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Exploring Students' Misconceptions and their Causes in Photosynthesis and Respiration: A Case Study of a Private Sector School of Sukkur, Sindh, Pakistan

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Abstract
This study aims to discover the misconceptions about photosynthesis and respiration processes and their causes among students at the elementary level. When students join the classrooms, they have a lot of misconceptions/ alternative ideas based on their previous understanding, learning experiences, and observation of their surroundings. The concepts are built at the very first, where children construct their knowledge by observing the world. These ideas, beliefs and observations make their preconceptions. This research has been conducted to discover misconceptions about respiration and photosynthesis and their causes. The nature of this research study was an exploratory case study of a private school in Sukkur, Sindh. Semi-structured interviews and unstructured observations are done to conduct the data for this research study. This research is conducted in higher secondary schools in Sukkur, Sindh. The research participants were two elementary school teachers (one male and one female) and 8th-grade students. The sample size for this research was eight students in class eight and two science teachers. Four girls, four boys, one female and one male teacher, were selected for data collection. It was determined that students needed to learn about photosynthesis and respiration processes.

Keywords: *Misconceptions, Respiration, Photosynthesis, Alternative ideas*

1. Introduction

Ideas, notions, and events that help us understand the world and reality are considered concepts (Eggen et al., 2007). Misconceptions and alternative conceptions are the ideas that provide an incorrect understanding of concepts and scientific ideas, which are based on individual perception, non-scientific beliefs, preconceived notions, and experience (Martin et al., 2001). Conceptions could be classified into two categories, i.e., misconceptions and preconceptions. Misconceptions are misunderstandings that have arisen as a result of previous formal education. On the contrary, preconceptions are beliefs formed due to experiences in ordinary life (De Corte & Weinert, 1996). Misconceptions occur when students do not understand a scientific concept accurately and provide a mistaken explanation. According to Piaget, children seek meaning in their interactions with the world around them (see: Eggen & Kauchak, 2004, p.281).

Children apply what they have learned to test and improve existing schemas. Children build up conceptions about the world when they experience what happens when they hit objects or push or pull anything (Driver et al., 2014). Various factors can lead to the formation of misconceptions in science. Most secondary science lessons consist of different topics, i.e., Plant and human growth, respiration, photosynthesis in plants, pulling and pushing forces, and living and non-living things.

These are the experiences children face in their daily lives, and these experiences leave traces in children's minds. Based on it, children construct many intuitive ideas about the world surrounding them (Kuhn, 1989). Only some experiences lead to the proper conclusion or allow children to view all possible outcomes. The main sources of misconceptions are the media, teachers, textbooks, parents, etc. Misconceptions can be caused by various factors, including misinterpreting accurate information or receiving contradictory information from trusted sources such as parents and instructors. It is challenging to change the misconceptions because students need to accept the new knowledge and unlearn the previous one.

1.1 Research Questions

The research questions of the study are (a). Do students hold misconceptions about respiration and photosynthesis process? (b). What is the nature of students' misconceptions about respiration and photosynthesis? (c). What are the causes of misconceptions in Science?

2. Review of Literature

Misconceptions are concepts that are different from the understanding of scientific concepts (Cordova et al., 2014). Several studies on scientific misconceptions have been implemented, and this study belongs to them to create a biological framework for my studies. According to the literature, the nature of Science is intangible, and it is very challenging to teach and explain its concepts due to its nature. Students also find difficulties in understanding science. Most teachers are using theoretical methods while teaching and consider rote memorization subjects. Inappropriate teaching and learning methods cause misconceptions in science. According to (Burgoon et al., 2011)**,** a teacher who has misconceptions cannot elicit students' misconceptions and causes new misconceptions**.** The complexity of the scientific topics and non-visible topics are causes of misconceptions (Sesli & Kara, 2012). These are unscientific statements learned through experiences, teachers, or other sources (Baysen et al., 2012).

