The Implementation of Conceptual Change Model to Reduce Misconception of Scientific Literacy to the Students of A7 PGSD UPY 2018

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Abstract: The purpose of this article is to present how to reduce the pre-service primary school teachers' misconceptions of scientific literacy through the implementation of Conceptual Change Model (CCM) in Universitas PGRI Yogyakarta (UPY). This study was a classroom action research that implemented Kemmis & Mc.Taggart's research design. The subjects of this study were 29 pre-service primary school teachers whereas the objects of this study were misconceptions regarding scientific literacy. The data are collected through tests and observations, then analysed by using descriptive and quantitative analysis. The results obtained from this study consisted of two indicators: the ability to understand the concepts and the ability to communicate the scientific rules in which both indicators were respectively measured through tests and observations. In the mapping tests of misconceptions of scientific literacy, the percentage of students' score was 67%. After CCM had been implemented in cycle I, the percentage of student score increased to 69%. After reflecting and improving the teaching intervention in cycle I, the presentation score in the cycle II was increased to 74%. The aforementioned results indicated the decrease of students' misconceptions rate from 34% to 31% and to 26% lastly. The results obtained at this stage were classified into four categories: poor, fair, good, and excellent. In the early stages, there were 7 students counted into poor category, 20 students were in fair category, and 2 students were in good category. After the cycle II, there were 5 students in poor category, 15 students were in fair category, and 4 students were in good category. After the cycle II had been accomplished, there was a significant increase where no students who fell into poor category, 19 students were in fair category, and 7 students were in good category, and 3 students were in excellent category. Expected after the model applied, the learning process in Indonesia is able to minimize misconception.

1 INTRODUCTION

In the aim of creating a professional teacher, concentration and focus are needed in two ways, namely the material and method of delivering the material. However, it is often found that students have the wrong understanding of a concept, which is caused by misunderstandings in receiving the material or lacking in the exact material taught by the teacher in the previous school year. This certainly creates its own problems in learning. With the wrong understanding of the concept or often referred to as misconception, students cannot describe the material correctly.

One of the subjects that must be taken by PGSD students in second semester is Natural Sciences (IPA) for Primary students. This course requires students to be able to master natural sciences material whose scope is still quite general and not too deep. However, if the understanding of the concept of this course, i.e. Natural Sciences for Primary Students, contains misconceptions, it will potentially have a big influence on the understanding of prospective students who will be taught when they have become teachers. Thus the accuracy of student understanding is crucial.

The underdevelopment of students' understanding of Natural Sciences material is often also called scientific literacy. (DeBoer, 2000) explains that scientific literacy is the main goal expected by all science learners to be able to react to phenomena that occur in the environment. An understanding of literacy is increasingly growing every day. Initially

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literacy was only related to the cognitive domain. However, lately literacy skills, especially scientific literacy, have evolved with coverage in both affective and psychomotor domains.

Based on the results of an interview with one of the lecturers of UPY (Universitas PGRI Yogyakarta) in February 14, 2018, information was found that PGSD's A7 class of 29 students could be categorized as active with the intensity of asking and answering as well as having a fairly solid class. The learning model commonly used by lecturers is inquiry. Overall, students can take courses well. However, there is one habit that is often shown by students, which is when they argue or answer questions often which are conveyed very far from the substance of the correct concept. In other words, students fail to reinterpret the correct conceptual understanding. This could be a symptom of misconceptions so that actions need to be taken that can reduce the student's scientific literacy misconceptions. One of them is by applying a learning model that can reduce the risk of scientific literacy misconceptions. The learning model chosen must have a relationship with the psychological conditions of students who tend to be idealistic.

One of the learning model that can be applied is Conceptual Change Model (CCM). The model is chosen because it has several stages. Firstly, the stage allows students to use the concept they have (idealism). Secondly, at the next stage the concept is "collided" with facts that can open students' thinking, so that students themselves ultimately decide to change their initial view of the concept. Thus Conceptual Change Learning will be applied to reduce scientific literacy misconceptions.

