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Perspectives in Education

Editors

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MISCONCEPTIONS IN BIOLOGICAL CONCEPTS: AN INVESTIGATION

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Background:

Science is defined as a cumulative and endless series of empirical observations which results in the formation of concept and theories of being subject to modification in the light of further empirical observation. It is both a body of knowledge and a process of acquiring it. "It is a systematic study of the facts and discovery of the reasons of happening (Kulshrestha & Pasricha, 2011). Now a day's Science occupies almost all the spheres of the world, like: Physical, Chemical and Biological world and its importance in our everyday life is now unavoidable. As a result, there is no controversy for inclusion of science as a school subject. The educational field concerned with sharing science content is known as the field of science education and from the past three decades the researchers are trying to focus on science education. The recent studies in science education have focused on how scientific concepts are perceived by the students and what are the learning difficulties as well as the misconceptions they have (Seckn, 2010).

Misconceptions are the interpretations of any phenomenon which differs, sometimes radically from those scientifically accepted concepts (Deshmukh & Deshmukh, n.d.). It is defined as a preconception of phenomena occurring in the real world which is not consisted with the scientific explanation (Modell et al. 2005, p.20, in Yates & Marek, 2014) and acts as a barrier among the students to acquire accurate scientific explanation.

Biology is the subject which covers content related to living beings. All the knowledge related to plants, animals, the relationship between animal and plant kingdom, animal behavior etc. are included here. All the concepts in Biological science are found in abstract form. So, sometime students feel difficulty in reading and understanding the Biological concepts as well as biological processes. So, school students sometimes use to memorize the content without understanding the basic concept or the fact. So a gap is found between the actual scientific concepts and the knowledge and understanding among the students. This becomes a misconception. So there is a need to identify the misconceptions and should try to find out the sources of it.

As written by Cokadar, 2012 "Photosynthesis (the fundamental process of life) and respiration (the process by which all organisms obtain energy from organic substances in aerobic or anaerobic conditions)" are the two basic chapters which are taught from very early schooling. There should be a clear concept in these two concepts as they are basic chapters in Biology and based on these chapters some other contents like ecosystem, mechanism of transfer of energy are interrelated.

In this connection, so many previous researchers tried to find out the misconceptions in Photosynthesis and respiration and found so many misconceptions in these two concepts. In this regard, Svandova (2014) found low- level knowledge about photosynthesis and respiration among Secondary school students. Cokadar (2012) conducted a study to determine and compare prospective teachers' conceptions of photosynthesis and respiration processes and found that the participants possess misconceptions related to photosynthesis and respiration. Misconceptions are like: Photosynthesis is a process that green plants convert CO₂ to O₂ in light. Photosynthesis is a kind of respiration that plants make in light. Glucose is the end product of photosynthesis. Respiration is an inverse reaction of photosynthesis. Respiration is the exchange of CO₂ and O₂ gases. Also found that the participants have problems in chemical reactions also. Another misconceptions are like photosynthesis occurs in plants by day and respiration occurs at night (Gooding & Metz, 2011). Kwen (2005) conducted a study on teachers' misconception of Biological Science Concepts and showed an incomplete understanding in Biological concepts like Breathing and respiration, plant respiration, plant reproduction: cell structure and mechanisms and in human systems. Haslam & Treagust (1987) found that

high percentage that secondary students do not comprehend the nature and function of plant respiration and have little understanding of the relationship between photosynthesis and respiration.

Substantial number of studies showed that students (Svandova,2014; Keles & Kefeli, 2010, Bulunuz, Jarreett & Bulunuz,2008; Perrone, 2007), pre- service & service teachers (Galvin & Grady, n.d.; Yates & Marek, 2014;) possesses misconceptions with them in various contents in Biology. There is an important initial step towards better Science teaching and learning (Yip,1998) is to find out the misconceptions holding among the perspective teachers as they are the new comers in this teaching field. They should enter into the classroom with clear concept about any content so that they will be able to explain the content properly in front of the students. According to Yates & Marek, 2014, not only the novices but also the experts hold misconceptions. The perspective teachers conceptions as well as misconceptions should be find out so that they know their conceptual understanding about any content before entering into the classroom for teaching. In this investigation we tried to find out the misconceptions among them in two basic Biological concepts i) Photosynthesis and ii) Respiration.

