The effectiveness of integrated science learning using cooperative learning model of group investigation type

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Abstract. Science learning in Junior High School is conducted through theoretical, practicum rarely done. The subject matter of science is not yet integrated. The ability of students in investigating is still low, consequently there are still many students who have not mastered in learning science. One of the efforts to improve the student investigation ability is to apply cooperative learning model of group investigation type. The aim of this research is to know the effectiveness of integrated science learning to improve the student competence. The research used quasi experiment method with pre-test post-test group control design. The subject of research is eighth grade students in Junior High School. Data were collected using observation sheets, test, and a questionnaire. The result of research shows that integrated science learning effective to improve student competence, based on (1) mastery learning of integrated science has been achieved by most students, (2) improving the student’s competence including the high category, (3) the average of the students competence in the experiment class are better than the control class, (4) the majority of students stated that integrated science learning can be implemented.

1. Introduction
Education is important to produce the quality human resources and are able to compete in the various changes and challenges. Education can form an intelligent, responsible and democratic nation. Education reform must be conducted continuously to improve the quality of education that has a positive effect towards improving human resources. To achieve educational goals the government has made various efforts to improve the quality of education such as improving the curriculum, improving educational facilities and infrastructure, and improving the quality of school management. Through various efforts that have been made, the government expects the national education goals to be realized [1].

Natural science (science) is a subject that students learn in an integrated. Science has three components, namely the scientific process, scientific products, and scientific attitudes. The scientific process includes observing, classifying, predicting, designing, and conducted experiments. Scientific products in the form of fact, concept, principle, law and procedure. Scientific attitude in the form of curiosity, careful, objective, and honest. Students must have the skills to investigate natural phenomena in a scientific stage to gain knowledge.

Efforts that have been made by the government to improve the quality of students not optimal, the fact shows that the student learning outcomes in science lessons in junior high schools are still low, and many students have not mastery learning the science. Based on the results of interviews with teachers and students it was found that student learning outcomes were low because students were less
motivated so students had difficulty mastering the subject matter. Science learning activities still use the lecture and discussion methods, practicum is rarely done. The learning process is teacher-centered, student was not involved in the learning process. This is due to teachers’ concerns that with the implementation of student-centre learning models, subject matter cannot be completed on time. As a result students lack the opportunity to develop their creativity. Science subjects are not yet integrated. The ability of students to conduct investigations is still low, as a result there are still many students who have not mastered science learning.

As one alternative to solving the problem of students learning outcomes are implementing cooperative learning model of group investigation type. Group investigation learning is very well used to develop academic inquiry, social integration, and social processes in learning [2]. In the cooperative learning of group investigation type students will experience meaningful learning if they are able to conduct the steps of scientific investigation [3]. The implementation of the group investigation model can improve student learning outcomes [4].

Through the implementation of the learning model of group investigation students are required to think creatively so that problems can be found a solution. This is supported by the opinion of Gangoli which states the investigative activities in science learning are intended to develop scientific skills, mastery of concepts, cognitive abilities, creative thinking, and scientific attitudes [5].

Science investigative ability is the ability that requires students to think about, develop, and investigate science problems in depth based on their thinking abilities. The relationship of group investigation with science investigative ability is that students must use their thinking skills in solving natural science problems. Science investigation activities are very dependent on the interest and differences in the ability to think of each student in solving problems [6].

Group investigation learning models involve students in discovery. Students are active in asking questions, proposing solutions, predictions, observations, organizing data, and concluding the results of the investigation. Students choose their own topics to be studied and the group agrees on the division of work to conduct the investigation. Group work results are reported as class discussion material. Evaluation of activities is conduct through individual work during the investigation. In the implementation of the group investigation model, students are grouped heterogeneously based on gender, ability, and ethnicity.

In each group there are students with low, medium and high abilities. In completing assignments, members group was work together and help to master the subject matter. Learning has not been completed if one of the students in the group has not mastered the subject matter [7]. The cooperative learning models have several characteristics, namely: (1) team learning; (2) based on cooperative management; (3) willingness to cooperate; and (4) cooperative skills [7]. The elements that must be possessed by cooperative learning models are: (1) positive interdependence, (2) individual responsibility, (3) face-to-face interaction, (4) implementation of collaborative skills, (5) work in group [8]. Learning of group investigation type is one of the cooperative learning methods that require students to use high-level thinking skills and emphasize heterogeneity and cooperation between students, the teacher acts as a facilitator [9].