1.1 Misconception of Scientific Literacy

As a prospective teacher, ideally PGSD (primary teacher education) students must have extensive and correct knowledge. Knowledge or understanding of this concept is not only in the form of theory, but also how to convey and practice it. Rosser stated that the correct conception is a conception that is in accordance with scientific concepts (Dahar, 1989). (Vosniadou, 2009) explains that there are 3 potential that will occur for a learner's understanding of preconceptions, misconceptions or alternative understandings that will be seen and will gradually become stronger. Sure, of these three possibilities the most unexpected is misconception.

(Suparno, 2005) explains that misconception is an inaccurate understanding of concepts, misuse of concepts, classification of false examples, chaos of different concepts and hierarchical relationships of incorrect concepts. Errors in understanding concepts are generally found at the level of students who are still early because they have not encountered much reinforcement. However, in fact, even an advanced student often finds misconceptions.

(Tayubi, 2005) reveals that misconception can occur for anyone. n connection with the lectures, misconceptions not only occur in students. However, it is also potentially experienced by teachers. When viewed from the process of guiding students to avoid misconceptions in learning, then the problem now is what the consequences if students experience misconception in learning. To answer this problem, a teacher must at least be able to know the causes of misconceptions in his students, understand the characteristics of their misconceptions, so that they are able to find the best solution to overcome the problem.

(Suparno, 2010) describes that a change in concept or accommodation requires some conditions and conditions as follows:

1. Students are not satisfied with the initial concept. Students will change the concept if they believe that their old concepts can not be used again to examine the issue and recent phenomenon.
2. The new concept should be understood, rational and able to solve problems and new phenomena.
3. The new concept should be able to troubleshoot and resolve the issues in advance, and are also consistent with theories or knowledge that already existed before.
4. The new concept must be useful for the development of new research and discoveries.

The word literacy may still be a bit foreign to some people, even though literacy has often been heard. The definition is still very limited that is able to read and write or free of illiteracy. A little worrying when there are many people involved in the world of education, there are still many who misinterpret the notion of literacy. Initially, literacy is the ability to use language and images in rich and diverse forms to read, write, listen, speak, see, present, and think critically about ideas. More broadly (Ravitch, 1983) explains that scientific literacy is the relationship between science and social life which goes hand in hand with the use of technology so that it can have a positive impact on everyday life.

With regard to each aspect of education, literacy has its own meaning, as well as literacy in the field of science which is also called scientific literacy. Scientific literacy is the ability of a person to understand, communicate, orally and in writing, and apply science knowledge in solving problems so as to have high attitudes and sensitivity to self and environment in making decisions based on facts, theories, concepts, and laws of science (Toharudin, Hendrawati and Rustaman, 2011). National Science Teachers Association, explains that someone who has good scientific literacy is a person who is able to use the concepts of science, process skills, and scientific values in every decision making when interacting with others or the environment , and understanding the interrelationships between science, technology and other aspects of society including social and economic development (National Science Teachers Association, 1971).

It is important for people to be able to adjust to the times to have a good level of scientific literacy. (National Science Teachers Association, 1982) states that the main purpose of science education is to develop individuals who have scientific literacy, namely individuals who understand how science, social and technology can influence everyday decision making. (Gallagher, 1971) adds that for a modern democratic society, understanding the relationship between science, social and technology is more important than just understanding the concepts and processes of science. This is reinforced by (Hofstein and Yager, 1982) who assert true science education is taught by connecting one's personal needs with the essentials encountered in everyday life, and added by (Ramsey, 1989) science education ideally produces students who are able to identify the use of science-related social issues that occur, understand the context of social issues, understand the decision-making process both personally and in groups, identify social issues around it in personal viewpoint, make planning steps to be undertaken, and implement the perceived planning or program the best thing to do.

1.2 Conceptual Change Model

Most learning models focus only on improving cognitive abilities, whereas affective and psychomotor abilities are later strongly demanded to be sharpened. (Pintrich, Marx and Boyle, 1993) explains that learning models that only focus on cognitive enhancement will reduce the potential of students to know their expectations, ideals and needs. One of the learning models that gives space for the development of cognitive, affective and psychomotor abilities is the Conceptual Change Model. The Conceptual Change Model (CCM) was first developed at Cornell University since 1978, and has grown to this day. The results of the CCM development study in science learning shaped the students' knowledge based on their understanding of a phenomenon and the effect of new information received. Posner argues that theoretically, CCM has two identifiable components in learning activities, ie status and conceptual ecology. The importance of understanding of concepts is also voiced by (Yip, 2001) which states the main purpose of science learning is not on how students are able to remember or memorize factual subject matter, but be able to comprehend concepts comprehensively.

