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The Modern Era of Mathematics Learning: Using Calculators in Classrooms, Why Not?

B Riantono^{1*}, L Fitriana¹, Mardiyana¹

¹Sebelas Maret University, Surakarta, Indonesia
email: *bagas.riantono@gmail.com

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ABSTRACT

Utilization of information and communication technology is needed to improve the efficiency and effectiveness of learning [1]. A calculator which can be found everywhere, has function as a device that performs arithmetic operations on numbers takes an important role in helping one complete a quick and precise calculation. However, the use of calculators in mathematics learning is still seen as an activity that can hinder the thinking ability of students in mastering a mathematical concept and even cause a dependency. The reality on the field shows that more than 80% of teachers in Salatiga never allow their students to use a calculator to solve a case involving a calculation. Based on the observations to 20 high-school students aged 16-19 years old, there are still more than 60% of students are still mistaken in solving real problems with the help of a calculator. In fact, from that 60% of the students mentioned earlier, it is obtained that more than 80% of them have understood the mathematical case appropriately. The author feels that there is a need for further discussion of that problem. This article will discuss the importance of using calculators as a useful calculation tool without reducing the students understanding of the mathematical case

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INTRODUCTION

Along with the advancement of era, the role of technology in life is also getting bigger. It makes teachers to be critical about the implementation of learning. Technology is an important component in learning mathematics [2]. Teachers must be able to form the character of students who can be blended with the era. One indicator that students can compete in this era of globalization is the ability of technology usage in life.

Calculator is one form of technology. Basically it is created to help a person to solve simple calculations such as addition, multiplication, subtraction, and division. Since the first invention of abacus calculator about 5000 years ago, the development of this calculating machine ability is growing rapidly. In 1642, Blaise Pascal invented a numerical wheel calculator (called Pascaline) that could add an eight-digit sum. The first calculator that can perform four basic arithmetic functions is the Colmar mechanical calculator (1820 by Charles Xavier Thomas de Colmar). The invention of Thomas Arithmometer got a positive response because until 1900, thousands units of this calculator were sold in Europe alone.

METHODS

The invention of various models of calculators marks the technology development. Mathematical calculations such as trigonometry, integrals, and drawing complicated function graphs can be overcome by using a calculator. Other advantages that can be obtained by using a calculator are as follows [3]

- Solving complicated arithmetic

For example: $\frac{1789}{1,0725} = \dots$

- Solving complicated equations quickly

For example : finding the real and complex solutions to the simple cubic polynomial equation $3x^3 + 2x^2 - 7x + 9 = 0$

- Accurate graphing of complicated functions

For example : drawing complicated function graphs

$$f(x) = \frac{x^3 - 17x + 7}{x^2 + 1}$$

- Solving complicated integral quickly

For example : solving

$$\int_0^{\frac{\pi}{2}} x^2 \sin(x) dx$$

- Problems not solvable by paper-and-pencil methods taught in schools

For example : solving

$$\int_1^2 \frac{\sin(x)}{x} dx$$

On the other hand, most teachers in Salatiga, Central Java, have a negative view of calculators usage in mathematics learning. This is also in contrast to the government's expectation to conduct technology-based education. However, a negative view of calculators usage in mathematics learning certainly has a reason. According to the interviews results with some teachers in Salatiga, related the reasons why they forbid students to use calculators in the classroom, they argue that using a calculator in mathematical learning will inhibit the students' sense of understanding when

performing calculations. In addition, the use of calculators in the classroom will make the students become lazy. That's why more than 80% of teachers in Salatiga never allow their students to use calculators.

Based on the description above, a test was conducted toward 20 students aged 16-29 to measure their skills in using a calculator to solve a simple arithmetic problem. Here is the question.

Theo has 24 packs of candy. From the candy, he took 6 packs to eat with his sister. The remaining candy is distributed equally to 3 of his friends for sale. The candy is Rp800.00 per pack. Based on that case, how much money did each Theo's friends earn?

The correct answer is Rp4.800,00. However, the students have different results. Over 60% of students (13 students) showed different answers on their calculator screens. The researcher then interviewed each student who did not answer correctly. This aims to know their understanding of the given question. As a result, more than 80% of students (11 students) can explain exactly what the question means. In the second test, students are required to solve the following operations using a calculator.

$$\frac{5^6 - 12361}{8} \times 3$$

The result, 16 students can answer correctly in less than 1.5 minutes. Meanwhile 2 other students showed the correct answer in about 3 minutes, and 2 others answered it wrong

RESULTS AND DISCUSSION

Based on the research, the students still have difficulty in interpreting their understanding so that they got the wrong answer. In the second question, all the students felt challenged to solve the problem with calculator. They feel that using a calculator during mathematic learning is new and fun. Then in a short time, mostly students can solve the second question quickly. This indicates that there is no effect to their concept of mathematic operation when using a calculator. So, the calculators usage does not reduce their understanding of the first problem/question.

Then why many students can not answer the first question correctly? Researcher assess that the results obtained by students in the first question were caused by habit factor. They are not used to using calculators so there is a need for adaptation. The calculators usage in the classroom can make learning mathematics become more active and dynamic. Students can explore more their knowledge of mathematics. In fact, that students' weakness in algebra / calculation can not prevent them from having more advanced understanding of mathematical ideas and concepts [4]. Moreover, the results of Third International Mathematics and Science Study (TIMSS) was that internationally, on all the tests at the advanced level, students who reported using calculators in their daily coursework performed well above those who rarely or never used them (TIMSS 1998) [3]. In general, it is fair to say that the research indicates that the use of calculators does not degrade the basic skills of students. In the review conducted by Hembree and Dessart (1992), calculators did appear to have positive effects on students' problem-solving abilities and attitudes toward mathematics[3].

CONCLUSION

Before computers and calculators, it was necessary for students to spend time mastering and becoming proficient in the use of paper-and-pencil computational and manipulative techniques. Today much of this time can be spent on developing deeper conceptual understanding and valuable critical-thinking and problem-solving skills [3]. Even though some people do not agree with calculators, but to limit the calculator usage for certain things need to be considered. Calculator can be used to help people calculating common calculation process, so they can be more focused on problem-solving activities, and calculator acts as a tool. Although there are research results showing that the calculator usage may not necessarily improve problem solving skills, but some research results indicate that students tend to use many strategies when they use a calculator. The main reason for using a calculator in mathematics learning is student can use their time to improve problem-solving strategies skills instead of doing common calculation

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