Discovery learning with SAVI approach in geometry learning

R Sahara¹*, Mardiyan¹ and D R S Saputro²

¹ Department of Magister Mathematics Education, Faculty of Teacher Trining and Education Sebelas Maret University
² Department of Mathematics, Faculty of Mathematics and Science Sebelas Maret University, Kentingan Surakarta, Indonesia

*Corresponding author’s email: syaharawii@gmail.com

Abstract. Geometry is one branch of mathematics that an important role in learning mathematics in the schools. This research aims to find out about Discovery Learning with SAVI approach to achievement of learning geometry. This research was conducted at Junior High School in Surakarta city. Research data were obtained through test and questionnaire. Furthermore, the data was analyzed by using two-way Anova. The results showed that Discovery Learning with SAVI approach gives a positive influence on mathematics learning achievement. Discovery Learning with SAVI approach provides better mathematics learning outcomes than direct learning. In addition, students with high self-efficacy categories have better mathematics learning achievement than those with moderate and low self-efficacy categories, while student with moderate self-efficacy categories are better mathematics learning achievers than students with low self-efficacy categories. There is an interaction between Discovery Learning with SAVI approach and self-efficacy toward student's mathematics learning achievement. Therefore, Discovery Learning with SAVI approach can improve mathematics learning achievement.

1. Introduction
Mathematics is one of the areas of study taught in every level of education. Many problems and activities in life that we must solve by using mathematical sciences such as counting, measuring, and others. In mathematics learning in school mathematics had divided into several sub subjects, including sub subjects geometry. Geometry is one branch of mathematics that an important role in learning mathematics in schools. However, geometry lessons include difficult and less favourable mathematics lessons by students. This can affect the students' low learning achievement. Based on the result of the national examination, it is found that absorption of Junior High School students in Surakarta is low in geometry learning which is 50.39% at the district level, 40.26% at the provincial level, and 47.19% at the national level [1]. Geometry is a branch of mathematics that describes the properties of lines, angles, planes, and spaces.

One of the determinants of student learning success is the learning model applied by the teacher. Teachers in the learning process of mathematics tend to use direct learning. The method teachers often use is the expository method which used to explain the material and then give the example problems [2]. Therefore, teachers be able to apply various learning models for each subject provided. The learning model that used as a solution to this problem is Discovery Learning. Discovery Learning is a type of learning where learners construct their own knowledge by experimenting with a domain, and
inferring the rules of the results of these experiments [3]. The Discovery Learning model is a teacher-led discussion process to enable students to discover and resolve issues that have been given to reach a conclusion. Stages in the Discovery Learning model are stimuli, problem statement, data collection, data processing, verification, and generalization. Learning Research about with Discovery Learning has shown that the learners have a high ability to follow very well, while the less ability of the group may increase ability of itself [4]. Discovery Learning facilitated through a variety of strategies in the classroom. The use of Discovery Learning methods means learning to improve quality of the students’ activity in the learning processes [2]. The improvement of the students’ mathematical analogical ability using Discovery Learning method had considered better than the expository group [2]. Discovery Learning had seen as a promising way of learning for several reasons, the main reason is that the active involvement of students with domains will result in a better structured knowledge base of learners who oppose more ways [3]. Discovery Learning is more effective than conventional learning and improves student ability [5].

But application of Discovery Learning, many students have difficulty in the discussion process. So that needed approach that can overcome the problem that is with approach of Somatics, Auditori, Visual, and Intellectual (SAVI). This approach had pioneered by Dave Meier. It consists of: (1) Somatics, learning by moving and doping activities, (2) Auditory, learning by speaking and listening, (3) Intellectuals, learning to solve problems and making reflection [6]. The thematic learning material using SAVI proved effective in improving the students’ speaking skills competence [7]. SAVI approach integrates the four terms so that student and teacher can make condition class become enjoyable [8]. SAVI trains students to interact with their students, informants, and environment to get a variety of information [7]. The information collected to used as the materials used in discussions. In this case, students are Place as the center of attention in instructional process as what the constructivist model explains. The students construct their knowledge based on their own experience to formulate the best solutions.