To put it another way, misconceptions are the incompatibility between the scientific concepts and the definition created by the children in their minds (AKGÜN et al.,2005). Misconceptions and alternative conceptions are the ideas that provide an incorrect understanding of concepts and scientific ideas which are based on individual perception, non-scientific beliefs, preconceived notions, and experience (Martin, 1998). Misconceptions are erroneous concepts, beliefs, ideas, and thoughts usually created by experiences, or misunderstanding the scientific concepts (Suwono et al., 2021). The **c**onceptions are categorized into two groups, i.e., misconceptions and preconceptions. Misconceptions are misunderstandings that instigate due to prior formal education, and preconceptions are conceptions that result from informal experiences (De Corte & Weinert, 1996)**.** Various factors are responsible for preconceptions, i.e., social, religious, economic factors, etc., and these factors are called exogenous factors. Another is endogenous factors that originate from the individual's psychological and biological characteristics. Children's preconceptions are stable, and it is difficult to diminish their preconceptions rapidly. Children have a cognitive level of beliefs and conceptions defined as quality and quantity; children learn from their surroundings

through all the senses. Every new experience contributes to concept formation. Children tend to observe nature and phenomena from their views and lens.

On the other hand, if children do not understand the scientific concept or ideas properly, they give false information (Driver & Easley, 1978). This happens when children form a symbiosis with new content but cannot scratch their previous misconceptions from their minds, and their previous understanding of the topic remains unchanged. Learning something new depends on the interaction between the previous knowledge and the new knowledge that is acquired (Vosniadou, 1991). Misconceptions are created when gaps between the new knowledge and previous knowledge and when previous information is not activated. Misconceptions can also be formed due to personal experience, poor articulation, or textual errors (Bukowski, 1995). Another issue arises when children believe their concepts are correct and do not want to accept the teacher's explanation (Minstrell & Smith, 1983). Teachers sometimes have misconceptions because they are not well-trained or unfamiliar with their subject matter knowledge. Misconceptions survive for years and are taken for granted without any critique from generation to generation. Elicitation of misconceptions is not simple.

Photosynthesis and respiration are major scientific concepts covered in many countries' curricula and from lower grades up to higher grades. Due to the complexity of topics, children have many misconceptions about these topics. Many studies are conducted to explore students' misconceptions about Science, especially about photosynthesis and respiration. It is considered the most challenging topic for students to understand at lower and higher levels (Stavy et al., 1987). It is widely believed that plants only acquire their sustenance from the soil. There are many misconceptions about photosynthesis and its relation to the respiration process (Amir & Tamir, 1994).

On the other hand, some students consider respiration to be the same as breathing (Bishop et al., 1985). Urey (Mustafa, 2018) conducted a study exploring conceptions and misconceptions of pre-service teachers on photosynthesis and respiration in plants. There are many studies exploring students' misconceptions on several complex scientific topics. This study (Kubiatko & Prokop, 2018) investigated students' misconceptions about mammals**.** Many studies have been conducted to explore students' misconceptions about the classification of animals based on their structures. Another study (Shepardson, 1997) explores misconceptions about the life cycles of insects. A meaningful learning of the photosynthesis process helps students to understand the other concepts of the biology i.e. matter, energy and their conversion from one form to another from is easily. Photosynthesis and respiration processes are overlapping so students do comparative studies of both these topics for better understanding (Akpinar, 2007). Pre-service teachers had misconceptions about the biochemical and chemical processes of photosynthesis (Skribe Dimec & Strgar, 2017).

The teaching methods that teachers used in the classrooms are traditional and teacher-centered (Rao, 2003). Students are trained to be rote memorizing facts and figures rather the inquiry-based teaching. Due to this, students are failed to apply the scientific concepts in daily life situations (Yip, 2001). Students retrieve the memorized information during the examination. The reason behind

this is a lack of awareness of the teaching theories and practices. Another reason for didactic teaching is the huge syllabus of science and the focus of teachers is to complete it within given time constraints.

2.1 Conceptual Change in Science

The role of teachers is to elicit students' ideas and change their misconceptions and preconceptions with accurate scientific concepts. This process involves discarding the previous knowledge and developing and reorganizing the new knowledge. Piaget believed that cognitive conflict is the cause of disequilibrium and that, with maturation, misconceptions would fall by the wayside (Piaget, 1977). Learning in Science is the gradual process of children's pre-existing knowledge being enriched and restructured (Kuhn, 1989). Children's intuitive ideas are anchoring conceptions (Clement et al., 1989) on which new knowledge is constructed. Another research (Spelke, 1991) argues that preexisting knowledge is elaborated with experiences, but fundamental principles are not replaced. Fundamental principles play a significant role in the process of learning. Prior knowledge in the form of naive beliefs is a common component of children's misconception of science.

