Self-assessment profile on statistics using computer-based mathematical summative test

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Abstract. Self-assessment is one of the students' growth and development processes so that students can immediately learn the learning mistakes they do. Students can improve their learning outcomes without having to wait for the results of the assessment of educators. The application of self-assessment is an attempt to improve the quality of learning, one of which is in a summative test of mathematics subjects using a computer. This study aims to look at the profile of self-assessment in computer-based summative tests. This study used qualitative descriptive. The research data was obtained from 110 students of senior high school 2 in Tasikmalaya using computer-based summative mathematical test on statistics material. The results of this study are the profile of students self-assessment in learning computer-based mathematics subjects.

1. Introduction

Every school certainly wants its students to be able to follow the learning well. Effective learning in improving the quality of mathematics learning, among others, must have a value of relevance to the achievement of thinking power and provide opportunities for the rise of creativity of students and educators themselves [1, 2]. Therefore each school is required to attract the attention of students and as much as possible can take advantage of technological developments. At present, we can use advanced technology by assessing the students' performance in the form of summative tests using computers [3-6]. This summative test is carried out to see the learning outcomes of students to fit the curriculum as an assessment standard applied by the school [7, 8].

Self-assessment is a process of assessing students by involving themselves in making judgments about their learning, especially about the learning outcomes of students. Also, self-assessment can be used to make improvements to the competencies of students who have not achieved completeness in their learning. Self-assessment should give a positive impact on personality development and direct the learner's perspective so that there will be no irregularities in learning [9-12]. Summative tests using a computer are judged to be faster and more accurate because the test results and the feedback provided can be used to conduct self-assessments by students [13].

The purpose of mathematics learning includes the five standards, among them, there are problem-solving, reasoning and verification, communication, connection, and representation [14]. In the curriculum standards, the purposes of mathematics learning include several things. First, to solve problems which consist of the ability to understand the problems, to design mathematics models, to solve the models, and to interpret the solution. Second, to communicate ideas using symbols, tables,
diagrams, and other media to clarify the situation or specific problem. Third, to have an attitude in respecting mathematics practicality in daily life, including to have curiosity, concerns and interest in learning mathematics, along with the tenacity and confidence in mathematics problem solving [15]. Therefore educators have the opportunity to see, to test, and to apply several conceptual models for success in learning [16-18].

To assess all the three aspects above, educators need to conduct the Assessment of Learning (AOL). Meanwhile, the current paradigm in today’s era demands the educators to invite their students to conduct evaluations by applying Assessment as Learning (AAL) and even Assessment for Learning (AFL) to improve their students’ learning achievement [19]. Every school always applies summative tests to carry out their assessments, but from 10 public schools in Tasikmalaya, only one school has implemented the summative test using a computer. The school uses the Learning Management System (LMS) to apply the summative test using a computer.

In this study, the indicators of summative tests used are based on the curriculum used to see the completeness of learning mathematics in mathematics statistics. Summative tests are carried out using an LMS-based computer in a computer laboratory. There is an influence of computer use in student behavior [1]. The disadvantage of this study is that the use of computers has not been applied in summative tests on mathematics subjects. Summative test is important to get feedback for teachers to streamline the learning model given [13]. The shortcomings of this study were that feedback was prioritized only to educators, not for students. This research is to analyze what is the profile of self-assessment in summative tests using computers in learning mathematics from feedback which has been given for students as learning.

2. Method
This research uses a qualitative descriptive method. The method in this research was used to analyze self-assessment student’s mathematics profile using computer-based on mathematical summative test on statistical material. The subject of this research was 110 senior high school students in SMA 2 Tasikmalaya with three classes. The class were selected with purposive sampling by choosing a class that first gets a computer-based summative test. The data used was mathematics summative test and interview. The summative test has been applied using computers through multiple choice for 70 minutes with the topic was statistical mathematics. Next, the data were descriptively analysed. Data analysis techniques in this study included: (1) reducing the data, by taking 2 summative test numbers that have the greatest error rate, (2) the presentation of the data, selected data will be analyzed from student answers and interview results, and (3) conclusion, will be taken from the results of the analysis of researchers taken from students’ answers.

In this study, we used indicators as described in Table 1 to see the students’ learning completeness based on the applied curriculum. Also, the summative test used is multiple choice with 15 questions. The questions given were mathematical statistics material that had previously been inputted first on computer media using an LMS. Every student uses a computer and uses random questions and random answers in the settings. Interviews were conducted for students who had taken a summative test using a computer that had met and had not met the passing grade on the specified learning indicators.

3. Results and Discussion
From the results of interviews, students stated that the use of computer-based summative mathematics tests was better than summative tests using the paper-based test. This testimony came up is because the questions and answer options that appear randomly by the computer can minimize cheating during the test. Also, students could know their mark objectively obtained at the end of the test. The results of the study are indicated by the mark and percentage of students in answering the questions given in Table 1. Although some questions have the same indicators, they have different types of questions. The difference is intended to measure the creativity of students in answering different questions on the same indicator. Besides, the difficulties and complexities found in summative tests can improve learning, as well as the success of students.
Table 1. Mathematical statistics summative test results using a computer

