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Article

Analysis of Students' Misconception Profile on Human Respiratory System Material using Four-Tier Diagnostic Test

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ABSTRACT

In science subjects, the material of the human respiratory system is widely misconceived by students. These students' misconceptions need to be identified because it may cause students to have difficulty connecting old concepts with new concepts. Based on this, a study was conducted to determine the students' misconception profile on the material of the respiratory system. This research method uses descriptive methods with a quantitative approach. This study involved 90 students of class VIII in Driyorejo District. The instrument used in this study was a *four-tier diagnostic test* with total 20 questions related to human respiratory system.. The results show that students in junior high schools in Driyorejo District experience 52% misconceptions which is categorized as moderate. Misconceptions occur in all concepts of respiratory system material with the highest percentage of misconceptions in the concept of respiratory frequency which is misconceived by 62% of SMP 5 YPM students.

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INTRODUCTION

Education is one of the foundations of national development in producing quality generations of the nation, where in its implementation the success of education can be judged by how well educational activities are carried out by the parties involved, one of which is the teacher (Depdiknas, 2006). When the learning process takes place, the teacher does not just transfer knowledge from teacher to student, but more than that the teacher is also obliged to ensure that students understand the concept of the material they have learned or are currently learning (Putri & Subekti, 2021). In essence, the learning carried out by the teacher aims to enable students to develop understanding, strengthen the application, and connect existing concepts (Dewi et al., 2021).

Learning concepts is the main result expected in education (Nainggolan, 2017). By learning concepts, students will have a strong conceptual understanding (Siwi, 2013). The strength of students' understanding of concepts can help students understand higher concepts (Oktavia & Walid, 2021; Yulianti, 2017). This is because each concept has a relationship with each other, so students have a foundation for understanding the next concept by having the

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right and strong initial concept (Nainggolan, 2017). Thus it can be concluded that it is important for students to understand the concept in the learning process.

The concept is one of the most important things for students (Muawana & Erman, 2023). However, in reality, before learning students already have an initial concept that they get from the phenomena or experiences they experience (Kaltakci Gurel et al., 2015). Seeing that students have different experiences in knowing the initial concept, there is a gap for students to have the wrong concept from the scientific concept that should be (Samsudin et al., 2018). Students who have an understanding of concepts that are not by scientific interpretations or explanations from scientists can be said to experience misconceptions (Dewi et al., 2021). Misconceptions are discrepancies in students' ideas about a concept with scientific concepts that researchers have accepted and tend to be difficult to change (Qian & Lehman, 2018).

Material on the human respiratory system is one of the science materials that has the opportunity for misconceptions (Dewi et al., 2021; Muawana & Erman, 2023; Siwi, 2013). The human respiratory system material is considered difficult by students because there are scientific terms that are difficult to understand (Aini & Habibi, 2020; Yuliana et al., 2013). This is in line with research (Hidayat & Kasmiruddin, 2020) which explains that misconceptions can occur because of the many foreign terms that are difficult for students to remember and understand. Material on the human respiratory system is also considered difficult because students only rely on feelings as a result of students' limitations in being able to see directly the organs in the respiratory system (Myanda et al., 2020).

The research above is also supported by a preliminary study by interviewing one of the science teachers at junior high school in Driyorejo District. Teacher revealed that there were indeed students who experienced misconceptions in respiratory system material. Students have difficulty understanding the organs of the respiratory system where the organs of the respiratory system have names that are almost similar to each other such as pharynx and larynx. In addition, teacher revealed that students need more time in learning the sub-matter of respiratory system disorders because it uses terms that are unfamiliar to students until finally misconceptions. Based on a preliminary study also found that the teacher did not identify students' misconceptions. Even though it is important to identify misconceptions in students because misconceptions that are not immediately identified and continue to be stored in students' memories can cause students difficulties in connecting old concepts with new concepts because science concepts are interrelated (Farihah et al., 2016). In the process, identifying student misconceptions can provide information regarding the mindset and views of students in determining answers about material concepts so that teachers can also determine appropriate learning strategies so that students easily understand concepts (Lestari & Susantini, 2020). Therefore, the identification of misconceptions needs to be done to find out the location of misconceptions and reduce the existence of misconceptions in students.

