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WHY TEACHERS FACES MISCONCEPTION: A STUDY TOWARD NATURAL SCIENCE TEACHERS IN PRIMARY SCHOOLS

Dek Ngurah Laba Laksana[1, 2],
I. Nyoman Sudana Degeng[3],
I. Wayan Dasna[4]
[1]Primary Teacher Education Department of STKIP Citra Bakti, Indonesia
[2, 3, 4]Eduational Technology at Universitas Negeri Malang, Indonesia

Abstract:
This present aims at identifying and describing the misconception faced by primary school teachers in natural science subject. This is a descriptive qualitative study which is conducted to 50 primary school teachers. The data are gathered through observation sheet, interview, and diagnostic test. The data are further analyzed descriptively through four stages analysis, namely data collection, data reduction, data presentation, and making conclusion. The result of the study shows that there are 74.6 % of total responses of misconception and non-misconception. On the other hand, there are 25.4% who have the scientific concepts. Mostly, the misconception occurs on, 1) the concept of substances which are needed for photosynthesis on plants, 2) concepts of the needs of sunlight in photosynthesis, 3) the concepts of substance density, and 4) the concepts of free fall motion.

Keywords: misconception, natural science, primary school teachers

1. Introduction

Natural science learning has been an appealing issue since it emerges critical thinking when it is conducted meaningfully (Piaget, 2000). Natural science learning aims at comprehending various natural phenomena, concepts, and principles of science that is useful for daily life; developing a competency for productive individuals, preserving, and sustaining natural resource (NRC, 2000).

Meaningful learning has been considered as a main way to teach natural science (Arend, 2013; Reigeluth & Carr-Cheliman, 2009). According to Anderson & Krathwohl (2001), meaningful learning is defined as a process to link new information to relevant concepts in somebody's cognitive domain. If somebody's cognitive structure does not contain relevant concepts, the new information are processed through memorizing.

Gagne (1985) states that there is a strong relationship between the quality of an explanation and teachers knowledge to students' learning achievement. Teachers' lack of knowledge will impact the clarity of lesson presentation and further results in misconception. Moreover, Seraphin (2012) argues that teachers' mastery of a certain subject is a basis for teaching and learning process. Teachers have been one of the learning components that prevent the students' misconception to happen.

According to a number of survey and research, the role of teachers has been seen a starting point where misconception happens and affects students. This is proven by the fact that teachers' mastery in natural science is still low. Thompson & Logue (2006) state that the most primary school teachers only master 45% from the whole materials that they should do. The same findings are stated in the study conducted by Longfield (2009) toward primary school teachers who teach natural science. It shows that the low mastery of teacher in natural science learning. In line with his findings, Buaraphan (2011; Cakir, 2008) also find that natural science teachers tend to have problems in how to change an old concept when it is viewed from the latest concept. Another problem happens on how teachers present the materials inappropriately, explain what should not be explained, premature concept explanation, use a confusing term, less emphasizes on the importance of context, ignore students background knowledge, and too little explanation on the concept application and too much using mathematic equation.

The misconceptions on natural science and mathematics (Akbas & Gencturk, 2011; Hershey, 2004; Howe, 1993; and Timur, 2012) occur on all level starting from primary school until university and it happens in a number of nations. The misconception happens on several specific materials such as force and motion, earth and space, plants and organism. Therefore, a deeper investigation on the misconception in different learning culture and environment is necessarily conducted.

According to some surveys and studies, it is shown that teachers are the starters for misconception to happen to students. This is reflected by teacher's' mastery in natural science which is still low (Laksana, 2014). Besides that, Timur (2012) finds out that teachers only master 45% of their materials on average. The same results are found in the study conducted by Cakir (2008). They find out that teachers mostly have problems on how to change an old concept to a new one. Another problem is located on how teachers deliver an inappropriate problem, explain an unnecessary material,

present a concept prematurely, use a confusing term, less-emphasize on the importance of context, ignore students' background knowledge, less discussion on the application and too much focus on using mathematic equation.

The latest study conducted by Setiawati (2011) substantiates the fact that misconception also occurs on prospective teachers. Her study reveals that the levels of misconception are varying with over 50% of them are experiencing misconception. Taking into account to this fact, is necessary to open up possibility that teachers in primary schools and other prospective teachers are experiencing it as well. Thus, a further study on scientific concepts and misconception faced by primary school teachers in natural science subject and the cause of misconception is needed.

