



## The Analysis of Students' Cognitive Learning Outcomes through the Implementation of Blended Learning in Junior High Schools Science

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### Abstract

Learning in the 21st century needs to accommodate e-learning without having to leave face to face in order to keep it interesting and effective. The innovation that can be done is through the implementation of blended learning to combine the two. Especially during the Covid-19 pandemic, students learn from home so online learning is a must. The purpose of this study is to analyze students' cognitive learning outcomes through the implementation of blended learning in Science in the material on temperature and its changes in Junior High School. This experimental research used a pretest-posttest control group design which contained an experimental class (blended learning) and a control class (online learning only). The sample of this research is the 7th grade students at SMPIT Harapan Bunda Semarang. Collecting data in this study used test methods in the form of pretest and posttest. For data analysis used analysis of learning outcomes completeness, N-gain test and t-test. Based on data analysis, it was found that the implementation of blended learning in Junior high school in science learning was effective enough to improve students' cognitive learning outcomes compared to face-to-face online learning only. This is indicated by the percentage of student learning completeness in the experimental class of 79.66%, while in the control class it is 68.33%. From the results of the N-gain test and t-test it was also found that the experimental class had a higher increase of 0.50, while the control class was 0.44.

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## INTRODUCTION

Education prioritizes the process, and through this process results can be obtained in accordance with predetermined learning objectives. Education is a learning process through continuous exploration and processing of experiences (Wasitohadi, 2014). According to Wardani et al. (2018) the learning process in the 21st century needs to accommodate technological developments (e-learning) without having to leave face-to-face learning. This is because most students think that technological developments are increasingly broad, so that learning can be done online. Face-to-face learning in class and online learning have their respective strengths and weaknesses, so that innovations made by combining the two through blended learning are needed (Istiningsih & Hasbullah, 2015). Especially in a pandemic like this time, the implementation of blended learning really helps teachers in delivering material and interacting with students.

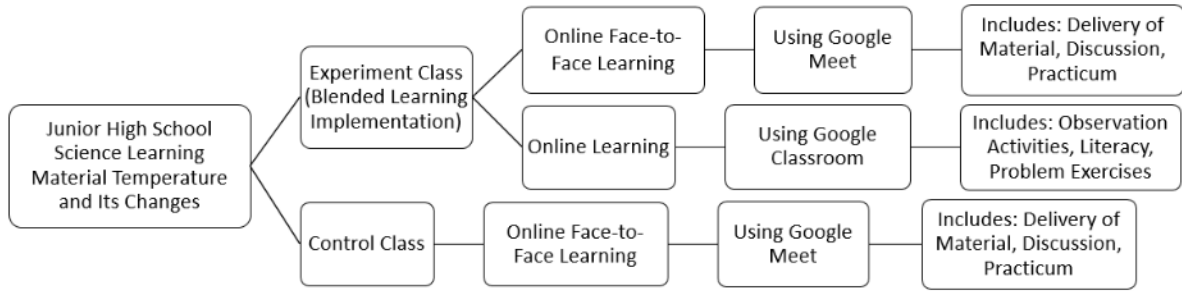
Blended learning is mixed learning that combines face-to-face online learning during class hours and online learning outside of class hours (Suhartono, 2017). This combination aims to make learning take place effectively, especially during the Covid 19 pandemic, which requires students to study from home. From the results of the 7th grade science teacher interviews at SMPIT Harapan Bunda, it was found that the student's cognitive learning outcomes were still low during online learning during this pandemic. Students are not familiar with independent learning activities outside of class hours, so they need to be guided systematically by the teacher. Moreover, learning science on certain materials requires the teacher to provide direct explanations to students face-to-face for understanding basic concepts. In addition, students need to increase their learning activities outside face-to-face learning to strengthen their cognitive competences. The implementation of blended learning *is* as an effort to improve students' cognitive learning outcomes can be used as an alternative. This is confirmed by previous research

which states that blended learning has a positive effect on learning (Oweis, 2018; Usman, 2018).

The blended learning model developed in this study is supplemental blended learning. In this model, students complete online learning to complement their face-to-face learning or vice versa. The achievement of learning objectives is essentially fulfilled completely in one room, while other spaces provide additional experiences. According to Alexandrova et al. (2019), the supplemental blended learning model is an effective learning innovation to improve students' learning outcomes. The implementation of this research blended learning modifies previous research according to the needs of science learning and the current pandemic conditions. From the results of the interview above, that the cognitive learning outcomes of students in science subjects at SMPIT Harapan Bunda are still low. During the Covid-19 pandemic, learning could not be carried out face-to-face in class, instead with face-to-face online via video conference by using google meet media. Face-to-face online learning is not optimal enough to provide student understanding, so it needs strengthening through online learning activities outside of class hours as an additional. Online learning is designed by the teacher systematically and practically (Hasjiandito et al., 2014) through learning activities provided to students by using google classroom media. The purpose of this study is to analyze students' cognitive learning outcomes through the implementation of blended learning in Science in the material on temperature and its changes in Junior high school.