Often students are unable to prove their academic achievement optimally according to their abilities. One reason is that they often feel unsure that they are capable of completing the tasks assigned to them. The term belief had called self efficacy. Self efficacy is belief about the individual’s ability to do things when in various conditions with whatever skills he or she possesses [9]. That is, a student who has good thinking skills, but lacks a strong belief in his own self efficacy, will not give well in determining an action. The self efficacy of a student possessed without anything pushing it. Therefore, teachers be able to foster such belief in students, but teachers often do not pay attention to it. The result were in line with the concern of the experts in mathematics with the students’ problem solving mathematical problems, but most teachers were aware of the condition [10]. To foster such beliefs will application of learning models that offer opportunities for students to build and explore the knowledge they have to find their own problem solving faced. The student-centered learning system may be attained if teachers may use various flexible teaching strategies [11, 12]. Self efficacy consists of several dimensions, namely Magnitude, Strength and Generality [13]. In this research, these three aspects used as reference in the self efficacy questionnaire. The purpose of this research is to know whether the learning model of Discovery Learning with SAVI approach gives better result of learning mathematics than direct learning model, better among students with high, medium or low self efficacy, knowing the interaction between learning model and self efficacy on student achievement.

2. Methods
This study is an experimental quasi-research, because the researcher is not possible to control all relevant variables. The purpose of quasi-experimental research is to get information that is an estimate for information that obtained by actual experiments in circumstances that are not possible to control and/or manipulate all the relevant variables [14].

This research used 2x3 factorial design with the aim to know influence of two independent variables to dependent variable. The independent variables in this research are Discovery Learning model with SAVI approach for experimental class and direct learning for control class, and self efficacy
of students categorized in high, medium and low. The population in this study is all students of class 8 Junior High School 4 Surakarta in academic year 2016/2017, while the sample used is class VIII C which amounted to 30 students as experimental class and class VIII A which amounted to 30 students as control class. Mathematics learning achievement data obtained through the test in the form of multiple choice about geometry, while the self efficacy data obtained through questionnaires based on indicators of self efficacy aspects.

3. Results and Discussion

Student math test results are 25 multiple choice items given to the experimental class and control class students. Based on the result of the test, the average of mathematics learning achievement of the experimental class is 80.6 and the average 70.3 for the control class student. Prior to the two-way Anava test, first test the normality and homogeneity of the data. Normality and homogeneity tests performed using SPSS with a significance level of 5%. The test results of the experimental class normality and control class showed that from the Kolmogorov-Smirnov test (value $sig. = 0.200 > 0.05$). Therefore it concluded that the sample comes from a normally distributed population. Homogeneity test results show that (value $sig. = 0.297 > 0.05$). Therefore it concluded that the population has the same or homogeneous variance. In this research, the result of data analysis with two-way Anava shown in Table 1 below.

| Source        | Type III Sum of Squares | df | Mean Square | F       | Sig.      |
|---------------|-------------------------|----|-------------|---------|-----------|
| Corrected Model | 2054.950               | 5  | 410.990     | 34.01   | 0.010     |
| Intercept    | 341562.150             | 1  | 341562.150  | 2.826E3 | 0.000     |
| Class        | 1591.350               | 1  | 1591.350    | 13.168  | 0.001     |
| SE           | 172.800                | 2  | 86.400      | .715    | 0.000     |
| Class*SE     | 290.800                | 2  | 145.400     | 1.203   | 0.031     |
| Error        | 6525.900               | 54 | 120.850     |         |           |
| Total        | 350143.000             | 60 |             |         |           |
| Corrected Total | 8580.850             | 59 |             |         |           |

Based on the above calculation results seen that influence of Discovery Learning model with SAVI approach to mathematics learning achievement has the value of $F$ obtained = 13.168 with $sig. = 0.001 < 0.05$, then Ho has rejected. So it concluded that there is a difference between mathematics learning achievement of experimental class students using Discovery Learning model with SAVI approach with mathematics learning achievement of control class students using direct learning. While based on the average of students' mathematics test results, the student group using the learning model of Discovery Learning with SAVI approach is greater than student with the direct learning model. Effect of self efficacy on mathematics learning achievement has the value of $F$ obtained by 0.715 and $sig. = 0.000 < 0.05$, it concluded that there are differences between categories in self efficacy. Based on table 1. on column Class*SE obtained $sig. = 0.031 < 0.05$, so it concluded that there is interaction between learning model of Discovery Learning with SAVI approach and self efficacy toward student's mathematics learning achievement.