Identifying misconceptions in students can be done using *four-tier diagnostic test*. *Four-tier diagnostic test* is the result of the refinement *three-tier diagnostic test* with the addition of a choice of beliefs on reasons (Hermita et al., 2017). In line with this, this method is considered the most accurate in detecting misconceptions because it can provide information in the form of an overview of students' conceptions which can be analyzed through the answers, reasons, and level of confidence chosen where this cannot be obtained in multiple choice instruments.*two-tier* and*three-tier* (V. E. Oktavia & Admoko, 2019). *Four-tier diagnostic test* also has the advantage of being able to explore more deeply about the power of students' conceptions, analyze misconceptions in students more deeply, define parts of the material that require more emphasis, and design more effective and meaningful learning activities to reduce misconceptions (Fariyani & Rusilowati, 2017). In addition, several studies have also confirmed that the four-tier diagnostic test is feasible and very suitable to be used to identify

misconceptions in students (Dewi et al., 2021; Muawana & Erman, 2023; Wulandari et al., 2021).

Based on the background above, this research was carried out to find out the profile of misconceptions of class VIII students on the subject of the human respiratory system.

METHODS

This study uses research methods descriptive with a type of quantitative approach. The subjects of this study were 90 class VIII students at SMP Negeri Driyorejo consisting of 30 class VIII students at SMP Negeri 8 Gresik, 30 students at SMP *Excellent*, and 30 students of SMP 5 YPM. The subject of this study uses the technique *purposive sampling*. Techniques that pay attention to special things to determine a research subject/sample are called technique *purposive sampling* (Aritiawati et al., 2018). In this study, special things that were given attention included the number of students, school accreditation, and students who had studied respiratory system material, each student had different abilities and was based on the considerations of the science subject teacher.

This study began by giving a four-tier diagnostic test instrument totaling 20 questions which had previously gone through validity and reliability tests using SPSS. The validity test was conducted using Pearson's Product Moment t analysis, with N = 30 with a significance level of 0.05. The results show that the rcount value (0.493) > rtable (0.361) so that the instrument can be considered valid (Sugiyono, 2018)). Furthermore, the reliability test used Cronbach's Alpha analysis, and obtained a value of $\alpha > 0.70$, which is a sign that the instrument is reliable or consistent. In a variable, if $\alpha > 0.60$, then the variable is considered reliable or consistent (Sugiyono, 2018)). The next step is to analyze quantitative data in the form of the answers to the four-tier diagnostic test instrument that was previously given to students. This analysis was carried out with the aim that students' misconceptions about the respiratory system material could be detected. Through the analysis of the results of the answers *four-tier student diagnostics* then it can be grouped students who understand the concept, do not understand the concept, and experience misconceptions. This grouping uses concession grouping criteria which are briefly shown in table 1.

Table 1. Criteria for Grouping Student Concepts Based on the Four-tier Diagnostic Test

Category	Response Type			
	Answer	Confidence Level	Reason	Confidence Level
Understand Concept	Correct	Height	Correct	Height
	Correct	Low	Correct	Low
	Correct	Height	Correct	Low
	Correct	Low	Correct	Height
Don't Understand the Concept	Correct	Low	Wrong	Low
	Wrong	Low	Correct	Low
	Wrong	Low	Wrong	Low
	Correct	Height	Wrong	Low
	Wrong	Low	Correct	Height
	Correct	Low	Wrong	Height
	Correct	Height	Wrong	Height
	Wrong	Height	Correct	Low
Misconceptions	Wrong	Height	Correct	Height
	Wrong	Height	Wrong	Low
	Wrong	Low	Wrong	Height
	Wrong	Height	Wrong	Height

Source: (Wilantika et al., 2018)

The level of confidence used in this study uses a scale of 1-6. The level of confidence is considered low if it is on a scale of 1-3. Scale 1 means totally guessed answer, scale 2 means almost guess, and scale 3 means not sure. The level of confidence is considered high if it is on

a scale of 4-6. Scale 4 means sure, scale 5 means almost certain, and scale 6 means certain (Hasan et al., 1999).

