IMPLEMENTATION OF GUIDED-INQUIRY LEARNING MODEL TO PROMOTE METACOGNITIVE SELF-REGULATION ON BUFFER MATERIAL FOR STUDENT GRADE XI-IPA 1 SMAN 1 MANYAR GRESIK

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Abstrak: Penelitian ini bertujuan untuk meningkatkan kemampuan metakognitif regulasi-diri siswa kelas XI-IPA 1 SMAN 1 Manyar Gresik melalui penerapan model pembelajaran inkuiri terbimbing. Penelitian ini merupakan penelitian pre-eksperimental yang menggunakan rancangan penelitian pretes-postes dengan Metacognitive Activity Inventory (MCA-I) sebagai instrumen penelitian yang didukung dengan hasil tes belajar dan tes wawancara. Data hasil penelitian dianalisis secara statistik deskriptif untuk mendeskripsikan peningkatan kemampuan metakognitif regulasi-diri pada ketiga aspeknya yaitu aspek perencanaan, pemantauan, dan evaluasi. Hasil penelitian juga menunjukkan peningkatan kemampuan metakognitif-regulasi-diri tertinggi terjadi pada aspek pemantauan diikuti dengan aspek evaluasi dan peningkatan terendah terjadi pada aspek perencanaan. Peningkatan pada aspek pemantauan dikarenakan banyaknya aktivitas pemantauan yang muncul selama pembelajaran daripada kedua aspek lainnya. Sementara rendahnya peningkatan aspek perencanaan dikarenakan kurangnya motivasi-diri siswa selama pembelajaran.

Kata Kunci: Inkuiri terbimbing, Metakognitif regulasi-diri.

Abstract: The aim of this research is to promote students' metacognitive self-regulation ability of grade XI-IPA 1 SMAN 1 Manyar Gresik through the implementation of guided inquiry learning model at buffer material. This is a pre-experimental research using one group pretest-posttest research design with a metacognitive Inventory Activity (MCA-I) as an instrument of research supported by the achievement and interview test. Result data were analyzed descriptive-statistic to describe the promotion in the ability of metacognitive self-regulation in the three aspect, they are planning, monitoring, and evaluation. The results also showed highest promotion of metacognitive self-regulation ability is in monitoring aspect followed with evaluation aspect and the lowest promotion occurred in planning aspect. The highest promotion in the monitoring aspect because the number of monitoring activities that occur during learning more than the two other aspects. While the lowest promotion of planning aspect due to lack of student self-motivation for learning.

Keyword: Guided-inquiry, Metacognitive self-regulation.

INTRODUCTION

Constructivism considers that student's learning success depends not only on the environment or conditions of learning but also on students' prior knowledge. The knowledge can not be transferred intact from the mind of teachers to students, but is actively constructed by students themselves through actual experience, it is appropriate to what is stated by Piaget (1995) in Sidik 2007 [1].

Teachers need to present to students a puzzle or events that cause cognitive conflict and curiosity of students, thus stimulating them to investigate. Students are then shown on the actual concept that can direct their thinking in order to enable them to compare with their prior knowledge. If it is accepted by the cognitive structure of students, students will act to investigate, assess and connect with their prior knowledge. The action taken by the students is a self-reflection that requires skill to design, monitor and evaluate learning and thinking processes that make the student seeks to master and implement the metacognitive processes (Gunstone and Northfield, 1995) [2].

Metacognition is defined by John Flavell (1976) as an individual's knowledge about cognitive processes and outcomes and use this knowledge to control their own cognitive processes [3]. Imel (2002) in Yuni Wibowo [4] states that metacognitive capability is indispensable for the success of learning, given metacognitive skills allow students to be able to manage themselves and be able to see much their cognitive weaknesses so it can be done to improve better actions. Further stated that the student's ability to use their metacognitive ability have a better learning outcomes than students who did not use their metacognitive ability. Fact that metacognitive ability can be taught and developed, increasing the significant of this concept in education (Özcan, 2000 in AKPUNAR, Burhan) [5].

