Effectiveness of Computer Assisted Tests Based on Macromedia Flash on Understanding Concept Ability in PGSD Students of Santo Thomas Catholic University Medan

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Abstract. The problem in this study is the lack of use of media in learning, the ability to understand concepts in learning is less effective, the lack of understanding in developing learning media. This study aims to determine the effectiveness of computer assisted tests based macromedia flash on the ability to understand concepts in PGSD students of Santo Thomas Catholic University. This research is using experimental research methods with quantitative approach. In field trials the average pretest score is 67.03 while the average posttest score is 90.14 with an average increase of 23.11. The minimum gain value is 0.70 with a high category while the maximum gain value is 1.00. The results of data processing showed that the effectiveness of computer assisted tests on Macromedia Flash was 95.00. It can be interpreted that the variable computer assisted test based on macromedia flash has a very positive effectiveness with a contribution of 95.00 with very good criteria for the ability to understand the concept of students and 5.00 others are influenced by other factors beyond the variable computer assisted test based macromedia flash. Thus it can be stated that using computer assisted test based macromedia flash in learning has a very positive effectiveness on the ability of understanding students' concepts.

Keywords: CAT, Macromedia, Understanding Ability.

1 Introduction

Learning is the process of interaction between the recipient of the message with the source of information and learning resources in the learning environment that exchanges information related to the topic presented. The process will result in the acquisition of knowledge and knowledge, mastery of skills and character, as well as the formation of attitudes and beliefs. In the context of education, the lecturer teaches that students can learn and master the content of the lesson to achieve something determined objectives that include cognitive aspects, attitudes (affective aspects), and skills (psychomotor aspects), but this teaching process gives the impression only as the work of one party, that is, teacher work, while learning implies the interaction between instructors and students.

In reality on the ground the learning process carried out at this time did not meet the expectations of the lecturers as the development of learning strategies in class. Students have difficulty in learning, especially in mastering learning topics with the ability to understand concepts. Thus, the ability to understand concepts is a very important factor for the cognitive

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development of students. This can be seen in measuring the ability to understand the concepts of students as follows: draw a house plan with a length of 20 m and a width of 10 m on the size of the land, this students do not understand the steps of problem solving because students do not have the ability to understand concepts, which should be from the planning stage students solve by modeling first into the form of mathematics in accordance with the problem, then solve it by determining the length of each building to be built. Understanding is interpreted from the word understanding. The degree of understanding is determined by the level of interconnectedness of an idea, procedure or mathematical fact understood comprehensively if these things form a network with a high connection. And the concept is interpreted as an abstract idea that can be used to classify a group of objects [1]. School mathematics, hereinafter referred to as mathematics, as follows: Mathematics as an activity to trace patterns and relationships, Mathematics as creativity that requires imagination, intuition and discovery, Mathematics as a problem solving activity, Mathematics as communication tool [2].

The indicators of understanding concepts according to the 2006 curriculum, namely: restating a concept, classifying objects according to certain properties (according to the concept), giving examples and non-examples of concepts, presenting concepts in various forms of mathematical representation, developing necessary conditions or a sufficient condition of a concept, using, utilizing, and choosing a particular procedure or operation, applying the concept or problem solving algorithm.

To address the problems that arise in the process of learning mathematics, learning approach solutions that can accommodate Computer Assisted Test are defined as a test method using computer aids that are used to obtain minimum standards of basic competency and staff competency standards. As for the stages the process of designing a CAT system begins with research and data collection, then planning, prototyping, testing, and improvement and development. The CAT system prototype has the following characteristics: (1) The application uses a windows platform or an open source website-based; (2) There is a narrative that contains instructions that are presented on a computer monitor screen; (3) The application is accompanied by a mouse movement video to facilitate its use in operating it, and (4) Equipped with tutorials and text containing instructions on a computer monitor screen so that all test takers can easily operate it [3]. CAT as one of the methods used in conducting tests has the following basic principles; (1) The CAT system is designed as easily as possible, so that test takers can operate it; (2) How to operate it is very easy, even for beginners because only by using the mouse to work on test questions and choose answers. The committee is required to provide guidance and display video instructions on how to operate the CAT system to provide instructions on using the CAT system; (3) the questions in the CAT application vary but with an equal difficulty level. Participants get different questions, and questions are randomized automatically and then distributed to each participant's computer; and (4) Automatic checking of test results is carried out by the application [4,5]. The score of the participant can be monitored simultaneously through the monitoring room outside the place of the test implementation. While the test participant can find out the value obtained shortly after completing the test through the monitor screen of each computer.

