

Inquiry Models One of the Alternatives in Improving Primary School Students' Scientific Process Skill

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Abstract: The process of teaching natural sciences in elementary schools is expected to emphasize the development of science process skills, conceptual understanding, conceptual application, and basing natural scientific activities on the current social and environmental issues in accordance with the students' ages and cognitive development. A scientific work in the dimension of science is a combination of scientific processes and scientific attitudes. As required by the science curriculum, the teaching of natural sciences should put an emphasis on the science process skills. A scientific work requires an improvement in the teaching quality of natural sciences to improve students' learning achievement, participation, science process skills, and scientific attitudes. The inquiry model is assumed to be able to reinforce the teaching quality of natural sciences in elementary schools. At the same time, the inquiry model is considered an alternative of development model in this study. This study is a descriptive experiment using the matched subjects design, in which a pre-test and post-test were conducted on students attending lessons on natural sciences in elementary schools (Sevilla,1993). A study of its like aims at describing the condition of an existing phenomenon objectively (Demsey,1996; Notoatmodjo,1993). The results revealed that there was a decline in the poor category from 70% to 10%. It goes to say that the inquiry model could improve elementary school students' science process skills including: observing, posing questions, clarifying, predicting, communicating, interpreting, formulating a hypothesis, planning an experiment, applying concepts, and concluding.

1 INTRODUCTION

The teaching of natural sciences plays an important role in the scientific need fulfillment of children at their age. Teaching science to elementary school students is not only about paying the teacher attention to them, but also about their scientific development under teacher guidance through problem identification process-based activities. When it happens, it should contain activities that can improve their science process skills.

The teaching of natural sciences in elementary schools is expected to interact with environments, and students are not only expected to understand scientific concepts and their application, but also to be able to develop values that are beneficial for themselves and the community in the future.

Therefore, the teaching of natural sciences in elementary schools should encourage students to internalize their learning experience, which in turn

will empower them to skilfully use their knowledge and skills to explain and solve problems in their everyday life. Similarly, it is also not wrong if science lessons develop scientific competence, knowledge, attitude, and behavior, in this case, through a teaching model that can improve scientific work-based science process skills.

A scientific work in the dimension of science is a combination of scientific processes and scientific attitudes. As required by the science curriculum, the teaching of natural sciences should put an emphasis on the science process skills. According to Karso in Nuryani (1992), students' understanding through the development of process skills will be more meaningful and linger longer more in memory, especially when they can practice it and do conceptual inquiry themselves. The core of teaching natural sciences is science process skills that enable students to do scientific activities such as observing, recording, analyzing data, and generalizing.

Studies show that the teaching process in elementary schools is generally teacher-centered and learning achievement of natural science subject is relatively lower than that of other subjects (Sardjono, 2000). Similarly, the result of an observation in a school, the teaching of natural sciences is too teacher-centered and text-book oriented. Students just sit, listen to the teacher, and take note. This makes learning less meaningful and students hardly remember what they learn.

During the lesson, teachers rarely use teaching properties even though the school provides them. As a result, students are made not used to doing an experiment. Students' low participation in a group or class discussion harms the development of their science process skills, scientific attitudes, scientific conceptual understanding. The teaching objectives do not put an emphasis on science process skills. As a result, the learning outcomes set by the curriculum are not optimally achieved. Science process skills are intellectual skills frequently used by scientist and could be used in science class to understand certain phenomena. Inquiry method makes learning more meaningful to students, especially when the instructional materials are related to their prior knowledge (Semiawan, 1990).

Another fact found in the field is that teachers are not well-prepared to carry out the teaching of natural sciences where science process skills become the learning goal. They often make an excuse that science process skills are never there in the final examination. Instructional activities are too focused on training students to do exercises in the course book or tests. If it continues to go this way, the learning objectives as set by the curriculum will never be achieved.

Some studies found many weaknesses in the teaching of natural sciences in elementary schools; among others, according to Supriyono (2003) are: (1) The most dominantly used method in science class is lecture where the teacher acts as a controller and information transmitter, (2) the course book becomes the sole material source, (3) the focus of teaching is to train students to do exercises available in the course book, (4) demonstration is rarely carried out in the classroom, so students act as passive participants, and (5) inquiry method is never done in the classroom because it is deemed to waste time, and the most frequently done activity is doing exercises in the student worksheets (LKS) and the course book.