## METHOD

This study used an experimental research design with a pretest-posttest control group design consisting of two groups, namely the experimental class and the control class. In this study, the experimental class was given the treatment in the form of blended learning implementation, while the control class was given face-to-face online learning only. The learning process between the two is shown in Figure 1.



**Figure 1.** Learning Process for Experiment Class and Control Class

The population in this study were students of SMPIT Islam Terpadu (SMPIT) Harapan Bunda Semarang, while the sample used was 7th grade students. The research data were obtained through pretest which was conducted before being given treatment, and posttest after being given treatment. In this study, the analysis of the achievement of students' cognitive learning outcomes was obtained through the analysis of learning completeness, the N-gain test, and the t-test. In the analysis of learning completeness, learning in class is said to be successful if 75% of the total students in the class have achieved mastery learning with a minimum value of 70. The percentage of student learning completeness is calculated using the formula according to Akbar (2013).

$$\text{Percentage} = \frac{\text{The number of students who completed the KKM}}{\text{The number of students}} \times 100\%$$

The N-gain test is obtained by calculating the difference between the pretest and posttest values using the formula and criteria for improvement according to Meltzer (2002).

$$N - \text{gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Furthermore, the calculated N-gain value is matched with the criteria table as shown in Table 1.

**Table 1.** N-gain criteria

N-gain value	Criteria
$N\text{-gain} \geq 0.7$	High
$0.3 \leq N\text{-gain} < 0.7$	Moderate
$N\text{-gain} < 0.3$	Low

The final analysis is to perform the t-test according to Winarsunu (2002).

$$t_{count} = \left( \frac{X_1 - X_2}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}} \right)$$

Where  $X_i$  is the average score of group  $i$ ,  $n_i$  as the number of respondents in group  $i$ , and  $s_i^2$  as the variance of group  $i$ 's score. If the value of  $t_{count} > t_{table}$  is obtained, it can be said that the data is significant.

## RESULTS AND DISCUSSION

The implementation of blended learning in this study is to combine learning activities in the form of face-to-face online during class hours with the enrichment of material provided online that must be done by students where the teacher will monitor through the learning syntax in Google classroom. This is intended to that students are interested in learning actively, not just listening to the material presented face-to-face online. Thus, students will be better in understanding the material presented so that ultimately these efforts can improve students' cognitive learning outcomes (Septiani & Putra, 2020). Where students' cognitive development can be done at the beginning of learning and at the end of learning (Awali, 2018). This is intended to determine more quantitatively the development of learning outcomes achieved. For this reason, this study also conducted a pretest to determine the initial state of students' knowledge and a posttest to determine the improvement of students' understanding after learning with blended learning. The pretest and posttest were carried out online using the google form. In the implementation of the pretest and posttest, the teacher provides a link that can be used to work on

the pretest and posttest via WhatsApp group. Furthermore, students work on the pretest and posttest questions according to the time given by the teacher.

Online tests have weaknesses such as the control system or teacher supervision of students while working on the pretest and posttest because they cannot see directly. To anticipate this, in this study students were asked to fill out and sign an integrity pact, among the points were that students took the test honestly, worked independently, did not ask or give answers to other friends. With the integrity fact, it is hoped that the children will do the pretest and posttest questions well, and not cheating, so that the test results can be used as valid data.

Based on the results of the pretest and posttest, then an analysis of the learning completeness obtained by students in both the

experimental class and the control class was carried out. From the average value obtained from the pretest and posttest results, the experimental class and the control class experienced an increase. This is because the provision of temperature material and its changes during face-to-face online learning is quite clearly conveyed by the teacher. At face-to-face online, teachers and students interact with each other in learning through question and answer conducted by teachers to students or vice versa, from students to teachers. The interactions between teachers and students that are carried out during learning and repeated during subsequent lessons, cause students' cognitive development to be formed and developed (Habibah, 2020). The results of the analysis of the calculation of students' learning completeness in the experimental and control classes are shown in Figure 2.

