover the following things.

1. Thermal balance:
   Statement:
   .....
   .....
2. Zeroth-law of thermodynamics:
   Statement:
   .....
   .....
3. The definition of work, heat, and energy:
   Work:
   Statement:
   .....
   .....
   Heat:
   Statement:
   .....
   .....
   Energy:
   Statement:
   .....
   .....

Creating Section

After completing the task, you will try to apply the theory into a simple tool.

PLANNING AN EXPERIMENT

1. In the previous activity, you have answered questions and given reasons. The answer to these questions is a theory that will guide you in the next activity, namely experiment. Prepare for the experimentation!
2. Plan an experiment to make a simple Stirling engine using the concept of work and thermodynamic processes!
3. Write your experiment plan consisting of the tools and materials needed, a sketch of the experiment plan and the steps below!
4. Use simple tools that you can find in your surroundings.

MAKING A SIMPLE STIRLING

9

Figure 3. Worksheet's Evaluating and Creating Sections

The student worksheet in learning helps students boost learning engagement, optimize concept understanding, sharpen skills, and provide guidance throughout learning activities, all while assisting students in applying the concepts discovered [31]. The student worksheet is a sheet that comprises exercises that inspire curiosity and encourage students to apply their thinking skills [32].

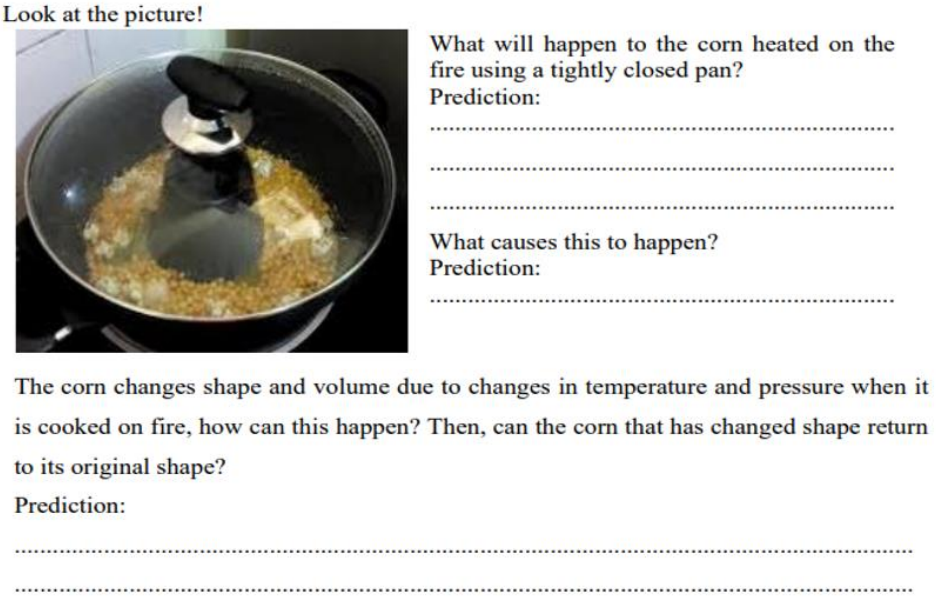


Figure 4. The Question in HOTS-based Student Worksheet

HOTS questions presented on student worksheets help students in learning because the practice questions are arranged systematically [33]. HOTS questions used as a measurement instrument are critical for assessing HOTS, which requires cognitive skills other than reading, remembering, and restating [34] so the HOTS-based student worksheets generated have an impact on students' HOTS abilities. The findings are consistent with previous research that found that HOTS-based student worksheets can help students improve their thinking skills and learning outcomes [35], help increase students' motivation, response, and learning outcomes [20], increase HOTS in learning outcomes[36], and improve critical thinking skills [1].

4. CONCLUSION

Data analysis revealed that the use of student worksheets influenced the HOTS of students at SMAN 13 Bandar Lampung, SMA Muhammadiyah Bandar Lampung, and MA Al-Hikmah Bandar Lampung. Student worksheets are successful in raising students' HOTS, but their implementation faces challenges because they are used through online learning, resulting in a poor learning experience. Based on the findings, further studies should focus on applying it directly in face-to-face learning.

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