(Jonassen, Strobel and Gottdenker, 2005) states conceptual change is the process of reconstructing and reorganizing one's understanding of a concept. (Strike and Posner, 1985) identifies seven components related to conceptual ecology: anomalies (specific rejection characters of new ideas), prototypical exemplars and images (past experiments), past experiences (conceptual-conceptual derived from past student experiences), analogies and metaphors, epistemological commitments, metaphysical beliefs and concepts (related to the development of orderliness, symmetry, or regularity of all phenomena universe and beliefs about the absolute space or time) as well as other knowledge (knowledge of other fields of study and conceptually competitive). (Lin, Liu and Chu, 2011) to change the concept of a person using cognitive conflict, the teacher must be able to bring up the concepts of existing students, present contradictory concepts, evaluate changes in students' concepts and motivations to further convince students of new concepts. Ratna Wilis said that in conditions of cognitive conflict students are faced with three choices, namely 1) maintaining their original intuition 2) revising some of their intuition through the process of assimilation 3) changing their intuition views and accommodating new knowledge. Conceptual change occurs when students decide on the third option (Dahar, 1996).

The application of Conceptual Change Model through cognitive conflict according to (Santyasa, 2004) has six stages: 1) the presentation of conceptual and contextual problems; 2) confrontation with misconceptions related to the problem; 3) confrontation of denial then demonstrating and making analogies; 4) confrontation of proof of scientific concepts and principles; 5) material confrontation and contextual examples; 6) confrontation questions to broaden the understanding and application of knowledge significantly.

2 METHOD

This study uses classroom action research or action research (PTK). The purpose of this study was to reduce the scientific misconceptions of the literacy of PGSD students of Yogyakarta PGRI University. This study consists of two variables, namely the dependent variable in the form of misconception of scientific literacy, while the free variable is Conceptual Change Model (CCM). This study was conducted in the second semester of class A7 PGSD UPY from March to May 2018. Subjects in this study were students of second semester class A7 PGSD UPY which amounted to 29 students. Whereas the object of this research is scientific literacy misconceptions on students that are carried out in a cycle, which begins with planning, then carrying out actions and observations or observations, and reflections can be seen in Figure 1.

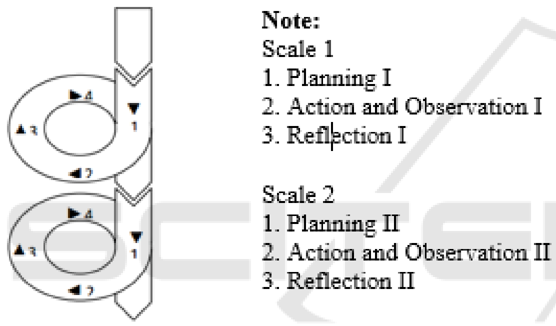

Figure 1: Spiral KemMis Mc Taggart model (Kusumah and Dwitagama, 2011).

In this study the research instrument used to collect data was tests and observations, which continued with analyzing research data. The steps in analyzing the data in this study are: quantitative data analysis and descriptive data analysis.

The test is a form of competency measurement that is examined in an objective manner. The form of questions used is a form of true and false questions. Indicators of scientific misconceptions of literacy measured through tests are the ability to understand material.

Observations were made to measure the ability to communicate materials. Observation is done in every meeting, where in a meeting of conducted games that require students to be able to explain the 16 elements in the material. Observations in this study used observer services to measure changes in scientific misconceptions of literacy, either before or after treatment. Researchers utilize the observer services for the results of measurements free of subjectivity researchers. Observation sheets are equipped with observation guidelines containing categories that are used as measurement parameters, so that objective and measurable data can be collected.

Table 1: Category formulation.

