Guided Inquiry Assisted Concept Map to Improve Students Metacognition Skills

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Abstract. Metacognition is an aspect in an effort to build students’ understanding of chemistry. Preliminary study conducted at SMAN 1 Banjarmasin showed that only a few students who can evaluate their learning process, so that the ability of students using metacognition in learning process is still low. The guided inquiry assisted concept map with metacognition approach is an alternative to improving students’ metacognition skills in learning process. The research was carried out using classroom action research design with two cycle. Each cycle consists of planning, action, observation and reflection stages. The subjects of this study were students of XI Natural Science 5 SMAN 1 Banjarmasin with 36 students. The research data collected using metacognition skills test instrument and non test instrument. Data were analyzed with quantitative descriptive and qualitative analysis. Metacognition skills of students has increased after treatment with guided inquiry assisted concept map. The process of implementation of the action is seen from teacher and student activity. Teacher activity increased from 71.77 to 87.94. Student activity increased to 87.4 from beginning at 68.16. Implementation of quided inquiry assisted concept map model with metacognition approach can improve students metacognition skill, student activity and teacher activity.

Keywords: metacognition skill, guided inquiry, concept map

1. Introduction
Curriculum 2013 is a curriculum for elementary, junior and senior high school in Indonesia that emphasizes students’ ability to solve problems. The concept of problem solving requires various skills, not only cognitive skills but also metacognitive skills. Metacognitive skills can be obtained through learning that involves metacognitive strategies. Metacognitive strategies are processes that are used to control cognitive activities and ensure that cognitive goals have been fulfilled. This process helps to organize and supervise learning which consists of planning and monitoring cognitive activities, as well as checking the results of these activities [1] [2].

Inquiry learning model is a series of learning activities that emphasize the activeness of students to have learning experiences in discovering concepts based on proposed problems [3] [4] [5]. One of inquiry learning is guided inquiry which is a learning model that directs students to get a conclusion from a series of activities carried out. Teachers play an active role in determining problems and carrying out activities by giving initial questions or problems and leading to a discussion [6].
Inquiry learning requires students to work in groups with the aim of mastering certain tasks. These specific tasks seek to develop student skills such as critical thinking skills, metacognition, communication, teamwork, management and assessment [7] [8]. Metacognition, which is the result of inquiry learning skills, aims to gain knowledge about self-learning or knowledge of how to learn [9]. Metacognition involves activities such as planning how to complete a learning task, monitoring comprehension and evaluating the progress [10] [11]. Ref [12], stated that metacognition is a person’s ability to control his learning process, starting from the planning stage, choosing the appropriate strategy, then monitoring progress in learning and simultaneously correcting if there are errors that occur during understanding the concept.

The indicator of each metacognition skill and its relation with guided inquiry stages, looks like in Table 1.

| Component Metacognitive Skills | Metacognition Indicators | Guided Inquiry Stages |
|-------------------------------|--------------------------|-----------------------|
| Planning                      | Students explore prior knowledge when they interpret information provided and refer to relevant concepts before developing a solution plan. Students make predictions about information in the problem to be solved based on what they have read. Students identify information on a topic and restate it in a more operational form. | Formulating problems Formulate the hypothesis Data collection |
| Monitoring                    | Students investigate a topic by verifying, classifying and developing, or changing their initial statements with accurate information. Students interpret the results and formulate an answer. Students produce new information and state problems with images, symbols or tables as they are organized into a plan. Students classify related ideas and identify strategies used. | Test the hypothesis Test the hypothesis |
| Evaluating                    | Students evaluate success and discard inappropriate strategies. Students identify strategies that can be used later and seek promising alternative approaches. | Make Conclusions |

The learning process, using learning media has an important role. One of the learning media that can be used to facilitate students in understanding the concepts in science is concept maps. Concept maps can be used for all levels of education, ranging from elementary to college students. Ref [13] suggests that concept maps represent representations of the relationship between one concept and another. The concept map is a two-dimensional diagram to identify the concepts and the relationships between the concepts that exist in his/her mind [14]. Concept maps can be used to help students understand chemistry concepts and used as a teaching method [15]. Ref [16] [17] argues that concept maps are representations of several concepts and various relationships between knowledge structures possessed by a person. Ref [18] states that one of the strong uses of concept maps is not only as a learning tool but also as an evaluation tool.

