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# Misconception Analysis of the Material Science Content of the Human Circulatory System Using Concept Map Assessment in Elementary School

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**Abstract:** Understanding of science concepts is important so that students are able to describe and relate a concept to other concepts. The reality is that students often do not understand science concepts in depth. This study aims to identify the misconceptions that occur in the content of IPA, the sub-concept of the human circulatory system with a concept map assessment. The method used is descriptive qualitative. This study uses tests and interviews as data collection techniques. This research was conducted at SD Negeri Manahan with the research subject being fifth grade students consisting of 25 students. The research guidelines were in the form of a concept map making test and interviews. The results showed that there were still students who had misconceptions about the human circulatory system, namely the value in the low category of 48% of students, medium category of 40% of students, and high category of 12% of students. The biggest misunderstanding occurs in the concept of the function and name of each organ in the human circulatory system.

**Keywords:** Misconceptions; Circulatory system; Concept map

## Introduction

Education is not only a process of transferring information between teacher with learners, but students are required to be able to master the concepts that have been given by the teacher. In the science learning process, teachers are required to be able to develop an understanding and application of science concepts in depth to students. Science is defined as a natural science that contains concepts, processes and attitudes. Science learning is a process to change the misunderstanding of students' conceptions from preconception (initial concept) or misconception to an appropriate concept by applying various appropriate learning methods (Handayani et al., 2018).

It is important for students to understand scientific concepts in order to be able to explain a concept and compare it with other concepts so that students can understand and explain what happens in everyday life (Fatmawati et al., 2018). However, many students experience misconceptions about science concepts and misunderstandings about scientific concepts. This is because students remember more about what a concept is than understanding the concepts involved (Meidinda et al., 2018). One of the materials that has suffered a lot of misconceptions is the human circulatory system, which is considered difficult for students to learn because it is considered quite a lot of material and is abstract. According to Alkhawaldeh (2012) of the human circulatory system is a core concept in the science curriculum is considered a difficult topic to learn.

In science content, misconceptions are a barrier factor for students and teachers (Juhji, 2017). Students often lack a deep understanding of science concepts. This is due to the low understanding of the concept of science by students. According to Suriani et al. (2022) misunderstandings about concepts show that the ability of students to understand concepts is still relatively low. A mistaken understanding of concepts can occur for several reasons, including the material presented by the teacher and the learner's own experience. This is in line with research Soeharto et al. (2019) that students understand the world through daily experiences obtained through a number of sources including

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teachers, textbooks, families, experiences, culture and media. Understanding concepts is a major foundation that must be instilled in students to avoid understanding the real concept (Fauzannur et al., 2022). Misunderstandings that plague elementary school learners can advance to the next level if they are not addressed immediately (Fatmawati et al., 2018).

Therefore, to facilitate effective science learning, teachers need to detect student misconceptions and plan appropriate (Vitharana, 2021). One way to detect the problem of misconceptions in students is through making concept maps. According to Kordaki et al. (2015) can serve both as a diagnostic tool to assess learners' knowledge before learning and as an assessment tool to measure learners' understanding of concepts.

In the world of education, concept maps can be used practically as a tool to support learning, increase cooperation between students, assess learning, present information, and develop curricula (Leung et al., 2018). To support learning, concept maps are commonly used as learning aids and taking notes. Concept mapping is creative because learners must look for efforts to clarify meanings, identify important concepts and their relationships.

This study discusses the misconception of the IPA content of the human circulatory system material that has been carried out in previous studies, but there are differences, namely using the concept map assessment. This can be shown in the findings of a study conducted by Hidayah et al. (2018), they indicate abnormalities in the functioning of the heart and blood vessels. 9.3% of students misunderstood the origin of the heart, 22.7% misunderstood muscles, 38.2% misunderstood tissues, 23.7% misunderstood muscles (arteries), 16.5% misunderstood about errors and cleavage of nerve muscles. Research conducted by Laksana, (2016) found that (1) elementary schools have misconceptions about various scientific concepts, (2) misconceptions and important topics related to motion disorders account for more than 60% (a) Understanding of the material needed. In the course of green growth, (b) the concept of photosynthesis should be clear, (3) the concept of the density of matter and (4) the theory of free fall motion.

Research according to Izza et al. (2021) confirms that there are still many students who have human heart problems in terms of mental health, social health, social and blood circulation and so on. In addition, the same problem can be observed in a study of Negoro et al. (2018) which showed that the understanding of learners increases and misconceptions decrease.