No	Range score	Category
1	1-4	Less
2	5-8	Enough
3	9-12	Good
4	13-16	Excellent

3 RESULT AND DISCUSSION

In this section, will be explained about the description of the results of research and the elaboration. Before the study was carried out, the researcher first made observations and interviews with lecturers who had taught in the class. Interviews conducted by researchers by asking the accuracy of the concept in answering questions in writing and when giving opinions or explaining. This study was conducted in PGSD UPY. Based on the observations made, in one class of PGSD study program in UPY has misconception of scientific literacy. Subjects in this study were all students of second semester class A7 PGSD UPY which amounted to 29 students with details of the number of male students 11 and the number of female students 18. Meanwhile, based on the results of observational data obtained data that 22 students are indicated to have misconception scientific linguistic. This section will describe the pre-action, the implementation of cycle 1 and the implementation of cycle 2.

3.1 Pre-action

The initial activity before the research was to find information about the initial conditions of students. The acquisition of the information is done by the researcher by doing material mapping test which indicates a misconception on the students. This test was conducted on March 16, 2018. The test contains 75 questions consisting of 15 sub-materials in natural sciences for the first and second semester. The results of the mapping of pre-action misconceptions for indicators capable of understanding the concepts of science shown in Table 2.

Table 2: Pre-action test results ability to understand natural sciences (IPA) concepts.

Material	Percentage of correct answers
1	92%
2	87%
3	67%
4	79%
5	77%
6	72%
7	70%
8	82%
9	72%
10	74%
11	76%
12	70%
13	68%
14	70%
15	74%

Based on the Table 2, the largest misconception on scientific literacy of the second semester students of class A7 PGSD UPY in pre-action mapping was in material 3, namely the respiratory system, material 7 circulatory system and material 13, namely addictive substances. While the observation results of students' ability to communicate the concepts of science properly shown at Table 3.

Table 3: Pre-action observation results of the ability to communicate scientific concepts.

No	Category	Students	%
1.	Less	7	24%
2.	Enough	20	68,9%
3.	Good	2	6,8%
4.	Excellent	0	0

Based on the table above, 7 out of 29 students still have less categories, 20 of 29 students have enough categories, and 2 of 29 students have good categories. Meanwhile, no students are categorized excellent.

Based on the observation data above, it can be concluded that scientific misconception of students' literacy semester II class A7 on indicators able to communicate the scientific concepts of literacy still need to be improved by reducing concepts containing misconception.

3.2 The Implementation of Cycle 1

This stage includes planning, action, test & observation, and reflection.

3.2.1 Planning

Action planning includes a discussion determining the material/competence used in this study is the theory of teaching materials development. The material to be tested at this stage is material 3, namely the human respiratory system which consists of 4 sub-chapters. After determining the subject that will be used in this study, the researcher prepares the lecture reference unit (SAP) to be used in this study, besides the researcher also preparing the test and observation sheet.

3.2.2 Action

Implementation of cycle 1 convey material about the human respiratory system consisting of 4 sub chapters namely understanding the respiratory system, respiratory equipment in humans, respiratory mechanisms in humans and disturbances that occur in the human respiratory system.

3.2.3 Test and Observation

The result of the cycle 1 test on human respiratory system material is 69%. This result shows an increase compared to the mapping score, but the improvement is very minimal. While the results of observation in cycle 1 regarding the ability to communicate scientific concepts can be seen in the Table 4.

Table 4. The results of observation cycle 1 ability to communicate the concepts of science.

No	Category	Students	%
1.	Less	5	17,2%
2.	Enough	18	62%
3.	Good	4	13,7%
4.	Excellent	0	0

The result of observation in the first cycle shows that the students' scientific misconception of literacy has started to decline, but there are still 5 students who are categorized as less, 18 students are categorized enough and 4 students are categorized good. While there are no students who are categorized excellent.

3.2.4 Reflection

Based on the results of the tests and observations in cycle I shows there is an increase in pre-action after the action in cycle I. But not all the scientific misconceptions of student literacy have been reduced.

There are several elements that need to be improved in the next meeting are as follows:

1. The use of analogy should be as close as possible to the condition of the student.
2. Does not limit students' initial opinions on material.
3. Increase evidence of facts related to the correct concept.