This Computer Assisted Test is designed using flash media macros. Macromedia Flash 8 is a software version of Macromedia.inc in the form of graphics and animation programs whose existence is intended for lovers of design and animation to be creative in creating interactive web animation, cartoon animated films, making company profile business presentations or interesting activities and flash games [6,7]. Based on the background above, the problems identified in this study are:

a. The lack of use of media in learning.
b. Lack of student skills with media development.
c. The ability to understand the concept is less than the maximum.

As for the limitation of the problem in this study are: effectiveness of computer assisted test based on macromedia flash against the ability to understand the concept of scale and comparison of higher class mathematics education subjects in PGSD semester III students in the University Catholic Santo Thomas Medan.

As for the formulation of the problem in this study are: how is the effectiveness of computer assisted test based on macromedia flash against the ability to understand the concept of scale and comparison of high class mathematics education subjects in PGSD III semester students in the University Catholic Santo Thomas Medan?

The objectives of this research are: to find out the effectiveness of computer assisted test based on macromedia flash on the ability to understand the concept of scale and comparison of higher class mathematics education subjects in PGSD semester III students in the University Catholic Santo Thomas Medan.

2 Research Method

In research, each researcher should first determine the method / type of research to be used. The research method used in this study is a quantitative method of experimental type. Place of Research This research was carried out in PGSD FKIP of University Catholic Santo Thomas Medan 2019/2020 academic year. The time of this research is estimated to take place in the odd semester of the 2019/2020 school year which is adjusted to the lecture schedule.

The research design used is the true experimental design method. One form of true experimental design method is pretest-posttest control group design. Pretest-posttest control group design is a design consisting of two groups chosen randomly, then given a pretest to find out the initial state is there a difference between the experimental group and the control group [2].

Table 1. Pretest-Posttest Control Group Design

Group	Pretest	Treatment	Posttest
E_1	O_1	X_1	O_2
E_2	O_3	X_2	O_4

Information

E1 = Group 1 (experimental class 1)
E2 = Group 2 (experimental class 2)
O1 = Experimental group pretest 1
O2 = Posttest of experimental group 1
X1 = Application of Computer Assisted Test
X2 = Ordinary Learning
O3 = Pretest the experimental group 2
O4 = Posttest of the experimental group 2

Populations are the whole subject of research. If someone wants to examine all the elements that exist in the research area, then the research is population research, the study or

research is also called population study or case study. Population is the area of generalization consisting of: objects / subjects that have certain quantities and characteristics set by researchers to be studied and then drawn conclusions [2]. This means that the population is not only to humans, but also objects or other objects that have the same nature / character.

The sample is a portion of the amount owned by the population with the same characteristics. Sample is part of the number and characteristics possessed by the population. If the population is large, and researchers may not study everything in the population, for example due to limited funds, manpower, and time, then researchers can use samples drawn from that population [2]. This means that a portion or amount that represents the population that is used as the object of research.

Data is the result of recording research, both in the form of facts and figures. Data collection can use primary sources and secondary sources [2]. Primary sources are data sources that directly provide data to data collectors, and secondary sources are sources that do not directly provide data to data collectors ". Then the researcher will use a data source that is primary data obtained directly from the research subject.

The source of research data is the subject from which data can be obtained". So in this study, the data source used was 60 fifth grade students from 117 populations. Observations as an assessment tool is widely used to measure the behavior of individuals or the process of the occurrence of an observed activity, both in actual situations and in artificial situations". In this study, researchers conducted direct observations of teaching and learning activities undertaken by teachers in the classroom while teaching. This observation is useful to find out the conditions of learning in the classroom conducted by lecturers during learning activities.

Researchers also use the test as a data collection tool. Test is a number of statements that must be responded with the aim of measuring a person's ability level or reveals certain aspects of the person subjected to the test". In this study, researchers will use multiple choice tests [2]. Multiple choice tests consist of a statement or notification about an incomplete understanding. And to complete it must choose one of several possible answers that have been provided ". The preparation of this instrument refers to the revised Bloom domain of cognitive taxonomy, starting from C1 - C4. C1 is the cognitive domain of remembering, C2 understanding, C3 applying, and C4 is analyzing.

