

IDENTIFICATION OF STUDENTS' PHYSICS MISCONCEPTIONS USING TWO TIER DIAGNOSTIC TEST

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Abstract

This study aims to determine the misconceptions of class X students on the concept of Temperature and Heat using a two-tier multiple choice diagnostic test at SMA Bersama Berastagi Private. This research is included in the descriptive qualitative research. The population in this study were students of class X MIA. The sample in this study were 68 people. Diagnostic test data were collected using a two-tier multiple choice to identify students' understanding of concepts into conceptual understanding, misconceptions, guessing and not understanding concepts. Based on the research results obtained from a two-tier multiple choice diagnostic test on students of class X MIA1 and X MIA3 SMA Bersama Berastagi Private High School, misconceptions were identified in each sub-concept of the concepts of Temperature and Heat. The sequence of sub-materials that identified misconceptions from those with the highest to the lowest proportions was as follows: black principle (77.94%) and the lowest misconception occurred in the heat sub-matter (4.41%).

Keywords: Misconceptions, Physics, Two Tier Diagnostic Test

Abstrak

Penelitian ini bertujuan untuk mengetahui miskonsepsi siswa kelas X pada konsep Suhu dan Kalor dengan menggunakan tes diagnostik pilihan ganda dua susun di SMA Bersama Berastagi Swasta. Penelitian ini termasuk dalam penelitian deskriptif kualitatif. Populasi dalam penelitian ini adalah siswa kelas X MIA. Sampel dalam penelitian ini adalah 68 orang. Data tes diagnostik dikumpulkan dengan menggunakan two-tier multiple choice untuk mengidentifikasi pemahaman konsep siswa menjadi pemahaman konsep, miskonsepsi, menebak dan tidak memahami konsep. Berdasarkan hasil penelitian yang diperoleh dari tes diagnostik pilihan ganda dua susun pada siswa kelas X MIA1 dan X MIA3 SMA Swasta Bersama Berastagi teridentifikasi miskonsepsi pada masing-masing subkonsep pada konsep Suhu dan Kalor. Urutan sub materi yang mengidentifikasi miskonsepsi dari proporsi tertinggi hingga terendah adalah sebagai berikut: prinsip hitam (77,94%) dan miskonsepsi terendah terjadi pada sub materi kalor (4,41%).

Kata Kunci: Miskonsepsi, Fisika, Tes Diagnostik Dua Tingkat

Introduction

The development of globalization era more advanced makes human needs become more complex. One of the needs which must be fulfilled is education, because it triggers the development of community potential. The purpose of an education is inseparable from the educational process such as teaching and learning activities. School as a formal education is one of the supporting facilities in learning activities (Sjöblom & Svens, 2019). However, one of obstacles in this activity is the concepts conveyed is not received by students well, especially in physics which contains scientific concepts that are difficult to understand and make them misconceptions, so the physics subject emphasizes understanding rather than memorizing a concept Education is important thing in life we, meaning that every man entitled get And hope For always develop in education. Education in a manner general have meaning a life process in develop self each individual for can life And carry out life (Rizky, 2021). So that become an educated person. That very important Education our first time get in the environment family, environment school And environment society In the era of globalization expected generation young capable develop knowledge gained so that No left behind in development era (Sheftyan et al., 2018). The low quality education in Indonesia is caused lack of internal teachers dig potency child (Inggit et al., 2021). Teachers often very impose his will without Once pay attention needs, interests And talent you have his students Weakness teachers that is they No Once dig problem And potency student (Cahyani et al., 2019; Maryam, 2020). Quality education in Indonesia is very apprehensive will hinder provision source Power humans who have skill And Skills For fulfil development nation in various field, in particular field studies physics (Mukhlisa, 2021; Triastutik et al., 2021). Misconception is a condition where there is a mismatch of concepts from students between new concepts and old concepts connected. Several causes of misconceptions can be found in students' personal, teachers' personal, textbooks used, the context and teaching methods. In addition, misconceptions can be caused by initial concepts or preconceptions from students. From some of the causes that have been mentioned, the most dominant aspect that causes misconceptions is students' personal, and this is the reason researchers make students as objects in this study. Misconceptions also have an impact on student learning outcomes, but misconceptions cannot be identified directly, so students have to take diagnostic tests to distinguish between students with misconceptions and not because of ignorance about the concept (Astuti et al., 2021); (Maison et al., 2020)/ According to Wandersee, Minsties and Novak (in Ali, 2019) explain that misconception happen in all field physics study Kasmianti quoted by Hasibuan (2011: 4), stated that misconception happen no only from category students who have mark low On in fact No all students who follow the learning process can understand draft physics he studied (Rizki & Setyarsih, 2022). Lots student think that lesson physics difficult And complicated For studied, a lot formula, so draft And principle physics difficult understood And digested (Bursa, 2012) and based on given questionnaire to student class X MIA1 and X MIA3 in a private high school Together Berastagi, there are 50 students out of a total of 68 students (75.76%), stated that lesson physics difficult studied with reason the most Because Lots memorization, formula And count (Suryawirawati et al., 2018; Agustin et al., 2018). Difficulty student in Study physics can overcome with the learning process effective teaching learning process teach can made effective with the teacher applying various type strategy learning one strategy learning that can increase effectiveness in the learning process in class is strategy Study complete (Handayani et al., 2018). In draft Study complete, a strategy learning can implemented inside class, with assumption that inside the right conditions all participant will capable Study with Good And obtain results Study in a manner maximum to whole learned load (Rohmah & Handhika, 2018).