3.3 The implementation of Cycle 2

This stage includes planning, action, test & observation, and reflection.

3.3.1 Planning

Action planning includes discussion determining the material to be taught in the study. The material chosen is material 7, namely the human blood circulation system. This material is divided into three sub-chapters namely human blood circulation, human circulatory system, and circulatory system disorders. After determining the subject that will be used in this research, the researcher prepares the lecture reference unit (SAP) to be used in this research, besides the researcher also preparing the test and observation sheet.

3.3.2 Action

In the implementation of cycle 2 is almost the same as the process of implementation of cycle 1, but some improvements have been made based on reflection with different materials.

3.3.3 Test and Observation

The results of the tests in cycle 2 show a better improvement than cycle 1 in reducing the scientific misconception of student literacy. In cycle 2, the overall student test results show a truth level of 74% answers. While the observation results in the student category shown at Table 5.

Table 5: The results of observation in cycle 2, the ability to communicate the concepts of science.

No	Category	Students	%
1.	Less	0	0%
2.	Enough	19	65,5%
3.	Good	7	24,1%
4.	Excellent	3	10,3%

From the Table 5, it can be seen that the increase is 19 students categorized enough, 7 students categorized good, and 3 students categorized excellent. While there are no students in the less category.

3.3.4 Reflection

The results of the overall study have shown a reduction in scientific literacy misconceptions that can be seen in the final test results of each cycle. This shows that the application of Conceptual Change Model can reduce the scientific misconceptions of second semester students of class A7 PGSD UPY.

The study was conducted in two cycles based on Kurt Lewin (Kurnianto, 2009). Each cycle consisted of two meetings. The action taken is to apply the learning method Conceptual Change Model. The results of actions in cycle I and cycle II show improvement in each cycle. The accuracy of understanding of any concept of science or other sciences absolutely must be owned by every prospective teacher, in other words the misconception should be avoided as much as possible. But it is inevitable that sometimes the conditions encountered by someone do not lead to the correct concept. From the results of this study, obtained data as follows:

1. For the first indicator, able to understand the concepts of science that conducted measurement through the test, obtained an increase in the number of correct answers, or reduced student's misconception. In the pre-action score, the average score of the students was 67%, the cycle score was 69% and in the 2nd cycle to 74%. It shows the ability to understand the scientific concepts of students increased.
2. In the next indicator, able to communicate the concepts of science correctly measured using observation also increased. The ability category to properly communicate science concepts to students during pre-action is 7 students in the less category, 20 students in the enough category and 2 students in the good category.
3. In cycle 1, there are 5 students who are in less category, 15 students in enough category, and 4 students in good categories. While in cycle 2, 19 students were in the enough category, 7 students in the good category, and 3 students in the excellent category. Thus the ability of students in communicating the scientific concepts correctly increased so that misconception on students' understanding can be said to be reduced.

Learning about Conceptual Change Model trains students to be able to correct students' misunderstanding in a non-coercive way. Based on the discussion of the results above, it can be concluded that by applying Conceptual Change Model can reduce the scientific misconceptions of the second semester students of class A7 PGSD UPY on literacy.

4 CONCLUSIONS

After CCM had been implemented in cycle I, the percentage of student score increased to 69%. After reflecting and improving the teaching intervention in cycle I, the presentation score in the cycle II was increased to 74%. The aforementioned results indicated the decrease of students' misconceptions rate from 34% to 31% and to 26% lastly. The results obtained at this stage were classified into four categories: poor, fair, good, and excellent. In the early stages, there were 7 students counted into poor category, 20 students were in fair category, and 2 students were in good category.

After the cycle II, there were 5 students in poor category, 15 students were in fair category, and 4 students were in good category. After the cycle II had been accomplished, there was a significant increase where no students who fell into poor category, 19 students were in fair category, and 7 students were in good category, and 3 students were in excellent category. Expected after the model is applied, the learning process in Indonesia is able to minimize misconception.

Based on the findings of the study and discussion of the results of the study, it can be concluded that, lecture activities carried out using Conceptual Change Model can reduce scientific misconceptions of student literacy. With these activities students will be accustomed to expressing answers and arguing appropriately.

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