After the results of the students' answers have been completed, they are grouped based on the category of understanding the concept. Then the level of student misconceptions is analyzed using the formula for calculating the percentage of misconceptions:

$$\text{Precentage of misconceptions} = \frac{\text{Number of students with misconceptions}}{\text{Total students who took the test}} \text{x100 \%}$$

(Beniarti et al., 2018)

The grouping of students' misconception levels is presented in table 2.

Table 2. Classification of Students' Misconception Levels

Misconception presentation	Misconception Category
61%-100%	Height
31%-60%	Currently
0%-30%	Low

Source: (Istighfarin, 2015)

By grouping the level of misconceptions above, it can be seen that the level of students' misconceptions is in the high, medium, and low categories. Thus, it can be seen that the concept of respiratory system material should be given more attention to taught to students.

RESULTS AND DISCUSSION

Based on the results of instrument data analysis *four-tier diagnostic test* a total of 20 questions that have been given to three junior high schools in the Driyorejo District can be known to understand the students' concepts as shown in Figure 1.

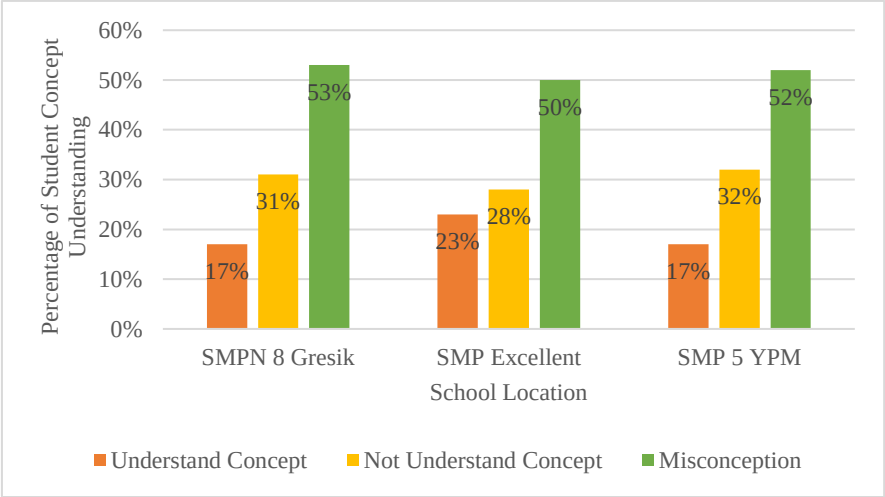

Figure 1. Graph of Students' Understanding and Misconception Percentages

Through results *four-tier diagnostic test* it can be seen the level of understanding of students starts from the category of understand concept, not understand concept, and misconception. Figure 1 shows that the level of student understanding that dominates is the category of misconceptions. The percentage of misconceptions at SMP Negeri 8 Gresik was 53% in the 'moderate' category, 50% in Excellent Middle School was included in the 'moderate' category, and 52% in YPM Middle School 5 was included in the 'moderate' category. From the percentage of misconceptions in the three schools, it can be seen that the average percentage of students' misconceptions in the Driyorejo District on the subject of the human respiratory system is 52% which is included in the 'medium' category.

Through data analysis *four-tier diagnostic test* It is also known that students experience misconceptions about all the material concepts of the respiratory system with varying percentages. Details on the percentage of misconceptions for each concept can be found in Figure 2.