Based on the conditions of natural science learning that have been described, research is conduct to integrated science learning using cooperative learning model of group investigation type. The research problem was formulated as follows: How was effectiveness of integrated science learning use cooperative learning model of group investigation type to improve student competence? The purpose of the research was to determine the effectiveness of integrated science learning using cooperative learning model of group investigation type to improve the student competency.

2. Methods
The quasi-experimental method with the pretest-posttest control group design use this research[10]. Pre-test and post-test were given to the experiment class and control class students use the same questions. Students in the experimental class conducted the learning by group investigation model. Control class students conducted the lecture method. The research was conducted on seventh grade
student of SMP Negeri 1 Bukittinggi in science subjects. The research instruments were: observation sheets, tests of science concepts mastery, and questionnaires.

The effectiveness of learning based on competency and student response. Students' competence improvement was analyzed by calculating the average normalized gain scores from the pre-test and post-test scores. The difference of students' competence in the experimental class and the control class was analyzed using the t-test. Student response on the learning implementation was analyzed by comparing the score with the category score.

3. Results and Discussion

The effectiveness of cooperative learning of group investigation type to improve student competence in terms of: (1) student learning mastery, (2) improving students' competencies, (3) differences in students' competence in the experimental class and control class, (4) students' response to the learning process. Then each of this aspect was analyzed to determine the effectiveness of the learning model.

3.1. Student Learning Mastery

The student's learning mastery of the knowledge domain seen from the post-test. The post-test conducted at the end of each session (face to face). The students' learning mastery can be seen in Table 1.

| Session | Average | Learning mastery (%) |
|---------|---------|----------------------|
| 1       | 77.3    | 71.9                 |
| 2       | 80.9    | 84.4                 |
| 3       | 82.3    | 78.1                 |
| 4       | 85.1    | 87.5                 |
| 5       | 87.6    | 90.6                 |
| 6       | 89.8    | 100                  |

The each session has an increased percentage of students' learning mastery (Table 1). The average of students' learning mastery for all sessions was 83.8 and 85.4% of students mastered the learning. In terms of the students' learning mastery can be stated that the science learning is effective in improving the students' competence.

3.2. Improvement of Student Learning Outcomes

Improvement of student learning outcome was analyzed by a normalized gain score. The student's learning outcome was increased at each session (Table 2). At the sixth session, the gain score was at the high category.

| Sessions | Pre-test | Post-test | Gain score | Category |
|----------|----------|-----------|------------|----------|
| 1        | 72.4     | 77.3      | 0.40       | Medium   |
| 2        | 72.4     | 80.9      | 0.49       | Medium   |
| 3        | 72.4     | 82.3      | 0.53       | Medium   |
| 4        | 72.4     | 85.1      | 0.60       | Medium   |
| 5        | 72.4     | 87.6      | 0.67       | Medium   |
| 6        | 72.4     | 89.8      | 0.73       | High     |
3.3. Difference of Student Learning Outcomes

The test result of data distribution normality show that data is normally distributed. The test result of data homogeneity obtained that the data is homogeneous. The students learning outcome of the experiment class and the control class before learning were not significantly different. The results of testing the hypothesis obtained that there are differences in learning outcomes between students who conducted learning with the cooperative learning model of group investigation type and students who conducted learning with the lecture model. Learning outcomes of students who use the cooperative learning model of group investigation type are better than the learning outcomes of students who use the lecture model.

3.4. Response of the Student

The student response questionnaire to the learning implementation consists of 15 items with 4 answer options. The data analysis of students’ response to the implemented of cooperative learning model of group investigation type shows that the average score of student response of 53.5 with deviation standard of 5.6 and include the very good category. This shows that most students can implemented the integrated science learning using cooperative learning model of group investigation type.