Representational Redescription (RR) model presented by (Karmiloff-Smith, 1994)**,** children's initial knowledge about the world helps them understand the world and interact with objects. They can accomplish it without any 'theories,' explanations, or knowledge that has been imparted to them. As a result, their implicit knowledge serves as the foundation for development, which entails reorganizing the information more explicitly.

3. Methodology

3.1 Methodological Orientation

Qualitative research helps us to examine the phenomena. Any theory will be generated through this research method, in which the researcher uses small samples for data collection. In the qualitative method, the researcher aims to understand how people think, feel, and understand the reality experienced by the research participants. In which researchers do not have a preconceived idea or hypothesis about the natural events and how it is unfolding during the research (Sorensen, 2021). A qualitative research method is used when the purpose of research is to explore, describe or explain phenomena (*The Practice of Qualitative Research 2nd by Hesse-Biber, Sharlene Nagy, Leavy, Patricia L. (Lina) (2010) Paperback*, 2021a).

In Science, the reason behind choosing qualitative methodology is to explore students' conceptions and misconceptions about Science. It will help to explore students' misconceptions without the researcher's views or choices. Data collection tools are tallied with qualitative research methodology. The second reason is the epistemological stance, such as interpretive, in which the nature of research is subjective. The third reason is the ontological stance. As per this, knowledge is constructed and shaped by people's experiences. Furthermore, the findings of this research study

will not generalize to the other context. Moreover, this research's exploratory case study approach explores students' conceptions and misconceptions about science and its causes.

3.2 *Exploratory Case Study as a Research Design*

This study is an exploratory case study of a private school in Sukkur. In this research design, multiple methods are used for data collection, i.e., interviews and unstructured classroom observations. In this type of research, an individual, group, or program has a 'Unit of Analysis'. This research had an elementary Science classroom as a unit of analysis. This study allowed gaining an in-depth understanding of students' conceptions and misconceptions of Science and how these affect students' learning. Moreover, this study also highlighted the causes of misconceptions in Science. This research is a snapshot case study conducted over a short period.

3.3 *Data Collection and Analysis*

Data was collected for this research through semi-structured interviews and unstructured classroom observations.

Three types of interviews are structured, unstructured, and semi-structured, but in this study, semi-structured interviews were used as a data collection tool. Semi-structured interviews are based on open-ended questions in which the researcher asks a question, and the participant has space to answer it in detail. Semi-structured interviews help to get an in-depth and explicit understanding of the participant's views (Edwards & Holland, 2013a). It directed them to ask prompt questions to the students to give them a proper direction and get a deeper understanding. After collecting data through semi-structured interviews, the interviews are translated, transcribed and analysed. English, Urdu, and Sindhi languages are used for the students' ease in interviews.

Unstructured classroom observations were used to describe what goes, who, and what involves in a particular setting (Jorgensen, 1989). It helped to observe the teaching of teachers and the student's misconception when they ask questions from teachers or vice versa in the classroom. The researcher's presence in the classroom disturbs the classroom environment, and the researcher cannot observe what they want, but it is ensured to maintain the classroom environment. Rapport was built with students and class teachers before conducting semi-structured interviews after unstructured classroom observation.

Thematic analysis was chosen for the analysis of research data. It is applied to the interview transcript. It helped to examine data to find common themes, especially similarities and relationships between different chunks of data. Audio-recorded interviews of participants were translated and then transcribed into English, then made codes from the data and organized systematically. After that, made a pattern from the coding of the transcripts and identified the themes from the repeated coding. Then themes were discussed in detail.

4. Results and Discussion

In this part of the research, the findings are presented systematically. This part is divided into two sections. In section one, findings of the misconceptions of the students in photosynthesis and

respirations are discussed, while in section two, the causes of the misconceptions are discussed. This first section of the findings answered the first objective of the research, followed by two research questions: Do students hold misconceptions about respiration and photosynthesis and what are misconceptions? The second section answered the second objective, which was about the causes of misconceptions and followed by one research question: "What are the causes about misconceptions in Science?

4.1 Section I: Misconceptions in Photosynthesis

The semi-structured interviews are conducted with the students to elicit the students' misconceptions about the photosynthesis process. Students needed clarification about this concept area of Science. Students need to be made aware that photosynthesis and respiration occur in plants. They considered that photosynthesis is plants' respiration, meaning the respiration process does not occur. Like humans respire through these different organs, plants do not respire like humans. However, for inhaling and exhaling gasses and fulfilling the energy requirements, students believed that they do the process of photosynthesis.