Before the test is given to the sample, the test is tested first. This test was tested on other students who were judged to have the same abilities as the students to be studied. The items that have been tested will be tried out to school. To see the characteristics of the test, the validity and reliability tests were performed and the application of IBM SPSS Statistics 22 was used.

Validity is a measure that shows the levels of validity or validity of an instrument. A valid or valid instrument has high validity ".

$$r_{xy} = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{(N\Sigma X^2 - \Sigma X)^2 (N\Sigma Y^2 - \Sigma Y)^2}}$$

Information:

r_{xy} = Correlation coefficient x and y
N = Number of respondents / many students taking the test
X = Number of scores obtained by students for each item items
Y = Correct total score

From the results of the calculation of the validity of the test instruments using the IBM SPSS Statistics 22 program according to the calculation results obtained rcount > rtable with a significance level of 5%. Reliability refers to an understanding that an instrument can be

trusted enough to be used as a tool to collect data because the instrument is already good. To test the reliability of the tests in the study the following KR-20 formula[2] is used:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(\frac{s^2-\Sigma pq}{s^2}\right)$$

Information:

R11 = Test reliability
p = proportion of subjects who answered the item correctly
q = The proportion of subjects who answered the item incorrectly
Σpq = Number of multiplication results between p and q
n = The number of items
S = standard deviation

The formula for finding the standard deviation is as follows:

$$SD = \sqrt{\frac{\Sigma f x^2}{N}}$$

Information:

SD = Standard Deviation
Σfx² = Number of multiplications between the frequencies of each interval with frequency squared
N = Number of samples

The interpretation of the value of r_{11} presented in the following table [8]:

Table 2. Correlation Coefficient Qualification

No	Qualification Correlation	Coefficient
1	$0,80 < r_{xy} \leq 1,00$	Very high
2	$0,60 < r_{xy} \leq 0,80$	Height
3	$0,40 < r_{xy} \leq 0,60$	Enough
4	$0,20 < r_{xy} \leq 0,40$	Low
5	$r_{xy} \leq 0,40$	Very low

This research was carried out with the help of SPSS program ver.21.0 and Ms. Exel 2007. The steps in the analysis prerequisite test and data analysis are as follows. Data normality test is intended to ensure that the sample data comes from populations that are normally distributed". To find out whether the data is normally distributed or not, the researchers used the Kolmogrov-Smirnov analysis with the help of the SPSS program ver. 21.0. The normal criteria are met if the test results are not significant for a certain level of significance ($\alpha = 0,05$) If significance obtained is>α, then samples from populations that are normally distributed. α H0 is rejected, that means the data is normally distributed.
If the significance obtained <α, then it does not come from a population that is normally distributed.α H0 received. That means the data is not normally distributed.

Homogeneity test is intended to show that groups or more sample data come from populations that have the same variance". In this study, the homogeneity test was performed on a difference test that would use the help of the SPSS program ver.21.0. The interpretation is done based on the determination of the significance level ($\alpha = 0,05$). If the significance obtained >α then the variance of each sample is homogeneous. If the significance obtained <α then the variance of each sample is not homogeneous.

Hypothesis testing is done by t-test analysis. T-test is used to determine whether the two means differ significantly or not at the chosen probability level. The calculation is done with

the help of the SPSS program ver. 21.0. The result is that if the price of t-count is equal to or greater than the price of t-table, the means are significantly different at the selected height.
Increased concept understanding ability to find out the improvement of students' mathematical understanding ability, they do a pre-test and post-test. The results of both tests are calculated with N-gain;

$$(g) = \frac{(gain)}{(gain)_{Max}} = \frac{(postest) - (pretest)}{100 - (pretest)}$$

Table 3. The upgrade criteria are determined as follows:

g < 0,3	Low Category
0,3 ≤ g ≤ 0,7	Medium Category
g ≥ 0,7	Category Height

Student learning activities are observed during the course of action. Observational data obtained were analyzed by determining the percentage of the average score of student activity, and then the success criteria were determined.
Student learning activity scores are calculated using the formula:
Percentage of average score (PA)= $\frac{\text{total score}}{\text{maximum score}}$ x 100%
Interpretation of average scores as follows:

90% ≤ SR ≤ 100%: Very good
80% ≤ SR <90%: Good
70% ≤ SR <80%: Enough
60% ≤ SR <70%: Poor
00% ≤ SR <60%: Very Poor

Success criteria for action for aspects of student activities are achieved when SR ≥ 80% and Criteria for completeness learning are classically achieved when P ≥ 85%.

