BE-19

ANALYSIS OF STUDENT'S MISCONCEPTIONS ON BASIC CONCEPTS OF NATURAL SCIENCE THROUGH CRI (CERTAINLY OF RESPONSE INDEX), CLINICAL INTERVIEW AND CONCEPT MAPS

Zulfiani[1], Nengsih Juanengsih[1], Iwan Permana Suwarna[2], Burhanudin Milama[3]

[1]Biology Education Program, Faculty of Tarbiya and Teaching Science, State Islamic University Jakarta; [3] Physics Education Program, Faculty of Tarbiya and Teaching Science, State Islamic University Jakarta; [4]Chemistry Education Program, Faculty of Tarbiya and Teaching Science, State Islamic University Jakarta

Abstract

The study is a descriptive study aims to investigate student's misconceptions in basic concepts of natural science through CRI (Certainly of Response Index), clinical interview and concept map. The basic concepts of natural science consist of concepts of Biology including cell concept and cell division, cellular respiration, photosynthesis, and heredity; concepts of Chemistry including atomic structure and periodic system of elements, stoichiometry, thermochemistry, and chemical kinetics; concepts of Physics including fluid, waves, electricity, and mechanics. Subjects of the study were 131 students majoring in Natural Science Education, class of 2010. Data were obtained by using achievement test and interview guidelines. The results show that both student misconceptions on Biology and Chemistry were categorized as low (26%), while Physic was categorized as moderate (32%). On Biology, the highest misconception for Heredity concept was second Mendel's Law (87%). On Chemistry, the highest misconception for Atomic Structure and Periodic System concept was electron configuration and elements stability concept (87%). On Physics, the highest misconception for Electricity concept was the function of electronic components. It suggested designing science instruction by constructivism approach that detects the student's preconceptions and designs the instruction from the preconceptions. The main principle in correcting student's misconception is gives the students learning experiences that show a conflict of the concept with natural events. Thus, hopefully, this conflict of experiences with the previous concept can cause a correction in conception.

Keywords: misconception, basic concepts of natural science, CRI

INTRODUCTION

I. Research Background, Objectives and Benefits

Background

Natural Science education is directed to inquire and to do so it can help the learners to get the deeper understanding about nature around. Natural Science is a scientific knowledge that had been verified by scientific methods, with the characteristics: objective, methodic, systematic, universal, and tentative. Natural Science is knowledge with the matter is natural phenomenon and all that in them (BSNP, 2006).

In the fact, students at high school level were often found had a low learning outcomes

on natural science due to an accumulated misconception. Lecturer often found the misconception on students majoring in Science Education at first grade, who take a class of Basic Biology, Basic Chemistry, and basic Physics. The misconception found on students related Biological concepts, such as they can't see the process of energy on photosynthesis and respiration and both of them as an antagonist metabolism process. Besides for plants, photosynthesis can occur with the intake of carbon dioxide obtained through respiration.

On motion concept, many students have misconception about the motion, when two objects moving in the same time and acceleration, they will also have the same distance. They forget that the initial velocity needs to be taken into account as an element that makes difference in distances. According to some studies, most misunderstanding happened in parabolic motion. Students still difficult to see why are the speed at the top of a projectile is zero although the acceleration is not zero. They thought that if the velocity is zero, must acceleration must also be zero (Suparno, 2005).

The results of relevant research conducted by Purba and Depari (2008) on the concept of electric circuits concluded that the largest proportion (almost all students) is on the category of misconception about electric circuits than other categories.

One of the causes for misconception was the conditions for learning that is inattention to the preconceptions belonging to students. This is because among lectures still teach based on the conception that all knowledge can be transferred to the students as a whole. This teaching style is more focused on teacher centered.

According to Piaget, knowledge consists of physical, mathematical logic, and social sciences. Except to social science, physical science and mathematical logic can't be transferred directly, but needs the process of knowledge-building by student self (constructivism). This way is conducted by students as an independent student effort to organize their lesson activities related with the scheme or existing mental structure (Dahar, 1996).

The student's construction process didn't always work smoothly. The perceived knowledge (conception) was not always in line with the scientific conception, which actually may affect further construction process. The learning should pay attention to student's preconception (prior knowledge). If this misconception was allowed, it would ensue to the lack of student motivation and finally to the low learning outcomes.

