

# Blanded Learning Model: Can It Reduce Students' Misconception In Physics.

*by Guntur Cahaya Kesuma Dkk*

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## Blended Learning Model: Can It Reduce Students' Misconception In Physics?

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**Abstract.** This study was designed to determine the effect of blended learning learning model on students' misconceptions in temperature and heat. The sample of this study comprised only 35 students from class X in one of the high schools in Pesawaran District, Lampung. The instruments used to measure students' misconception was four-tier diagnostic test with the Certainty of Response Index (CRI). Quantitative descriptive with pre-experimental design was used as the methods. The results showed that before learning with blended learning model, students' misconception reached 54.90%, and after tested with the blended learning model, the students' misconception presentation dropped to 22.04%. Thus, decreasing misconception by implementing blended learning model reached 33%. From the results of the t-test, it was also known that  $t_{mi} > T_{table}$  ( $9,099 > 2,035$ ) which means  $H_0$  is rejected and  $H_1$  is accepted. Based on this result, it can be concluded that blended learning can reduce students' misconception in temperature and heat.

**Keywords:** blended learning, concept understanding, CRI, four tier diagnostic test, misconception

### 1. Introduction

Nowaday, the world is facing the Fourth Industrial Revolution [1] which is marked by the advancement of information technology that can connect the whole world through digital technology [44], so that it changes the way of human life and human work processes fundamentally [2, 3]. The industrial revolution 4.0 is an era where human life is oriented toward digital technology [4]. Then, the problems in this era become more complex, and human must be able to survive to overcome these problems [5].

In order to prepare themselves to face the challenges in the fourth industrial revolution era, students, as the nation's successors, must be equipped with quality education [6]. This demand has an impact on the learning process at school. Learning method and learning model used in the learning process at school must be designed to meet the demands of learning outcomes [7]. The learning model used must lead to the use of digital technology.

The results of the pre-research at one of the high schools in Pesawaran District, Lampung, showed that learning physics, did not use digital technology. Learning process was dominated by teacher-centered lecture methods. This causes the teacher to be the only source of information for students. Students also tend to memorize without understanding the concepts.

Understanding concepts is more important in learning physics compared to just remembering or memorizing [8]. Learning physics contains many explanations about phenomena that occur in everyday



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life [9, 10]. By learning physics, students are expected to be able to understand concept or phenomena through discoveries or through practice [11].

In the learning process, sometimes students' concept understanding deviates from the actual concepts [12–14]. Students also often experience errors in understanding a concept or commonly known as a misconception [15–17]. Misconception is when a concept understood by students is not in accordance with scientific concepts or theories of experts [18–20]. Misconception can hinder the learning process of students [21, 22] misconception causes interference when students learn new concept that is contrary to the concept they have understood [12, 23]. Misconception can cause cognitive learning outcomes to be low [24, 25].

One solution that can be done to overcome misconception is through the use of various learning models [26,27]. The blended learning model is a good learning model used in the industrial era 4.0 [28, 29]. The blended learning model combines face to face learning (traditional learning) and online learning (learning with digital technology) [30 - 32].

The advantages of blended learning model are that students be more free to study independently by utilizing materials available online, students can have discussions with teachers or other students outside the classroom, teacher can add many lessons through internet facilities, teacher can ask students to read the material or take a test that has been provided by teacher, students can share files with other students [34–36]. Utilization of technology in learning makes it easier for students to access information flexibly [36]. Students are more free to get information about the lesson, so students' concept understanding becomes better and reduces the risk of misconception.

There are several studies on the application of blended learning, such as: blended learning model can improve student learning outcomes [37]. Blended learning model can increase students' motivation and learning interest [30, 39] and the blended learning model can make students' reasoning and students' concept mastery better [39]. The difference between this research and previous researches is that in this research, blended learning model was used to reduce students' misconceptions in physics, so this research aimed to determine the influence of blended learning model on students' misconceptions in temperature and heat.

