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The Effectiveness of Group Investigation Cooperative Learning Model on Students' Science Learning Achievement

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Abstract: This research aimed at describing the difference of the students learning achievement between-group investigation learning model and conventional learning model, describing the difference of the student's learning achievement between mastery goal orientation and performance goal orientation, describing the interaction effect of learning model and goal orientations on learning achievement. The population of this research was VIII grade of Junior high school students. The population member consisted of 296 students. The sample was chosen for 4 classes by group random sampling. The research used a quasi-experimental with pretest-posttest nonequivalent control group design. The data were collected by two kinds of tests; they are questionnaires for goal orientations and objective tests for learning achievement. Learning achievement data were analyzed by descriptive statistics and ANCOVA 2 × 2 where the pretest scores were as a covariant. Further action after ANCOVA, the least significant difference (LSD) was used. Results of this research showed that: there was a significant difference of the students learning achievement between-group investigation learning model and conventional learning model ($F = 135.568$; $p < 0.05$); there was a significant difference of the students learning achievement between mastery goal orientation and performance goal orientation ($F = 23.522$; $p < 0.05$); there was no significant interactive effect between learning model and goal orientations on learning achievement ($F = 0.118$; $p > 0.05$).

Keywords: Conventional learning model; Group investigation learning model; Learning achievement; Mastery goal orientation; Performance goal orientation

Introduction

Science and education are the main assets of a nation. Science (NS) has an important role in improving the quality of education, especially in developing people who have logical reasoning and take initiative in society. The science learning process emphasizes providing direct experience to develop students' competencies to understand the natural surroundings scientifically (BSNP, 2006).

The government has tried to improve the quality of education by implementing several efforts, namely: improving the quality of teachers through teacher certification activities, subject teacher consultations, teacher professional training, teacher competency tests, improving curriculum, procurement of electronic school books, and complete facilities and infrastructure in schools (Kemendikbud, 2012). Improving the quality of education will not succeed if it is not implemented by parties directly involved in improving the quality of physics education in schools and the government (Alhadza & Zulkifli, 2017).

One who plays a direct role in improving the quality of physics learning in schools is the teacher. Teachers are expected to function as facilitators who guide and direct students in learning activities so that students can be more active in seeking information in learning a physics concept (Bürgener & Barth, 2018; Burmeister & Eilks, 2013). In the current reality, there are still many students who learn to only memorize concepts, noting what the teacher preached, passive, and

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prior knowledge was rarely used as the basis for lesson planning (Waltner et al., 2020; Rapi, 2011).

The low student achievement in physics is influenced by several factors, one of which is the teacher. Teachers are sometimes less able to design, develop, implement, manage, and evaluate learning processes and resources. The lecture method is a method used by teachers in the order of explaining, giving examples, exercises, and homework (Subratha, 2007; Marito, 2012).

To achieve the objectives of learning physics as stated in the curriculum, students must use innovative, student-centered learning models, one of which is the group investigation cooperative learning model. Group investigation is a form of cooperative learning model in which student study together in small groups (5-6 people) that are heterogeneous, choose the topic under investigation, conduct investigations, and present reports to the whole class (Ibrahim et al., 2000). The group investigation model has learning steps, namely: grouping, planning, investigation, organizing, presenting and evaluating (Slavin, 1995).

The application of the group investigation model in physics learning is oriented to developing thinking skills, activating initial knowledge, learning how to learn, and learning about the real world based on investigations to provide opportunities for students to act as experts so that learning becomes more meaningful (Santyasa & Suwindra, 2008).

Two main goals give reasons why students want to get achievement, namely: mastery goal orientation, which focuses on developing competence, and performance goal orientation, which focuses on demonstrating competence (Pandya, 2011). Individual characteristics affect the types of goals students use in the learning environment. The type of goal orientations that students have will affect their learning motivation (Woolfolk, 2008).

Previous research has shown that the application of the group investigation cooperative learning model in physics learning has proven to be effective in improving student achievement (Gunawan, 2011). The cooperative learning model is more effective for students with a mastery goal orientation, while the conventional learning model is more effective for students with a performance goal orientation (Pandya, 2011).

