The relationship between conceptual understanding and student learning outcomes through the use of geometers Sketchpad software

E Istikomah*

Program Studi Pendidikan Matematika, Universitas Islam Riau, Jl. Kaharuddin Nasution No. 113, Perhentian Marpoyan Pekanbaru 28284, Indonesia

*endangistikomah@edu.uir.ac.id

Abstract. This study aims to determine the relationship between understanding the concept with student learning outcomes through the use of geometers sketchpad software. This research is quasi experiment research conducted on 88 students class 3 SMAN 1 Pasirpenyu Inhu for 7 weeks. Instruments used in this study is the concept of understanding the exam and test results of learning. This instrument has been tested in preliminary studies to determine reliability and validity. Data ware analysed using pearson correlation statistics. There was a significant relationship between conceptual understanding of mathematics and mathematics experimental group ($r = 0.797$) and control group ($r = 0.721$).

1. Introduction

The development of ICT now brings many benefits, especially in learning mathematics. Geometer's Sketchpad has brought many benefits to the teaching and learning of mathematics in general and the field of geometry in particular [1]. One of the many computer programs that can help students understand better is Geometer's Sketchpad (GSP). GSP is one of the tools of information technology that can help teachers to deliver teaching content especially geometry topic. GSP is one of the computerized software specialties to create, explore and analyze various mathematical concepts in the field of algebra, geometry, trigonometry, calculus, and other fields [2]. GPL software with a capacity of 1.33 MB is generated to make it easier for users to paint any geometric shapes and shapes in three dimensions [3].

The research based on result of student's mathematics learning is still low [4]. The low learning outcomes of mathematics are due to a mathematical concept that is difficult to remember or not understood at all, the student only as a passive recipient. This is because teachers tend to implement the traditional learning process. This means that teachers tend to explain the title, give examples of problems and provide training for both at school and at home. Thus the teacher serves as a giver of material and students as recipients of the material. The curriculum demands require teachers to choose, be creative in using teaching processes that can engage students actively in learning, both mentally, physically, and socially and emphasizing math learning on conceptual comprehension, problem-solving skills and problem solving skills [5].

The Geometer's Sketchpad app help greatly in improving achievements in geometry. "Helps students' understanding of geometric relationships, making mathematical generalizations and allowing them to
focus on concepts of the problems" [6]. Which means The Geometer's Sketchpad can help students in understanding geometric relationships, make mathematical generalizations and enable them to focus on the concept of problems. Furthermore, the application of GSP in learning mathematics "which means students say that this method can help them clear the concept and they are easy to visualize when use this method [7]. This means that if students are already interested in the method of using The Geometer's Sketchpad in learning then the student's own achievement can develop by itself. In the results of his study of the GSP affects the way students work and think mathematics in understanding additional mathematics [8]. This means students can understand geometry concept more easily through GSP.

The purpose of this study was to determine the relationship between understanding mathematical concepts between experimental group students and control group students with student learning outcomes. This research is very useful for the parties related to education such as principals, teachers, schools, students and researchers. The results of this study can provide information about GSP software on understanding students' math concepts. GSP software can be used as a tool by math teachers in high school. In terms of theoretical, this learning can provide and develop knowledge about the learning process of mathematics, especially about efforts to improve the learning of mathematics through GSP software that uses computers as a learning tool. Thus, the knowledge gained from this research can be developed to improve the learning of mathematics.

2. Experimental method
This study used a quasi-experimental method involving experimental and control groups. The experimental group used learning by integrating GSP, while the control group used traditional learning. Both groups do pre and post exams. The pre exam is run to know that both groups have the same understanding of the same concept of transformation. After that the research is done as it should and each student score is collected. The experimental group and the control group consisted of 44 students of third grade IPA of SMA in Indragiri Hulu Riau. The Test of student's understanding concept prepared by the reviewer is assisted by the mentor, two university lecturers, and an experienced teacher at the upstream level by adjusting the questions of the study [9]. 16 items given to students to complete. Each item is assigned a different grade according to the student's understanding stage and the total score of 42. The comprehension test of this concept uses the Van Hiele geometry test which is made to measure the understanding stage of student transformation which is one of the teaching materials in the field of geometry [10]. Then the student learning outcomes are also tested by using the transformation topic test which is made by the researchers and some lecturers of Universitas Kebangsaan Malaysia with guidance counselor. Both groups will hold pre-examination exams for understanding and post-exams for understanding exams and learning outcomes. The data of the research were analyzed by person correlation.

