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Cooperative Learning Type Group Investigation with Scientific Approach to Improve Problem Solving Ability In Elementary School

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Abstract. This study aims to: (1) determine the characteristics of mathematics learning Group Investigation model with scientific approach, (2) develop a valid learning device, (3) test the practicality, and (4) test the effectiveness. The study refers to the model development Plomp: (1) Preliminary Investigation, (2) design, (3) realization, (4) testing, evaluation, and revision. First prototype validated and revised according to input into second prototype. Validator then tested in a trial class. Device trials conducted in elementary school in V grade. The data is taken from sheet validation, observations, questionnaires, tests, and processed with the thoroughness of testing, test regression effect, comparisons, test of the improvement of problem solving ability. The results showed: (1) syllabus score of 4,28; lesson plan 4,41; student worksheet 4,09; student book 4,52; problem solving ability test 4,16 in the range of 1–5 showed that it was already categorized valid, (2) the effectiveness of the implementation of learning characterized by : (a) learners who value the problem solving more than 75 (minimum thoroughness criteria) reached 95.8%, (b) self-reliance and activity of 89.6% effect on the ability of solving problem (c) the average problem solving ability of Group Investigation Sainitific Approach class was 85,70 greater than the control class was 63,11, and (d) problem solving ability of students in Group Investigation Saintific Approach class increased 61,8%.

INTRODUCTION

Math is important both as a tool, as a science (for scientists), as a mentor mindset as well as forming attitudes (Russefendi, 2006). Once the importance of mathematics, it is of course a challenge for teachers to teach mathematics in the classroom. Based on the report *The Trends in International Mathematics and Science Study* (TIMSS) 2007 stated that the mathematics achievement Indonesia ranks 36th out of 49 countries with an average score of 405 and is far below the international average score of 500 (Tjalla, 2010), while of the report note that the TIMSS 2011 mathematics achievement of learners Indonesia was ranked 38th out of 42 countries with an average score dropped to 386 (Mullis *et al*., 2012). The Study results of *The Programme for International Student Assessment* (PISA) 2012 stated that the mathematical abilities of learners Indonesia was ranked 64th out of 65 countries with an average score of 375 (OECD, 2013). The study results of the TIMSS and PISA suggests that learners Indonesia has a low ability to answer the questions of international standards, especially in mathematical problem solving ability. These weaknesses arise due to the learning of mathematics learners are unfamiliar resolve non-routine problems that challenge so that learners think.

In general, in elementary schools shows that the learning of mathematics given classically through lectures without looking at the possibility of applying other models in accordance with the material that will be taught to lead learners are less active to follow the lessons delivered teachers, learners are not interested in taking lessons, and in the absence awareness of the importance of math (Ardiawan, 2013: 2). Resulting in learners do not understand the lessons and ultimately rely on teachers and their friends. It is one of the low independence of learners and will result in lower math skills learners. As research conducted by Feza (2012: 62) conclude that there are two factors that

hampered the learning of mathematics, namely the knowledge of teachers and teaching strategies that are not relevant.

In the course of learning, independence is crucial because independence is the personal attitude that is required by every individual. According Sumarmo (2006: 5) with independence, learners tend to learn better, be able to monitor, evaluate, and adjust the learning effectively, saving time efficiently, will be able to steer and control yourself in thinking and acting, and does not feel dependent on others emotionally.

Research conducted by Stillman and Galbraith (Rochmad, 2004: 8) concludes that the learning model is required procedures to facilitate the performance of learners in solving problems. Therefore, in achieving the goal of developing problem solving skills, the teacher of mathematics also need to select the model or approach appropriate learning. The use of the model or the lack of proper learning approaches can lead to boredom, lack of understanding which ultimately decrease the activity and independence of students in learning.

Scientific approach or scientific approach is now beginning to be applied to the new curriculum. This approach leads to 5M is watching, ask, Trying, Rework / Processing, Presenting / Publish (Kemendikbud, 2013). 5M into use in curriculum in 2013 because the students considered not sufficiently active in the teaching-learning process.

Cooperative Model Type Investigation Group is one type of cooperative learning model that combines small groups with a number of 4-6 people. Each member of heterogeneous groups according to the level of achievement, gender and ethnicity. In the learning of students will follow several stages, Grouping, planning, investigation, organizing, presenting and evaluating (Sharan & Sharan, 1990). In the learning model of Group Investigation teacher can increase the activity of the students so as to encourage students to express their ideas and also can increase the independence of learners.