Based on this background, this research will answer three research questions as follows. (1) Is there a difference in science learning achievement between students who study with the group investigation type of cooperative learning model and students who study with the conventional learning model? (2) Is there a difference in science learning achievement between students who have a mastery goal orientation and students who have a performance goal orientation? (3) Is there an interaction between the learning model and goal orientations on students' science learning achievement?

Method

This type of research is quasi-experimental with a pretest-posttest nonequivalent control group design (Sugiyono, 2008). The population of the study was class VIII Junior High School which consisted of 8 equivalent classes, namely: VIII A2, VIII A3, VIII B1, VIII B2, VIII B3, VIII C1, VIII C2, and VIII C3 with a total population of 296 students.

Samples were taken by group random sampling technique, namely experimental classes VIII A3 and VIII B1, as well as control classes VIII A2 and VIII B2. Each sample group is given a goals orientation questionnaire which then scores are sorted from highest to lowest. 27% of the experimental group students with the highest scores were categorized as having a mastery goal orientation and 27% of the students with the lowest scores were categorized as having a performance goal orientation. Similarly, 27% of the control group students with the highest scores were categorized as having a mastery goal orientation and 27% of the control group students with the lowest scores were categorized as having a performance goal orientation. Based on the results of the draw, the research sample for each treatment unit was 20 students.

The independent variable in this study is the learning model which consists of two dimensions, namely the group investigation cooperative learning model given to the experimental group and the conventional learning model given to the control group. The covariate variable is the initial knowledge obtained from the pretest score. The moderator variable is goal orientation which consists of two dimensions, namely mastery goal orientation, and performance goal orientation. The dependent variable is learning achievement.

Data collection using test techniques. The learning achievement data collection instrument uses 25 multiple-choice questions with the criteria of correct answer getting a score of 1 and wrong answer getting a score of 0. The cognitive domains measured in the learning achievement test based on Bloom's taxonomy are remembering, understanding, and applying, with material coverage, namely: vibration, waves, and sound. The internal consistency of the grains moved from PBI = 0.162 to PBI = 0.616, with a reliability coefficient of KR-20 = 0.813. The goal orientation data collection instrument uses 28 questionnaires. Calculation of the weight of the goal orientations questionnaire assessment using a Likert scale, namely: strongly agree (SS), agree

(S), uncertain (RR), disagree (TS), and strongly disagree (STS). The internal consistency of the questionnaire items moves from r = 0.105 to r = 0.573 with the reliability coefficient = 0.659.

Pre-knowledge data (pretest) and learning achievement data (posttest) were analyzed descriptively and ANCOVA 2 × 2. Descriptive analysis is used to describe the average value and standard deviation of learning achievement tests. ANCOVA 2 × 2 was used to test the research hypothesis. Before testing the hypothesis, the assumptions were tested, namely: normality test of data distribution, homogeneity of variance test, linearity test, and regression line significance. As a follow-up, ANCOVA used the least significant difference (LSD).

Result and Discussion

Result

General Description of Research Results

The mean (M) and standard deviation (SD) of science learning achievement data are presented in Table 1.

Table 1. General Description of Research Data

Group	M and SD Learning Achievement			
	Pretest	Category	Posttest	Category
GI-MGO	M = 34.40	Less	M = 73.20	Good
	SD = 7.94		SD = 7.58	
GI-PGO	M = 33.60	Less	M = 68.60	Fair
	SD = 7.50		SD = 7.49	
MPK-MGO	M = 33.60	Less	M = 63.00	Fair
	SD = 7.16		SD = 7.77	
MPK-PGO	M = 33.00	Less	M = 57.80	Fair
	SD = 7.88		SD = 6.93	

Based on Table 1, it appears that before the treatment the average pretest value of each group was still in the very poor category. After the treatment, there was an increase in the average posttest value in all treatment groups. The GI-MGO group showed the highest achievement in science learning in the good category, while the GI-PGO, MPK-MGO, and MPK-PGO groups had the average posttest score in the sufficient category.

Hypothesis Testing

The results of data normality testing using Kolmogorov Smirnov and Shapiro-Wilk statistics showed that the distribution of data in all units of analysis was normally distributed (p > 0.05). The results of the homogeneity of variance test using Levene's Test of Equality of Error Variances obtained F_{values} = 0.150 and p > 0.05, then means that the overall data variance is homogeneous.