L1; "In plants the respiration process does not occur but at that place, they do the process of photosynthesis."

L2; "Respiration and breathing are only occurring in animals and photosynthesis occurs in plants. Plants take gasses during photosynthesis that are utilized for the process of Respiration."

Participants classify the animals and plants on behalf of respiration and photosynthesis, respectively. Furthermore, they needed help to differentiate these two processes effectively. Misconceptions arise due to the overlapping of both concepts.

L3; "Photosynthesis occurs only in higher plants."

L3 stated that photosynthesis occurs only in higher plants and it is absent in bacteria, algae, etc.

It is concluded that students need to be more accurate with these two concepts of photosynthesis and respiration. They considered that photosynthesis only occurs in higher plants, and this process does not occur in bacteria and algae. They made this interpretation because they see plants in their surroundings and cannot see the bacteria and algae due to their minute size. Hence, teachers must clear all the concepts in science by telling them different examples. This was also noticed in the unstructured observations that teachers should have given examples of an organism in which photosynthesis occurs. They do not use thought-provoking questions before the start of the lecture, which activates the student's prior knowledge.

Moreover, students needed to distinguish the nature of the gasses that plants take and take out during the photosynthesis process. Some students gave vague responses, as our parents restricted us from going under the trees at night because there was a ghost. So, these misconceptions arise when we listen to a story or myth from our elders.

4.2 Dark and Light Reaction

Students needed clarification about light and dark reactions in the process of photosynthesis. They considered that dark reactions occur in plants at night and light reactions occur during the day.

L1; "Due to the unavailability of sunlight at night time the dark reaction occurs to fulfil the need of plants."
L2; we can say dark and light reactions on the basis of day and night. Dark reactions occur at night time in the same way, light reactions during day time."
While conducting semi-structured interviews and unstructured observations, it is noted that participants respond to the question based on the terminologies, i.e. light and dark reactions. They have yet to learn the exact phenomena behind it. Hence, it was concluded that students make their understanding of the scientific concepts based on the terminologies. They were unable to comprehend scientific concepts. This was a finding that should have been discussed in the literature.

4.3 Respiration and Breathing

The theme is presented under the sub-theme consumption of gasses into the body.
L1; "Respiration is a process that defines how we inhale air."
L2; "So respiration is the process of the inhalation of gasses, like how we inhale the gasses and exhale the gasses through the lungs."
When they were asked separately about breathing, they defined it as the process of inhaling and exhaling gasses and the same answer they gave when asked about respiration. However, these are not similar processes. Breathing is the physical process, and respiration is the chemical process. On the other hand, some students consider respiration to be the same as breathing (Bishop et al., 1985). Furthermore, in observation, it was noted that teachers needed to differentiate these two terms separately. According to the literature, the same misconceptions were found: students need to differentiate between these two processes (Oztas, 2012).

4.4 Consumption of Gasses

L1; "Humans only take Oxygen and release carbon dioxide in their body."
L2; "Tiny hair of the nose filters other gasses and provides pure oxygen to our lungs for survival."
Seven out of eight participants stated that our body only takes one gas (Oxygen) and releases (carbon dioxide). Moreover, they said the body consumes full oxygen, and there is no ratio of oxygen gas during exhalation. They considered that tiny hairs in the nose of humans separate the other gases present in the atmosphere, and only the body takes the oxygen. Carbon dioxide forms from the oxidation of food, which mixes in the blood, and the exchange of gases occurs in every organ of the human body (Badenhorst et al., 2015). They considered the body's different organs as part of the respiratory tract. Such kind of misconceptions arises when teachers did not demonstrate the process in the classroom properly.
L1; "Plant takes only carbon dioxide and releases oxygen day and night."
L2; "Plant only takes in air which means oxygen."
It is concluded that in plants photosynthesis process occurs. This produces oxygen with the consumption of carbon dioxide and that oxygen that humans use. During the unstructured

observations and interviews, it was revealed that students could not properly differentiate the photosynthesis and respiration processes.

4.5 Heart, Food Pipe, Intestine Parts of the Respiratory Tract

Research participants believed that the heart, food pipe, and small intestine are parts of the respiratory system. Research data found that students mixed the organ of the respiratory tract and other organs of the body.