Based on previous research and to get an initial picture of the initial condition of students in school, researchers conducted an interview with one of the teachers at SD Negeri Manahan. The results of the interview obtained information that students had difficulties in the material of the human circulatory system and the teacher had never detected misconceptions in students. This study aims to identify misconceptions that occur in the IPA content of the human circulatory system material using concept map assessment.

## Method

This research is qualitative descriptive research, namely research that contains a description of explanatory sentences. This research took place at SD Negeri Manahan which is located at Jl. Mliwis II No. 4, Manahan, Banjarsari, Surakarta. The respondents to the research used were homeroom teachers in class V and class V students totaling 25 students.

The data collection techniques used in this study were tests, interviews, and documentation (Arikunto. S, 2017). The test used is in the form of making concept maps by students. The concept map that has been made is then assessed the concept map referring to Novak and analyzed to determine the percentage of misconceptions in students. Research data obtained by interview techniques were carried out to strengthen the results of clearer and more accurate research on students who experienced misconceptions.

The research instrument used is a test instrument to test the abilities of students by providing student worksheets in the form of making concept maps. In addition, interview guidelines are used to interview students who experience misconceptions and also teachers.

Data analysis technique is performed using the data triangulation method (Moleong, 2019). In this data analysis technique, there are three stages in analyzing, namely data reduction, data exposure/data display, and drawing conclusions/verification. The categories of misconceptions according to Sundari et al. (2018) can be seen in Table 1.

**Table 1.** Misconception Level Categories

| Percentage (%) | Category |
|---|---|
| 0-30 | Low |
| 31-60 | Medium |
| 61-100 | High |

## Result and Discussion

Based on the research that has been carried out, it is obtained that misconceptions that occur in students show the results of making concept maps about the diverse human circulatory system.


**Figure 1.** Documentation of students reading

Literacy or reading activities of students in understanding the material of the human circulatory system before making concept maps on student worksheets.

**Figure 2.** Documentation of students working on concept maps

Student activities in making a concept map of the human circulatory system in accordance with the instructions in the student worksheets. Of the 25 students who were respondents, 3 (three) categories of misconception values were found. The category of misconception results based on the test obtained the average percentage can be seen in Table 2.

**Table 2.** Learner Misconception Value Categories (Primary Data, 2022)

| Category | Number of Students | Percentage (%) |
|---|---|---|
| Low | 16 | 64 |
| Moderate | 7 | 24 |
| High | 2 | 12 |

In Table 2, it can be seen that the misconceptions that exist in research respondents are grouped into three categories (Dwilestari et al., 2022). Low misconceptions are that students do not know concepts (between concepts are not accompanied by connecting words and there are also missing concepts), in this category students do not understand the concepts conveyed in the sub-concepts of the human circulatory system, so students only become memorizers but do not understand the concepts that the teacher wants to convey.

The second category is the value of moderate misconceptions, namely students who experience misconceptions (between concepts there is no right relationship), not accompanied by the right connecting words so as to cause meanings that are note accordance with experts or scientists (Purwaningrum, 2021). Third is the high value of misconceptions, in this category students know the concept (statements between concepts accompanied by the right connecting words that cause meaningfulness), this category understands the concepts given through making concept maps and can explain well about the human circulatory system.

The results of the use of concept maps *(mapping)* in students are presented in figure 3 to figure 5.

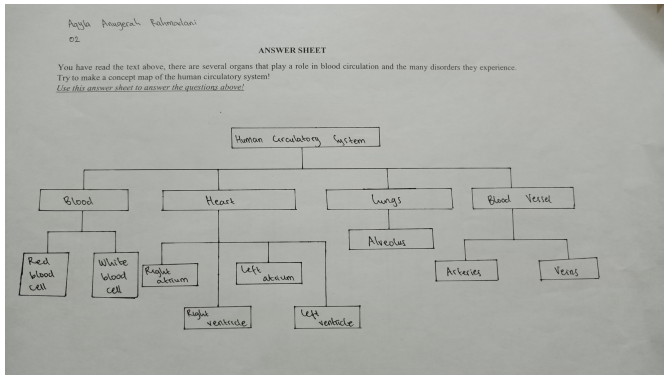


**Figure 3.** Low misconception concept map

Misconceptions are obstacles experienced by students in understanding and mastering the material because misconceptions can be called mistakes (Badruzzaman et al., 2019). According to Mursadam (2017) misconceptions can arise in learners derived from everyday experiences when interacting with the surrounding nature. Misconceptions can happen to anyone because basically everyone has a different mindset in solving a problem that cannot be in the same direction as the thinking of scientists (Hidayah et al., 2018).

