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Beyond effective teaching: Enhancing students' metacognitive skill through guided inquiry

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Beyond effective teaching: Enhancing students' metacognitive skill through guided inquiry

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Abstract. This research was quasi experimental with pretest posttes non-equivalent control group design. This research aimed to compare metacognitive skill of students between tought by guided inquiry and traditional teaching. Sample of this research was the students at even semester at the first year, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar, Indonesia. The data of students' metacognitive skill was measured by essay test. The data was analyzed by inferential statistic of ANCOVA test. The result of research showed that there was the effect of teaching model towards metacognitive skill of students. Students were tought by guided inquiry had higher metacognitive skill than tought by traditional teaching. The lecturer can use the guided inquiry model in others courses with considering the course materials and also student characteristics.

Keywords: Guided inquiry, learning model, metacognitive skill, biology teaching, effective teaching

1. Introduction

One of many factors which determine the quality of education is successful education in university. Starategy, model, or lecturers pattern are important aspects in education process beside materials to gain the achievement. Learning experiences are gained as long as the lectures ran, really determine on ability and quality from lecturers. So, the lecturers have responsibility to create learning experiences of their students by the implementation of appropriate model or learning strategy.

Science learning is expected to enhance students on how to fullfill 21 centuries skill and one of the skills is learning skill and inovation. Integrated science included Biology can be implemented by scientific inquiry to grow up the thinking skills, and could change from passive learning to active learning. So, the process of Animal Structure course as a part of Biology learning in university, emphasize on learning experiences directly through implementation and development of skill of thinking included metacognitive.

The result of observation showed that empowerment of student metacognitive skill was still unsufficient. Metacognitive skill should be trained so student so they could perform their affection and skills in terms of manage their learning [1]. Teaching method which implemented, less of giving chances and learning experiences to construct the concepts which is learned through thinking process. Metacognitive skill needs a metacognitive strategy to be taught. Metacognitive strategy can be described as routine activity, which represented managing the mental process, as a part of complexity process and apllied of getting goals [2]. Metacognitive related also with thinking level, cognitive style, and learning style of students. Thinking level, cognitive style, and learning style of students have an influence on metacognitive of students [3]-[6].

Metacognitive skill was very important to be applied because student who knew the effective strategy to learn, tend to have good learning achievement [7]. Metacognition was the strong variable

to affect academic succesfull [8][9]. The research showed that there was positive contribution of metacognitive skill towards learning outcomes of students [10][11].

Based on that problem, need to apply the learning model that can empower the metacognitive skills of students in learning process. One of learning model based on constructivistic for instance guided inquiry. Implementation of guided inquiry trained the students to do many activities, for example obsevation, investigation, experiments, and compare one experiments with other experiments, ask a question, and find answer of self question. Guided inquiry learning aims to give chance for students to build their intelectual behaviour and motivated to give ideas when teacher give a problem.

2. Methods

This research was a quasy experimental designed to compare effects of guided inquiry and traditional teaching towards metacognitive skill of students in the first year, even semester in Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar, Indonesia. Research design was Pretest-Posttest Nonequivalent Control Group Design [12] as showed in Table 1.

Table 1. Quasy experimental design research

Pretest	Group	Posttest
T_1	X_1	T_2
T_3	X_2	T_4

T_1& T_3: Pretest
T_2& T_4: Posttest
X_1: Guided Inquiry
X_2: Traditional Teaching

The sample of research randomly choosed, consists of 125 students in 4 classes which take Animal Structure course. Each teaching model would represent by 2 classe. The sample of research in each group consists of students with equal academic ability, based on grouping test. Before giving a treatment, 2 groups of students with classes given essay test which developed by researcher to measure metacognitive skill of students. Instrument was validated before implemetation. During 2 months, 4 classes taught with different learning model. Then, they were given final test. Data analyzed by statistical inferencial as ANCOVA test using SPSS for windows 22.

3. Results and Discussion

The results of normality and homogenity test shows that the data were normally distributed and homogeny. Normality test showed p value of pretest > 0.05 (p = 0.302) and p value for posttest = 0.312. Homogenity test showed p value > 0.05, pretest p value = 0,117 and posttest p value = 0.428.

Hipothesys test with ANCOVA test showed that the learning model give affect towards metacognitive skill of students (p < sig. 0,05). The summary of ANCOVA test of metacognitive skill of student showed on Table 2.

Tabel 2. Summary of ANCOVA test of metacognitive skill of student.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8765.919[a]	2	4382.959	34.104	<0.001
Intercept	9207.351	1	9207.351	71.643	<0.001
XmetacogSkill	7111.269	1	7111.269	55.334	<0.001
Model	1556.508	1	1556.508	12.111	0.001
Error	15678.993	122	128.516		

Total	467750.000	125
Corrected Total	24444.912	124

The result of research showed that metacognitive skill of students successfully improved through guided inquiry model higher than conventional teaching. It is stated that result gained by students with this inquiry model could enhance their metacognitive skill. Guided inquiry is one of learning model whereas lecturer provided materials, subject, and problem for investigation [13]. Student plan their procedural to overcome the problem. Steps in inquiry learning model were observation to found problem, create core of problem, make a hypothesis, plan the problem solving, do the experiments, make observation and collect data, data analysis, and make inferencial [14]. Those activity will train skill of student on how plan, manage, and evaluate their learning. Result of this research in line with reference [15] found that guided inquiry affect on metacognitive skill of students.