2. Method

This present study employs a descriptive qualitative design through three stages of study covering (1) preliminary study, this stage covers framing, planning, and preparing all the materials which are needed as the basis for the next step, (2) field stage, this stage involves data collection, and utilizes instruments that have been prepared beforehand, some to mention are field notes, diagnostic test, and interview. Next, the data are classified into; data of conceptual mastery, the profile of misconception and its causes, and (3) post field stage, this covers advanced data analysis, making conclusion, confirmation, and report construction. The analysis is done when all the data are collected and after field, stage is finished.

The subjects in this study are 50 natural science teachers in Ngada regency, the province of east Nusa Tenggara, Indonesia. The criterion to become the subject of the study is that they are teachers who have five years at least experience to teach in school. The descriptive analysis is then conducted toward the teachers' response regarding the information gathered during interview. Mostly, the information gathered is about concepts in natural science and findings in diagnostic test.

3. Result and Discussion

3.1 Result

The result of diagnostic test and interview toward the subjects reveals that misconceptions occur in every item of diagnostic test. Based on the researcher investigation, the misconception is generally concerning on the subject's failure to understand the relation among natural science concepts in primary schools.

Meanwhile, an advanced analysis on the data shows that the percentages of teachers who master their materials are 25.5%. Meanwhile, 74.6% teachers are not mastering their materials fairly well, with the details of 31% is classified as misconception and 43.6% is classified as non-misconception. The findings also show the misconception dominantly occurs in more than 50% in the following concepts, 1) the concepts of substance that are needed for photosynthesis (60%), 2) the concept of the needs of sunlight for photosynthesis (50%), 3) the concept of density of a certain (68%), and 4) the concept of free fall motion (78%). Further, the profile of teachers' misconception is provided in the following Table 1.

Table 1: Teachers' Misconception on Natural Science Subject

No	Subject Response	Conception Types	Percentage (%)
1	Water is essential for plants in the process of photosynthesis to produce oxygen and carbohydrate (Glucose).	Scientific Concept	16%
	Water is an essential unsure to transport nutrition to every part of the plants.	Misconception	18%
	Water is need for the growth of any living creature	Misconception	16%
	The process of photosynthesis needs both oxygen and carbon dioxide.	Misconception	4%
	Water contains nutrients which are needed in the process of photosynthesis.	Misconception	8%
	Water is needed in evaporation process.	Misconception	2%
	Water vapor is one of the substances needed in photosynthesis	Misconception	12%
	Does not answer the question or repeat questions as the reason for their answer.	Non-Misconception	24%
2	The process of photosynthesis can occur in the present of sunlight s if in lamp light that has particular energy to engage the process of photosynthesis.	Scientific Concept	26%
	The process of photosynthesis can occur in the evening because photosynthesis occurs in the leaves with the extract of nutrition being absorbed by the roots.	Misconception	8%
	Photosynthesis cannot occur in the evening because it can only occur in the present of sunlight	Misconception	44%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	22%
3	The big amount of gas production by plants in the present of sunlight is oxygen, meanwhile carbon dioxide is the unsure needed in the process.	Scientific Concept	32%
	The big amount of gas production in the present of sunlight is called carbon dioxide because oxygen is needed in its process.	Misconception	8%
	The plants produce a large number of carbon dioxide because it is	Misconception	10%

No	Subject Response	Conception Types	Percentage (%)
	used for respiration.		
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	50%
4	Plants respiratory occurs during the day because all living creatures must breathe to gain energy for their sustainability.	Scientific Concept	66%
	Plants respire during the day because they are in the process of photosynthesis.	Misconception	6%
	Plants respire during the day because carbon dioxide exists around them.	Misconception	6%
	During the day, plants respire by inhaling carbon dioxide and exhaling oxygen.	Misconception	4%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	18%
5	Plants get their food by photosynthesis.	Scientific Concept	22%
	Plants absorb nutrients from grounds and use it in the process of photosynthesis.	Misconception	34%
	Plants get their food by absorbing water from the ground because water is the main food source for plants.	Misconception	4%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	40%
6	The bubbles that arise when boiling water is water vapor because when water boils it will change the form from liquid to gas.	Scientific Concept	14%
	The bubbles that appear when the water is boiling are the air at the bottom of the water that flows into the upper part of the water.	Misconception	12%
	The bubbles that appear when the water is boiling are oxygen because the gas will evaporate when the water is boiling.	Misconception	16%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	58%
7	The quantities that can be measured using a sitting balance sheet are mass with kilogram units while weight is affected by earth's gravity.	Scientific Concept	12%
	The quantity that can be measured using a sitting balance is weight because it has a kilogram unit.	Misconception	8%
	The quantity that can be measured using a sitting balance is weight because mass and weight refer to the same thing.	Misconception	8%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	72%
8	Based on the picture, two objects which are made of the same material but have different masses will float if we put into water because the two objects have the same density.	Scientific Concept	8%
	Based on the figure, there are two objects with the same materials	Misconception	56%