**2. Method**

The method used in this research was quantitative method with pre-experimental design. This research was conducted at one of the high schools in Pesawaran District, Lampung. The sampling technique is purposive sampling.

The instrument used in this research was a multiple-choice question with four tier diagnostic design equipped with CRI. CRI is a scale of students' confidence in choosing answers and reasons for answers, so that it will be more accurate [42, 43]. The categories of the combination of the four tier diagnostic test answers are presented in Table 1 and the CRI confidence level scale category is shown in Table 2 [42]

**Table 1.**Combination of Four-Tier Diagnostic Test Answers [43]

Answer Combination	Answer Combination			
	Answer	Confidence Level		Confidence Level of Reason
Understand the concept (UC)	Right	Sure	Right	Sure
	Right	Not Sure	Right	Not Sure
	Right	Sure	Right	Not Sure
	Right	Not Sure	Right	Sure
Don't understand the concept (DUC)	Right	Not Sure	Wrong	Not Sure
	Right	Not Sure	Right	Not Sure
	Right	Not Sure	Wrong	Not Sure
	Right	Sure	Wrong	Not Sure
	Right	Not Sure	Right	Sure

Answer Combination	Answer Combination			Confidence Level of Reason
	Answer	Confidence Level	Reason	
Misconception	Right	Not Sure	Wrong	Sure
	Right	Sure	Wrong	Sure
	Wrong	Sure	Right	Not Sure
	Wrong	Sure	Right	Sure
	Wrong	Sure	Wrong	Not Sure
	Wrong	Not Sure	Wrong	Sure
	Wrong	Sure	Wrong	Sure

**Table 2.** CRI Confidence Level Scale Category[43]

Category	Scale	Confidence Level
Guessing	0	Low/Not Sure
Very Unsure	1	
Not sure	2	
Sure	3	High/Sure
Very sure	4	
Strongly Sure	5	

Before being used, the instrument was tested for validity, difficulty level, discrimination power, and reliability.

The data analysis technique used is the N-Gain Test with formula [44]:

$$N\text{-Gain } (g) = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

N-gain scores are categorized according to Table 3:

**Table 3.** N-Gain Category[45]

N-Gain Category	Criteria
$g > 0,70$	High
$0,30 \leq g \leq 0,70$	Medium
$g < 0,30$	Low

Percentage of misconceptions is analyzed by:

$$P = \frac{9}{N} \times 100\%$$

With:

$P$  = the percentage of misconception students.

$F$  = the number of students who understand the concept.

$N$  = the number of participants.

The results of the misconception calculation are categorized based on Table 4.

**Table 4.** Misconception Level Criteria [46]

P	Criteria
61% - 100%	High
31% - 60%	Medium
0% - 30%	Low

The hypothesis test used is the t-test, because the data are normally distributed. The t-test is a statistical test that compare two average scores.

**5 Results and Discussion**

The results of the N-gain test are presented in Table 5:

**Table 5.** Experimental Class Students N-Gain

Result	Maximum Score	Pretest	Posttest	N-Gain
Average Score	28	12.37	19.49	0.441
	Category			Medium

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Based on Table 29 it can be seen that the average N-Gain of students is in the medium category.

To find out whether the data is normally distributed or not, we used normality test. The result of normality test is presented in Table 6:

**Table 6.** Liliefors Normality Test Results

Statistic	Pretest	Posttest
$L_{count}$	0.084	0.110
$L_{table}$	0.149	0.149
Sig	0.05	0.05
Liliefors	$L_c < L_t$	$L_c < L_t$
Conclusion	Normal	Normal

Furthermore, to see the homogeneity of the data, we used homogeneity test, the result is presented in Table 7

**Table 7.** Homogeneity Test Results

Statistic	Result
$F_{count}$	1.049
$F_{table}$	4.139
Sig	0.05
F-Test	$F_c < F_t$
Conclusion	Homogen