The lecturers are supposed to pay attention to the presence of these symptoms so that they can anticipate the wrong knowledge. In carrying out their functions as a facilitator and mediator of learning, at the time of the emergence of misconception, lecturers present the cognitive conflict thus cause an imbalance on students. The cognitive conflicts presented by lecturers are expected to bring the students up to their mistake conception, and in the end, they reconstruct their conception to the scientific conception. Thus, Natural Science learning will lead to the meaningful learning condition. Meaningful learning occurs if the information is related to the relevant concepts contained in the cognitive structure (Dahar, 1988).

Euwe van den Berg (1991) in Purba (2008) stated that the most students consistently developed a misconception that inadvertently will continue to disrupt their study. If the misconception in the learning is overlooked, it will hamper the students to acquire the correct knowledge.

In this study, the misconceptions are investigated by standard instrument of CRI that revealed students answer with four categories, (1) guessing, (2) lack of knowledge, (3) misconception, and they who are really (4) understand the concepts. This diagnostic was not complete if the clinical interview process was not performed, which can ensure the result of CRI and find the more specific form of misconception on science concepts. Efforts to overcome the misconception on basic concept of natural science were followed up with an integrated concept map in natural science learning (Susilo, 2002).

Based on the background, researchers were interested in conducting descriptive

research with the title: **Analysis of Student Misconceptions on Basic Concepts of Natural Science through CRI (Certainly of Response Index), Clinical Interview, and Concept Maps.**

Objectives

This study aims:

1. To know about the level of student's misconceptions on the basic concept of natural science.
2. To know about the concepts of Biology those are wrongly understood by students.
3. To know about the concepts of Chemistry those are wrongly understood by students.
4. To know about the concepts of Physics those are wrongly understood by students.

Benefits

1. To get information about the level of misconception on the basic concept of natural science.
2. To notice the lecturers to be aware of things that are allow the misconceptions during the lecture.
3. To provide information about the basic concept of natural science those were wrongly understood by students and take appropriate action to prevent and address the misconceptions of freshman in the form of a proper learning model development.

RESEARCH METHOD

The population in this study was all students of Natural Science Education Department, FITK UIN SyarifHidayatullah Jakarta who had taken courses of basic chemistry, basic physics, and basic biology in the second semester academic year 2010/2011. Samples were 131 students of Natural Science Education Department class of 2010.

The method used in this study was descriptive analysis methods which restricted the generalization on certain individuals in the group were observed. To get an idea about the revealed problems, data was collected by the test and non-test technique. The test was intended to reveal the misconceptions of students, while the non-test (interview) was intended to do triangulation of the data previously obtained by the test.

The written test were arranged in the form of multiple choice test with options of certainty level of student answers to determine the level of Certainty of Response Index (CRI). The multiple choice test was made and designed to identify student's misconceptions on science concepts (biology, chemistry, and physics).

Achievement test in this study consisted of questions that contain the essential concepts of science (biology, physics, and chemistry). Achievement test was multiple choices with number of questions 40 with 5 options. This achievement test requires student's answers and also their certainty of the answer they choose. From these test are expected, firstly, can show whether the student's choices were based on the correct concept, and then the certainty that useful to capture student's misconceptions. The main subject matter which is used for basic biology, basic chemistry, and basic physics each 4 concept.

Interview in this study was to clarify the causes of misconceptions and according to the function of interview to check out and reveal the concepts which are misunderstood (misconception). Interview conducted for students who represent groups appropriate for their misconception level, they are low, medium, and high misconception group.

The procedures that must be performed in this study (Emzir, 2008) were as follow: (1) Planning, (2) Defining the population, (3) Sampling, (4) Constructing instrument, (5) Conducting survey, (6) analyzing and interpreting the data (Processing the data), (7) Composing and writing of research result.

For the data of achievement test results performed steps of data processing as follows:

1. On each student answer sheet, the answer choice combines with levels of certainty that the students presented on each number.
2. Assessment for achievement test, for student's answers is given score 1 if they are correct and 0 (zero) if they are incorrect.
3. The criteria of doing guess well (lucky guess) is if the answer given by students on the answer sheet is correct but The CRI is low or under 2,5.
4. The criteria of knowing the concept well is if the student's answer that was given contain the correct answer and the CRI is high or above 2,5.
5. The criteria of not knowing the concepts is if the student's answer that was given contain the incorrect answer and the CRI is low or under 2,5.
6. The criteria of misconception is if the answer given by students on the answer sheet is incorrect but the CRI is high or above 2,5.