| No | Indicator of the Mathematical Statistics Summative Test | Students Answers |       |       |
|----|--------------------------------------------------------|------------------|-------|-------|
|    |                                                         | N    | %     | N     | %     |
| 1  | Students can solve problems from bar charts.           | 104  | 94,55%| 6    | 5,45% |
| 2  | Students can solve word problems.                      | 106  | 96,36%| 4    | 3,64% |
| 3  | Students can solve word problems.                      | 105  | 95,45%| 5    | 4,55% |
| 4  | Students can solve problems from group data made in table form. | 72   | 65,45%| 38   | 34,55%|
| 5  | Students can solve problems from line diagrams.        | 87   | 79,09%| 23   | 20,91%|
| 6  | Students can solve word problems.                      | 105  | 95,45%| 5    | 4,55% |
| 7  | Students can solve problems from group data made in table form. | 108  | 98,18%| 2    | 1,82% |
| 8  | Students can solve problems from group data made in table form. | 104  | 94,55%| 6    | 5,45% |
| 9  | Students can solve problems from bar charts.           | 110  | 100%  | 0    | 0%    |
| 10 | Students can solve problems from line diagrams.        | 90   | 81,82%| 20   | 18,18%|
| 11 | Students can solve word problems.                      | 99   | 90%   | 11   | 10%   |
| 12 | Students can solve problems from group data made in table form. | 39   | 35,45%| 71   | 64,55%|
| 13 | Students can solve problems from the statistical data shown. | 99   | 90%   | 11   | 10%   |
| 14 | Students can solve problems from the statistical data shown. | 103  | 93,64%| 7    | 6,36% |
| 15 | Students can solve problems from the statistical data shown. | 98   | 89,09%| 12   | 10,91%|

Based on Table 1, questions that are considered difficult are questions number 4 (See Figure 1) and number 12 (See Figure 2). It can be seen from a large number of students who answered incorrectly to the question. Out of 110 students, 87 students said to meet the completeness of mathematics learning while 23 students have not fulfilled the completeness of learning under the learning indicators provided. Therefore, researchers will analyze several self-assessment profiles using computers on summative tests on statistical material on mathematics subjects.

Figure 1. Problem number 4 of mathematical statistics summative test using a computer.

Figure 2. Problem number 12 of mathematical statistics summative test using a computer.
The following is an analysis of some of the students' answers from 23 students have not fulfilled the completeness of learning by the indicators provided:

![Figure 3. Students' error answer number 4](image3)

Figure 3 shows that the most errors of students in answering question number 4. Errors are seen in the cumulative frequency which should be taken to the frequency before the group data is taken. Mistakes then reduced mathematical symbols changed to mathematical symbols of accretion, which resulted in the misapplication of the formula. Students explain the confusion in the application of the formula because the formula used there are several types such as median, quartile, decile, etc. As written in the answers of the students: “Because \( x = 0 \), then those that have a score more than 58.5 do not exist, so the answer is \( 80 - (5 + 8 + 10) = 57 \)”. However, errors in the application of mathematical symbols often occur in solving problem solving and this answer error can be shown as feedback to students.

Figure 4 shows that the most errors of students in answering question number 12. Almost all students answered the amount of data on \( p \) is 20. Learners are wrong in applying Median formulas in grouped data in tables and substituting lower edge (Tb) with a value of 160. Students explain the confusion in determining the bottom edge because they focus more on the value of \( n, f_i, \) and \( f_k \) on the solution using the median formula. Erroneous answers to these students are given at the end of the summative test as feedback of students in conducting self-assessment, in order to correct learning errors.

The following is an analysis of some of the students' answers from 87 students who have fulfilled the completeness of learning by the indicators provided:

![Figure 5. Answer key for question number 4](image5)

Figure 5 and Figure 6 shows the answer to the question that should be 65.45% and 35.45% of students answered the questions correctly in mathematical statistical. As written in the answers of the students: “because those who have a value more than 58.5 are in the 21\textsuperscript{st} data, it can be concluded that \( 80 - 21 = 59 \)”. However, errors in the application of mathematical symbols often occur in solving problem-solving. Even so, it is better if this answer can be shown as feedback and still displayed to foster internal motivation [20, 21]. Internal motivation is one indicator of student learning success [22, 23].
Apart from the error feedback both answers from question 4 and 12, students are wrong in answering because they do not know the median formula, miscalculations, or incorrectly placing a mathematical symbol. Therefore the feedback provided can be in the form of formula information used and an appeal to re-examine the calculation to solve the problem in the question, can be seen in Figure 7 and Figure 8.

Feedback on answers is a form of self-assessment in the objectivity of students to improve insight (comprehensive) and can be used as a form of learning assessment transparency, as well as improve students' learning ability in learning mathematics [24]. Summative tests using computers have a high level of accountability (accountable) because students are required to complete the summative test independently. Therefore, the students who have not been able to answer questions correctly can do self-assessment to improve their learning outcomes on summative tests using computers. A summative feedback test using a computer will always be given to students as a form of transparency in the assessment of mathematics learning.

4. Conclusion
Self-assessment can be applied in mathematics subjects on summative tests using computers. The results of the answers that appear or are displayed to students are adjusted to the ability of knowledge in solving the given problems. Every student taking a summative test is given feedback from each question he answers. The profile of self-assessment on summative testing uses a computer in the form of insight enhancement (comprehensive), the objective in conducting an assessment (objectivity), open in assessment (transparency) and having a high level of responsibility (accountable). Therefore, students can immediately conduct self-assessment, to improve their learning abilities.

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