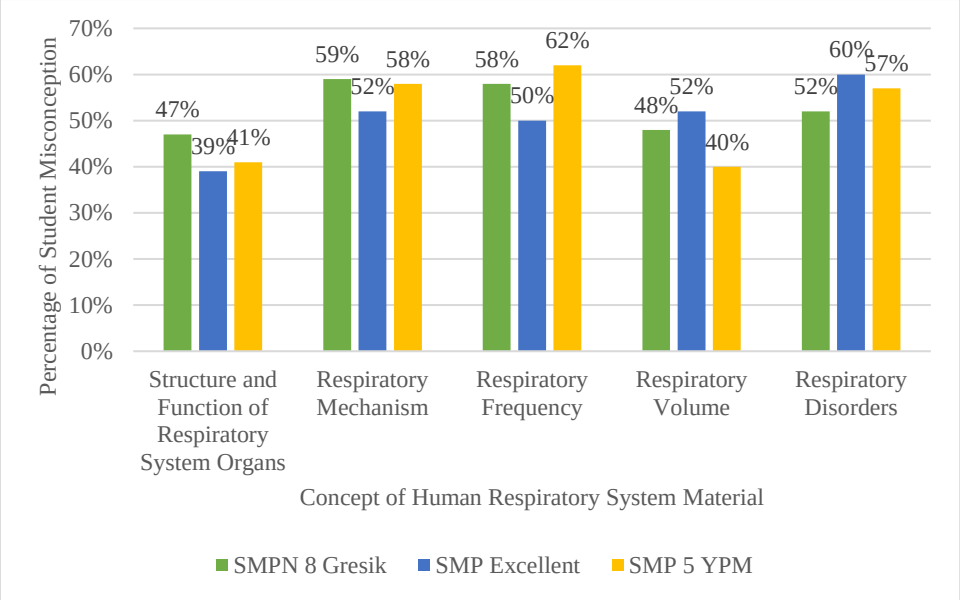

Figure 2. Graph of Students' Misconception Percentage on Each Respiratory System Concept

In the material of the respiratory system, there are 5 concepts that must be understood by students. Based on Figure 2, it can be seen that students experience misconceptions about all concepts of the respiratory system. The highest percentage of misconceptions was in the concept of respiratory frequency at YPM 5 Middle School by 62% and respiratory system disorders at Excellent Junior High School by 60%.

The list of misconceptions that occur in students can also be identified through an analysis of the answers *four-tier diagnostic test* students presented in Table 2.

Table 3. List of Student Misconceptions on Each Question Item

Question Items	Student Misconceptions
1	The entry of air into the respiratory system starts from the nasal cavity and ends in the lungs, namely the bronchioles
2	Blood capillaries in the nasal cavities function to produce mucus
3	The epiglottis is responsible for producing loud sounds
4	The vocal cords lie in the pharynx
5	The lung lobes have function to protect the lungs from friction during the expiratory and inspiratory phases
6	Dust in the air that is not filtered by nasal hairs will be filtered again in the bronchioles
7	The process of inspiration is characterized by a relaxed diaphragm and an enlarged chest cavity
8	The expiration process is indicated by the condition of the balloons in bottles A and C which deflate when the balloon is pulled out, while the balloon in bottle B does not change.
9	When the diaphragm is in a horizontal position, the nasal cavity will release air
10	The type of breathing that occurs when the diaphragm muscle contracts is chest breathing
11	The ambient temperature can affect the respiratory frequency because the higher the ambient temperature, the higher the respiratory frequency
12	The elderly have a higher respiratory rate than toddlers
13	The frequency of breathing of people who exercise is low because they can control the rhythm of their breathing
14	The volume of air that remains in the lungs even after maximal expiration is called the expiratory reserve volume
15	The maximum volume of exhaled air is known as the vital capacity of the lungs
16	The cause of tonsillitis is the uncontrolled growth of cells
17	A person who does not smoke will not be exposed to the dangers of smoking when only being around smokers
18	The carcinogenic ingredient in cigarettes is nicotine
19	CO gas is dangerous for the respiratory tract because it can inhibit the exchange of O_2 with CO_2
20	Handling respiratory tract disease by suctioning fluid in the lungs is tuberculosis

Based on Figure 2, it is explained that the highest percentage of misconceptions is in the concept of respiratory frequency in SMP 5 YPM by 62% and respiratory system disorders in

SMP Excellent by 60%. The concept of respiratory frequency is found in item numbers 11, 12, and 13. Furthermore, the concept of respiratory disorders is found in item numbers 16, 17, 18, 19, and 20.