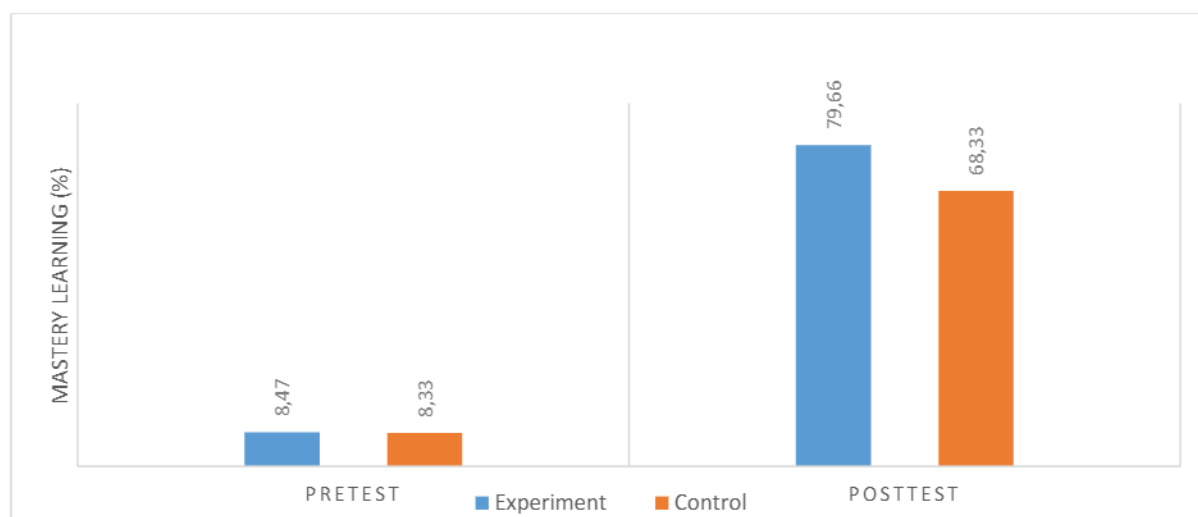


Figure 2. Students' completeness in learning cognitive competencies

Based on Figure 2, it can be seen that there was a significant increase after the implementation of blended learning and face-to-face online for the experimental class and control class by 71.19% and 60.00%. However, in this study, I wanted to see how the effect of blended learning to improve students' cognitive learning outcomes, where it is said that blended learning is effective if students obtain more than 75% completeness in learning. From Figure 2, it is shown that after the implementation of blended learning, students who experienced learning completeness were 79.66%, meaning that the implementation of blended learning was effective to improve students'

cognitive learning outcomes at SMPIT Harapan Bunda Semarang. These results are also in accordance with the results of previous studies which state that blended learning contributes to high cognitive learning outcomes (Ningrum et al., 2020; Priono et al., 2018).

The increase that occurred after giving blended learning and face-to-face online treatment in the experimental and control classes was followed by N-gain testing. This is to be more supportive qualitatively. The results of the calculation of the N-gain test for the experimental and control classes are shown in Table 2.

**Table 2.** N-gain Test Results on Student Cognitive Learning Outcomes

Class	N-gain Mean	Criteria
Experiment	0.50	Moderate
Control	0.44	Moderate

Based on Table 2, it can be seen that the N-gain average obtained for the experimental and control classes is 0.50 and 0.44, both of which fall into the moderate criteria. Based on these moderate criteria, it can be said that the provision of online blended learning and face-to-face learning in science SMP in the material temperature and changes does not show a significant increase for the experimental and control classes. However, when viewed from the N-gain average score, it can be seen that the experimental class is higher than the control class, which means that the experimental class learning outcomes are better than the control class. These results are also in accordance with the results of previous studies which state that the cognitive learning outcomes of the experimental class are higher than the control class (Inayah et al., 2020; Putri et al., 2021).

The last test is the t test, to determine the difference between the two means of research results for the experimental and control classes. From the t-test results on the pretest data, it shows that there is no difference between the experimental and control classes. However, from the results of the t-test on the posttest data, it was found that between the experimental and control classes there was a significant difference of 6.21. Thus the t-test results reinforce the statement of the results of learning completeness and the N-gain test which states that learning using blended learning can be used to improve student cognitive learning outcomes. These results are also in accordance with the results of previous studies which state that the blended learning strategy provides a significant increase compared to conventional learning strategies and can improve students' learning achievement (Fitriyana et al., 2020; Harahap et al., 2019).

Factors that affect the results of the analysis of the achievement of student cognitive learning outcomes include understanding the basic concepts received by students and the media used in the student learning process. In the experimental class,

students' understanding of basic concepts is built through face-to-face online learning and is strengthened when online learning through various learning activities is carried out, in contrast to the control class which only gets face-to-face online learning. According to Riyatuljannah & Suyadi (2020), students who have a good understanding of basic concepts have an effect on their cognitive development. In addition, learning media is one of the factors that determines the differences in the improvement of students' cognitive competencies (Nabilah et al., 2020). In the experimental class, the learning media used are more varied than the control class, where students do online learning through google classroom to do various learning activities. Therefore, it can be said that the implementation of blended learning provides attractiveness in learning, so that it can be used as an alternative solution in an effort to improve student learning outcomes (Septiani & Putra, 2020). Based on the analysis of learning completeness, the N-gain test, and the t-test above, it can be stated that the implementation of blended learning is effective in improving students' cognitive learning outcomes compared to face-to-face online learning alone. This can be seen from the increase in students' cognitive learning outcomes between before and after the implementation of blended learning in the experimental class that is bigger than the control class.

## CONCLUSIONS

Analysis of cognitive learning outcomes on the implementation of blended learning and face-to-face online has been successfully carried out. Based on the results of the learning mastery analysis, it was found that students in the experimental class or who were given blended learning treatment obtained a learning completeness percentage of 79.66%. This means that students in the experimental class experience higher learning completeness than the control class which applies online face-to-face learning only. For the analysis of the improvement in learning outcomes using the N-gain test, the N-gain mean values for the experimental and control classes were 0.50 and 0.44. Furthermore, for the t test conducted, it was found that the implementation of

blended learning was more significant for improving students' cognitive learning outcomes than face-to-face online learning. Thus it can be concluded that the implementation of blended learning is effective in improving students' cognitive learning outcomes in Science in the material of temperature and its changes in Junior high school.

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