For improve the learning process, assessment must characteristic diagnostic, that is evaluation the can used for know weaknesses students, so based on weakness the can done gift proper handling one (Mukhlisa, 2021) form questions that can used For do diagnostic is a two-tier diagnostic test (Astuti et al., 2021). Two tier diagnostic test has excess when compared to with form general matter used like conventional multiple choice (Irianti, 2021). Advantages of two tier diagnostic tests compared conventional multiple choice is reduce error in measurement, conventional multiple choice with five choices answer own chance answer Correct with guess by 20%, so most student Study technique guess answer No on material, students can answer with Correct without need know the reason (Saputri et al., 2021).

Method

This type of research is descriptive qualitative research, namely research that is intended to find out the state of something regarding what, and how, how much, to what extent and so on (Habellia et al., 2021); Taufik & Warsono, (2020);(Darmansyah et al., 2022). In other words, research with a descriptive attitude is able to provide an explanation, description or description of something being researched in the form of a narrative description (Nurulwati & Rahmadani, 2020) .

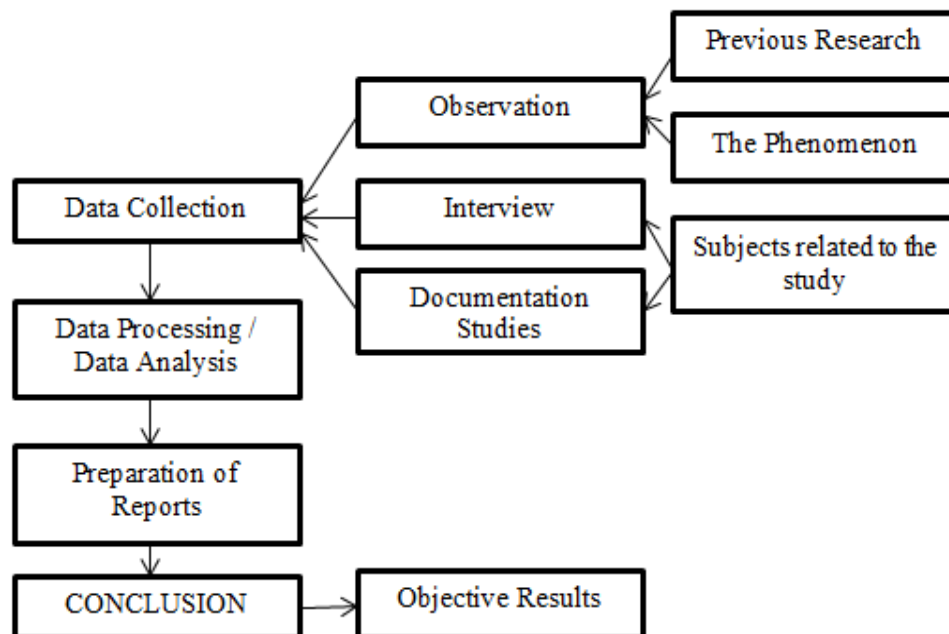


Figure 1 Descriptive qualitative design

This research was conducted by giving physics concept questions on the material that has been learned by students (Julianda & Halim, 2022). In collecting this data, the researcher immediately went into the field in giving tests to the research sample. The number of questions given is 20 items. Each question is accompanied by a reason for selecting the answer. Each student's answer is data which is then processed and analyzed. Meanwhile, reasons are used to trace students' misconceptions about concepts that will be processed and analyzed (Julianda & Halim, 2022). The data obtained is then identified using *the Two Tier Diagnostic Test* , where students must choose the reasons in choosing the answers given. The material on the test given had been previously studied by the respondents (Jannah & Rahmi, 2020). The following are provisions for distinguishing students' understanding of concepts, namely understanding concepts, not understanding concepts, misconceptions , and not knowing concepts (*errors*) (Maison et al., 2020). Answer student based on criteria understand , no understand or msiconception percentage use equation :