Considering the above facts, it is urgently needed to improve the quality of teaching and learning

process of natural sciences in elementary schools as required by the curriculum.

An improvement in the teaching quality of natural sciences is badly needed to improve students' learning achievement, participation, science process skills, and scientific attitudes. The inquiry model is assumed to be able to reinforce the teaching quality of natural sciences in elementary schools. At the same time, the inquiry model is considered an alternative of development model in this study. The bases for choosing the inquiry model as an alternative in this study are: (1) this model encourages students to make inquiries, (2) this model can improve students' critical thinking skills, (3) this model can develop science process skills, (4) this model enable students to apply his knowledge in everyday life, (5) this model can equally develop cognitive, affective, and psychomotor domains, so the learning is more meaningful, and (6) this model corresponds to the development of modern psychology which views learning as a process of behavioral change as a result of experience. This description indicates that the teaching of the natural sciences is an active teaching both physically and mentally.

According Mulyasa (2008), it is better that the teaching of natural sciences is carried out using scientific inquiry model to develop the ability to think, work, and behave scientifically. Therefore, teaching natural sciences in elementary schools emphasizes direct experience through the development of science process skills and scientific attitudes (Depdiknas, 2006). Similarly, according to Joyce (1980), the use of inquiry method can improve scientific understanding, creative thinking skills, and skills to acquire and analyze information.

This study seeks to answer the following research question: can the use of inquiry model in teaching natural sciences improve elementary school students' science process skills?

This descriptive experiment used the match subjects design with the focus on the development of science process skills in science class in elementary schools. The descriptive analysis was done on science process skills developed through the natural science teaching activities using the inquiry model in elementary schools.

2 RESEARCH METHODS

The study was conducted by comparing the pre-test scores of science process skills with the post-test scores.

This study is a descriptive experiment using the matched subjects design, in which a pre-test and post-test were conducted on students attending lessons on natural sciences in elementary schools (Sevilla, 1993). A study of its like aims at describing the condition of an existing phenomenon objectively (Demsey, 1996; Notoatmodjo, 1993).

The research instruments included: (1) science process skill test, (2) student activity observation sheets, and (3) observation sheet of inquiry model implementation in the teaching of natural sciences in elementary school.

The pre-test scores represent the elementary school students' science process skills.

3 RESULT AND DISCUSSION

The results revealed that there was an improvement in the elementary school students' science process skills including: (1) observing, (2) posing questions, (3) clarifying, (4) predicting, (5) communicating, (6) interpreting, (7) formulating a hypothesis, (8) planning an experiment, (9) applying concepts, and (10) concluding.

3.1 Research Result

3.1.1 Test Result

The pre-test scores and percentage before the implementation inquiry model and the post-test scores and percentage after the implementation inquiry model indicate an improvement in the science process skills. The percentage of the average test score is presented in the following table:

Table 1: The Scores of Pretest and Post-test of Science Process Skills.

Treatment	Poor		Fair		Good		Very Good	
	X	%	X	%	X	%	X	%
Pretest	7	70	2	20	1	10	-	-
Posttest	1	10	3	30	5	60	-	-

The above table shows that the percentage of average score science process skills before the implementation of inquiry model was 70%, and it significantly declined to 10% after the implementation of inquiry model. It indicates that the elementary school students' science process skills improved after the implementation of inquiry-based teaching in the science class.

3.1.2 Result of Observation of Student Activities

The description of student activities was obtained through an observation by an observer. The observed aspects were: (1) observing, (2) posing questions, (3) clarifying, (4) predicting, (5) communicating, (6) interpreting, (7) formulating a hypothesis, (8) planning an experiment, (9) applying concepts, and (10) concluding.