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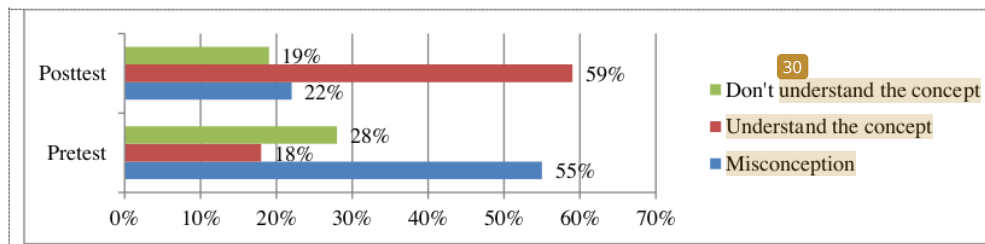
The results of the hypothesis test are shown in Table 8.

**Table 8.** Hypothesis Test Results

Statistic	Result
$T_{count}$	2.035
$T_{table}$	9.099
Sig	0.05
Uji-t	$T_{count} > T_{table}$
Conclusion	$H_0$ is rejected $H_1$ is accepted

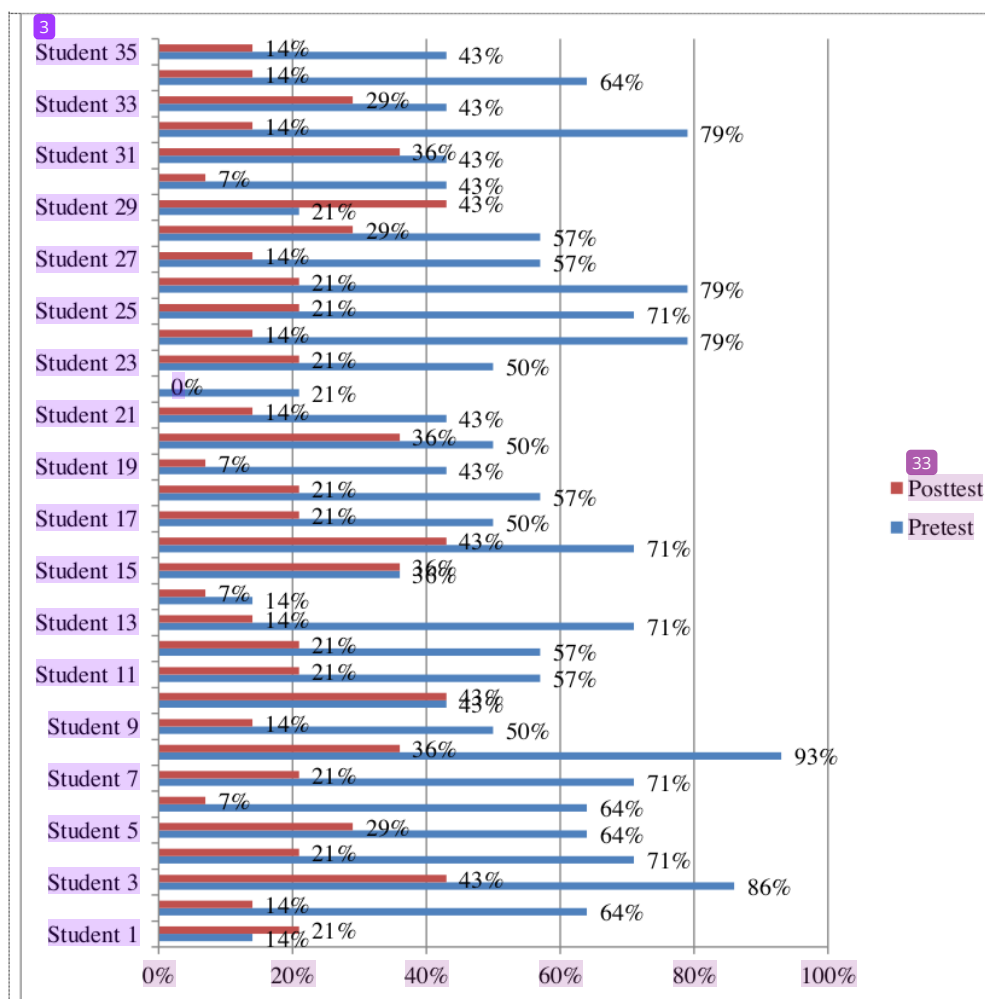
Hypothesis test results indicate the effect of blended learning learning models on students' misconceptions.