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

Information:

P = percentage number (%group)

f = number of students in each group

N = the total number of students who were used as research subjects

The percentage calculation results are interpreted in terms of the level of misconception criteria presented in the table below.

Table 1. Criteria for the Level of Misconceptions

Criteria	Percentage
Tall	61% - 100%
Currently	31% - 60%
Low	0% - 30%

Source : Sudijono , 2009:43

Results percentage based on each criteria understand , no understand or misconception can grouped become a number of level misconception following :

Table 2. Category Levels misconceptions

No.	Category	Criteria
1.	Understand Draft	Answer Correct And Reason Correct
2.	No Understand Draft	Answer Correct And Wrong Reason
3.	misconceptions	Wrong Answer and Reason Correct
4.	Don't Know Concept	Wrong Answer and Wrong Reason

Source : Kasanah , 2013: 60

Results and Discussion

This study describes the profile of understanding the concept of physics on the subject matter of heat which is grouped based on four categories, namely students who understand the concept, do not understand the concept, have misconceptions, and do not know the concept. Before being used to analyze the required data, test questions were prepared first, then validated by 2 expert validators who were competent in their fields. The results of the students' overall misconception questionnaire are presented in the table below.

Table 3. Concept Understanding Profile of the Entire Sample

Profile understanding Student									
Sub Material	grain Question	Understand Draft		No Understand Draft		misconception		Don't Know Concept	
		Jl Sister Wow	%	Jl Sister Wow	%	Jl Sister wow	%	Jl Sister wo w	%
Heat	1	57	83.82%	4	5.88%	3	4.41%	4	5.88%
Capacity Heat	2	44	64.70%	15	22.05%	5	7.35%	4	5.88%
Basic Black	3	5	7.35%	4	5.88%	50	73.52%	9	13.23%
	4	6	8.82%	5	7.35%	53	77.94%	4	5.88%
Change Form	5	10	14.70%	50	73.52%	4	5.88%	4	5.88%
Substance	6	57	83.80%	2	2.94%	5	7.35%	4	5.88%
Latent Heat	7	29	42.64%	4	5.88%	9	13.23%	26	38.23%
Basic Black	8	34	50%	7	10.29%	20	29.41%	7	10.29%
Change Form	9	48	70.58%	8	11.76%	3	4.41%	9	13.23%

