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A COMPARISON STUDY: EFFECTS OF THE GROUP INVESTIGATION MODEL AND THE DIRECT INSTRUCTION MODEL TOWARD SCIENCE CONCEPT UNDERSTANDING

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ABSTRACT

This study aimed to compare the effects between the group investigation model and the direct instruction model toward science concept understanding in non-science first-year students. This study was a quasi-experimental research with the posttest-only control group design. This research was conducted in the Basic Sciences class in the first semester of the Islamic Education study program at Pangeran Diponegoro Islamic Institute, Nganjuk. This study used a purposive sampling technique, with one class as a control group and another as an experimental group. The type of study was a quasi-experimental research with 2x2 nonequivalent control group design factorial design. The data were analyzed using one-way ANOVA with SPSS for Windows. The test results showed that there was a difference in the average value of learning outcomes of students' understanding in the two treatment classes, that is, the average value of learning outcomes by students experiencing group investigation model was 76.63, while the average value of learning outcomes by students experiencing the direct instruction model was 71.16. These results indicated that the investigation group had a better effect than the direct instruction model on the learning outcomes since the significance value was smaller or less than alpha 0.05 (0.000 <0.05), which means that the two models applied had different influences towards learning outcomes of students' understanding. Similarly, the average value of students who were taught by the group investigation model with high and low achievement motivation was also better than the direct instruction model with high and low achievement motivation. The analysis test showed a significance value of 0.002, which was smaller than 0.05 (0.002 <0.05). It means that the group investigation model and student achievement motivation had a better influence on the learning outcomes on the students' understanding of basic natural science concepts compared to the direct instruction model.

Keywords: group investigation, direct instruction, understanding concepts, science

INTRODUCTION

Basic science is one of the knowledge that everyone must have (Aysan, 2015; Deckelbaum et al., 2011). This course contains a collection of knowledge about the basic concepts of science and technology besides examining events that occur in the universe. Thus, Basic Sciences is often referred to as Science. The Basic Sciences learning objective is to provide students with a broader understanding and insight into the sciences (Hartoyo, 2018; Sari, 2009). It is assumed that science is very important for students to understand themselves and their surrounding phenomena as well as to examine the possibility of applying science in everyday life.

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Concept understanding is an essential factor to achieve an expected goal and an obligatory requirement to accomplish successful learning (Marlina & Yuliati , 2017; Laksana, 2017). Hailikari et al. (2008) and Jbeili (2012) state that understanding concepts is the ability to link relationships between newly acquired knowledge and prior knowledge. In addition, the indicators of concept understanding include seven cognitive processes: the ability to interpret, to give examples, to classify, to summarize, to draw inference/ to make a conclusion, to compare, and to explain (Anderson & Krathwoh, 2001). Science concepts understanding is very advantageous for students to solve problems that occur in everyday life (Anderson & Krathwoh, 2001; O'Dwyer et al., 2015). Therefore, understanding the full scientific concepts is imperative for students to understand natural phenomena better in everyday life.

However, the learning process of basic science has not been able to provide a deeper understanding of science concepts for students since the learning objective is simply providing students with concepts (Suja, 2017), focusing on memorizing the theories (Widyasari et al., 2018; Winarsih & Mulyani, 2012; Yen & Halili, 2015). In addition, the learning process is teacher-centered since it is only the teacher who is usually active in the classroom (Adhitama, 2015; Syafi'Kharitsa et al., 2016; Maretta, 2016; Margiastuti et al., 2015; Widyasari, 2018). These scholars also suggested that an effective and enjoyable science learning process must be student-centered in which students keenly take part in the learning process. The learning activity that encourages students to actively participate in the classroom will make students understand the concepts that have been learned better (Awang & Ramly, 2008; Khusniati & Pamelasari, 2014; Yadav et al., 2011).

The learning quality improvement must be continuously done by applying learning strategies that can stimulate students' participation. As a result, the students master not only knowledge/ concept but also an experience of the theory after the teaching-learning process (Amnah, 2014). The learning process is an effort to make students do the learning (Degeng, 2013). One vital component of learning that determines the success of the learning process relies on how the teacher/lecturer chooses and applies an appropriate teaching-learning model (Hartini et al., 2014; Suyitno et al. 2016). The selection and application of the group investigation model by lecturers on Basic Sciences learning in the initial semester of the non-science study program are very applicable. Most of the students were from social and religious major, hence they are not aware of the importance of science in everyday life.