The linearity test shows the value of F = 0.696 on Deviation from Linearity (p > 0.05), so the relationship between prior knowledge and learning achievement is linear. The value of F = 71.143 is obtained at Linearity (p < 0.05), then it shows that the relationship between prior knowledge and learning achievement is significant.

After testing the assumptions, the analysis continued with 2 × 2 ANCOVA. The results of the 2 × 2 ANCOVA analysis are presented in Table 2.

Table 2. Results of ANCOVA 2 x 2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	359.907	4	89.977	94.407	0.001
Intercept	337.047	1	337.047	353.643	0.001
PA	191.970	1	191.970	201.422	0.001
MP	129.206	1	129.206	135.568	0.001
GO	22.418	1	22.418	23.522	0.001
MP * GO	0.112	1	0.112	0.118	0.732
Error	71.480	75	0.953		
Total	21981.000	80			
Corrected Total	431.388	79			

Based on Table 2, the following findings can be informed that the source of the influence of initial knowledge on learning achievement appears to be the value of F = 201.422 and p < 0.05. So, there is a significant effect of initial knowledge covariates on learning achievement. From the source of the influence of the learning model on learning achievement, it was obtained that the value of F = 135.568 and p < 0.05. These results indicate that there are significant differences in the learning model on science learning achievement. The difference in the average value of learning achievement is and LSD (PB) = with a standard deviation of 0.218 and p < 0.05. So, the average value of learning achievement for the GI and MPK learning model groups is significantly different. The estimated average score (μ) for the GI learning model is = 17.684 and for the conventional learning, model = 15.141. So, the average score of learning achievement for the GI learning model group is statistically higher than the average score for the MPK group. From the source of the influence of goal orientations on learning achievement, the value of F = 23.522 was obtained with p < 0.05. These results indicate that there are significant differences in goal orientations towards science learning achievement. The difference in the average value of learning achievement is and LSD (PB) = with a standard deviation of 0.191 and p < 0.05. So, the average score of learning achievement in the MGO and PGO groups was significantly different. The estimated mean score (μ) for MGO is = 16.943 and for PGO = 15.882. So, the average score of learning achievement in the MGO group was statistically higher than the average score of the PGO group. From the

source of the influence of MP*MGO on learning achievement, the value of F = 0.118 and p > 0.05. So, there is no significant interactive effect between the learning model and goal orientations on learning achievement.

Discussion

The Influence of Learning Models on Learning Achievement

Based on the findings obtained through the results of descriptive analysis and univariate analysis, it can be justified that the group investigation model has a better effect than the conventional model in achieving learning achievement for the following reasons.

In terms of the theoretical basis of the constructivist group investigation learning model. When conducting an investigation, students have the opportunity to interact with their group mates, discuss planning research, exchange ideas, jointly integrate their findings, and plan how to present their findings to their classmates (Sharan, 2009; Telaumbanua et al., 2021; Silviana, 2017). Through the group investigation model, students can get opportunities to construct scientific knowledge through group investigations so that learning becomes meaningful (Suriyanti et al., 2022).

The flow of the conventional learning psychology model is behavioristic (Sanjaya, 2009). In the conventional learning model, students make discoveries with practicum after being given information about the learning material, this is considered less constructivist. The responsibility of students towards learning becomes small because students learn. After all, the teacher gives assignments to study the teaching material. Students' interest in discovery activities is lacking because students have been treated to detailed information about what they will get. This can reduce the independence of students in learning to construct their knowledge.

Second, in terms of the role of teachers and students in the group investigation model, when students carry out investigations, students can find answers to the problems given by the teacher, build on the knowledge they gain, and not only accept what the teacher gives them (Sanjaya, 2009). In the group investigation model, the teacher only acts as a facilitator and moderator who gives responsibility to students to obtain the concepts needed by themselves through interaction with group members.

In the conventional learning model, the subject matter is presented first by the teacher. So, many learning activities are dominated by teachers, so that learning activities become less interesting and passive. This reduces students' independence in learning to construct their knowledge and has an impact on their low learning achievement.

Third, from an empirical operational point of view in the presentation of learning, groups of students who learn to use the group investigation model are facilitated by group investigation worksheets, while the conventional model groups are facilitated by conventional worksheets. In the LKS (worksheet) group investigation, students are presented with contextual problems. Then students are divided into several groups. Next, students and their groups propose hypotheses by combining their prior knowledge and then students discuss to solve them, one of which is by conducting investigative activities in the laboratory. After that, they discussed how to present their findings to their classmates through group presentations.