Ann Brown (1987) identifies two basic metacognitive abilities. The first is knowledge of cognition or self-understanding *(Metacognitive self-regulation).* Knowledge of cognition includes knowledge of what the students themselves know and what students do not know about how his or her own learning. The second basic ability associated with setting up and promotion of cognition ability that is also called the cognitive control or self-regulation *(Metacognitive self-regulation).* Metacognitive self-regulation involves planning*,* monitoring*,* and reflection or evaluation *(evaluation),* where students can plan the activities of thinking, monitor the progress of learning, and thinking how to transform better in the future [6]. Metacognitive self-regulation abilities can be taught to students by engaging them in self-regulated learning. Metacognitive ability can be enhanced through learning constructivist learning [7].

Metacognitive self-regulation ability is the ability to relate to the setting and self-enhancement of cognition. This capability consists of three essential components include planning, monitoring, and evaluation. Planning related to one's ability to select learning strategies, set goals, and determine the allocation of time to study alone. Monitoring is concerned with how a person thinks that monitor their own progress. While the reflections related to the evaluation of its own way of thinking so that can be better in the future.

Guided inquiry learning model as one kind of constructivist learning has five phases, namely *planning* phase, *retrieving*, *processing*, *creating*, *sharing*, and *evaluating* [8]. According to the CV Schwarz & YN Gwekwerere (no year), guided inquiry learning model is learning which there were several activities of a scientific nature, where students are asked to submit their ideas before they are studying the topic, students investigate a phenomenon or phenomena they consider odd, students explain the facts and compare

scientifically [9]. According to Carol C. Kuhltahu (2007), there are six characteristics of guided-inquiry learning include: 1) students' active learning and reflected on the experience, 2) students learn based on what they already know, 3) students develop higher level thinking skills through guidance, 4) students have a way or a different learning strategies, 5) students learn through social interaction with peers or teachers, and 6) students learn through instruction and experience in accordance with the cognitive development [10].

Guided inquiry learning is related to the metacognitive self-regulation ability (Magnusson & Palinscar (2005) and Zimmerman and Campillo (2003)) [11]. In guided inquiry learning, careful planning is an important aspect, starting from designing experiments, determine the trial step, define literature are used, make hypotheses, to determine how to analyze data, and so on. Either with the monitoring, students monitor their progress of his or her own by asking his or her self what he's or she's done, why he or she did that, did he or she make advances to his or her and so on. While the evaluation in inquiry learning, students evaluate and reflect on the learning activities if it appropriates with planning objectives and strategies previously [6].

Pre studies have been conducted on 12th December 2011 against 27 students of grade XI-IPA 1 and 30 student of grade XII-IPA 4 and 7, R-SMAN-BI 1 by using Likert scale questionnaire (Always up to Never). The questionnaire contains 13 questions to know their metacognitive self-regulation ability. At grade XI-IPA 1 just as much as 11.10% of students always think that chemistry is an easy lesson, 22.20% of students always use planning skills, 74.00% of students always use monitoring skills, and 25,90% of students always use evaluation skills. In grade XII-IPA 4 and 7 for Buffer Solution subject matter as much as

56.67% of students stated that the material is not easy. More, less of 75% of total students grade XI-IPA 1 is not passed in buffer material in previous year. Overall results showed that the ability of students 'metacognitive self-regulation ability of grade XI-1 IPA 1 is said to be less and still learning chemistry can be said to be less effective to develop students' metacognitive self-regulation.

METHODS

This study is a pre-experimental research, because the design of this study is not yet a serious experiment, because there are external variables that also affected the formation of the dependent variable. Thus, experimental results are dependent result was not solely influenced by the dependent variable. This can occur in the absence of control variables, and the sample was not randomly chosen [12].