Some researches have shown that the group investigation model could have a positive effect on the accomplishment of learning outcomes. Similarly, Akcay & Doymuş (2012), Simsek et al. (2013), Damini & Surian (2013) and Hosseini (2014) conclude from their research that the group investigation model has a positive effect on pedagogical objectives. In the same way, the results of the research by Asrial & Dwijaya (2014), Rusdiyana (2017), Siregar (2016), and Oktaviani & Diani (2018) show that the group investigation model has a significant influence on the understanding of the scientific concepts. In short, those studies have confirmed that the group investigation model is one of the effective learning models that gives a positive impact on learning outcomes, specifically students' science concepts understanding.

The group investigation model is a cooperative learning model in which students work together in a small group to investigate a learning topic (Kagan 1994; Slavin, 1990). The investigation group model was initially designed by Hebert Thellen then revised and improved by Sharan and his colleagues at Tel Aviv University in 1970 (Hosseini, 2014; Slavin, 1996). Through the investigation model, students can acquire knowledge through experiencing (Odom & Bell, 2011) and provide opportunities for students to be more active, independent, and creative in the learning process (Degeng, 2013). There are 6 steps in the group investigation model, starting with (1) identifying topics and grouping arrangements for students; (2) planning the tasks to be learned; (3) investigating the topic; (4) preparing the results in form of reports; (5) presenting the result; and (6) evaluating each stage (Sejpal, 2013; Slavin, 1996).

The above description shows that the investigation group model is a student-centered learning model which engages students' involvement during a classroom activity. From the first stage to the last, the model encourages students to actively participate in the activity. Thus, this model is appropriate to help non-science students in understanding a new concept. Therefore, this research analyzes the use of the group investigation model to improve non-science students' understanding of science concepts in the first semester.

So far, there has been no comparative study between Group Investigation (GI) and Direct Instruction (DI) with three variables, i.e., the independent variable, the dependent variable, and the moderator variable. As for the comparative study between GI and DI, no studies has been

accompanied by moderators of achievement motivation. A research conducted by Asrial & Dwijaya (2014) uses three variables, but in this study, the moderator variable is limited to learning motivation. Motivation to learn is a non-intellectual psychological factor that becomes as an encouragement of passion and enthusiasm in learning (Sardiman, 2000), while achievement motivation is the desire to obtain achievement with established standards (Degeng, 1997). Furthermore, a research done by Sunardjoand SukoWiyono (Widyasari et al., 2018) also uses three variables, but the independent variables are contextual models and conventional models instead of GI and DI.

In line with the applied learning model, the characteristics of students in terms of achievement motivation also influence the learning outcomes of conceptual understanding. Learners will be able to achieve the learning outcomes of a more maximal understanding if they are not only limited to learning motivation but they must also have achievement motivation. Achievement motivation can be influenced by the learning model applied. Two sides of the learning model between GI and DI, accompanied by achievement motivation, certainly have differences in the achievement of learning outcomes in the students' understanding of concepts. Achievement motivation is an important factor for learning and achievement for students in the school (Rehman & Haider, 2013). Achievement motivation is a desire to achieve achievement by established standards (Degeng, 1997). The difference in achievement motivation in each student will differ, the learning outcomes. The higher the achievement motivation in students, the higher the achievement of learning outcomes (Lee & Liu, 2009).

METHODS

This study used a nonequivalent control group design. In this study, there were two research classes as independent variables, namely the experimental class and the control class. When referring to a comparative study between GI and DI, the independent variable is conceptual understanding. The experimental class is treated with a model of cooperative learning investigation group type, and the control class is taught by the direct instruction model. The moderator variable used was high and low achievement motivation. Meanwhile, the dependent variable is the result of understanding learning. Understanding of concepts refers to the ability of learners to connect new concepts with concepts they know to describe situations in different ways (Holme et al., 2015; Jbeili, 2012). In terms of understanding, this concept consists of indicators of understanding concepts in Bloom's taxonomy revised by Anderson & Krathwohl (2001) which includes the ability to interpret, give examples, classify, summarize, conclude, compare, and explain. To test the hypothesis, this study used a 2 x 2 factorial design to determine the effect of independent variables on the dependent variable, the effect of the moderator variable on the dependent variable, and the influence of the interaction of independent variables and moderator variables. The factorial design is 2x2, according to Setyosari (2009), as in Table 1 as follows:

Table 1. Factorial Design 2 x 2

Independent Variable / **Moderator Variable**		**Learning Model**	
		Cooperative Learning Model type of Group Investigation (K_1)	**Direct Instruction Model (K_2)**
Achievement motivation	High (M_1)	$K_1 M_1$	$K_2 M_1$
	Low (M_2)	$K_1 M_2$	$K_2 M_2$

M_1 . = High achievement motivation,
M_2· = Low achievement motivation,
K_1 = Model GI,
K_2· = Model DI

This study is a quasi-experimental research with a post-test to only control group design. Convenience Sampling technique was used to choose the sample because it has specific criteria in deciding the sample. Determining the respondent as the experimental class and the control class was done through a purposive sampling technique with the assumption that the students who are the subjects of the classes are homogeneous. Meanwhile, the whole class from a similar study program is PAI. This technique was used because of several considerations including the highest number of students who were from other study programs, students having a low understanding of Natural Sciences because most of them came from high school/MA majoring in social studies, and Basic Natural Sciences learning that was was limited to only the introduction of material that has not yet been directed towards understanding. The aim of the researchers was to better the level of non-exact students (PAI) understanding of Basic Natural Sciences material. With understanding,

PAI students can integrate the science of religion and science in their environment. Furthermore, there were 137 students involved in this study. Of the seven meetings conducted (including pretest and posttest), only 124 students participated in the full study. Subjects not included in the analysis were those who were absent (permit and illness) and did not actively participate in either the pretest or the posttest. The data analysis in this study was divided into two, one to test requirements for analysis and another to test the research hypothesis. For test requirements, the analysis was in the form of data normality test and variance homogeneity test. Data normality test used the Kolmogorov-Smirnov technique and test the variance homogeneity used Leven's test. Data normality test and data homogeneity test were used to fulfill the pharmaceutical assumptions as Test of Variance (ANOVA) test requirements. Data analysis to test the research hypothesis used the two-way Analysis of Variance (ANOVA) statistical technique with the help of the SPSS for Windows program and all the parametric assumption tests were carried out at a significance value of 5% ($\alpha = 0.05$). The sample was students of Islamic program in the first semester of 2018/2019 academic year. The 124 students participating in the study were divided into two class. The classes have been formed before, as the research design was planned and structured by the researchers to obtain answers of research questions. The research design used in this study was a quasi-experimental research design, because the selection of research subjects was not random, instead, they were taken from existing classes that have been structured by the educational institution (the place where the research was conducted). Therefore, there were two classes namely the experimental class and the control class available as they are and are not random or randomly selected (Setyosari, 2009). The classes taken were 1 A and 1 C (experimental class) consisting of 60 students, and class 1 B and 1 D (control class) consisting of 64 students.

In this study, there are three variables; the understanding of the concept model is the independent variable, and the dependent variable is the science concept understanding. The research instrument used was a test to measure the understanding of science concept. The instruments used to obtain data in this study consisted of (1) tests of understanding the concept of IAD material by using pretest and posttest in the form of essay tests used to determine the learning outcomes achieved by students, and (2) achievement motivation questionnaire to identify achievement motivation of learners. The test was an essay test consisting of 10 items. Of the 10 items in question, 3 items were invalid, and 7 items were valid. The reliability of 7 items of test questions obtained a value of 0, 780. Based on the interpretation of the magnitude of reliability coefficient according to Arikunto (2013) which consists of very high (0.80-1.00), high (0.60-0,799), sufficient (0 , 40-0,599), low (0,200-0,399), and very low (0,00-0,20), the 7 questions were included in the High and reliable categories that can be used for research.