The research procedure is the stages of activities that will be carried out by preparing learning material and collecting data. Done with the steps as follows:

1) Preliminary Research
2) Planning Phase
3) Research Implementation Stage
4) The final stage

3 Results and Discussion

This research focuses on the following questions: The Effectiveness of computer assisted tests based macromedia flash on the Ability to Understand the Concept of Scale and Comparison of Higher Class Mathematics Education Subjects in PGSD Semester III Students in the of University Catholic Santo Thomas Medan.

The following will be explained one by one the research questions based on the results of research data analysis: Ability to Understand Scale Concepts and Comparison of High Class Mathematics Education Subjects in PGSD Semester III Students of University Catholic Santo Thomas Medan with computer assisted tests based macromedia flash. Learning outcomes are the results of student evaluations in the form of values concerning knowledge (cognitive)

obtained from the learning process. There are two types of learning outcomes in this study, namely the pre-test and post-test scores. The pre-test score is the value of learning outcomes before being given treatment with the application of computer assisted tests based macromedia flash. Posttest value is the value of learning outcomes after treatment, namely the application of computer assisted tests based macromedia flash.

Based on the results of the study obtained a pre-test minimum value of 45 and a maximum value of 80. The results of the calculation of student learning outcomes obtained an average value (mean) of pre-test of 67.03. While the minimum posttest score is 80 and the maximum value is 98. The results of calculations from student learning outcomes obtained an average value (mean) posttest of 90.14. Based on the acquisition of the average value of pre-test and post-test, it can be said that the value of learning outcomes by applying computer assisted tests based macromedia flash in semester III students is very good because it is above the indicator criteria determined by the researcher. Learning activities before and after treatment with the application of computer assisted tests based macromedia flash is effective on the ability of students to understand concepts. This is evident from the increase in the average value, increase in the average value of 23.11. The gain value is 0.70 with a high category while the maximum gain value is 1.00. The results of data processing showed that the effectiveness of computer assisted tests based macromedia flash was 95.00. It can be interpreted that the computer assisted test variable based on macro flash media has a very positive effectiveness with a contribution of 95.00 with excellent criteria for the ability to understand student concepts and 5.00 others are influenced by other factors beyond the variable computer assisted tests based macromedia flash. This improvement shows that the application of computer assisted tests based macromedia flash makes students better mastered the concepts in the learning process in high-class mathematics education subjects on scale and comparison topics. This is because the computer assisted tests based macromedia flash emphasizes concept understanding.

4 Conclusions

Based on the results and discussion of research on The Effectiveness of Macro Media-Based Flash Computer Assisted Tests on the Ability to Understand the Concept of Scale and Comparison of Higher Class Mathematics Education Subjects in PGSD Semester III Students in the University Catholic Santo Thomas Medan, it can be concluded that the ability to understand the concept of scale and comparison of high-class mathematics education courses in the third semester students of the PGSD University Catholic Santo Thomas Medan with the computer assisted tests based macromedia flash with an average score of 67.03 pretest and posttest 90.14. The gain value is 0.70 with a high category while the maximum gain value is 1.00. The results of data processing showed that the effectiveness of a computer assisted test based on macro flash media was 95.00. With an increase of 23.11 so that it can be said that with computer assisted tests based macromedia flash is effectively applied in improving the Concept Understanding Ability.

Based on the conclusions, implications, and limitations of the research that has been submitted, the following suggestions can be given:

1) For students, they should be more creative in improving their ability to understand concepts, in developing media as future teacher candidates.

2) For lecturers, especially lecturers supporting subjects, so that they can be creative in improving their students' understanding ability. Because these students are a mirror of ourselves as future teacher candidates.
3) For further researchers to be able to apply more effective learning in further research in order to improve students 'understanding of concept skills and to increase students' knowledge in the application of learning.

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