Improving self-regulated learning junior high school students through computer-based learning

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Abstract. This study is back grounded by the importance of self-regulated learning as an affective aspect that determines the success of students in learning mathematics. The purpose of this research is to see how the improvement of junior high school students' self-regulated learning through computer based learning is reviewed in whole and school level. This research used a quasi-experimental research method. This is because individual sample subjects are not randomly selected. The research design used is Pretest-and-Posttest Control Group Design. Subjects in this study were students of grade VIII junior high school in Bandung taken from high school (A) and middle school (B). The results of this study showed that the increase of the students' self-regulated learning who obtain learning with computer-based learning is higher than students who obtain conventional learning. School-level factors have a significant effect on increasing of the students' self-regulated learning.

1. Introduction
In mathematics learning in addition to cognitive aspects, affective aspects are also important to develop. The affective aspect contributed to determine the success of students in learning mathematics, one of the affective aspects is self-regulated learning [1]. NCTM suggests that the role of affective and cognitive aspects in mathematics learning is very important [2]. Both aspects are simultaneously very influential in the achievement of student achievement. Thus the students' self-regulated learning mathematics is a very important factor in determining their success in learning mathematics. The rapid technological developments have resulted in an increasing number of accessible learning resources. This will greatly support learning for students who have high self-regulated learning. Characteristics of students who have self-regulated learning are: they view themselves as agents of their own behavior and actions; they believe that learning is a proactive process; they can motivate themselves; And they use various strategies to get the desired learning outcomes[3]. In addition to being able to have self-regulated learning students must have knowledge about himself, about the subject to be studied, about the task, about learning strategies and about the application of the subjects studied. The learning independence has a high correlation with student success [4]. Students with good self-regulated learning have high learning motivation. Indicators of the students' self-regulated learning in this study refers to Sumarmo [5], namely: (1) learning initiatives, (2) diagnose learning needs, (3) set learning goals, (4) organize and control learning performance, (5) view difficulty as a challenge , (6) finding and utilizing relevant learning resources, (7) selecting and implementing learning strategies, 8) evaluating learning processes and outcomes, and (9) self-efficacy.
Learning with computer-based learning is one of the factors that allegedly can improve students’ learning independence. This is because learning with computer-based learning can serve and overcome individual differences of students, giving experimental and exploratory opportunities, student’s speed in mastery of learned concepts is higher and student attitudes toward mathematics become more positive [6].

Given that mathematics is a structured science, then to master a mathematical concept is necessary mastery of the underlying mathematical concepts, so that the initial cognitive abilities of students expressed KAM (high, medium, low) to mathematics play a very important role for the mastery of new concepts of mathematics. Arends [7] suggests that students’ early ability to learn new ideas depends on their previous prior knowledge and existing cognitive structures. The findings of Kariadinata's research [8] conclude that the categories of students' mathematical abilities based on KAM (high, medium and low) indicate that (1) there are significant differences in geometrical spatial visualization capabilities based on categories of students’ math skills, (2) Geometry space visualization ability and math ability.

In the variable of initial ability level of students, the results showed that the initial ability level variable contributes to student learning outcomes based on the level of: (1) high ability to give effect size of 0.91; (2) moderate ability of 0.70; (3) Low ability of 0.64 Marzano) [9]. These results illustrate that the ability of students are empirically formed according to the rank of each student's ability and of course participate coloring the learning process. Thus the variables of initial ability level need to be considered in seeing the success of teaching and learning process.

In addition to KAM factors, school level factors need to be considered in improving students' self-reliance with computer-based learning. This is done to represent the existing schools, both in terms of quality and in terms of student ability.

In addition, school level determination is based on facilities owned by the school. These facilities include the building, learning tools both used by teachers or used by students to receive the materials taught. Such learning tools such as books in the library, laboratory, or other learning media used as a tool in learning. Complete and appropriate teaching tools will facilitate the acceptance of instructional materials provided to students. If students are easy to accept the lesson and master it then the students will be motivated to study harder. Therefore, to create a learning process that is able to optimize the potential of students, school-level factors need to be one of the material considerations.

The use of school level in this study aims to ensure that all school groups are represented so that the conclusions obtained are more representative. This grouping also aims to see whether there is a shared influence between the learning used and the school level on improving students' self-reliance in mathematics.