Data on the results of misconceptions using the four-tier diagnostic test with CRI are shown in Figure 1.



**Figure 1.** Misconception Test Results using Four Tier Diagnostic Test with CRI

Figure 1 shows that there was a decrease in students' misconceptions from 55% to 33%. The details of the percentage of misconceptions per student is presented in Figure 2.



**Figure 2.** Percentage of Students Misconceptions



From Figure 2, it can be seen that the biggest decrease in misconception is 64% occurred in students 24. However, there were also seen there are 2 students (student 1 and 29) experiencing an increase in misconceptions after being treated with blended learning learning models. Meanwhile, students 10 and 15 experienced the same percentage of misconceptions from the results of the pretest and posttest.

Misconceptions occur in each sub-concept of temperature and heat. Misconceptions experienced by students are shown in Table 9:

**Table 9. Students Misconceptions**

Sub-concept	Misconception	The Real Concept
Temperature	The temperature of water that is heated continuously will continue to grow	Water temperature will be constant when it reaches its maximum boiling point
	The temperature of the water in the glass is different, depending on the volume Changes in properties due to changes in temperature are called the expansion properties	The volume of water does not affect changes in temperature Properties that change due to temperature changes are thermometric properties because thermometrics are the structural properties of substances that change when there is an increase or decrease in temperature
Expansion	The application of expansion is a) the use of a gas stove for cooking, b) the use of an electric solder to connect two pieces of cable	Splicing of steel plates using rivets, and the use of bimetal in automatic electric irons, this is because expansion is a change in the size of objects due to temperature changes.
	The heated iron ball will reduce its mass	The heated iron ball will not make the mass of the iron ball decrease, but the volume of the iron will increase because the distance between the particles increases due to expansion.
Change of Matter	Ice that is put into a box with a temperature of 20°C Ice that is put into a box with a temperature of 200C will not melt and the temperature in the box constant.	Ice that is put into a box with a temperature of 20°C will melt in part or all and the temperature of the box will drop (the ice will melt and the temperature of the box drops so the temperature is less than 20°C)
Black Principle	Glass A is filled with hot water and Glass B is filled with plain water. If both are mixed, the final temperature will raise	The final temperature of the water mixture will be same, because hot water in Glass A gives heat to water in Glass B, or the heat it receives is the same as the heat released ( $Q_{\text{released}} = Q_{\text{receive}}$ )



Sub-concept	Misconception	The Real Concept
Heat and Heat Transfer	Substances that heat quickly when put into boiling water is aluminum (Specific heat = 900J/Kg.K) because specific heat does not affect changes in the temperature of a substance	Substances that heat quickly are silver because of the small specific heat of silver (230J/Kg.K) so that the specific heat influences the amount of temperature change of a substance
	Heat transfer when boiling water with a pan is convection.	The heat transfer when boiling water with a pot is the heat transfer by conduction and convection, this is because the heat from the stove fire moves to the pan and there is an up and down movement of water when boiling.
	Heat transfer when ironing is radiation.	Heat transfer when ironing is conduction, because when ironing there is heat transfer with an intermediate and is not accompanied by particle transfer.
	The heat transferred by conduction occurs in all substances	The heat transferred by conduction only occurs in solids, because heat moves with an intermediate without particle transfer.
	The body feels cold in the morning. This is because heat moves from the body into the surrounding air by convection.	The body feels cold in the morning because it receives cold heat from the surrounding air, because the heat moves from a higher temperature to a lower temperature.
	Water with a mass of 5 Kg is heated from 10 <sup>0</sup> C to 40 <sup>0</sup> C, if the heat type of water is 4,200 J/Kg <sup>0</sup> C, the amount of heat needed is 840 KJ	The heat required is 630KJ, this is obtained from the product of the mass of the substance, the specific heat, and the temperature rise
	Cuprum and aluminum cannot be hot, this is because heat does not affect the heat absorption of objects	Cuprum is a metal that is easily heated because the heat type of cuprum is smaller than aluminum, so the greater the heat, the more difficult objects to heat