3.5. Discussion

The first stage of the group investigation learning model is determined the topic of the problem to be studied. At this stage students must know the learning material to be studied so as to be able to determine topics that are in accordance with the learning material to be studied. Students must read and learn first the learning material to be studied so that they understand the learning material being studied. The reading activities are one way to understand subject matter[11]. Students who diligently read subject matter will more quickly understand the subject matter. The second stage of the group investigation learning model is to plan tasks that will be carried out in accordance with a predetermined topic. At this stage students must understand the learning material that is relevant to the learning material being studied so that there is no confusion about the subject matter [12]. Reading learning material that is relevant to the learning material being studied can add insight to students.

The third stage of the group investigation learning model is conducting an investigation in accordance with the investigation plan that has been made. At the group investigation stage each group is required to investigate and collect data on the topics discussed. One way to do this is to read and summarize the textbooks. Summarizing activities carried out by students can improve their cognitive abilities [13]. All students are involved in learning activities. The active role of students in learning activities can improve students' cognitive abilities, because they conduct learning activities directly so that they get their own learning experience. Students learn more when doing an activity actively rather than just seeing and listening [14]. The fourth stage of the group investigation learning model is to prepare a final report. At this stage all group members work together to prepare reports. The fifth stage of the group investigation learning model is to present the final report. The final report is presented in front of the class by each group. The final report presentation requires a good understanding of the learning material in order to be able to present the final report with a firm and straightforward and confident in front of the class. Cognitive and affective abilities affect a student's confidence [15].

The sixth stage of the group investigation learning model is evaluation. At this stage students are given the opportunity to respond to the appearance of their friends who have presented the report in front of the class. All students have the same opportunity to respond to the appearance of their friends. Responding to a person's appearance requires a good understanding of the learning material being studied. Good understanding of the learning material will enable students to responses and inputs that are in accordance with the learning material being studied. Group investigation models influence the improvement of student learning outcomes [16]. Students work together to find the information needed in accordance with the topics discussed. Students become active so that the learning material learned can last long time in students' memories. The knowledge can be long time in students' memory if learning activities involve students as active learners[17].
Heterogeneous group division greatly helps the formation of interaction between students during learning activities. Each group member constructs learning material and discusses with other group members to check comprehension and equate perception in groups. This interaction is able to build collaboration and mutual support to improve learning outcomes of each group member. Heterogeneous groups provide opportunities for peer teaching [18]. The genius students can teach their friends who are less intelligent and students who are less intelligent can ask to genius students if there are learning material that is not yet understood.

Each group can work together well if its members respect each other. One of the positive results of cooperative learning is that students have concern for other students [19]. The good communication between group members can affects the group's success in completing tasks. Group investigation models provide opportunities for students to be able to work together with their groups. Group investigation learning models can develop the habit of working together of students [20]. All stages in the group investigation learning model are able to develop social attitudes of students. Group investigation learning models require high social interaction in students. The group investigation model can build students' leadership attitudes and social skills, and involve students in learning activities that can build cooperative habits [21].

At the stage of presenting the final report, students are required to present the results of their group discussions. The presentation of the results of the investigation can improve students' understanding of the learning material being studied. The task of presenting the results of the investigations is able to improve students' understanding [22]. The presentation of the final report requires the courage of students in front of the class in front of all their friends. Self-confidence and enhancement of students' cognitive and affective competencies can influence students to dare to express their opinions in front of all their friends. Cognitive and affective abilities affect a student's self-confidence [15].

At the evaluation stage, students are given the opportunity to respond to final reports by their friends. This stage trains students' courage to express their opinions in public. The courage of a student to express his opinion in public is not only influenced by internal factors, but external factors such as class conditions can also influence the courage of students to express their opinions. Conducive class conditions can bring up the courageous attitude of students to speak in public [23]. The assessment to the group is able to increase the motivation of each group to compete to be the most superior group. The assessment can be in the form of awards to the most superior groups. One stage in cooperative learning is team appreciation [24]. Team awards can help improve student learning outcomes.

4. Conclusion
The results research show that integrated science learning using cooperative learning model of group investigation type was effective to improve the students’ competence based on: (1) mastery learning of integrated science has been achieved by most students, (2) improvement of student learning outcome including the high category, (3) the average of the students learning outcome in the experiment class are better than the control class, (4) the majority of students stated that integrated science learning can be implemented. The physics teacher was expected to be able to implement the integrated science learning using cooperative learning model of group investigation type.

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