Concept Understanding Test

Tests for understanding IAD concepts were derived from IAD subject matter for semester 1 students (one) in Islamic Education study programs. The concept of the understanding test in this study is in the form of an essay test consisting of 10 questions. This comprehension test was compiled based on indicators of understanding cognitive learning outcomes (C2) with operational verbs in the revised Bloom taxonomy (Anderson & Krathwoh, 2001), including (1) interpreting, (2) exemplifying, (3) classifying, (4) summarizing, (5) concluding, (6) comparing, and (7) explaining. Furthermore, the scoring of each item refers to the concept understanding assessment rubric by Setyowati (2009) which consists of (1) score 4 for correct answers and contains all scientific concepts, (2) score 3 for correct answers and contains at least one scientific concept and does not contain conceptual errors, (3) score 2 for answers giving partially correct information but also shows conceptual errors in the explanation, (4) score 1 for answers that show fundamental errors about the concepts being studied, and (5) score 0 for wrong answers, irrelevant, repeat questions, or blank answers.

Achievement Motivation Questionnaire

The achievement motivation questionnaire was compiled based on the characteristics of achievement motivation. The achievement motivation questionnaire used by researchers was one compiled by I. Nyoman S. Degeng.The questionnaire consists of 14 items on the Likert scale method. The indicators of achievement motivation includes having high responsibility, having work programs based on concrete plans and objectives and trying to make them happen, having the ability to make decisions and dare to take risks, doing meaningful work and completing tasks with satisfactory results, and having the ability to be the

best in a particular field. Afterward, the test result was tested for its validity and reliability. Then the test result was analyzed by using SPSS with the one-way ANOVA test. Eventually, the hypothesis was made on whether to accept or reject the alternative hypothesis. The result of test normality and homogeneity shows the significance level of 0.05, with a significance value greater than α (Sig> 0.05). The alternative research hypothesis was accepted if the significance value is smaller than α (Sig <0.05). On the other hand, if the significance value is greater than α (Sig> 0.05), the alternative hypothesis of the study is rejected.

RESULTS AND DISCUSSION

Before doing research and giving treatment, students who would be involved in the study were given a pretest to find out their initial abilities.An essay test with 7 items with material knowledge of the basics of basic natural sciences were given. The pretest results were presented in the table as follows:

Table 2. Pre-test Results of Learning Concept Understanding

	N	Min	Max	Mean	Std. D
Pretest (Experiment class)	60	43	71	58.10	8.235
Pretest (Control class)	64	39	75	58.53	8.547
Valid N (listwise)	60				

Table 2 shows that the average score of the pre-test results on the learning outcomes of understanding the concept of the experimental class (class model cooperative learning type group investigation) is 58.10 with a standard deviation of 8.235. Meanwhile, the control class (direct instruction model class) obtained an average score of 58.53 with a standard deviation of 8.547. The differences in the initial ability of conceptual understanding in the two treatment classes are presented in the Table 3, as follows:

Table 3. One Way Test Results Analysis of Variance (ANOVA) Pretest Score Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.759	1	5.759	.082	.776
Within Groups	8603.338	122	70.519		
Total	8609.097	123			

Table 3 shows that the pre-test results of the learning outcomes of conceptual understanding between the experimental class and the control class with a significance value of 0.776 (p> 0.05). It means that there are no significant differences in the pre-test results of learning outcomes in understanding concepts between experimental classes and control class.

Table 4. Post-test Results of Learning Concept Understanding

Class	Motivation Level	Mean	Std. D	N
GI	High	79.71	5.380	31
	Low	73.55	4.610	29
	Total	76.73	5.868	60
DI	High	71.09	6.354	35
	Low	71.24	5.956	29
	Total	71.16	6.129	64
Total	High	75.14	7.300	66
	Low	72.40	5.406	58
	Total	73.85	6.602	124

The post-test results of understanding concepts in this study were obtained from essay tests of conceptual understanding after the students got treatment with a model of cooperative learning, investigation group type, and direct instruction model. The post-test results of concept understanding are presented in Table 4.

Table 4 shows that the learning outcomes of understanding the experimental class concept, namely the class that used a model of cooperative learning group investigation type with high achievement motivation obtained an average score of 79.71, a standard deviation of 5.380, N of 31 learners. Meanwhile, students who have low achievement motivation get an average score of 73.55, standard deviation of 4.610, and N of 29. Furthermore, the results of learning conceptual understanding in the control class taught by using the direct instruction model with high achievement motivation obtained an average score of 71.09, standard deviation of 6.354, and N as many as 35 students, while students who have low achievement motivation obtained an average score of 71.24, standard deviation of 5.956, and N of 29 students.