Students who are in high school level are assumed to have higher self-regulated learning compared with students who are at the middle school level, especially at the low school level. High-level students are better able to manage time and control themselves in thinking, planning strategies, then implementing them, and evaluating or reflecting [4]. This is in line with Hargins [5] which states that individuals who have high self-regulated learning tend to learn better. They are able to monitor, organize and evaluate the learning process effectively. This is supported by the results of Darr and Fisher's study [4] who report that self-study is highly correlated with student learning success.

Thus, one of the chosen learning strategies that is thought to potentially explore the students' mathematical abilities, especially the geometry of building a flat side room, is learning with computer based learning. This study chose and tested the learning strategy with computer-based learning, with consideration because in learning through computer based learning contained learning activities more meaningful (meaningful) based on constructivism, interactivity, feedback and reflexive approach. Learning by computer-based learning can facilitate in improving the ability of conceptual understanding through computer-provided animations in constructing conceptual knowledge, strategic knowledge, linking various concepts. Learning with computer-based learning can facilitate students' self-regulated learning through interactivity and feedback provided by the computer in initiating, diagnosing learning, learning performance, learning strategies, and evaluation of the process &
learning outcomes provided in the program features. Research through computer based- learning by researchers using several models of learning that is drill-practice model, simulation model, tutorial model, and discovery learning model.

Looking at the learning process with computer-based learning is closely related to the self-regulated learning, learning through computer based learning is expected to improve students' self-regulated learning. So the formulation of the problem in this study is How to increase the students' self-regulated learning junior high school students through learning with computer - based learning in terms of overall and, school level?.

2. Methods
This research is a quasi-experimental research (quasi experiment). This is because individual sample subjects are not randomly selected. The sample subject is already within the learning group in the classroom, so it will be difficult and disrupt the teaching and learning activities in school if individual sample subjects are randomly selected. Ruseffendi [10] states that in quasi experimental subjects are not randomly grouped, but the researcher accepts the state of the makeshift subjects. The research design used was Pretest-Posttest Control Group Design. Subjects in this study were students of grade VIII junior high school in Bandung taken from high school (A) and middle school (B).

The research instrument used is the scale of students' self-regulated learning. The scale of this 35-item statement self-regulated learningscale in mathematics consists of 35 items of statement with four choices of answers, namely: SS (Strongly Agree), S (Agree), TS (Disagree), and STS (Strongly Disagree). The choice of N (Neutral) answers is not used to avoid student hesitation. Preparation of the self-regulated learning scale begins by making the scale of the scale includes the measured aspect and the positive and negative statements.

This scale is developed and developed based on nine aspects of self-regulated learning, namely: (1) learning initiatives, (2) diagnosing learning needs, (3) setting learning goals, (4) organizing and controlling learning performance, (5) viewing difficulties as challenges, (6) finding and utilizing relevant learning resources, (7) selecting and implementing learning strategies, (8) evaluating learning processes and outcomes, and (9) self-efficacy.

3. Results and Discussion

3.1. A. Increasing self-regulated learning after Gaining Learning
In this section we will examine the differences in improving students' self-regulated learning based on overall learning. Prior to the test, prerequisite tests were performed, normality test and homogeneity of variance of both groups of N-Gain data samples. Test results are presented in Table 1 and Table 2 below.

| Group | n  | Mean | KS-Z | Sig. (2-tailed) | Ho |
|-------|----|------|------|----------------|----|
| CBL   | 79 | 0.4111 | 0.486 | 0.972          | Accepted |
| CL    | 81 | 0.2512 | 0.757 | 0.616          | Accepted |

Table 1 shows that both learning groups have sig values. (2-tailed) is greater than 0.05, so Ho is accepted. Thus, based on data increasing the students' self-regulated learning of the two learning groups, the population is normally distributed. After it is known that the data is normally distributed, the homogeneity test of N-Gain data independence of the students' learning of the two groups of learning with the following hypothesis.

H0: There is no difference variance score N-Gain self-regulated learning in terms of learning groups.

H1: There is a difference variance score N-Gain self-regulated learning in terms of learning groups.
Testing criteria: if the probability value (sig.) is greater than $\alpha = 0.05$, then $H_0$ is accepted, and in the opposite case $H_0$ is rejected. To test the hypothesis is used Levene test (Levene's Test for Equality of Variances). The results of homogeneity test calculations are presented in Table 2 below.