L1; "Heart, food pipe, small intestine are the parts of the respiration because the heart is the main organ that pumps blood towards our lungs and we can inhale gasses through the mouth that moves into our lungs through the food pipe."

L2; "Breathing and respiration occur in all parts of the body, so all organs are part of the respiratory system."

Participants believe that the heart is the main organ for respiration; the food pipe also contributes to respiration, and through the small intestine, the inhaling and exhaling of gasses occur; that is why these are the parts of the respiratory system. In the same way, they consider the intestine part of the respiratory tract because blood takes oxygen and releases carbon dioxide from food. Students considered that the food pipe and windpipe are the same pipes from which humans swallow food and take gasses for respiration (Harman, 2012). Moreover, it was found during the unstructured observation that teachers needed to give a clearer understanding of the respiration topic and the organs involved in it. They should make differences between the functions of the other organs with the organs of the respiratory tract.

Section II: Causes of Misconceptions

4.6 Pedagogical Content Knowledge

Pedagogical knowledge means the knowledge about different teaching and learning strategies teachers use during teaching and learning. Subject knowledge does refer to the knowledge of a related subject a teacher teaches in the classroom; it is also called content knowledge.

L1; "Lack of subject matter knowledge is one of the causes of misconceptions."

L2; "Teacher only delivered the lecture and did not address all the questions of the students and did not use different teaching strategies due to shortage of time."

The teacher did not use inquiry-based, game-based teaching and learning in the classroom and could not address all the students' questions due to the class's limited time, and they had to cover the course.

L1; "Irrelevant examples coded by teachers are one of the causes of misconceptions."

L2; "Use of different strategies like puppetry, animated videos are the causes of misconception and few children do not want to change their misconceptions because they heard from their beloved person."

The teachers' pedagogical and subject knowledge impacts the students' concepts regarding photosynthesis and respiration. Teachers' lack of pedagogical and subject matter knowledge creates

misconceptions in the students regarding respiration and photosynthesis. From observation, it was noted that non-science background teachers were also teaching science in the classroom. Literature and survey also support this point. About 91% of teachers are from non-science backgrounds (The tribune,2019). Teachers needed to gain more knowledge about the strategies for teaching science subjects. They needed to make proper objectives for the classroom and be aware of the objectives of the science topics mentioned in the science curriculum. However, it is explicitly described in the science curriculum how to teach a topic and how to assess that specific topic. Student learning objectives and benchmarks are defined very well in the science curriculum. The teaching methods teachers used in the classrooms are traditional and teacher-centered (Ebenezer et al., 2010). Students are trained to be rote memorizing facts and figures rather the inquiry-based teaching. Due to this, students are failed to apply the scientific concepts in daily life situations (Yip, 2001). Didactic teaching in science is dominant in Pakistan.

L1; "Language barrier is another cause of misconceptions because teachers cannot translate all concepts in different languages.

It was noticed that teachers convey their ideas and lecture in their mother tongue and slightly use the English language. Students in the classroom have different languages, so they need help understanding the lecture Due to language issues, teachers did not convey the message in a scientific language causing misconceptions in science.

4.7 Educational and Cultural Backgrounds

Educational background does mean here the prior educational experiences of the students. The schools and the content students studied. Cultural background means the background of students with different norms, traditions, and values they developed historically from the society where they live.

L1; "Students who come from government schools hold misconceptions because of non-qualified subject matter teachers."

L2; "Cultural values are also responsible for misconceptions. Parents tell-tale to children which are also the reasons for alternative concepts about the things."

Both backgrounds of the students impact the concepts of the students. Schooling standards, the students build their knowledge of students accordingly, and cultural norms, values, and practices also build students' knowledge from different perspectives. From observation, it was noted that students with a good educational background participate in the classroom very well and ask questions of the teachers. Students from good schooling backgrounds had different experiences and fewer misconceptions because well-educated teachers were recruited in their schools and had a variety of learning materials.

Cultural values are also the main cause of misconceptions in science because children listen to stories and myths from their elders. Many misconceptions and myths are embedded in those stories, and children assimilate that knowledge into their schema, which is resistant to change with new phenomena. Sometimes, students' previous concepts are inadequate and do not allow them to accommodate the new knowledge in their minds (p.212). Conflict arises between the new

knowledge and previous knowledge of the children. It was concluded from the teachers' responses that those students who came from a good educational background performed well in the classroom compared to those from public sector schools. Because their teachers usually do not teach in the classroom, there needs to be better checks and balances on the performance of teachers and students.