The value of the post-test results of learning the understanding of student concepts in both classes shows that there were significant differences between the experimental class (class model cooperative learning type inves-

tigation group) and the control class (direct instruction model class). The mean value of the post-test results of the learning concept understanding in the experimental class (class model cooperative learning type group investigation) is 76.73 and the control class (direct instruction model class) is 71.16. This shows that the average value of the experimental class (class model cooperative learning group investigation type) is higher than the average value of the control class (direct instruction model class).

In terms of the post-test score of the learning outcomes of understanding the concept of students with high achievement motivation with the number of students (N) 66, the average score is 75.14 with a standard deviation of 7.300. Meanwhile, in terms of the value of post-test learning outcomes in understanding the concept of students with low achievement motivation with the number of students (N) 58, the average score is 72.40, with a standard deviation of 5.406. This shows that the class of students with high achievement motivation has a better understanding of the concept than the class of students who have low achievement motivation.

The results of research data analysis with the two-track Analysis of Variance (ANOVA) technique using the SPSS program with a significance level of 0.05 are presented in Table 5.The results of the first hypothesis based on the results of the two-lane Analysis of Variance (ANOVA) test in Table 5 show that the learning model marked with the code "K" has a calculated F value of 28.864 and the significance value is 0,000. The significance value is smaller than 0.05 (0.000 <0.05), then the null hypothesis (H_0) is rejected so that there is a significant difference in learning outcomes between students learning class learning model cooperative learning investigation group type and student class taught with direct models instruction.

The results of testing the second hypothesis are based on the results of the two-lane Analysis of Variance (ANOVA) in Table 5.

Table 5. Result of Anova Two Ways Tests of Between-Subjects Effects

Dependent Variable: understanding of concepts					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	1531.774[a]	3	510.591	15.999	.000
Intercept	673158.07	1	673158.07	21093.25	.000
K	921.138	1	921.138	28.864	.000
M	277.572	1	277.572	8.698	.004
K * M	307.113	1	307.113	9.623	.002
Error	3829.613	120	31.913		
Total	681724.000	124			
Corrected Total	5361.387	123			
R Squared = ,286 (Adjusted R Squared = ,268)					

The student achievement motivation marked with the code "M" in table 5 shows that the value of F calculated learning outcomes of student understanding is 8.698 with a significance value of achievement motivation is 0.004. The significance value is smaller than the significance level of 0.05 (0.004 <0.05), then the null hypothesis (H_0) is rejected, so there is a significant difference in understanding learning outcomes between groups of students who have high achievement motivation and groups of students who have low achievement motivation. This also means that students with high achievement motivation have a better understanding of learning outcomes than those who have low achievement motivation.

The results of testing the third hypothesis are based on the results of the two-track Analysis of Variance (ANOVA) in Table 5. There is an interaction between the cooperative learning model group investigation type and achievement motivation towards understanding learning outcomes. It can be seen from the F value calculated and the significance value of the cooperative learning model group investigation type and achievement motivation (K * M). Based on the table, it is also known that F count is 9.623, with a significance value of 0.002 which means it is smaller than

0.05 (0.002 <0.05), meaning that the null hypothesis (H_0) is rejected, so that there is an interaction between cooperative learning group investigation types and achievement motivation towards understanding learning outcomes.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that the group investigation model has a positive effect on non-science students' understanding of the science concepts in the first semester. The results of the one-way ANOVA test obtained F-score = 17.241 with a significance of 0.00 and the LSD test results obtained the average normalized gain value of 9.152 with a standard deviation of 2.204 and a significance value of 0.000. The result of the significance value is smaller than the significance level of 0.05 (0.000 <0.05). It can be concluded that there is a significant difference in the students' understanding of science concepts. The Group Investigation (GI) model class is more effective and has a more positive effect on non-science students' understanding of the science concepts in the first semester compared to the Direct Instruction (DI) class. From the findings and discussion above, it can also be concluded that the Group Investigation model is a complex but effective learning model to teach science concepts. For this reason, the model is very appropriate to be implemented to improve non-science students' understanding of the science concepts in the first semester.

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