The use of learning model aims to overcome the problems in the learning process so that the subject delivered optimally. Most students learn geometry based on memorization. Students only memorize a concept, so when faced with problems that use some concepts, students do not understand. Therefore, teachers apply Discovery Learning with SAVI approach to teach materials about geometry. The use of Discovery Learning with SAVI approach can change the passive learning conditions active and creative. Based on the results of the research show that the learning model of Discovery Learning with SAVI approach and self efficacy influence mathematics learning achievement. These findings
suggest a strong positive correlation between class climate dimensions: satisfaction and enjoyment, support, teacher rules and instruction, competitiveness and between self efficacy and mathematical achievement in mathematics [15]. The success of self efficacy and mathematical mathematics is positively related. Students with high mathematical self efficacy had associated with high mathematical achievement [16].

One of the benefits that gained from Discovery Learning with SAVI approach is emergence of objective attitude, curiosity to solve problems well, and critical thinking. Curiosity students give motivation for students to seek answers to questions or problems that arise and deal with it. Presenting geometry in a way that stimulates curiosity and encourages exploration can enhance students' learning and their attitudes toward mathematics [17]. Student self-confidence will make students feel confident to express their opinions and not be ashamed to ask when something is not understood.

4. Conclusion
Based on the result of the research, the conclusion that taken is difference of students' mathematics learning achievement between student group and Discovery Learning model with SAVI approach and direct learning, the learning model of Discovery Learning with SAVI approach gives better result of mathematics learning than direct learning. There are differences in student achievement between students who have high, medium and low category. There is an interaction between learning model of Discovery Learning with SAVI approach and self efficacy toward student's mathematics learning achievement. Based on discussion of research results show that influence of learning model of Discovery Learning with SAVI approach on learning mathematics can improve student's mathematics learning achievement higher than direct learning.

5. References
[1] BSNP 2016 Laporan Hasil Ujian Nasional Tahun Pelajaran 2015/2016
[2] Maarif S 2016 International Journal of Research in Education and Science (IJRES) 2 1 114-124
[3] Wouter V J 1999 International Journal of Artificial Intelligence in Education 10 385-397
[4] Alex A M and Olubusuyi M F 2013 Guided-discovery Learning Strategy and Senior School Students Performance in Mathematics in Ejigbo, Nigeria Journal of Education and Practice 4 12
[5] Martins O and Oyebanji R K 2000 The effects of inquiry and lecture teaching approaches on the cognitive achievement of integrated science students Journal of Science Teachers' Association of Nigeria 35 1&2 25-30
[6] Meier D 2002 The Accelerated Learning Handbooks: Panduan Kreatif dan Efektif Merancang Program Pendidikan dan Pelatihan (Bandung: Kaifa)
[7] Eni D K, Herman J W, Slamet S T Y and Andayanid 2013 Online International Interdisciplinary Research Journal 3 5 444-455
[8] Ayu L and Utiya A. 2012 Unesa Journal of Chemical Education ISSN: 2252-9454 1 1 41-46
[9] Bandura A 2002 Self-efficacy: The Exercise of Control New York: W. H. Freeman & Campany
[10] In’am A and Hajar S 2017 International Journal of Instruction ISSN: 1308-1470 10 1 55-70
[11] Baxter S and Gray C 2001 International Journal of Language & Communication Disorder/Royal College of Speech & Language Therapists 36 (Supplement) 35 11 2071
[12] Chase C C and Geldenhuys K M 2001 Medical Education 35 11 1071
[13] Aimee D, Steven R H dan Richard D J 2014 Exploring the Dimensions of Self-Efficacy in Virtual World Learning: Environment, Task, and Content MERLOT Journal of Online Learning and Teaching 10 2
[14] Budiyono 2003 Metodologi Penelitian Pendidikan (Surakarta: UNS Press)
[15] Zedan R and Bitar J 2014 Environment learning as a predictor of mathematics self-efficacy and math achievement American International Journal of Social Science 3 6 85-97
[16] Liu X and Koirala H 2009 The effect of mathematics self-efficacy on mathematics achievement of high school students annual conference of the Northeastern Educational Research
Association, University of Connecticut, Connecticut

[17] Jones K 2002 Issues in the Teaching and Learning of Geometry. In: Linda Haggarty (Ed), Aspects of Teaching Secondary Mathematics: perspectives on practice (London: RoutledgeFalmer) 8 121-139

Acknowledgments
The authors would like to thank the Department of Mathematics Education, Faculty of Teacher Training and Education, Sebelas Maret University