Based on Figure 3, a concept map with a low value indicates that it cannot create improper concept map propositions and crosslinks. Cross-linking is the relationship between one concept and another.

Students are considered to have difficulty in understanding and do not understand the material of the human circulatory system. In figure 3, the concept is only written without being accompanied by a connecting word and the relationship between concepts is wrong. In this case, students are stated to not understand the concept. Although the hierarchical value indicates low but the propositions and crosslinks are not appropriate. A hierarchy is an assessment of a concept map from a general to a specific concept map.

Hierarchical judgments are expressed if the placement of concepts is appropriate.

The results of interviews with learners who obtained low misconception scores said that the material of the human circulatory system is considered difficult, too abstract if only imagining, and difficult to find important concepts in the material of the human circulatory system. This is in line with research Taufiqoh et al. (2012) material of the human circulatory system contains essential and complex concepts that must be mastered by learners and processes that are difficult to observe directly so that it is not possible if shown conventionally.

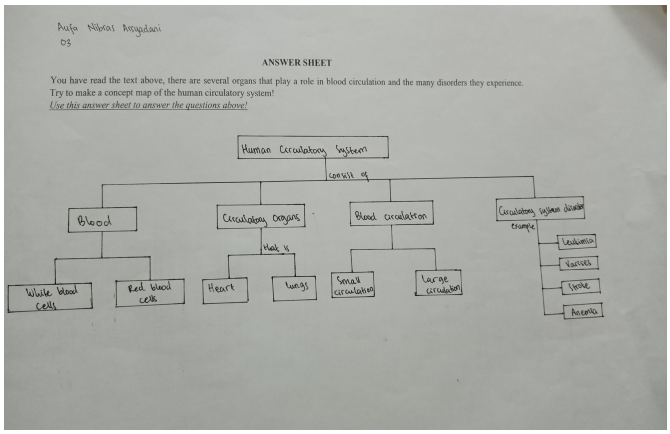


**Figure 4.** Medium misconception concept map

Based on Figure 4 concept maps with medium values, it shows the proposition and crosslinking of the concept map is not quite right. A proposition consists of a section used to relate, explain and limit an opinion. Crosslinking is declared correct if it is appropriate in choosing a connecting word so that it can relate to concepts that have a different hierarchy, on the other hand, if the cross link is stated to be incorrect if the choice of connecting words is not appropriate but still relates to concepts that have different hierarchies.

Students are considered to still have difficulty in understanding the material of the human circulatory system. In figure 4, it is written that the concept is accompanied by a connecting word, but there are some incorrect placement of the concept. In this case the student is stated to have a misconception.

The results of interviews with learners who obtained misconception scores are saying that the material of the human circulatory system is considered many terms that are difficult to memorize and difficult to connect concepts in the material of the human circulatory system. This is reinforced by Hasanah (2017) that many students do not like science lessons because many Latin is found and the pronunciation is difficult to memorize and remember.

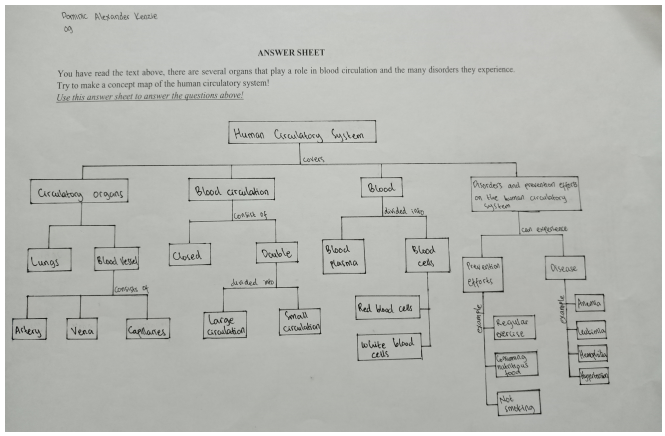


**Figure 5.** High misconception concept map

Based on the Figure 5 concept maps with high values shows the exact proposition and crosslinking of the concept map. Learners understand the material of the human circulatory system. In the picture, the concept is written accompanied by a connecting word and examples are mentioned. In this case student stated to know the concept.