The objectives of this study are all students grade XI-IPA 1 SMA 1 Manyar Gresik, amounting to 32 students and conducted in second semester of academic year 2011/2012. Study used a design *once group pretest-posttest design,* where students will be given a test at the beginning and end of the guided inquiry learning model.

The experiment was conducted in three phases, initial stage, implementation stage, and final stage. In the initial stage, the validation of learning tools conducted by two professors of Chemistry Department of Surabaya State University, and one chemistry teacher with the result the learning tools is proper for use with a little revision. At the implementation stage, performed the pretest, then the implementation of guided inquiry learning model for 5 meeting, then do the achievement test, posttest, and the interview at the fifth meeting. In the final stage, performed the analysis and discussion and conclusions are made.

Data collection techniques used in this study is test technique. Instrument pretest and posttest are used

in this case is *metacognitive Activities Inventory* (MCA-I) was adapted from the dissertation of the research conducted by Cooper [13]. To support the results of the pretest-posttest also used achievement and interview test. Sheet of achievement test had been reviewed and validated by two professors of Chemistry and a chemistry teacher while interview test of metacognition adopted *Awareness Inventory* (MAI) of Schraw and Dennison (2008) [14].

The device used is the syllabus of learning, lesson plan, and the student worksheet are all adapted to guided inquiry learning model and is designed to enhance students' metacognitive self-regulation.

The data have been collected and analyzed. Value of metacognitive self-regulation of students from the MCA-I is obtained by calculating the total score of the students' responses based on the Likert scale (always–never). MCA-I contains 19 positive items and 8 negative items. For positive item, "always" answer get a value of 5, "often" gets the value of 4, "sometimes" gets a value of 3, "seldom" gets the value 2, and "never" gets a value of 1. As for the negative items have a value of 1 for "always" answer, "often" gets a value of 2, "sometimes" gets a value of 3, "seldom" gets the value of 4, and "never" gets the value of 5. Next, is calculating the average value ($\bar{x}$) of metacognitive self-regulation ability and standard deviation (SD) from pretest result. From these results the group made three categories of metacognitive self-regulation. Groups of low-level group of metacognitive self-regulation, the range of values (least mean value until ((-SD) + $\bar{x}$)). Moderate-level group has range of values ((-SD) + $\bar{x}$ until ($\bar{x}$ + (SD)). High-level group has range of values (($\bar{x}$ + (SD) until maximum average value). The next step is to calculate the average of the end of the metacognitive ability *(posttest)*. From the results of the pretest and posttest are could be comparable the average value

of the initial capability with the final capability, with a descriptive analysis of their ability in every aspect of the planning, monitoring, and evaluation.

Achievement rating calculated using the formula:

$$\text{Student's Learning Achievement} = \frac{\text{Gotten Score}}{\text{Total Score}}$$

The results were then analyzed in a descriptive study to compare the value of Minimum Competency Testing (MCT) at SMAN 1 Manyar Gresik for the chemistry subjects of ≥75 for individual cut score and of $\geq75\%$ for classical cut score. Meanwhile, interview test results were analyzed descriptively. Data of achievement test and interview test results are analyzed to support the *metacognitive Activities Inventory* (MCA-I).

RESULTS AND DISCUSSION

From the test results obtained by MCA-I mean the ability of metacognitive regulation d envy students in the pretest was 82.69 and the posttest was 94.75. Data from the pretest has standard deviation 9.65, so that can make three group levels category of metacognitive self-regulation ability of as follows:

Table 1 Metacognitive Self-Regulation Level Group of XI-IPA Class 1 SMAN 1 Manyar Gresik

Group Rankings	Range of Values
Low-level	27.00 till 74.98
Moderate-level	74.98 till 90.39
High-level	90.39 till 135.00

Value of 27 on the low level is the lowest value on MCA-I (27 items x value 1) while the 135 is the highest score (27 items x value 5). Based on the grouping was obtained by 5 student categories of low-level group, 23 students the moderate-level group, and 4 students of high-level group.