The observer noted every aspect of science process skills found in the student activities during the teaching process. The results of observation were as follows:

- At the first meeting, students generally were unable to do the observation well. It was seen in the non-optimal use of all sense organs that could be used to describe the characteristics of a particular object and its relationship with another object. Students generally were just doing a direct observation. At the following meeting, they seemed to get used to doing an observation using other sense organs because most students were able to do an observation correctly.
- At the first meeting, students generally were not able to pose questions or express opinions. At the following meeting, they started to pose questions and express opinions. Students should be trained to question what, why, and how during the class meeting.
- Students did not seem to find any difficulties in doing a classification, be it at the first and the final meeting. The observer categorized student's skills in doing classification good.
- Students seemed to find difficulties in predicting. Therefore, this skill was categorized poor by the observer. However, at the following meeting, there was a creating phase, and this improve their skills to predict.
- Students communicating skill were deemed fair at the first meeting because this skill was frequently used in the teaching and learning process. However, at the following meeting, it was deemed good.
- Interpreting skill is one of difficult aspect to be mastered by students. It was deemed low by the observer. At the next meeting, this skill slightly improved and was deemed fair.
- Students also found difficulties in formulating a hypothesis. Thus, the observer gave a poor category for this skill. However, at the next meeting deemed it good. Students' skill to formulate a hypothesis was trained in the

discussion and reflection phase available in the inquiry model considering that the required hypothesis was just predicting a deductive thing.

- In inquiry-based instruction, students are always asked to plan an experiment. Therefore, even at the first meeting their skill to plan an experiment was deemed good, considering this skill only required students to prepare tools and materials before the experiment.
- Applying concepts was found difficult by elementary school students. It was due to the fact that their conceptual understandings were not at the same level. Therefore, this aspect was deemed poor at the first meeting. However, at the following meeting they could applied simple concepts.
- At the first meeting, student's skill to draw a conclusion was deemed fair. It was less meaningful to the students since the conclusion was drawn from a conceptual description. However, at the following meeting, the observer considered this aspect good. This happened because in the inquiry model, students were only expected to draw a conclusion by generalizing the results of a series of experiments, regardless of that the process was under guidance of the teacher.

Observation was also carried out to record the activities of the lecturer who acted as the model teacher in this study. The observers were his fellow lecturer and an elementary school teacher.

During the conduct of the study, the writer found some important things to note considering that this study will provide invaluable recommendation for elementary school teacher education lecturers with the concentration in science education who will give lectures to prospective elementary school teachers.

What follows are some major findings of this study:

- Elementary school student's science process skills cannot be developed if the teaching of natural sciences is only focused on explaining what is written in the course book and students are only made sit, silent, listen, and take note.
- At the first meeting, most students did not have science process skills. 90% of 10 science process skills tested were deemed not good. This is due to the fact that the teacher was not accustomed to using a teaching model that emphasized the provision of direct experience through the development of science process skills and scientific attitudes as mandated by Depdiknas (2006).

- The inquiry model could be used as a natural science teaching model with five phases: asking, investigating, creating, discussing, and reflecting. This model was proven to significantly improve elementary school students' science process skills. This is in line with Harlen's (1990) opinion that the meaningfulness of learning natural sciences highly relies on student active participation in the lesson. Therefore, scientific inquiry method is suggested to be applied to teaching natural sciences in order to develop skills to think, work, and behave scientifically.

4 CONCLUSIONS

Based on the result of data analysis and research findings, it was concluded that the inquiry model could improve elementary school students' science process skills. It was evident in the following findings:

There was an improvement in elementary school students' science process skills as a result of the application of inquiry model to teaching natural sciences in elementary school so that students could perform a scientific inquiry using a proper scientific framework. The result of this study confirms a previous research conducted by Deur and Harvey (2005), which suggested that the inquiry teaching strategy significantly affected students' conceptual understanding and learning outcomes.

Elementary school students earned experience of learning natural sciences through an inquiry model that can improve their science process skills in addition to other skills such as the skill to think, work, and behave scientifically. This is in line with Balim's (2009) opinion that learning through an inquiry model can improve students' cognitive and affective domain.

Science lecturers in the elementary school teacher education earned a practical experience of improving students' science process skills through the implementation of inquiry model.

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