The results of interviews with learners who obtained misconception scores are saying that the material of the human circulatory system is considered many terms that are difficult to memorize and difficult to connect concepts in the material of the human circulatory system. Based on the results of the test analysis of students, it can be known that the correct misconceptions and misconceptions experienced by students in the material of the human circulatory system in class V of SD Negeri Manahan. The correct conception and misconception of the human circulatory system matter can be seen in Table 3.

The results of the interview with the teacher stated that the main obstacle faced in learning science sub-concept of human blood circulation is the low catchability of students when given an explanation of the sub-concept of human blood circulation. Furthermore, the resource person also explained that to overcome these problems, teachers innovate by using innovative learning media such as learning videos that are in accordance with the material. Then the teacher continues with the learners to make a concept map of the subject matter that has been delivered.

The teacher also explained that in providing material on human circulatory sub-concepts, he has also carried out varied learning methods, for example using appropriate learning strategies (application, discovery learning models, varied learning methods, and adding teaching materials) to minimize misconceptions that may arise.

In the learning process, one of the main components is students (Djamarah, 2019). The involvement of learners as part of the transfer of knowledge is indispensable. In the learning of the human circulatory

sub concept, learners from all three groups of misconceptions, had difficulty memorizing the names of body organs related to human blood circulation. This difficulty is caused, among others, the language used is different between the language that students usually use daily and the language used (Badruzzaman et al., 2019).

**Table 3.** Correct Misconceptions and Misconceptions

| Misconceptions | Correct Misconceptions |
|---|---|
| Distinguishing the flow of the large circulatory system and the small circulatory system | Systemic blood circulation functions to carry blood from the heart to all parts of the body and back again. For this reason, it is also called large blood circulation.<br><br>Pulmonary blood circulation is more commonly referred to as small blood circulation. This is because the circulation is short, namely from the heart to the lungs and back again. |
| Functions and names of each of the organs present in the human circulatory system | The heart consists of four chambers, namely the left and right porch (atrium), and the left and right chambers (ventricles). There are also four heart valves that separate the four chambers.<br><br>Blood vessels are elastic channels that function to carry blood from the heart to other parts of the body or vice versa in the human circulatory system. There are three main blood vessels in the heart, namely arteries, veins, and capillaries.<br><br>Arteries, blood vessels that carry oxygen-rich blood from the heart to other parts of the body. Arteries have walls that are elastic enough to keep blood pressure consistent.<br><br>Veins, blood vessels that carry oxygen-poor or full carbon dioxide blood from all over the body to return to the heart. Veins have thinner vessel walls than arteries.<br><br>Capillaries, blood vessels in charge of connecting the smallest arteries with the smallest veins. Capillaries have thin walls that allow blood vessels to exchange compounds with surrounding tissues, such as carbon dioxide, water, oxygen, waste, and nutrients. |

Furthermore, students also state that to understand the sub-concepts of circulatory learning is carried out by reading themes, which almost all learners do not help to understand the sub-concepts of the human circulatory system. To overcome this and improve the understanding of students, some students, especially those who belong to the group of high misconceptions, search through the internet to better understand the sub-concepts of the human circulatory system.

Students also argue that the use of learning media and the diversity of methods used when teachers teach, will make it easier to understand the material of the human circulatory system. According to Puspitarini et al. (2019) learning methods cannot stand alone, so learning media is needed as a means of supporting the learning process so that learning goals can be achieved and the material is easily accepted by students. Students also argue that one of the things that makes it difficult to understand is the characteristics of the circulatory system and what disorders may occur in the sub-concept of the human circulatory system.

Furthermore, students suggest that the difficulty in making a concept map is to draw relationships or find correlations between each part of the concept map. In learners who enter high misconceptions are able to re-explain what they have written in the concept map, in students with moderate misconceptions they can explain the concept map they made and finally students who belong to low misconceptions are unable to re-explain the concept map they have made.

## Conclusion

Based on the results of research that has been carried out regarding the misconception analysis of science content of the human circulatory system using concept map assessment in class V students at SD Negeri Manahan as a whole, it can be concluded that: 1) the results of data analysis show that there are still students who experience misconceptions, categorized with a low percentage of scores (64%) of 16 students, medium scores (24%) of 7 learners, and high scores (12%) of 2 learners. 2) The use of concept maps helps learners to better understand the concept of the human circulatory system in depth.

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