Operation of CRI in this study used a grading scale as follows:

Table 1 The Assessment Scale

Score of certainty level	**Interpretation shows the answer**	**Score of certainty level**	**Interpretation shows the answer**
0	100% is guessed	3	25-49% is guessed
1	75-99% is guessed	4	1-24% is guessed
2	50-74% is guessed	5	No guessing

Table 2 The Matrix of Provisions for Individual Students and for each question were given, based on a combination of correct and incorrect answers and high or low CRI.

Criteria of answer	Low CRI (<2,5)	High CRI (>2,5)
Correct answer	The answer is correct but the CRI is low means student guess well (lucky guess)	The answer is correct and the CRI is high means student know the concept well
Incorrect answer	The answer is incorrect and the CRI is low means student doesn't know the concept	The answer is incorrect but the CRI is high means there is a misconception

For the categorization of misconception levels the criteria used as follow:

Table 3 The Misconception Categorizations

Percentage of Misconceptions	Category
0,00 – 0,30	Low
0,31 – 0,60	Moderate
0,61 – 100	High

Analysis of achievement test and interview result which showed student's misconceptions was conducted to find out what concepts are misunderstood (misconceptions). Meanwhile, to determine the causes of misconceptions, the analysis was also performed to the student's oral answer and matched with the answer given on the written test.

II. RESULT AND DISCUSSION

1. Test result of basic concept of natural science : Biology, Chemistry and Physics Concept

From mastery test result of biology concepts, for all concepts such as cell and cell division, cellular respiration, photosynthesis, and heredity, is known that the average of misconception level for biology concept is 26% (low category), chemistry concept is 26% (low category), and physics concept is 32% (low category). The percentage of students who had misconceptions on biology, chemistry, and physics concepts based on the categories (Table 4) and the CRI (table 5 –7) are as follows:

Table 4 Percentage of Misconception Categories on Biology, Chemistry, and Physics Concepts

Categories	**Percentage**		
	Biology	**Chemistry**	**Physics**
No misconception	1%	3%	0
Low misconception	60%	57%	53
Moderate misconception	39%	40%	47

Table 5 Percentage of CRI for Biology Concepts

Concepts	Know the concept well	Guess	Does not Know the Concept	Misconception
Cell and Cell Div.	42	9	22	26
Respiration	53	11	20	17
Photosynthesis	37	13	21	29
Heredity	26	11	33	31

Table 6 Percentage of CRI for Chemical Concepts

Concept	Greatly to Know the Concept	Guess	Does not Know the Concept	Misconception
Atomic Structure & Periodic System	17	9	24	50
Stoichiometry	21	12	41	26
Thermochemistry	18	7	49	26
Chemical Kinetics	14	9	41	36

Table 7 Percentage of CRI for Physics Concepts

Concept	Know the Concept Well	Guess	Does not Know the Concept	Misconception
Fluid	79	4	7	2
Wave	51	11	8	27
Electricity	47	7	8	36
Mechanics	41	6	12	35

2. Misconception Analysis by Clinical Interview

Table 8 Concept of Biology, Physics, Chemistry, that high in misconception

Biology			Physics			Chemistry		
Concept	**No of Quest.**	**(%)**	**Concept**	**No of Quest.**	**(%)**	**Concept**	**No of Quest.**	**(%)**
Cell and Cell Divission	3	33	**Structure of atom and element periodic system**	1	70	**Wave**	16	65
	4	37		4	73	**Mechanics**	6	68
	9	39		5	87		12	71
Cellular Respiration	17	30		7	87		40	65
	18	30	**Stoichiometry**	16	56	**Electricity**	31	74
	20	30	**Thermochemical**	28	33			
Photosyntesis	22	39	**Chemical kinetics**	31	47			
	26	34		33	57			
	30	48						
Heredity	36	87						
	37	57						
	38	42						

Basic Concept of Natural Science: Biology

The interview was conducted to 8 students (3 high categories, 2 moderate categories, and 3 low categories). The clinical questions were only specific for the matters that high in misconception. That table indicates to the concepts which are high in misconception.