**Table 2. Homogeneity Test of Variance of N-Gain Data of Student self-regulated learning Both Learning Groups**

| Levene Statistic (F) | df1 | df2 | Sig. | $H_0$ |
|----------------------|-----|-----|------|-------|
| 3.252                | 1   | 158 | 0.073| Accepted |

Table 2 shows that the sig value, (2-tailed) of 0.073 is greater than 0.05, so $H_0$ is accepted. Thus, the variance of both groups of data increases students' self-regulated learning both homogeneous learning groups. Therefore, to examine the differences in the increase in students' self-regulated learning both groups of learning were used independent $t$ statistics. To test the hypothesis, hypotheses were then proposed to examine the differences in the increased students' self-regulated learning of the two learning groups. Statement of statistical hypothesis tested: $H_0$: $\mu_e \leq \mu_k$ $H_1$: $\mu_e > \mu_k$ with $\mu_e =$ average increase in students' self-regulated learning who gain learning with computer based-learning $\mu_k =$ the average increase in students' self-regulated learning that obtains conventional learning Testing Criteria: if the probability value (sig.) is greater than $\alpha = 0.05$, then $H_0$ is accepted; In other cases, $H_0$ is rejected. The results of the significance test of the differences in the increase of students' self-regulated learning by using independent $t$ test, are presented in Table 3.

**Table 3. Differences Test Increased Self-Regulated Learning Both Student Learning Group**

| Learning    | n  | Rerata | t     | Sig. (1-tailed) | $H_0$ |
|-------------|----|--------|-------|-----------------|-------|
| Computer    | 79 | 0.4111 | 7.157 | 0.00            | Rejected |
| Convensional| 81 | 0.2512 |       |                 |       |

Table 3 shows that the probability value or sig. (1-tailed) is smaller than $\alpha = 0.05$, so $H_0$ is rejected. Thus, students who gain learning with computer-based learning significantly have an average increase in higher self-regulated learning than students who have received conventional learning. Based on Hake's criteria, the increase of students' self-regulated learning in both learning groups is moderate and low. This is possible because the activities of students who study with computer-based learning is highly motivated, enthusiasm, and big curiosity. For example, students are asked to construct a space-building model when a known view scheme is as follows (Figure1).

**Figure 1.** space-building model
An example of student interactivity in CBL learning and one of the students’ work in answering the question can be seen in the figure 2 and 3. Based on the above drawings (Figure 2), students can create five spatial models that match the predefined view scheme. Each model made can be moved to the desired position, so it is obvious if you want to see front view, right side view, and top view. While students who get conventional learning, using small unit cubes forwarded to the class no one who can construct the model wake up the space is more than one form. Furthermore, they were instructed to draw the model of the space on the board. Based on the activities undertaken they can not describe the form of wake up space.

3.2. Increased Self-Regulated Learning after Gaining Learning by School Level
Increased learning independence after school-based learning was tested using a Two-WayANOVA test. Prior to the Two-WayANOVA test, the increased data on learning independence was tested for normality and homogeneity of variance based on the school level as presented in Table 4 and Table 5.
Table 4. Normality test results n-gain self-regulated learning based on school level

| School Level | Statistic | MBK | PKV | Combined |
|--------------|-----------|-----|-----|----------|
|              | N         | 40  | 41  | 81       |
| Upper        | KS-Z      | 0.369| 0.825| 0.805   |
|              | Sig.      | 0.999| 0.504| 0.537   |
|              | N         | 39  | 40  | 79       |
| Middle       | KS-Z      | 0.485| 0.630| 0.860   |
|              | Sig.      | 0.972| 0.822| 0.450   |

Table 4 shows that both sig values. (2-tailed) is greater than 0.05, so Ho is accepted. Thus, based on data of increasing students' self-regulated learning in both learning groups at each school level, the population is normally distributed. After it is known that the data is normally distributed, the homogeneity test of N-Gain self-regulated learning data of the students of the two groups of learning based on the school level with the following hypothesis.

H0: There is no difference in variance score N-Gain self-regulated learning in terms of learning groups and school level.

H1: There is a difference variance score of N-Gain self-regulated learning in terms of learning groups and school level.