Example:

11.1 The following factors affecting the correct frequency of human breathing are...

a. Age
b. Body Height
c. Air Velocity
d. Ambient Temperature

11.2 Level of confidence in answer choices:

1	2	3	4	5	6

11.3 Reason for answer choices:

a. Age affects respiratory frequency, the younger a person is, the higher the respiratory frequency.
b. Body height affects the frequency of breathing because the taller a person's body, the higher the breathing frequency.
c. Air velocity affects the frequency of breathing because the faster the air the body inhales, the higher the frequency of breathing
d. The temperature of the environment affects the frequency of breathing because the higher the temperature of the environment, the higher the frequency of breathing
e. e. ...
f. (Give the reason for the answer if the answer provided is not appropriate)

11.4 Level of confidence in answer choices:

1	2	3	4	5	6

In question number 11 students were asked to name the factors that affect respiratory frequency. Students confidently answer that ambient temperature can affect respiratory frequency because the higher the ambient temperature, the higher the respiratory frequency. This answer is not precise because of factors that affect the respiratory frequency, including age (Takayama et al., 2019), gender (Lomauro & Aliverti, 2018), body temperature (Davies & Maconochie, 2009), position or position of the body (Katz et al., 2018), and level of activity intensity (Sheff, 2016). So it can be seen that the ambient temperature is not a factor that affects respiratory frequency and the correct answer choice is answer option a, namely age.

Example:

12.1 Look at the picture below:


(a) (b)

Based on the picture, the correct statement regarding the frequency of breathing is....

a. Picture (a) has the same breathing frequency as picture (b)
b. Picture (a) has a higher breathing frequency than picture (b)
c. Picture (b) has a higher breathing frequency than picture (a)
d. Picture (a) has a medium breathing frequency

12.2 Reason for answer choices:

1	2	3	4	5	6

12.3 Reason for answer choices:

a. The energy requirement in figure b is greater than the energy requirement of figure a so figure b requires more O2 intake.
b. The older a person gets, the lower the frequency of breathing. This is related to the reduction in the proportion of energy needs.
c. In picture a does not require a lot of energy so the frequency of breathing is moderate.

d. Both energy needs are the same so the breathing frequency between pictures a and b is the same.
e. ...
(Give a reason for the answer if the answer provided is not appropriate)

12.4 Level of confidence in answer choices:

1	2	3	4	5	6

In question number 12, two pictures are presented with one picture of a toddler (picture a) and one picture of an elderly person (picture b). Students are asked to connect the two pictures with the concept of respiratory frequency. Some answered confidently that picture b has a higher respiratory rate than picture a. The student's answer was not quite right, because when a person's age increases, the respiratory rate decreases. This condition is due to the decreasing proportion of energy needs (Napitupulu et al., 2019).

Example:

13.1 The appropriate analysis of the image below in relation to the human respiratory system is....

a. People who exercise regularly will be healthy and strong.
b. People who exercise will affect the health of human lungs to be worse
c. People who exercise have a high frequency of breathing because of the large amount of O2 needed
d. People who exercise have a low breathing frequency because they are able to control the breathing rhythm

13.2 Level of confidence in answer choices:

1	2	3	4	5	6

13.3 Reason for answer choices:

a. People who exercise a lot will affect lung health poorly because it forces the lungs to perform a stable breathing process during strenuous activity.
b. People who diligently exercise require high O2 so that they have a low breathing frequency because they are able to control the rhythm of breathing.
c. People who diligently exercise the heart muscle will be trained and become stronger to pump blood so that the body also becomes healthier
d. When the body needs a lot of energy, the body needs more oxygen so that the frequency of breathing increases
e. ...
(Give a reason for the answer if the answer provided is not appropriate)

13.4 Level of confidence in answer choices:

1	2	3	4	5	6

In question number 13, two pictures are presented where each picture is a portrait of a group of people exercising. Through these two pictures, students are asked to analyze the relationship between these pictures and the respiratory system. Students answer confidently that the respiratory rate of people who exercise is low because they are able to control their breathing rhythm. The student's answer is not quite right because the intensity of a person's activity can affect respiratory frequency, where the heavier a person's activity, the faster the respiratory frequency (Sheff, 2016). This is because when a person exercises, the production of carbon dioxide will increase and cells need a very high supply of oxygen. CO_2 disposal by the respiratory system. So someone who regularly exercises will have a higher respiratory rate to produce greater lung ventilation (Hakked et al., 2017).