Here are the results of clinical interview for every question which is misconceptions (Criteria of incorrect answer, with CRI > 2, 5) on concept of biology.

Heredity Concept	
Analysis of Question Number 36 Question: Animal that inherit gene AaBb will has a phenotype Answer: Grey curly (student Di) Black straight (student An) (student Ab) Error in conceiving the intermediate concept, dominance, recessive	**Analysis of Question Number 37** Question: A normal man marries a normal woman whose her father is a hemophilia. The probability of their sons whose homophiles are.... Answer: 25% (student Ay) (Student Ab) Error in calculation

Basic Concept of Science: Chemistry

The interview was conducted to 8 students (3 high categories, 2 average categories, and 3 low categories). Clinical questions is only specific to matters that high misconception. That table indicates to conception that high misconception.

Structure of Atom and Element Periodic System Concept	
Analysis of Question Number 1 Question: Inside an atom, number of maximum electron that has quantum numeric	**Analysis of Question Number 4** Question: If an atom X that has atomic number 19, the electron configuration is written so that

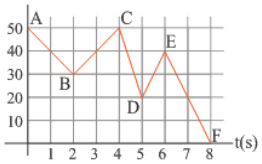
n = 3 and m = +1 is.... Answer: In this question students were wrong on made the orbital so for make certain about number of maximum electron for m = +1 as a mistake. This student used an additional of of quantum spin (s) number, then all of the orbital in n = 3 filled up but actually in this case it is not necessary because only orbital which is containing +1 that should be filled.	atom has characteristics.... Answer : in this question, student was able to make the electron configuration but was wrong in determining the outer electron so that the valence electrons was also wrong (student x). In this question that has misconception from beginning, after clinical interviewed being correct (student Y).

Based on clinical interviews with several students from the class of low, medium or high can be determined several misconceptions that occur on concept Atomic Structure and Elements Periodic System, such as:

a. determining the maximum number of electrons from the principal quantum number (n) and the magnetic quantum number without spin quantum number known
b. electrons when move from the K skin to the further skin from the nucleus such as M skin, release or absorb energy
c. determining the valence electrons of the outer skin from the electron configuration that has been made
d. making the electron configurations
e. the negatively charged atom whether the atomic number is plus or minus
f. making the orbital of the electron configuration from the stable and unstable elements
g. determining the atomic radius, electronegativity, energy of ionization, electropositivity in one period and in one group
h. determining the charge of an element that is isoelectric with noble gases
i. Determining the relationship between protons, neutrons, electrons and make the electron configuration of protons, neutrons or electrons when it is not in the form of atomic number or mass number.

Basic Concept of Science: Physics

The interview was conducted to 7 students whose the misconception is high level. The clinical questions were specific to the matters with the high level misconception. Table 10 shows the concepts which the level of misconception is high. Here are results of clinical interview for every question which is misconceptions (Criteria of incorrect answer, with CRI > 2, 5) on concept of physics.

Concept of Motion	Concept of Electricity
Analysis of Question Number 40 Question: information about the motion of a car from moving until its stops is served with the (v-t) graph as showed by the picture.  Travelled distance of a car from t = 2 second to t = 5 second is ..... A. 225 m B. 150 mC. **115 m** D. 110 m Answer:	

65% of students who have misconceptions, could not understand the graph:
(1) They also didn't understand the difference between graph of uniform motion (UM) and uniformly accelerated motion (UAM), so the didn't know which physics equations should be used. (2) Students couldn't distinguish the characteristics or attributes of UM and UAM concept. Students couldn't understand, if the graph was presented is the distance versus time graph, the variables that may be asked are velocity, acceleration, or time. Meanwhile, if the velocity versus time graph, the variables that will be asked are the distance, or acceleration

Analysis of Question Number 31

Question: The function of the fuse in an electrical circuit is to....

A. Limit the current
B. Increase the current
C. Connect and disconnect the electrical current
D. Decrease the current
E. Reducing the current

Answer:
74% of students who have misconceptions understand the function of the fuse is to connect and disconnect electrialc current. Whereas the function of the fuse is to limit the electrical current coming into the circuit. Students confused with the concept of scalar or socket.