From the results of pretest and posttest obtained an average value of metacognitive self-regulation ability in all three aspects of metacognitive self-regulation with the information in Table 2 and 3.

Table 2 The pretest average value of three aspects of metacognitive self-regulation ability of students grades XI-IPA 1 SMAN 1 Manyar Gresik

Group Rankings	Aspects of Metacognitive Ability of Self-Regulation		
	Planning	Monitoring	Evaluation
Low	16.40	29.00	23.80
Intermediate	21.65	34.09	28.00
Height	26.00	36.00	31.50

Table 3 The posttest's average value of three aspects of metacognitive self-regulation ability of students grades XI-IPA 1 SMAN 1 Manyar Gresik

Group Rankings	Aspects of Metacognitive Ability of Self-Regulation		
	Planning	Monitoring	Evaluation
Low	21.20	35.40	29.00
Intermediate	25.43	38.22	31.78
Height	29.00	38.75	34.50

Low-level group

Table 2 shows that the average value of planning, monitoring, and evaluating aspects are 16.4, 29.0, and 23.80 while the average value of the three aspects of the metacognitive self-regulation abilities on the posttest as shown in Table 3 are respectively at 21.20, 35.40 and 29.00. This means that there is promotion especially in the monitoring aspect with difference value 6.40. While the difference value in the pretest-posttest on aspects of planning and evaluation is 4.80 and 5.20. This is supported by interviews data with three students of low-level metacognitive self-regulation ability that they are superior in terms of monitoring aspect because they are learning to use learning strategies, especially write chemical reaction, tables, or notes, view solutions to problems, check the progress to goals, and ask a friend or anyone else for help.

Moderate-level groups

The average value of pretest on all three aspects of metacognitive self-regulation ability includes planning, monitoring and evaluation aspect respectively are 21.65, 34.09, and 28.00. Meanwhile posttest results show the average values of the three aspects of metacognitive self-regulation ability respectively are 25.43, 38.22, and 31.78. This means that there is promotion especially in the monitoring aspect with the difference in value 4.13. While the difference in the pretest-posttest on aspects of planning and evaluation is 3.78 and 3. 78. This is supported by data from interviews with three students of moderate-level group, that they are superior in terms of monitoring as well as in the low group.

High-level group

The average value of pretest on all three aspects of metacognitive self-regulation ability is aspects of planning, monitoring, and evaluation aimed at 26.00, 36.00, and 31. 50. Meanwhile, from posttest shows the average value of the three aspects of metacognitive self-regulation abilities on the posttest are respectively at 29.00, 38.75, and 34. 50. This means that there is promotion in metacognitive self-regulation ability mainly in aspects of planning and evaluation of the difference in the pretest-posttest respectively 3.00 and 3.00. While the difference value in the pretest-posttest on the pitch as the monitoring is 2.75. This is supported by data from interviews with three students

of moderate-level group which showed that the higher aspects are planning and evaluation aspects than monitoring aspect. This means that they have been able to formulate the problem, set goals, determine the information needed to solve problems, and determine the problem-solving steps. While the evaluation aspects they have been able to double-check whether the objectives have been achieved, reflecting learning strategy which is more efficient, and self-respect after studying or completing assignments.

On the whole aspect of metacognitive self-regulation ability, the highest promotion found in monitoring aspect, followed by evaluation aspect and the lowest in planning aspect. This is evident from the three level groups, the largest promotion found in monitoring aspect. At the low-level group increased in monitoring aspects at 6.40 values. In moderate-level group promote as 4.13 values and at the high-level group promote as 2.75 values. The highest promotion in monitoring aspect is caused student activities that include monitoring aspects on the six phases of guided inquiry learning models more often occur.