Example:

16.1 Look at the table below!

No,	Diseases	Characteristics
1	Asthma	Caused by allergies resulting in narrowing of the respiratory tract so that the sufferer has difficulty breathing
2	Pharyngitis	Caused by Mycobacterium tuberculosis bacterial infection causing fever with a temperature of more than 39℃, runny nose, sneezing.
3	Emphysema	Caused by Influenza virus infection causing fluid to enter the lungs resulting in difficulty breathing
4	Tonsil inflammation	Caused by uncontrolled cell growth resulting in tonsil inflammation

The correct pair of respiratory diseases and their characteristics is shown by the number....

a. 1
b. 2
c. 3
d. 4

16.2 Level of confidence in answer choices:

1	2	3	4	5	6

16.3 Reason for answer choices:

a. Asthma can be caused by environmental factors. The introduction of allergens triggers the body to produce chemical compounds. These chemical compounds trigger narrowing of the respiratory tract.
b. A person suffering from pharyngitis is usually characterized by the appearance of coughing symptoms, allergies, and narrowing of the respiratory tract.
c. Emphysema is a chronic disease due to damage to the air bags or alveolus in the lungs, causing allergies and narrowing of the respiratory tract.
d. Tonsillitis is a condition in which the tonsils become inflamed, which can cause allergies and narrowing of the respiratory tract.
e. ...

(Give a reason for the answer if the answer provided is not appropriate)

16.4 Level of confidence in answer choices:

1	2	3	4	5	6

For question number 16 students are presented with a table containing the names of respiratory system disorders along with their characteristics. Students are asked to identify the name pairs of respiratory system disorders with their proper characteristics. Some students confidently answered that the correct partner was partner number 4. The student's answer was not quite right, because tonsillitis or also called tonsillitis is inflammation or acute swelling of the tonsils caused by bacteria. *streptococcus* or *staphylococcus* (Haryo et al., 2019). So, the correct answer is partner number 1, namely asthma. In accordance with the scientific concept that asthma is a chronic inflammatory disease of the respiratory tract with the characteristics experienced by patients with asthma, including coughing, wheezing, chest tightness, and difficulty breathing (Rahmah & Pratiwi, 2020).

Example:

17.1 Adi's father had to be rushed to the hospital because he had lung cancer, this was because Adi's father was a heavy smoker. The solution that can be done to avoid the dangers of smoking is...

a. Making friends with friends who habitually smoke
b. Being in an environment that does not care about the dangers of smoking
c. Intense and intensive information about the dangers of smoking
d. The absence of good role models at home, school and other environments

17.2 Level of confidence in answer choices:

1	2	3	4	5	6

17.3 Reason for answer choices:

a. The dangers of smoking will not occur if you are only close to smokers without smoking.
b. With intensive counseling will provide education to avoid the dangers of smoking
c. There is no need to stay away from friends who smoke because the dangers of smoking are not so important for health
d. By implementing a healthy life, it will be free from the dangers of smoking.
e. …
(Provide a reason for the answer if the answer provided is not appropriate)

17.4 Level of confidence in answer choices:

1	2	3	4	5	6

Problem number 17 students are given a word problem, students are asked to find the right solution to avoid the dangers of smoking. Most students have answered correctly, but there are still students who think that the right solution to avoid the dangers of smoking is to be in an environment that does not care about the dangers of smoking because the dangers of smoking will not occur if they are only close to smokers without smoking. The student's concept is not quite right. Someone who does not smoke but still inhales cigarette smoke exhaled by people around him is called a passive smoker (Saputri et al., 2018). Cigarette smoke exhaled by passive smokers and inhaled by passive smokers is stated to be more dangerous because it contains five times more carbon monoxide and four times more tar and nicotine (Astuti et al., 2016).