3. The Result of Mind Map

Concept of Biology

Attempts to rectify misconceptions on basic concept of natural science are followed up with a strategy concept map. The results of student's concept maps in higher categories have high complexity, yet a mistake was still found in the concept of "cell division" which is not appropriate to be disclosed in the Heredity material. The relevancy of the correct concept such as inheritance, mutation, and genetic material, which is the study of heredity on the concept were described in detail.

Students in moderate category made concept map with the medium level of complexity, mistakes of ideas/concepts were found on "Mendel 2nd Law" with the concept of monohybrid cross, trihybrid cross, backcross, and testcross". The concept of "genetic quality improvement" was found revealed in heredity concepts, this concept should more appropriately be revealed on genetic engineering concept (biotechnology).

Concept map created by students with low category have little valid proposition, such as heredity associated with dihybrid, monohibrid, Mendel's 1st and 2nd Law. There were errors in the pouring proposition, for example, monohybrid cross linked with apparent deviation, linkage, crossing over, sex determination, and classification of blood.

Concept of Chemistry

From the concept maps for high level students, can be described as follow: (1) generally, concept maps had been created has a moderate complexity, (2) the concept structure described was still incorrect, and also the proportion of the concept. For example: (a) in writing the type of reaction, the students determined the equilibrium constant for homogeneous and heterogeneous reactions in the form of Kp and Kc which are supposed to be included in the equilibrium constant because of the relationship between Kp and Kc. (b) on the concept of equilibrium constant student didn't explain why are the equilibrium constant (K) based on the concentration and pressure. (c) On the concept of equilibrium shifts didn't explained why do the concentration, temperature, catalyst, surface area affect the balance and how the influences are.

On the concept map of students in moderate category, can be described as follows: (1) Concept maps were created had a low complexity (2) The structure of the concept made was

still not right and so was the proposition between concepts. For example: (a) Students didn't describe a concept proposition that explains the meaning of thermochemical connecting with the first law of thermodynamics, (b) On the proposition of thermochemical, forming of enthalpy was errors, it should be changing of enthalpy, (c) On the heat proposition valuable positive and negative reactions should be described under the concept of the types of reaction heat.

Concept of Physics

The results of concept maps was made by students who have misconception on the concept of electricity had made progress. It is seen from the concept maps that students created, they have shown the correct proposition, with another concept proposition. Students were able to determine the hierarchy of concept proposition appropriate with the correct concepts.

DISCUSSION

Study about misconception has been a central issue in science education over the last three decades (Özkan&Tekkaya, 2001; Çapa, 2000; Sungur, 2000; Valanides, 2000 in Turgutat. all, 2011). This study showed that misconception occurred in perceiving concept of Biology and Chemistry were low (26%) meanwhile concept of Physics were moderate (32%).

In Biology, the most frequently student's misconception was heredity concept, mainly Mendel Law II (87%). Misconceptions occurred in perceiving concept about intermediate, dominant and recessive. In Chemistry, the most frequently student's misconception was atomic structure, mainly electron configuration and element stability (87%). These misconceptions were the result of student's misleading about electron stability that would be reached by coupled or independent electron. In Physics, the most frequently student's misconception was electricity, mainly electronic components (74%). This misconception caused by student's retention about the concept.

According to the concept mapping created by student from high, moderate and low mastery, we know that students had not placed the concepts in the right proposition yet. Students still found difficulty in distinguishing high and low preposition.

Through the concept map can be seen the ability of pouring the knowledge that had been learned in the form of concept map, so that the meaningful learning happened. The more often students using concept maps the more strong student's memories and the more students understand the concepts being studied so there is no misconception. Concept map were effective in identifying whether it is valid or ideas used by students.

Concept maps can help directing students in understanding the concepts so that students not only memorize but fully understand the concepts learned. According to Novak (1984) concept map is a term of the strategies used by teachers to help students organize concepts lessons learned based on meaning and relationships between its components.