In general, the activities of metacognitive self-regulation can occur at any phase of guided-inquiry learning model. However, it can be analyzed that the activity of metacognitive self-regulation of planning aspect activity tends to occur in the *planning* phase. Monitoring activities tends in the phase *of retrieving, processing, creating,* and *sharing.* While the activity of evaluation aspects tends to occur in phases *evaluation.* Thus the monitoring aspect has opportunity to grow higher than the other aspects because aspects of the monitoring activities appear more dominant in the learning phase of guided-inquiry learning model.

In the study, planning aspect is an aspect of metacognitive self-regulation has developed with lowest promotion. This is possible due to low self-motivation. This statement is

supported that teacher as researcher in giving motivation only through giving phenomenon that appropriate with buffer material. Low self-motivation in students makes students failing to use their learning strategy because they have not or do not feel happy with the results of its business or using his or her strategy (Rabinowitz, Freeman, & Cohen, 1992) [6]. Low ability to plan due to several factors of self-motivation, they are:

1) Low self-efficacy. Low self-efficacy of students means he or she was not sure of the type of learning strategy used.

2) Students' outcome expectations are not supported by the self-efficacy. This means that students want something outcome of learning is a gift from a teacher, a high value, respect of friends, and so on, but he or she did not have self-confidence to get these things.

3) Lack of student interest in the material or task *(Task interest or valuing).* This factor relates to the sense of likes and dislikes of students to the material or task due to the nature of the material or task compared with the quality of the materials or the task itself, so teachers need to strive to make the material or task to be liked by the students.

4) Weak students' learning goal orientation *(learning goal orientation).* Students who have a strong learning goal orientation tend to try to learn in earnest to implement learning strategies that are beneficial *(advantageous "deep" learning strategies).* On the other hand, students who are weak in learning goal orientation, she will tend to lazy to learn.

Low student metacognitive self-regulation ability would affect student's achievement. This is evident in student learning achievement in Table 4 which shows that there are three students who were not passed. They are students who

belong to the category of low-level of metacognitive self-regulation. Meanwhile, student of moderate-level has been completed in the study. Even student of high-level got satisfying learning outcomes. This is in accordance show that students who use the metacognitive skills have better achievement than students who do not use their metacognitive skills [4]. This is because the metacognitive skills allow students to do the planning, keeping track, and monitor their learning.

Table 4 Learning Achievement of Student Grade XI-IPA 1 SMAN 1 Manyar Gresik

Characteristics	All Meetings
Number of students	32
Number of students who completed	29
Number of students who did not complete	3
Classical achievement percentage	**90.63%**

Based on data in Table 4 were obtained classical score students is 90.63%. It could be argued that the student's learning achievement in the classical style is said to have exceeded because classical score of MCT is set at $\geq 75\%$. This means that as many as 29 students have been able to master the competencies that set the students are able to explain the properties of the buffer solution and its usefulness in living things.

CONCLUSION

Based on the results of research and discussion, the obtained conclusions are as follows:
1) Metacognitive self-regulation ability of students has promoted especially in the monitoring aspect, followed by evaluation aspect, and the lowest in the planning aspect. As many as 60% of students of low-level groups become high-level, and 69. 56% of

students of moderate-level group become high-level category.
2) The low increase in the aspect of planning due to the low-motivation students.
3) Student learning achievement obtained with guided inquiry learning model has made it to the classical score of MCT with a percentage of 90.63% or as many as 29 students from 32 students were completed. While as many as 9.46% or 3 students from 32 students declared not passed.

Based on the conclusions that have been made, the researchers propose suggestions or recommendations as follows:
1) Need to test the students' initial ability to know how much prior knowledge they had before applied to the guided-inquiry learning model.
2) Interviews need to be made more effective by not asking whether the activity of metacognitive self-regulation has or has not been done, but to ask students why do so.
3) Teacher must give more motivation in order to promote the student's metacognitive skills.
4) To see clearly the extent to which increased the ability of students' metacognitive self-regulation is necessary to the existence of a homogeneous comparison class so that further research needs to use the research design of the study *control group pretest-posttest design.*

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