Talmagae and Hart (1977) suggested that the class atmosphere investigations encourage students to want to explore and deepen their way of thinking to find a variety of alternative thinking, analyzed the data, and learn to accept the input of others or the environment so that teachers feel that the class is familiar, both among learners and between teachers and learners. Based on these studies it can be concluded on learning investigations are phases that will explore the activity of learners and encourage independence of students in learning while Fraiser, et al (1989) noted that many educators agree that changes in the learning environment in line with expectations of learners will affect the increase learning outcomes of students. Thus with the learning environment that stimulate the activity and independence of learners will be able to influence the improvement of student learning outcomes.

Development of the learning device is expected to deliver learners to achieve minimum value stipulated mastery learning, improving learning outcomes of students in this case problem solving skills, foster activity and increase the independence of learners during the learning of mathematics in particular.

The purpose of this study was to (1) determine the characteristics of mathematics learning Group Investigation model approach to scientific, (2) developing the teaching of mathematical model of Group Investigation approach is scientifically valid, (3) test the practicality of the mathematics model of Group Investigation approach to scientific, and (4) to test the effectiveness of mathematics teaching model of Group Investigation scientific approach .

RESEARCH METHODS

This study included in this type of research development, namely the development of the research study of mathematics. Learning tools developed include syllabi, lesson plans, wokrsheet, teaching materials, and test problem-solving abilities. This study uses a model of software development learning design Plomp with four stages, namely: 1) the preliminary investigation stage, 2) stage of planning (design), 3) the realization phase (construction), and 4) the stage of testing, evaluation, and revision. This research trial conducted on students in V grade elementary school. The experimental class students will be asked to provide a response to the learning tools that have been tested.

Validation data analysis experts and practitioners using the average to obtain the validity of the study before it is implemented. Effectiveness analysis using the average of completeness of test, test of proportions, comparisons, regression, and testing the normalized gain. Average of completeness of test to determine the achievement of minimum completeness criteria (KKM) that has been determined is equal to 75. The proportion test to determine at least 75% of students scored minimal problem-solving ability test 75. The average difference for comparing the problem-solving abilities of participants students taught by cooperative model type Group Investigation Scientific approach with learners who are taught expository models. Normality and homogeneity test conducted as a prerequisite test. Regression test to determine the effect of independence and activities of learners towards problem

solving abilities. To determine the increase problem solving skills and increase independence of the experimental class and the control based on the value calculated using the normalized gain (g) (Hake, 1998).

RESULTS AND DISCUSSION

Results of the validation of learning tools developed by the cooperative model of type Group Investigation Scientific approach as follows:

Table 1. the result of the validation of learning tools

No	Instrumen	V1	V2	V3	V4	V5	Rata2	Kriteria
1	Syllabus	4.08	4.62	3.77	4.15	4.77	4.28	Very good
2	Lesson Plan	4.00	4.71	3.79	4.88	4.67	4.41	Very good
3	Student Book	4.05	4.85	4.00	4.80	4.90	4.52	Very good
4	Student Worksheet	4.00	4.20	3.87	4.07	4.33	4.09	Good
5	PSAT	4.00	4.45	3.55	4.45	4.36	4.16	Good
Average							4,29	Very good

Test the validity of test items were problem-solving ability that consists of 10 questions about the essay with 8 valid, a high level of reliability is r_{11} = 0,827 that is the level of difficulty 2 about the difficulty level of easy, 3 items with the category of difficulty, and 3 items with a moderate level of difficulty. The ability of teachers to manage learning observed by two observers, the overall value of the average teacher's ability to manage learning is 4.04 including good categories. The average response of the students to the learning tools developed and the learning model used is 4.51 and included in good category, meaning it can be said the response was positive learners.

Results normality test classes taught by cooperative model type Group Investigation Scientific approach and classes taught by the normal distribution model of expository dalah with sig = 0.200. Based on the homogeneity test both classes derived from a homogeneous class with sig = 0.617.

Based on experiment can be concluded, 1) the average results of PSAT learners experimental class has exceeded KKM, 2) more than 75% of learners experimental class scored problem solving ability at least 75 and 3) problem-solving ability of students taught by cooperative model type Group Investigation Scientific approach better than students taught by expository models.

Based on the results of test calculations influence of independent variables on the dependent variable was obtained R2 = 0.896 = 89.6% while the regression equation obtained was $Y = -22.250 + 0.666\ X_1 + 0{,}634X_2$. X_1 variable states of activity, X_2 declared independence, and the variable Y represents problem-solving abilities. Meaning of the regression equation is that each additional variable X_1 for one unit, it will add to the value of 0.666 PSAT and any additions X_2 for one unit, there will be additional PSAT value of 0.634.