Concept maps are visual graphics that organize the information used in carrying out different educational purposes, like learning strategy, teaching method and measurement tools [19]. According to the constructivist learning theory, educators can use the concept maps as a teaching tool to achieve more meaningful and permanent learning students’ levels [20] [21]. Concrete models, graphics, schemes and simulations are especially very helpful for visualizing and coding the relations between the main dimensions and subdimensions of the information. In this context, concept maps, which present
complicated interconceptual relations in a hierarchical manner, going from general concepts to special concepts, is one of the teaching materials which can be used to ensure effective teaching and/or to help students reach higher learning levels [22].

Preliminary research on students of SMAN 1 Banjarmasin, stated that only 8.6% (low) of students determined adequate planning steps while studying. This situation indicates that students have not been able or unfamiliar in determining their learning steps. Furthermore, only 8.6% (low) of students do monitoring learning in the learning process, and only 10.3% of students have achieved their learning goals. This shows that only a few students evaluate the learning process, the number is still too small, so students are said to still have a low category of evaluation skills.

Concepts of buffer solution had been taught in science class especially in chemistry. Many students assume that buffer is one of difficult concept in chemistry [23]. Based on the results of observations and interviews with teachers, it was found that the teacher taught buffer concepts using the guided inquiry learning model. However, the teacher stated that students were less interested in the learning process that took place so that student learning outcomes were not maximally achieved. This can be seen from the results of the test answers given at the time of observation.

One way to motivate students to be more interested in learning must be given something new and interesting so that they are more eager to listen to what the teacher has to say. Based on this, the teacher tries to use concept maps to motivate students. Ref [24], it is known that guided inquiry learning models with concept maps have a significant effect on metacognitive abilities and learning outcomes. Other research conducted by Nurfiah and Sugiarto [25] showed that the implementation of the guided inquiry model obtained good criteria at each phase of metacognitive skills. Ref [26] in their study stated that students have metacognitive skills consisting of skills in planning, monitoring skills, and evaluating skills with the most dominant metacognitive skills are planning skills. Ref [27] in their research obtained the results of metacognition skills using a guided inquiry model as a whole metacognition skills of students can be said to be well-trained and excellent. Based on the description above, the researcher intends to conduct research on improving metacognition skills and learning outcomes of buffer solutions with a guided inquiry learning model assisted by concept maps.

2. Method
The study was conducted using a classroom action research design consisting two cycles. Each cycle consists of planning, action, observation and reflection [28]. Every cycle consisted two meeting and at the end of each cycle an evaluation is carried out to determine the learning outcomes of students' metacognition skills and their activity, likes students and teacher activity. This research was conducted in class XI IPA 5 SMAN 1 Banjarmasin with 36 research subjects. The object of the research is the activities of teachers and students and metacognition skills. Data analysis was performed using the results of metacognition skills tests, teacher and student activity observations, and concept maps evaluation.

3. Result and Discussion
This research was carried out in two cycles with the aim of increasing students' ability to solve chemical problems about the concept of buffer solutions. The guided inquiry model assisted with concept maps carried out in six stages, namely the orientation, formulating the problem, formulating hypotheses, collecting data, testing hypotheses and formulating conclusions. Concept maps are used at the orientation stage in guided inquiry learning. The orientation in question is in the form of teacher's apperception in starting learning. So that apperception at the orientation stage in guided inquiry learning uses concept maps.

The use of a guided inquiry model assisted by a concept map shows the results that a guided inquiry model can increase teacher activity which was originally only categorized as Good in the first cycle to be Very Good in cycle II. This increase can be seen in Table 2.
Table 2. Teacher activity using guided inquiry learning model assisted concept maps

| Cycle | 1st Meeting | 2nd Meeting | Mean |
|-------|-------------|-------------|------|
| I     | 68,71       | 74,84       | 71,77|
| II    | 85,64       | 90,24       | 87,94|

Increased teacher activity occurs because the teacher has made improvements to the learning process in each cycle. The teacher is able to guide students in solving problems, so students who are initially less active become more active. The stages in the guided inquiry model assisted by the concept map have been carried out optimally so that in this case it affects the activities of students in the learning process. The first cycle in the design of this study is a reflection of the teacher to make improvements and plan the next lesson in the second cycle. From observers' observational data, the teacher reflects on himself by improving the learning plan in the next cycle. Reflection is an important activity for teachers in increasing their ability to teach. Reflections are in the form of activities to review the learning activities that have been carried out by the teacher and discuss with observers who become observers in the learning process.