No	Subject Response	Conception Types	Percentage (%)
	but having different mass, yet one object will float and the other one will drown because the density is different.		
	Based on the figure, two objects made of the same materials but have different masses will float if it is put into the sea water because the place affects whether or not an object is floating.	Misconception	6%
	Based on the figure, two objects made of the same material but having different masses will be floating and drowning because the two objects have different pressures.	Misconception	6%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	24%
9	Based on the figure, the biggest pressure is on point T because deeper substance in the liquid the greater the pressure will be.	Scientific Concept	36%
	Based on the figure, the biggest pressure point is on point P because the object at the top gets a great pressure from the liquid.	Misconception	8%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	56%
10	When air balloons continuously to move upward, the balloon will pop up because the air contained in the balloon will face an expansion.	Scientific Concept	18%
	When air balloon continuously to move upward, the balloon will pop up because it experiences a great air pressure thus making it has a different pressure than the outside part.	Misconception	44%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	38%
11	Based on the illustration, a stationary object will experience the force of friction with floor as well as gravity which is influenced by the mass of the object and the force of earth's gravity.	Scientific Concept	30%
	Based on the illustration, a stationary object does not experience force because it does not move.	Misconception	44%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	26%
12	Based on the illustration, a dropped object on the surface of the moon will fall down because it is influenced by the moon's gravitational force.	Scientific Concept	14%
	Based on the illustration, a dropped object on the surface of the moon will not fall down because there is no gravitational force on the moon.	Misconception	34%
	Based on the illustration, a dropped object on the surface of the moon will not fall down because there is no air on the moon	Misconception	14%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	38%
13	Based on the figure, the strong electric current coming into the.	Scientific	16%

No	Subject Response	Conception Types	Percentage (%)
	lamp is equal to the strong current coming out from the lamp because the electric current is not affected by the lamp resistance.	Concept	
	Based on the figure, the strong electric current coming into the lamp is as large as the strong current coming out of the lamp as it has series circuit.	Misconception	4%
	Based on the figure, the electric current after coming out from the lamp will be reduced because the electric current is already used by the lamp.	Misconception	30%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	50%
14	Two balls which are made from different materials will reach the ground at the same time when it is dropped from the same altitude because these two objects have the same acceleration and travel time so that they touch the floor simultaneously.	Scientific Concept	12%
	Two balls which are made from different materials will reach the ground at a different time when it is dropped from the same altitude because the weightier object will reach the ground first.	Misconception	78%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	10%
15	Based on the figure, the magnitude of a tensile force possessed by an object (i) is equal to the attraction force possessed by the object (ii) this is because the tensile force is not affected by the surface area.	Scientific Concept	24%
	Based on the drawing, the magnitude of tensile force possessed by an object (i) is greater than the object (ii) this is because the friction force occurring in the object (i) is greater than the object itself. (ii)	Misconception	4%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	72%
16	The phenomenon of sun rises in the east and set to the west is caused by the earth's rotation on its axis where its rotation impacts in some parts of the earth are exposed to sunlight and some are not.	Scientific Concept	50%
	The phenomenon of the sun rises in the east and set to the west is caused by earth movement around the sun where every planet moves surrounds its center of the solar system.	Misconception	18%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	32%
17	The moon is a celestial body that cannot emit its own light because the moonlight seen from the earth is the reflection of sunlight by the lunar surface.	Scientific Concept	58%
	The moon is a celestial body that can emit its own light because the moon is classified as stars.	Misconception	6%

No	Subject Response	Conception Types	Percentage (%)
	The moon is a celestial body that can emit its own light because the moon is classified as luminous satellites.	Misconception	6%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	30%
18	All planets within a solar system including the moon moves surround the sun because it is the center of the solar system. Thus all celestial bodies in this system moves surrounds it.	Scientific Concept	42%
	All planets within the solar system including the moon moves surrounds the sun because of the revolution phenomenon.	Misconception	4%
	All planets move surrounds the sun except the moon because it moves surround the earth.	Misconception	6%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	48%
19	Based on the figure, there is no correct answer regarding the occurrence of lunar eclipses because the lunar eclipse occurs when the moonlight (the result of the sun's reflection) is blocked toward the part of the earth that is not exposed to sunlight.	Scientific Concept	10%
	Based on the figure, the solar eclipse occurs when the position of the moon is between the earth and the sun.	Misconception	10%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	80%
20	Based on the figure, the solar eclipse occurs when the position of the moon is between the earth and the sun. This is due to the sun's light is blocked toward the earth that should have been exposed to.	Scientific Concept	2%
	Based on the figure, the solar eclipse occurs when the earth's position is between the moon and the sun.	Misconception	16%
	Does not answer or repeat the questions as the reason for their answers.	Non-Misconception	82%
Average			
1.	**Scientific Concept**		25%
2.	**Misconception**		17%
3.	**Does not answer or non-misconception**		58%

4. Discussion

The conceptual mastery on natural science subject of primary school teachers are varies. Accordingly, the number of teachers who do not master the concept of natural science (including who does not answer and non-misconception) is at 58%. Meanwhile, the amount those who have misconception are at 17% and 25% for those who master the

concept of natural science. This means most teachers still do not master the concept of natural science or having a misconception.