Research questions:

In this connection two research questions were framed:

- i) What kinds of misconceptions are posses by perspective Biology teachers about
a) photosynthesis and b) respiration and
- ii) What are the possible reasons of misconceptions?

Objectives:

The objectives for the present investigation are:

- 1) To identify misconceptions among the perspective teachers in following biological concepts:
 - a) Photosynthesis
 - b) Respiration
- 2) To find out the possible reasons that lead to the misconceptions among the perspective teachers.

Methodology:

In view of the objectives and nature of data to be collected qualitative research paradigm is used and descriptive research method is carried out.

Participants:

For the present investigation total 25 B.Ed. students who belong to Biology field and completed their B.Sc. or M.Sc. in Life Sciences were selected as the sample by using purposive sampling technique.

Research instrument:

For the first objective an open ended questionnaire was developed by the researchers. There were 10 questions related to photosynthesis and respiration in the questionnaire. For the second one literature review were done.

Analysis and interpretation of data:

Analysis of Objective 1:

Misconceptions related to photosynthesis:

- After analysis of collected data it is found that the students have misconceptions that soil, leaf, chlorophyll are the raw materials used in photosynthesis. Some of them also think that O₂ is used as a raw material and CO₂ is the released material.
- Another misconception related to photosynthesis is, water is a food for plants.
- The respondents have misconception in factors affecting in the rate of photosynthesis. Like: when concentration of Carbon-Di- Oxide is increased the rate of photosynthesis is increased to a certain point and then it decreased gradually.

From the analysis it can be concluded that they know the concept of photosynthesis but there is lack of clear concept and posses so many misconception. Same finding findings were found in the study of Svandova (2014) & Cokadar (2012)

Misconceptions related to respiration:

- Students are unable to differentiate between respiration and breathing. They thought that plants also breathe. Respiration is understood as gaseous exchange only. The respondents have misconception that through the respiration the plants release the O₂ gas by doing this, plants maintain the temperature in the environment.

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- They have no clear concept about how cellular respiration is associated to life. Some of them said that respiration is helpful for transferring food material which is necessary for our living. They did not mention the oxidation of food materials.
 - Maximum respondents are unable to write the proper equation of respiration.
- From the above analysis it can be concluded that perspective teachers possess misconceptions in respiration also. They are unable to write the equations because they only memorize those equations only for passing the examination without understanding the concept. The finding is similar to the previous study of Kwen (2005) & Haslam & Treagust (1987).

Analysis of Objective 2:

Sources of misconceptions:

Svandova (2014) written that these misconceptions are most often arise by misinterpretation or bad understanding of curriculum when students do not create a symbiosis with curriculum. Ozcan, Yildirim & Ozgur (2012) wrote, that misconceptions arise because the nature of biology is microscopic so it becomes difficult to understand. According to Cimer (2012) wrote that abstract concepts and so many Latin/French words are used in Biology. This creates barriers to understand the concept properly. Sometimes teachers becomes one of the causative agents of misconceptions, Cokadar (2012). Gooding & Metz (2011) point out that parents, folklore, teachers, media and even learners themselves are responsible for cultivating and fostering misconceptions. They also mentioned that science curricula and text books are also responsible for perpetuating misconceptions. Keles & Kefeli, (2010) found that daily life experiences are one of the reasons for creating misconceptions. According to Cobanoglu, Sahin & Karakaya (2009) & Tekkaya (2002) text books sometimes acts as the sources of misconceptions.

Education implication of the study:

We are living in modern era of rapid change. Science is playing is vital role in our lives. So we should possess clear concepts about scientific phenomena. But we the students learn only for getting good marks in examination so we memorize all the things without understanding the appropriate scientific fact. As a result, so many misconceptions are framed in our mind. So we should try to find out them and along with this diagnose them. In this study we tried to find out the misconceptions related to photosynthesis and respiration which are the two basic chapters in Biology subject and with what are the possible reasons of these misconceptions are found out. This will helpful for the teachers, students as well as the parents that be conscious about the learning of science subject. Though we study from very early instead of this we possess so many misconceptions and unable to interpret such basic concepts.

Conclusion:

From the above we come to the conclusion that though we collect degree of B.Sc. and M.Sc. in our educational life but we hold so many misconceptions with us in basic biological concepts. So not only by memorizing things in science, we should learn scientific concepts in a proper way by understanding it properly and scientifically. If not understood by any individual we always hesitate to ask others. We should remove this kind of attitude and try to learn accurately and scientifically.

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