Teachers in guided guiding learning are only facilitators who play a role in directing students so that the activities carried out are in accordance with the learning objectives. Group discussion or class discussion is one of the main activities that need to be carried out in each learning process with guided inquiry. Ref [29] states that in guided inquiry learning, teachers must be able to create effective and efficient learning conditions. This is because student-centered learning requires a longer implementation time compared to ordinary learning in general, so that effectiveness and time efficiency are very necessary.

Increased teacher activity is because teachers make improvements in terms of planning and implementing learning. One of the improvements made and has a positive impact on increasing teacher activity is the intensity and quality of teachers in guiding students to solve problems, so that students who are initially less active become more active in discussing and expressing opinions. Ref [30] [31] in their study revealed that the guided inquiry model can improve teacher activity in teaching in school conditions that are not much different from the condition of the school that is the object of research.

The increase that occurs in teacher activities also affects the increase in student activity learning (Table 3), because students have been able to follow the learning process by using a guided inquiry model assisted by concept maps well. Student activities in learning using a guided inquiry model assisted by concept maps are in the active category. The increase in student activity is due to the direct involvement of students in the learning process at each stage of the guided inquiry model [6]. The characteristics of the guided inquiry learning model are emphasizing on student activities to the maximum to find their own answers to existing questions so that it is expected to foster an attitude of self-confidence that indicates the increase in student activity [32] [31] [33].

Table 3. Result and student activity using guided inquiry learning model assisted concept maps

| 1st Cycle | 2nd Cycle |
|-----------|-----------|
| Students activity | 68,16 | 87,40 |
| Students metacognition skills | 43,64 | 65,10 |
| Students concept maps | 42,75 | 61,84 |

In learning using a guided inquiry model assisted by concept maps, in addition to increasing student activity, there is also an increase in student metacognition, especially in its metacognitive skills. This is almost similar to the results of Eka [24] study that a guided inquiry model assisted by concept maps has a significant effect on students' metacognitive skills and learning outcomes. Metacognition skills consist of three aspects, planning, monitoring, and evaluation skills [34].

Guided inquiry activities combined with metacognitive skills tend to improve students' metacognitive abilities. Improvement can occur due to the support of learning materials that exist in the surrounding environment, so that students are easier to understand each of the material studied. The application of learning strategies such as self regulation can train students to talk to themselves and
make students always monitor their own behavior [1]. Students who apply new information processing strategies with initial knowledge can improve their own understanding of judgment.

Students who are active in learning can optimize their metacognition. Students will become independent learners, not just waiting for information provided by the teacher but students themselves who are active in seeking information. The findings obtained by students with a series of metacognition processes starting from planning, monitoring, then evaluating, and cognitive strategies that will and have been used can associate with concepts in the material being studied. Student with metacognition ability is able to become an independent learner, foster an honest attitude, dare to admit mistakes and can improve learning outcomes in real terms [35] [32] [36].

In this study, there has been an increase students' metacognition skills (Table 3). This shows that students have been able to develop and carry out the learning process well so that metacognition skills can be formed well. Based on research by ref [26] that with good metacognition skills, students have been able to think in overcoming their own problems because they often take themselves to learn from mistakes. Metacognitive skills have an important role in solving problems from various fields, including problems in learning chemistry as well as giving a big influence on students' problem solving ability. The importance of metacognitive skills in problem solving is inseparable from the role of motivation, so metacognition and motivation skills become an important part of students' problem-solving abilities. Students need to be assisted in empowering or developing their metacognitive skills since students with metacognitive skills will be able to solve problems well because they are capable of planning, monitoring and evaluating in problem solving [37].

The role of concept maps in this study as learning media that helps guide inquiry models in learning to improve student independence and be used as material reinforcement. This can be seen in Table 3. Based on the results of the data obtained shows that students who have increased metacognition skills, have the results of concept maps which also increase from cycle I to cycle II. Student concept maps make it easier for students to remember and connect the concepts students have received before, so the new concept of learning outcomes will last longer in memory which results in increased student metacognition [6]. Concept mapping is an active learning process that involves students in meaningful learning because it engages complex cognitive structures within the brain. Meaningful learning refers to the acquisition of new information by an individual and its interrelationship with existing relevant knowledge mental structures [38] [39].

4. Conclusion

Metacognition skills of students has increased after treatment with guided inquiry assisted concept map. The process of implementation of the action is seen from teacher and student activity. Teacher activity increased from 71.77 at cycle I to 87.94 at cycle II. Student activity increased to 87.4 from beginning at 68.16. Implementation of quided inqury assisted concept map model with metacognition approach can improve students metacognition skill, student activity and teacher activity.

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