Example:

18.1 The carcinogens found in cigarette tobacco that are very dangerous are....

a. Nicotine
b. Tar
c. Carbon monoxide
d. Carbon dioxide

18.2 Level of confidence in answer choices:

1	2	3	4	5	6

18.3 Reason for answer choices:

a. Carbon monoxide as one of the toxic gases found in cigarettes. Although it has no odor and taste, it will bind to red blood cells in the body.
b. Nicotine smoked by smokers will enter the bloodstream so that it will produce more adrenaline hormone and cause increased blood pressure, heart rate, and breathing
c. Tar is very high risk of causing lung cancer and emphysema
d. Carbon dioxide that binds to the blood will be harmful and cause death
e. ...

(Give a reason for the answer if the answer provided is not appropriate)

18.4 Level of confidence in answer choices:

1	2	3	4	5	6

In question number 18 students are asked to identify carcinogens found in cigarette tobacco. Most of the students answered confidently that the carcinogen in question was nicotine. The student's answer was not quite right, in cigarettes there are several chemicals including nicotine, tar, CO (carbon monoxide), and various heavy metals (Aji et al., 2017). Tar is a substance that is carcinogenic so tar inhaled by the respiratory tract will precipitate and accumulate in the lungs and if inhaled for a long time can cause cancer (Alberg et al., 2013).

Example:

19.1 CO gas in our environment is very harmful to the respiratory tract. This is because...

a. Inhibits the exchange of O2 with CO2
b. Inhibits the binding of CO2 in the blood
c. Inhibits O2 processing in the trachea

d. Inhibits the O2 binding process in the blood

19.2 Level of confidence in answer choices:

1	2	3	4	5	6

19.3 Reason for answer choices:

a. CO gas can affect the performance of the alveolus in the respiratory system so that it will inhibit the exchange of O2 and CO2.
b. In CO gas can bind to the body's hemoglobin so that it can interfere with the binding of oxygen by the blood
c. The presence of CO gas will cause oxygen entering the body through the trachea to be inhibited
d. CO gas will affect the binding of carbon monoxide that occurs in the blood
e. ...

(Give the reason for the answer if the answer provided is not appropriate)

19.4 Level of confidence in answer choices:

1	2	3	4	5	6

Question number 19 students are asked to identify the dangers of CO gas for the respiratory tract. Students confidently answer CO gas is dangerous for the respiratory tract because it can inhibit O exchange$_2$ with CO_2. The student's answer was not quite right, CO gas or carbon monoxide gas has the characteristics of a high affinity for hemoglobin, around 210 to 300 times stronger than the affinity of oxygen for hemoglobin (Amelia et al., 2016). When the body inhales carbon monoxide gas, it will bind to hemoglobin to form carboxyhemoglobin bonds. High carboxyhemoglobin concentrations will result in decreased oxygen-carrying capacity by hemoglobin so that the body can experience tissue hypoxia (Mariani & Kartini, 2018).

Example:

20.1 One day, Juna developed a fever accompanied by chest pains that made it difficult for him to breathe. After being rushed to the hospital, Juna was given antibiotics and treatment for suctioning fluid in the lungs. The disease that affects Juna's respiratory tract is....

a. Tuberculosis
b. Pneunomia
c. Asthma
d. Lung cancer

20.2 Level of confidence in answer choices:

1	2	3	4	5	6

20.3 Reason for answer choices:

a. Tuberculosis is caused by infection with the bacteria Mycobacterium tuberculosis. Symptoms of this disease include fatigue, loss of appetite, fever, difficulty breathing, chest pain, and coughing up blood.
b. Asthma is a disease of the respiratory tract because it attacks the lung organs causing narrowing of the respiratory tract, coughing, and shortness of breath.
c. Pneumonia is generally caused by the Streptococcus pneumoniae bacteria, which causes thick fluid to fill the lungs, disrupting gas exchange in the lungs.
d. Lung cancer occurs due to the uncontrolled growth of cells in the tissues of the lungs. Symptoms of people suffering from lung cancer are coughing with blood, drastic weight loss, shortness of breath, and chest pain.
e. ...