Unlike the case with conventional LKS (worksheet). In conventional worksheets, the implementation is based on controlled steps through instructions, informative explanations of principles and concepts by the teacher, then continued with practice questions related to the material that has been taught. The presentation of learning with conventional worksheets does not give students the freedom to explore their prior knowledge so that students learn based on teaching materials and clear instructions from the teacher. So, learning through conventional worksheets cannot have a maximum effect on learning achievement.

The results of this study support research by Gunawan (2011), Wahyuni et al. (2014), and Sangadji (2016) which states that groups of students who study using the group investigation learning model show better learning achievements than groups of students who study using conventional learning models.

The Effect of Goal Orientation on Learning Achievement

Based on the findings obtained through the results of descriptive analysis and univariate analysis, it can be justified that mastery goal orientation has a better effect than performance goal orientation in achieving learning achievement.

A central construct in goal theory is goal orientation, which refers to the goals and focus of individual involvement in achievement activities (Schunk, 2009). There are two types of student goal orientations, namely: mastery goal orientation and performance goal orientation.

Individuals with a mastery goal orientation tend to focus on learning activities, trying to master tasks, developing new skills, improving competencies, completing challenging tasks, and trying to gain experience from what is learned (Woolfolk, 2008). Individuals with a mastery goal orientation believe that they can develop abilities based on previous experience and never give up if given a task and tend not to worry if their abilities are measured and compared with others.

Performance goal orientation is the opposite of mastery goal orientation. Individuals with a

performance goal orientation are characterized by always comparing their abilities with others and always avoiding failure. Individuals who have a performance goal orientation always focus on success. They tend to show off their achievements and abilities. Students with performance goal orientation always want to get high scores and be the best so they learn by memorizing not by understanding the lesson.

Students with mastery goal orientations try to maintain their goal orientations, focus on learning, develop themselves, and improve themselves while continuing to try to get good grades. Students who have a mastery goal orientation are more motivated to understand the lesson, not only want to get high marks compared to others. Therefore they work hard to learn. Meanwhile, students who have a performance goal orientation are only motivated because they want to be the best and get the highest score among their friends.

The results of this study are in line with research conducted by Pandya (2011) that there is a significant difference in the acquisition of physics learning achievement between students who have a mastery goal orientation and students who have a performance goal orientation. Students who have a mastery goal orientation get higher learning achievements than students who have a performance goal orientation (Putri & Saleh, 2020).

Interaction of Learning Models and Goal Orientations on Learning Achievement

In this study, it was revealed that there was no interaction between the learning model and goal orientations. The group investigation learning model and the conventional learning model affect student achievement without being influenced by students' goal orientations. Likewise, mastery goal orientation and performance goal orientation have an impact on student achievement without being influenced by the learning model applied.

Based on these findings, it is suspected that several things have the opportunity to cause students' learning models and goal orientations to not interact significantly in influencing learning achievement, namely learning time at school is relatively short, while it takes a relatively long time to develop students' abilities in participating in group investigations, especially for students with performance goal orientation.

The application of the group investigation learning model in the form of group learning in class is expected to provide opportunities for students to exchange ideas and complement each other with group members (Harahap & Turnip, 2014). However, students have not been able to take advantage of these opportunities optimally. This happens because students are not used to learning to interact and discuss groups with other students in learning activities. After all, teachers tend to only use conventional learning models in learning science in class.

A conventional model is a teaching approach that can help students learn basic skills and acquire information that can be taught step by step. This model requires a well-structured learning environment and teacher descriptions, in its implementation the teacher needs to provide clear descriptions, demonstrate and demonstrate correct behavior, provide opportunities for students to practice.

Conclusion

Based on the exposure of the research results and discussion, the following conclusions are presented. First, there is a significant difference in science learning achievement between groups of students who study with the group investigation cooperative learning model and groups of students who study with conventional learning models. Second, there are significant differences in science learning achievement between groups of students who have a mastery goal orientation and groups of students who have a performance goal orientation. Third, there is no significant interaction effect between the learning model and goal orientations on learning achievement.

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Conflicts of Interest

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