3. Results and discussion
In this study applied the use of software geometers Sketchpad to all students involved in the subject of research is no exception to the field of study. All students use 1 laptop or computer for 1 student. This is intended to facilitate the learning process. Based on the data analysis of the research results obtained that the relationship between conceptual understandings with student learning outcomes was analyzed by correlation person. The result of the analysis shows that the relationship between conceptual understanding and mathematics learning outcomes for experimental group obtained r value is 0.797 is a high correlation value [11]. As for the relationship of concept understanding with the students' mathematics learning outcomes control group is 0.721 which is also a high correlation value [11]. There is a strong relationship between conceptual understanding and students' mathematics learning outcomes. The results of this study underpin the results of [12], he obtained a strong relationship between conceptual understanding and learning outcomes. Furthermore [13] mentions that understanding or deepening of the concept is very important to explore the results of good learning. In his research also said high student learning outcomes show students' understanding of the concept is also high [1].
Obviously the interdisciplinary concept with student learning outcomes has a close relationship. To be more clear note the table 1 and table 2 below:

**Table 1.** The relationship between understanding students' concepts and student learning outcomes of experimental groups.

| Understanding Concept | Study Result |
|------------------------|--------------|
| Pearson Correlation    | .797**       |
| Sig.(2-Tailed) N       | 44 44        |

**Table 2.** The relationship between conceptual understanding and student learning outcomes of the control group.

| Understanding Concept | Study Result |
|------------------------|--------------|
| Pearson Correlation    | .721**       |
| Sig.(2-Tailed) N       | 44 44        |

Tables 1 and 2, describes data about the relationship between understanding mathematical concepts of students with student learning outcomes that were analyzed using Pearson correlation test. The result of data analysis shows that the correlation between students' concept comprehension and student learning outcomes for the experimental group is 0.797. This suggests that the relationship between students' conceptions of understanding and student learning outcomes is high [11]. When analysis result of relation between understanding student concept with student learning result of control group is 0.721. This suggests that the relationship between students' conceptions of understanding and student learning outcomes is high [11]. It can be interpreted also that the higher the understanding of student concepts, the higher the student learning outcomes and apply to the opposite.
4. Conclusion
This study explains there is a significant relationship between understanding the concept of mathematical transformation with the achievement of the learner. That is, the higher the understanding of the mathematical concepts of students the higher the value of achievement. The results of the study also have implications especially on students and teachers to make an atmosphere of teaching and learning that add insight by using computers and increase the skills of teachers in using computers in learning.

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References
[1] Hai N L and Kamran S 2010 Can interactive visualization tools engage and support pre-university students in exploring non-trivial mathematical concepts? Komputers and Education 54 pp 972-991
[2] Geometer’s 2001 Sketchpad Reference Manual (Fall) (California: Key Curriculum Prass)
[3] Nicholas J 1995 The Geometer’s Sketchpad (Berkeley. California: Key Curriculum Prass)
[4] Ropinus and Sidabutar 2016 The Efforts to Improve Mathematics Learning Achievement Results of High School Students as Required by Competency Based Curriculum and Lesson Level-Based Curriculum Journal of Education and Practice 7 (15)
[5] Depdikbud 2005 Kurikulum Berbasis Kompetensi (Jakarta Pusat: Kurikulum)
[6] Dimakos G and N Zaranis 2010 The Influence Of The Geometer’s Sketchpad On The Geometry Achievement Of Greek School Students The Teaching Of Mathematics 13 (2) pp 113-124
[7] Yuce and Ertugrul 2016 Effect of Utilizing Geometer’s Sketchpad Software on Students’ Academic Achievement in Mathematics’ Training at High Schools The International Journal Of Engineering and Science (IJES) 5 (10) pp 90-92
[8] Kamariah A B 2009 Effect of utilizing Geometer’s Sketchpad on performance and mathematical thinking of secondary mathematics learners: An initial exploration International journal of education and information technologies 3 (1)
[9] Rafidah B M N 2003 Mengenal Pasti Tahap Pemahaman Pelajar Sekolah Menengah Mengenai Konsep Geometri Berdasarkan Kepada Teori Van Hiele (Tesis: UKM)
[10] Van Hiele-Geldof D 1957 De didaktiek van de meetkunde in de eerste klas van het V. H. M. O. The didactics of geometry in the lowest class of the secondary school (English summary of doctoral dissertation, University of Utrecht) pp 179-183
[11] Alias B 1999 Statistik Penyelidikan dalam Pendidikan dan Sains Sosial (Bangi, Malaysia: Universiti Kebangsaan Malaysia)
[12] Sarjiman P 2006 Peningkatan Pemahaman Rumus Geometri Melalui Pendekatan Realistik Di Sekolah Dasar Cakrawala Pendidikan Journal UNY 25 (1)
[13] Despina V M 2012 Can Students’ Concept of Learning Influence Their Learning Outcomes? High. Learn. Res. Commun European University Cyprus 22
[14] Marlina A and Nurhidayah U 2010 Tahap Kefahaman Pelajar Tingkatan Dua Bagi Topik Nombor Negatif(Johor: Universiti Teknologi Malaysia)