Blended learning model that is learning in face to face and online, in this study it is conducted as 3 meetings. This learning gets a positive response from students, based on interviews and conditions in the field where students are very active in learning. This is reinforced by the results of previous studies, where the blended learning model of learning can increase students' learning motivation [30]. Learning using blended learning models can foster learning independence [47]. The use of blended learning models can facilitate students in discussing and getting information about the material taught both online and face to face.

Learning steps using blended learning model can be followed by students well. The steps of blended learning model are: (1) Seeking of information, in this step students were asked to find information about the lesson through online media (website), (2) Acquisition of information, after students looked for information in the first step, students were required to interpret the information that had been obtained by working on the questions that had been provided in mysuhukalor.blogspot.com. Students discussed information that had been obtained until the actual information was found and did not deviate from the actual concept. (3) Synthesizing of knowledge, at this stage the students did a simulation through Phet simulation in the blog page provided. At this stage students could reconstruct the information they got in the first step, then the results of the discussion in the second step, and found out whether the information they got was right or wrong through experiments and they drew conclusions based on the three steps.

Through the steps of the blended learning model it is hoped that it can improve the effectiveness of learning. It is suited to the previous research, the use of a blended learning model to improve the effectiveness of learning [31]. But in this study the researchers focused on the use of blended learning modes to reduce misconceptions. Misconceptions that occur in students are still quite high, it was shown from the results of the students' pretest with a percentage of 54.90%, this is very dangerous because misconceptions cause learning outcomes to be low.

Misconceptions often occur because of the factors within students, significantly these are following causes misconceptions experienced by students: students' preconceptions or initial concepts are wrong, associative thinking, humanistic thinking, reasoning or incomplete reasoning, wrong intuition, and student interest in learning [48]. But misconceptions that occur in students can still be overcome by using varied learning models that make students become more activate in the learning process, such as blended learning model that combine online learning and face to face learning, so that students are required to be more active in learning.

Using blended learning in the classroom made students very active, because online learning was very helpful for students in getting information about the lesson and the use of phet simulation was very helpful for students to understand the theory factually, and students could freely ask the teacher in class face to face. So that students were become even more motivated in learning. Because in the industrial revolution 4.0 era, students are now familiar with the use of the internet and students are more interested in this than just listening to the teacher's explanation.

In physics learning, especially students will understand better through learning through practice where this will foster students' knowledge factually or in real terms, such as in the temperature and heat lesson, many students experiencing misconceptions because the temperature and heat material is abstract and difficult to understand, so there is a need for practice in the explanation of the material temperature and heat in learning.

Learning using blended learning models that was conducted online can reduce students' misconceptions. This was proven by the results of the average percentage of students' misconceptions having decreased by 33%, which at pretest, students experienced misconceptions by 55%, and at the posttest by 22%. Students experience the biggest misconception in the expansion sub concept, reaching 56%. However, this study has not been completely reduced the misconceptions, because misconceptions are difficult to fix. This opinion is also strengthened from previous research [49] that misconceptions are resistant to change, because basically, humans always tend to maintain the concepts they believe in the beginning, so it is difficult to change (persistent).

#### 4. Conclusion

Based on the results of the study, it can be concluded that there is an influence of the blended learning model in reducing students' misconceptions, as evidenced by the results of the hypothesis test obtained by  $t_{count} > t_{table}$ , which is  $9,099 > 2,035$ , which means  $H_0$  is rejected and  $H_1$  is accepted. Blended learning model also affects students' learning outcomes, after the implementation of the blended learning model, the posttest is increased up to 69.59% while the pretest was 41,18% and based on the normalized N-Gain value of 0.441 in the medium category.

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