Results of analysis of test increase in the experimental class obtained average value is 0.618, which means an increase in problem solving experimental class students are in the category of medium and test analysis results obtained control class increase the average value is 0.25, meaning that an increase in the ability of solving problem learners control class is at a low category. Based Gain increasing criteria, test the problem solving ability of students is said to increase, if the criterion is the value of Gain on minimal medium category. quality improvement of the independence of learners class Scientific Group Investigation approach amounted to 58.8% and 16.5% expository classes. And if based on the interpretation criteria proposed by Hake gain, the index gain independence learners Scientific Investigation Group classes medium and low Expository classes.

Based comparative test obtained that an average increase problem-solving ability of students taught by cooperative model type Group Investigation Scientific approach better than students taught by expository models.

Achievement of learners problem solving ability is not independent of the developed learning tools and learning model used. The average achievement of value-class problem-solving capabilities experiments that is equal to 85.70 statistically it can be said that the experimental class problem-solving ability is better than the control class that is empirically gained an average of 63.11. The average difference problem-solving abilities of learners experimental

class and control class occurs because of the different treatment in the learning process. Learning in the classroom learning using the experimental model of cooperative GI, where this model emphasizes active learners in the learning process, to train students to be more independent and can boost problem-solving abilities.

This finding is not surprising, when one considers that GI cooperative learning model is a model of group learning, with students in the group are encouraged to interact and learn together to improve the understanding of each. The tools used to encourage such interaction is material or a challenging problem, and forms of interaction in question is a discussion, ask each other questions and express opinions, it is sufficient reasoned if the cooperative model is able to develop problem-solving abilities of learners, is superior to conventional models. The use of this learning model illustrates the difference between the problem solving ability of the experimental class and the control class Circle materials. These results concur with those of Zacharias, et al (2013) showed that cooperative learning produces higher mathematics achievement than traditional teaching methods.

Linearity regression showed there is an significant effect on the independence and activity of learners towards problem solving abilities. If the activity is high then the learning achievement will also be high. This is in line with research from Nataria (2010) which states that the positive influence the activity of learners with their learning achievement. As well as students who have a high learning independence tend to have a high learning results as well. This is in line with the results of research Hapsari and Main (2013: 162-163) showed that independence contributed to mathematics learning outcomes. Independent learning is one of the factors that comes from learners that affect mathematics learning outcomes. Learners who have high motivation to learn to be more confident in achieving learning outcomes in mathematics. This is confirmed by research Gyasi (2013), the study found that many students believe in their own abilities, they are working hard to learn at home so that they understand the math very well.

Gain calculation results of the test showed that both classes increased, improved problem-solving abilities experimental class with an average of 0.618 and a control class with an average increase of 0.25. This increase occurred due to differences in the experimental class are treated using cooperative learning model type Group Investigation with Scientific approach. This is in accordance with the opinion of Munandar (2004: 12) that the optimal development of problem solving skills are closely related to teaching. Improved problem solving ability of students to the role of learning tools are developed and applied learning models in the learning process. Teaching materials and other learning tools designed to enhance the problem solving ability of students, especially in the matter Circle. Results of this increase is in line with research conducted by Musriandi (2013) which concluded that the ability of solving mathematical learners acquire learning model mathematics type of group investigation better than learners who obtain conventional learning and there is also an increase in the ability of solving mathematical problems, especially on the matter circle.

CONCLUSION

Learning tools developed by the cooperative model of type Group Investigation Scientific approach is valid. Valid learning tools that have been developed are supported by research data validator validation of experts and practitioners. Learning tools developed is practical, it is seen in the positive response of the students and the teacher's ability to manage the type of cooperative learning model approach Scientific Investigation Group. Learning mathematics by implementing cooperative model of type Group Investigation approach Scientific is effective, because it meets the following criteria: (1) obtaining an average score of problem-solving ability of students who exceed the KKM 75 and more than 75% of all students in the experimental class reaches a value KKM, (2) there are significant differences between the classes taught by the cooperative model of type Group Investigation approach Scientific and classes taught by models expository, meaning that the results TKPM learners in materials Circle, (3) there is influence between independence and activity learners together on problem-solving ability, and (4) an increase in the problem solving ability of students in the experimental class with the criteria modest increase and improvement of problem solving ability of students in the control class kritiria low increase.

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