The high misconception on the concepts of biology, chemistry, and physics were caused by several factors, such as (1) the students' prior knowledge while studying in high school was almost the same. (2) There was no changing of knowledge for students as long as the lectures, (3) the absence of the student learning experience condition to examine whether the conception has been in accordance with the theory, (4) the availability of the correct textbook. The results showed that the students come to class with their knowledge (preconception) and will construct knowledge by experience or learning in school (Fetherstonhaugh&Treagust, 1992). Some preconceptions that are not in line with the views of scientists are misconceptions (Driver, 1989; Tytler, 2002; Widodo, Duit& Müller, 2002). Students, teachers, and textbooks factors are the main reason of misconceptions (Chi 1992).

Based on the data Tabel 6, beside to inform about misconception, CRI can also reveal

the student who knows the concept well, guess, and didn't know. Based on the four biological concepts that are to be tested, the concept of the most well understood is cellular respiration by 42% of students. For the concept of the most predictable was the concept of photosynthesis by 13%, while the percentage of students who don't know the concept is 33% for heredity concepts.

Based on the data Table 7, four chemistry concepts that are examined, the concept of the most well understood is Stoichiometry by the 21% students. For the most predictable concept is the concept of stoichiometry by 12%, whereas the percentage of students who don't know the concept is 33% for Thermochemistry concepts.

Based on the data Table 8, from four physics concept that are examined, the concept of the most well understood is a fluid by 79% of students. For the most predictable concept is the concept of the wave by 11%, while students who don't know know the concept, namely the concept of mechanics by 12% of students.

The reason why students do not know the concept well is about their retention in lower level. Low retention is because of the passive learning. Results of student learning abilities through various ways such as the following: a. 10% of what is being heard; 20% of what you read; 30% of what is seen; 50% of what is seen and heard; 70% of what is being said; 90% of what is said and done. Thus when someone passive, students conception are going a little bit, whereas if the active students who had been seen in the teaching and learning process, their conception will be more and high.

The misconception is extremely difficult to overcome because of the high level of resistance from students. It because a number of misconceptions are resistant although it has been identified with logical reasoning through the appointment of differences and actual observations. The reason of resistant misconception is because everyone forming the knowledge in her head exactly with the experience acquired. So knowledge is formed by direct experience, then it becomes difficult to tell the students to convert the misconception (Wilantara 2005)

The difficulty in overcoming misconception to Berg in Aryani (2009) are durable and difficult to modify, if teachers successfully correcting the students misconceptions on the some concept, then when the students were given a problem with that concept which is stray from the original concept, the misconception will appear again

Despite overcoming the misconception is difficult, but there is a way that can be done to overcome or reduce the misconceptions students, namely designing the natural science learning with constructivism approach, This design is to detect students' preconception and designing the learning from that. Smoothing the already good and correct the wrong part. The main principle in the correction of misconceptions is students were given the learning experience that shows the contradiction the concept with natural events. Thus it is expected that this experience conflict with the old concept that will cause the correction of conception.

CONCLUSION AND SUGGESTION

1. The level of Biology and Chemistry misconceptions is in the middle category, and Physics including high category.
2. For Biology students, there are 39% students who has low misconceptions, 39% students are in the middle level; For Chemistry students, there are 57% students who has low misconceptions, 40% students are in the middle level; For Physics students, there are 53% students who has low misconceptions, 47% students are in the middle level.
3. On the matter of biology concepts for cell and cell division, there are 42% of students who knew the concept well, 9% who guess, 22% do not know the concept, and 26% misconception; The concept of Respiration, 53% of students knew the concept well, 11% who guess, 20% do not know the concept, 17% misconception; The concept of Photosynthesis, 37% student knows the concept well, 13% who guess, 21% do not know

the concept, 29% misconception; The concept of Heredity, 26% students know the concept well, 11% who guess, 33% don't know the concept and 31% misconception.