Testing criteria: if the probability value (sig.) is greater than $\alpha = 0.05$, then Ho is accepted, and in the opposite case H0 is rejected. To test the hypothesis is used Levene test (Levene's Test for Equality of Variances). The results of homogeneity test calculations are presented in Table 5.

Table 5. Homogeneity test of variance of n-gain data of students'self-regulated learning both learning group based on the school level

| Statistik Levene (F) | df1 | df2   | Sig. | H0   |
|----------------------|-----|-------|------|------|
| 0.341                | 1   | 158   | 0.560| Accepted|

Table 5 shows that the sig value. (2-tailed) of 0.560 is greater than 0.05, so Ho is accepted. Thus, the variance of both groups of data increased students'self-regulated learning at both homogeneous school levels. Therefore, to examine the differences in the increase in students'self-regulated learning, both groups of learning used two-way ANOVA statistics. Furthermore, hypotheses are proposed to examine the differences in the increase in self-regulated learning of both levels of learning. Statement of statistical hypothesis tested: Ho: $\mu_a \leq \mu_t$ H1: $\mu_a > \mu_t$ with $\mu_a =$ the average increase in student self-sufficiency in high school $\mu_t =$ the average increase in students'self-regulated learning in middle school Testing Criteria: if the probability value (sig.) Is greater than $\alpha = 0.05$, then Ho is accepted; In other cases, Ho is rejected. The results of the significance test of the differences in the increase of students'self-regulated learning are presented in Table 6.

Table 6. Test results two way anova n-gain self-regulated learning based on the school level

| Source        | Sum of Squares | df | Average Squares | F      | Sig. | H0   |
|---------------|----------------|----|-----------------|--------|------|------|
| Learning      | 1.016          | 1  | 1.016           | 52.913 | 0.000| Rejected |
| School Level  | 0.096          | 1  | 0.096           | 5.022  | 0.026| Rejected |
| Learning* School Level | 0.065 | 1  | 0.065           | 3.373  | 0.068| Accepted |

Two-WayANOVA test results based on the school level in Table 6 obtained a significance value of 0.026 smaller than 0.05 or $p$(sig)> 0.05. This means that there is a significant difference in the average score of students'self-regulated learning between high school and middle school level or in other
words the students' self-regulated learning between high school and middle school is significantly different. When viewed from the average of the students' self-regulated learning, the upper level school has higher self-regulated learning (0.3542) compared with the middle school level self-regulated learning (0.3056).

Based on the results of the study showed that students who gain computer-based learning significantly have an average increase in the students' self-regulated learning is higher than students who obtain conventional learning. This is in accordance with the principles of computer-based learning in Rusman et al. stating that [11], computer-based learning is oriented towards individual learning and oriented to self-learning. In learning computer-based learning students are given the flexibility to use the time in accordance with the needs and capabilities that require independent learning, where the teacher only acts as a facilitator, all learning experiences are packaged in computer-based leaning learning program. It also shows that the application of computer-based learning has a greater impact than conventional learning in improving learning independence. To develop and apply learning independence, confidence and motivation are required. The existence of motivation and monitoring conducted during the learning process is thought to be the trigger factor of increasing the students' self-regulated learning in computer-based learning group. This is in accordance with the opinion of Zimmerman [12] states that independent students are students who have high confidence and intrinsic motivation.

The results also indicate that there is a difference in the average score of students' self-regulated learning significantly between upper and middle school level or in other words the students' self-regulated learning between high school and middle school is significantly different. This is because students who are at the previous top school have a good learning achievement. The learning achievement is obtained with persistence and high motivation. This is in line with the opinion of Zimmerman which describes the self-regulated learning that learning is largely from the influence of building their own thoughts, feelings, strategies, and learning behaviors that are oriented towards achieving learning goals. Motivation is consistently seen as a determinant of student learning and achievement. So it is natural that students in high school have higher self-regulated learning than students in middle school.

4. Conclusion
Based on the results of research, it can be concluded that the increase of the students' self-regulated learning who obtain learning with computer-based learning is higher than students who obtain conventional learning. School-level factors have a significant effect on increasing the students' self-regulated learning. Based on the results of research studies through computer-based learning can be applied by teachers as an alternative to develop the students' self-regulated learning of junior high school and can be applied at all levels of school.

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