(Give the reason for the answer if the answer is not appropriate)

20.4 Level of confidence in answer choices:

1	2	3	4	5	6

Question number 20 students are asked to analyze respiratory system disorders. Most of the answers to the respiratory system disorders in question are tuberculosis. For those who answered lung cancer because the question contained the sentence 'fluid suction in the lungs'.

All of the student's answers were wrong because the correct respiratory system disorder was pneumonia. According to *World Health Organization* (WHO), pneumonia is an acute respiratory infection that causes sufferers to experience pain when breathing and their oxygen intake becomes limited due to fluid and pus in the alveoli (Corten et al., 2015). The main cause of this disease is most commonly caused by microaspiration organisms (*Strep. pneumoniae, H. influenzae, Staph. aureus, Enterobacteriaceae spp* (Periselneris et al., 2020). Treatment of pneumonia patients can use various methods or a series of methods such as oxygen support, fluid therapy, and *chest physiotherapy* (CPT) as well as the possibility of using suction to remove mucus from the airways (Corten & Morrow, 2020).

The high percentage of students who experienced misconceptions was mostly caused by students' incorrect reasoning on the concept of the human respiratory system. According to Andariana et al., (2020) the wrong reasoning can be caused by the incomplete information received from the direct learning process, information obtained independently, or from peers. Students' previous learning experiences also contribute to the formation of concepts (Suparno, 2013). Before learning students already have an initial concept that they get from the phenomena or experiences they experience (Kaltakci Gurel et al., 2015). Initial concept that are wrong will often be carried by students to next grade(Wulandari et al., 2021). Based on the research that has been done, it is known that the four-tier diagnostic test instrument can identify misconceptions in students. This is in line with research (Hermita et al., 2017) that identifying misconceptions in students can be done using four-tier diagnostic test. Four-tier diagnostic test also considered the most accurate in detecting misconceptions (Oktavia & Admoko, 2019). These misconceptions themselves are very important to identify. Because misconceptions that are not immediately identified and continue to be stored in students' memories can cause students difficulties in connecting old concepts with new concepts because science concepts are interrelated (Farihah et al., 2016).

CONCLUSION

Instrument four-tier diagnostic test can map the level of students' understanding of concepts starting from students understanding concepts, not understanding concepts, and misconceptions. Based on the results of students' four-tier diagnostic test answers, it can be concluded that students in Driyorejo District Junior High School are 52% which is included in the 'medium' category with details of the percentage of student misconceptions in SMP Negeri 8 Gresik by 53%, in Excellent Junior High School by 50%, in SMP 5 YPM by 52%. Misconceptions occur in all concepts of respiratory system material. The highest percentage of misconceptions in 3 junior high schools in Driyorejo Subdistrict is on the concept of respiratory frequency with details of the percentage of misconceptions of students of SMP 8 Gresik by 67% then students of SMP 5 YPM and SMP Excellent each by 63%.

This study has the advantage of providing a real picture to teachers and the world of education that there are still many students who experience misconceptions even though it has been taught before by the teacher, especially in human respiratory system material. This study also provides an instrument that can be used to detect student misconceptions in the form of a four-tier diagnostic test instrument. This study has limitations only conducted in 3 schools and only examined one material in science lessons. Suggestions that can be given to future researchers are to identify misconceptions in other science materials, then suggestions for teachers, teachers need to identify difficulties and pay attention to students' preconceptions before starting to teach human respiratory system material to avoid misconceptions. Teachers also need to pay attention to learning methods, learning media, and learning resources. The

application of appropriate learning methods, as well as the use of selective information/learning media and learning resources can support students in understanding a concept more easily.

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