4. On the matter of chemistry concepts for cell for atomic structure of the periodic system, there are 17% of students who knew the concept well, 9% who guess, 24% do not know the concept, and 50% misconception; The concept of Stoichiometry, 21% of students knew the concept well, 12% who guess, 41% do not know the concept, 26% misconception; The concept of Thermochemistry, 18% student knows the concept well, 7% who guess, 49% do not know the concept, 26% misconception; The concept of Chemical cinetics, 14% students know the concept well, 9% who guess, 41% don't know the concept and 36% misconception.
5. On the matter of Physics concepts for Fluid, there are 79% of students who knew the concept well, 4% who guess, 7% do not know the concept, and 2% misconception; The concept of Wave, 51% of students knew the concept well, 11% who guess, 8% do not know the concept, 27% misconception; The concept of Electricity, 47% student knows the concept well, 7% who guess, 8% do not know the concept, 36% misconception; The concept of Mechanical, 41% students know the concept well, 6% who guess, 12% don't know the concept and 35% misconception.
6. In biology, the Law of Mendel II (87%) in heredity chapter taking the highest misconception. In chemistry, the concept of electon configuration and the stability of the elements (87%) in Atomic Structure and the Periodic System chapter taking the highest misconception. In Physics, the concept of electronics components (74%) in Electric chapter taking the highest misconception.

Suggestion

1. The reference or textbooks of students which used as a reference for mind map are need to be checked. Error interpretation students are affected by the reference.
2. Learning activities directed to the process of active students (student centered), this will affect the extent of the concept that will be owned by the students, so it can reduce the occurrence of misconceptions.

REFERENCES

Ariani, Desvi. (2009). Analisis Miskonsepsi Siswa PGRI I Padang Kelas XI IPA dalam Materi Kesetimbangan dengan Remediasi Melalui Metode Praktikum. Tesis. Universitas Negeri padang.

Badan Standard Nasional Pendidikan.(2006). Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan, Jakarta.

Dahar, R. W. (2011). Teori-Teori Belajar & Pembelajaran. Jakarta: Erlangga.

Dykstra, et al. (1992). "Studying Conceptual Change in Learning Physics". Journal Research in Science Teaching, 74 (5)

Emzir. (2008). Metodologi Penelitian Pendidikan. Jakarta: Raja Grafindo Persada.

Hasan, S. Bagayoko, D. and Kelly, E. L. (1992). "Misconception and The Certainty of Respons Index". Journal of Physics Education, 30.

Liliawati Winny, Ramalis Taufik R (2006) Profil Miskonsepsi Materi IPBA di SMA dengan Menggunakan CRI (CERTAINLY OF RESPONS INDEX)Tersedia : www. fpmipa.upi.edu/.../jurnal/desember2008/Jurnal MIPAl Winny Fisika.pdf [29 Maret 2011]

May Y. Chau, Mau Y.(1998). Computer Supported Concept Maps: Excellent Tools for Enhancing Library Workshop Presentations. Library and Information Science Research Electronic Journal. 8 (2) September 1998

Purba, J. P, and Depari, G.(2008).Penelusuran Miskonsepsi Mahasiswa Tentang Konsep dalam Rangkaian Listrik Menggunakan Certainty of Response Index dan Interview. UPI Bandung

Rustaman, N. et al. (2005). Strategi Belajar Mengaja Biologi. Malang: UNM Press

Siregar, N. (1998). Penelitian Kelas: Teori, Metodologi, dan Analisis. Bandung: IKIP Bandung Press.

Suhirman. (2006). Prakonsepsi, Miskonsepsi, dan Pemahaman Konsep dalam Pembelajaran Sains. Jurnal Teknologi Pembelajaran : Teori dan Penelitian. No.2.1998

Suparno, P. (2005). Miskonsepsi dan Perubahan Konsep Pendidikan Fisika. Jakarta: Gramedia

Susilo, H. dkk (2002). Kapita Selekta Pembelajaran Biologi. Jakarta: UT Press.

Turgut, Umit; Gurbuz, Fath., Turgut, Guven. (2011) An Investigation 10th grade Student's Misconceptions about Electric Current. Science Direct. Procedia Social & Behavioral Science 15 (2011) 1965-1971.

Wilantara I Putu Eka (2004) Implementasi Model Belajar Konstruktivis DalamPembelajaran Fisika Untuk Mengubah Miskonsepsi Siswa Ditinjau Dari Penalaran Formal Siswa. Tesis. IKIP Singaraja, Bali. Tidak diterbitkan.

Yusuf, Muhammad. (2004). Analisis Miskonsepsi Siswa SLTP Negeri pada Pembelajaran Konsep Fungsi Alat Tubuh Tumbuhan. Tesis. UPI Bandung. Tidak diterbitkan.