The misconception occurs in more than 50% of the total response. These concepts are regarding 1) the concept of substance which is needed for plants having photosynthesis (60%), 2) the concept of photosynthesis which needs the present of sunlight to support its process (50%), 3) the concept of substance density (68%), and 4) the concept of free fall motion (78%).

Regarding the concept of the substance which is needed for photosynthesis, there are total 60% teachers who experience a misconception. This means most teachers are still not mastering the concept of natural science particularly on the concept of photosynthesis. The subjects argue that the water which is needed for photosynthesis is in form of gas (water vapor). In fact, the form of the water is in liquid. In this present study, it is also found that teachers think that this substance in photosynthesis functions to dissolve the nutrients from the ground at accelerate the photosynthesis.

Teachers are also lack of understanding regarding the concept of photosynthesis and sunlight. They tend to comprehend that light is a must to support the process of photosynthesis. This is indicated by percentage of misconception in this concept which is 50%. In this respect, it is possible that teachers have not understood the function of lights in this process. Light functions as the source of energy in the reaction of CO_2 and H_2O to become $C_6H_{12}O_6$.

Most teachers (68%) are also experiencing a misconception in the concept of materials in floating and drowning phenomena or so called as the concept of density. They construct their own concept that materials with greater mass will drown. In fact, drowning and floating are much influenced by press force of a material toward liquid which is known as Archimedes law.

The highest misconception occurs in the concept of free fall motion. In this respect, teachers assume that materials with greater mass will fall faster. A number 78% teacher believes in this concept. This argument clearly does not match to the scientific concept that states free fall motion depends a lot on force. The concept also states that if two things are dropped from the same height without being given any force and there is no other force works on these materials, they will reach the ground simultaneously because they have the same speed.

The misconceptions found in this study are mental images imagined intuitively by a person on the basis of everyday experience. As experienced Thompson & Logue (2006), misconceptions can only be accepted in certain cases and do not apply to other cases and can't be generalized. Some conceptions are generally awakened in an attempt to give meaning to the world of their everyday experience and are merely a pragmatic

extension of the real world. Misconceptions may also be obtained by a person from a previous learning process within a certain level of education.

The discovery of misconception in this study is in line with the above explanation. Although the prospective teacher has obtained a course on science material in primary school because of higher education, will misconception still occur. This is due to the construction as described above. In addition, the existence of misconception can also be caused by the construction of new knowledge of its own construction that is not in accordance with scientific knowledge (Timur, 2012).

The misconceptions in the subject matter of natural science in these findings vary widely. Previous findings see misconceptions in most mathematics and science materials (Akbas & Gencturk, 2011; Hershey, 2004; Howe, 1993; Setiawati, 2011; and Timur, 2012). This indicates that misconceptions can occur in students, pre-service teachers, and teachers (Buaraphan, 2011).

Through this research there is also the cause of misconception is the teaching material. Based on the results of the study, the material that causes the prospective misconception teachers are the books for elementary level students who have never been teachers and student's book sheet books that are widely used in elementary schools. This finding is in line with research conducted by Timur (2012). The result of the research stated that the cause of misconception can come from book owned by students. Akbas & Gencturk (2011) argues that misconceptions derived from textbooks may be due to difficult language or because of incorrect explanations. In addition, drawings, charts, graphs, or other information sources generated from the book may also lead to misconceptions of learners. The research result of Setiawati (2011) also got result of 3.80% misconception of teacher candidate caused by textbook.

5. Conclusion

Regarding the mastery of scientific concept, there are total 25% of total responses that indicate teachers have mastered their materials, yet 75% of them having misconception and non-misconception (repeating questions as the reasons for their answer). From total 20 concepts given in a form of multiple choice tests with arguments, all those concepts are misinterpreted with various percentage. Some of them even have misconception up to 50%. They are 1) the concept of substances which are needed for photosynthesis on plants (60%), 2) concepts of the needs of sunlight in photosynthesis (50%), 3) the concepts of substance density (68%), and 4) the concepts of free fall motion (78).

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