4.8 Study Materials and Sources

L1; "Students follow websites where erroneous information is given which are the main causes of misconceptions and books must be updated where all the things mentioned clearly and differentiate the concepts."

L1 stated that there is quite a difference between the books taught in the private sector and the books of the government sector schools. The books are black and white. It did not grab the attention of students, and it did not motivate them to study. Hence, many things still need to be updated in the books, and for students who read the other books, conflict arises between the things they read from the two different books and hence many chances of misconceptions. However, during observation, it was noted that students did bring study material like books in the classrooms and few students did not purchase it yet. This is the obvious thing causing misconceptions because it was difficult to grasp the concepts of intangible phenomena without pictorial representation from the book and study material. Students need more lab apparatus to perform experiments. They just read the experiments from the books and lab practicals and memorize them without doing them practically, which is the main cause of misconceptions. It was also concluded from the literature that lack of experiments and the wrong relationship between textbooks and the thoughts of students are reasons for misconceptions (Södervik et al., 2014).

This study is concerned with finding misconceptions among children about photosynthesis, the respiration process, and its causes. One participant stated, "I cannot explain why I said that dark reactions occur at day time. But frankly speaking, I was not really convinced with these concepts that why it happens in day time." these examples addressed that misconceptions cannot be eliminated by telling them facts and simply stated that this is a wrong concept and this is the right concept. (Tamayo Alzate & Sanmartí Puig, 2007). It is a long-term procedure in which interventions are given to students to replace their false knowledge with the right scientific knowledge. Moreover, they said that even after reading the books, some students were still confused. They cannot distinguish which concepts are right and which are wrong. This is because sometimes children get the concepts from their beloved person, and they have blind trust in that person, which restricts children from replacing the false knowledge. The literature revealed that some of the misconceptions arise from the textbooks and sometimes from the poor illustration of the concepts and examples from the teacher's side (Fensham et al., 1994). One study finding affirmed the above notion "that air is necessary for photosynthesis", which was used in the textbooks, and many students gave the same responses. A misconception found in this regard, i.e. that oxygen is absent, so the photosynthesis is stopped; they could not discriminate which oxygen or carbon dioxide is necessary. Students were unable to describe the role of chlorophyll in the

energy conversion process in photosynthesis (Métioui et al., 2016). One of the studies found out that photosynthesis occurs in higher plants, and the data obtained from the participants also gave the same answer that photosynthesis does not occur in lower plants, bacteria, and algae (Mustafa, 2018). Another finding which was found in previous studies is that individuals had misconceptions about the input and output of the respiration and photosynthesis processes (Akçay, 2017). However, this study also finds out the causes of misconception in Science, and the previous studies needed to be more focused on it.

7. Conclusion

The exploration of the understanding of students about two scientific concepts, photosynthesis and respiration, unveiled many misconceptions and vague understanding at the elementary level. From the responses, themes were extracted based on the similarities and differences in the students' understanding. There were two types of themes that were aligned with the objectives of the research. In the first section, themes about photosynthesis and respiration were made after coding and analyzing the patterning of the student's responses. In section two, the teachers' responses generated themes about the causes of misconceptions in science. From the participants' data, it was concluded that students needed more knowledge about these two scientific concepts. Due to the overlapping of these two topics, students needed more clarification. They need the answers in proper scientific terminologies of these two topics. Many misconceptions were highlighted in respiration as the consumption of gasses from plants and animals. Students were confused that respiration processes do not occur in plants. They consider that respiration occurs in animals and photosynthesis occurs in plants only.

Moreover, they considered that respiration occurs in every organ of the animals and where the exchange of gasses from the blood takes place. According to this understanding, they considered that the heart, the kidney, and the intestines are the parts of the respiratory tract. Most of the students needed to have identified the breathing and respiration process. Similarly, they needed to be more aware of taking in and out of the gasses in the respiration and photosynthesis process.

Students gave the responses in their language without using the correct scientific terminologies about respiration and photosynthesis processes. It depicts that teachers needed to use the correct terminologies while defining the concepts during classroom lectures. It was also noticed during the classroom observation that the teacher needed to use proper scientific terminologies. From the demographic information of the teachers, it was determined that teachers were from non-scientific backgrounds and a few teachers only gave papers of bachelor in science without taking regular classes.

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