Substance	10	46	67.64%	8	11.76%	8	11.76%	6	8.82%
AsasBlack	11	24	35.29%	18	26.47%	9	13.23%	17	25%
Heat Type	12	21	30.88%	31	45.58%	4	5.88%	12	17.64%
Change Form Substance	13	35	51.47%	8	11.76%	8	11.76%	17	25%
Capacity Heat	14	26	38.23%	17	25%	8	11.76%	17	25%
Latent Heat	15	28	41.17%	14	20.58%	3	4.41%	23	33.82%
Change Form Substance	16	35	51.47%	11	16.17%	6	8.82%	16	23.52%
Asa Black	17	34	50 %	4	5.88%	13	19.11%	17	50%
Heat Type	18	33	48.52%	6	8.82%	10	14.70%	18	26.47%
Basic Black	19	15	22.05%	6	8.82%	10	14.70%	37	54.41%
Displacement Heat	20	51	75%	4	5.88%	4	5.88%	9	13.23%
Amount									
Whole		638	938.23 %	226	332.35%	235	345.58%	260	382.35 %
Amount Per Item		32	46.91%	11	16.61%	12	17.27%	13	19.11%

Then the percentage of the results of the questionnaire was calculated based on the categories of understanding the concept, not understanding the concept, misconceptions, not knowing the concept. The results of the percentage of work done by students are presented in table 1.2 below :

Table 4. Percentage of Student Understanding

Profile understanding Students (%)				
Class	Understand Draft	No Understand Draft	misconception	Don't Know Concept
X MIA1	45,29	16,47	17.50	20,73
X MIA3	48,52	16,76	17.05	17,64

In class X MIA1 students who understand the concept (45.29%), students are categorized as understanding the concept if the answer is correct and the reason is correct for the questions tested in the form of a Two Tier Multiple Choice Test. Students who do not understand the concept of (16.47%), students are categorized as not understanding the concept if the answers are correct and the reasons are wrong for the questions tested in the form of a Two Tier Multiple Choice Test. Students who experience misconceptions (17.50%), students are categorized as misconceptions if the student's answers are wrong and the reasons are correct for the questions tested in the form of a Two Tier Multiple Choice Test. Students who do not know the concept are (20.73%), students are categorized as not knowing the concept if the student's answers are wrong and the reason is wrong for the questions tested in the form of a Two Tier Multiple Choice Test (Rukmana et al., 2020) .

For class X MIA3 students who understand the concept (48.52%), students are categorized as understanding the concept if the answer is correct and the reason is correct for the questions tested in the form of a Two Tier Multiple Choice Test. Students who do not understand the concept are (16.76%), students are categorized as not understanding the concept if the student's answers are correct and the reasons are wrong for the questions tested in the form of a Two Tier Multiple Choice Test. Students who experience misconceptions are (17.05%), students are categorized as misconceptions if the answers are wrong and the reasons are correct for the questions tested in the form of the Two Tier Multiple Choice Test and students who do not know the concept are (17.64%), students are

categorized as not knowing concept if the student's answer is wrong and the reason is wrong for the questions tested in the form of the Two Tier Multiple Choice Test (Sutrisno, 2019) . Thus the results of the identification of students' misconceptions about physics in class X by using the Two Tier Multiple Choice Test, the level of students' misconceptions about heat is low. (Setianita & Liliawati, 2019) .

Conclusion

Based on results research obtained from test two-tier multiple choice diagnostic of student class X MIA1 and X MIA3 SMA SMA Private Together Berastagi that misconception identified at each sub concept on draft Temperature And heat With thereby results identification misconception physics student class X with using the Two Tier Multiple Choice Test level misconception student to material heat belong low. For class X MIA3 students who understand the concept (48.52%), students are categorized as understanding the concept if the answer is correct and the reason is correct for the questions tested in the form of a Two Tier Multiple Choice Test. Students who do not understand the concept are (16.76%), students are categorized as not understanding the concept if the student's answers are correct and the reasons are wrong for the questions tested in the form of a Two Tier Multiple Choice Test. Students who experience misconceptions are (17.05%), students are categorized as misconceptions if the answers are wrong and the reasons are correct for the questions tested in the form of the Two Tier Multiple Choice Test and students who do not know the concept are (17.64%)

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