Metacognitive skills refers to three essential skill were planning skills, monitoring skills, and evaluating skills [16]. Steps in guided inquiry learning model had reflected metacognitive skill aspects. Founding problem phase, creating core of problem, make a hypothesis, and plan the problem solving (design experiments) in guided inquiry are planning aspects in metacognitive skills. Doing experiments phase, observation and data collection, and data analysis in guided inquiry learning are monitoring aspects in metacognitive skill. Making inferencial phase in inquiry are evaluation aspects in metacognitive skill. This shows that guided inquiry have integrated with metacognitive strategy and can be used to empower metacognitive skill of student.

At the planning phase, the students explore their thoughts to find out what previous knowledge they have, that will help them to complete the task, the students know what needs to be done first in order to help in completing the task, and the students plans the time management in planning the task [17]. When the students working on a sheet of metacognitive skills, students have used their prior knowledge to help in completing task. The prior knowledge is the knowledge, which students have gained in the material they have learned. Furthermore, in doing the problem of metacognitive skills, students know and formulate what things need to be done first in completing the task. Students have also arranged their time in working out the metacognitive skills question that can be seen from the timeliness of students in collecting answers about metacognitive skills.

Students also perform planning skills in completing tasks. As long as the students are planning (planning skills), students will ask themselves what information should be known based on the questions provided and the time needed to solve the problem [18]. If the student can know exactly the information provided in the question, then the student can determine what strategy is used to solve the problem.

In monitoring activity (monitoring skills), students take action to solve the problems, remember important information, and check whether it is on the right track. As long as the student performs the monitoring, the student will ask himself or herself what related information is important to remember and what to do to solve the problem. Furthermore, based on the information known in the question, the student can determine the further steps that must be done so that the problem can be solved.

In evaluating activity (evaluation skills), the student will check the conformity between what is known and the steps used to solve the problem. Students can ask themselves how well they have solved the problem. It is indicated by the expression of the students' reasons in determining the steps to solve the problem based on prior knowledge.

In Biology learning, guided inquiry is a very closely related to the laboratory activities. The inquiry presents students' involvement in laboratory using their own thinking process. These learning phases include focusing on students and explaining inquiry processes, presenting problems or phenomena, helping students formulate hypotheses to explain that problems or phenomena, encouraging students to collect data, formulate explanations, reflect problem situations and thought processes [13]. These activities require students to find their own concepts in solving problems related to animal structure

materials. It can empower students' metacognitive skills in thinking how they learn and understand the course material.

Laboratory activities require the existence of an active role of students to prove the hypothesis and analyze the results of practice in accordance with existing theories so that students can build their own understanding. It was stated that a learning model was required to help students involve in the lab activity [19]. Through guided inquiry, lecturer helps students to investigate the problem and discover and construct the concept by themselves. It can build metacognitive skills of students. In the process of discovery of the concept, students are encouraged to conduct monitoring of each stage carried out in guided inquiry. Because the inquiry stages of the students occur over and over again, the self-learning monitoring process also occurs more than once. Such conditions can stimulate the students' metacognition skills empowerment. It can causes the application of guided inquiry can improve students' metacognitive skills.

In line with this result of research, reference [20] concluded that the application of guided inquiry in chemistry learning enhanced metacognitive skills, particularly the planning skills. Associated with metacognitive awareness as measured by MAI (metcognitive awareness inventory), planning skills show the most dominant performance. To further improve students' thinking skills, metacognitive skills need to be trained periodically on subsequent lessons.

Similarly, research found that the metacognitive skills of students experience improvement in each face to face when tought by guided inquiry [19]. Research found that metacognitive skills have a positive relationship to learning outcomes. It means that the improvement of students' metacognitive skills will followed by the improvement of cognitive learning outcomes [10][21]. Its found that after implementation of guided inquiry, there was an improvement from pretest score to posttest of self-regulation skills, especially aspects of monitoring, followed by evaluation and planning [22].

Guided inquiry makes students construct concepts and discuss in concept discovery so that students gain more meaningful knowledge in the long term. Based on the results of the research, it suggested that metacognitive skills should be trained continuously so that students are accustomed to control the students' thinking, including self-planning, self-monitoring, and self-evaluation. Thus the students will be trained to become self-regulated learners. This is in line with arguements that metacognitive skills were useful for making the students become self-regulated learners, encouraging them to become their own managers as well as assessing their own thoughts and learning [23]. Therefore, lecturers need to apply learning strategies that not only emphasize cognitive development but more metacognitive aspects are also important to be empowered during learning process.

4. Conclussion

Based on the results of research and discussion, it can be concluded that there was the effect of implementation of guided inquiry toward students' metacognitive skills. The implementation of guided inquiry proved able to empower students' metacognitive skills higher than traditional learning. Lecturers can apply guided inquiry in other courses by considering the course material and students' characteristics.

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