



**DEVELOPING STUDENTS' PROBLEM SOLVING SKILLS,  
MATHEMATICS ACHIEVEMENT, AND ATTITUDES TOWARDS  
MATHEMATICS THROUGH THE INTEGRATION  
fx991 ID PLUS SCIENTIFIC CALCULATOR  
INTO MATHEMATICS LEARNING**

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**Collaboration between  
Department of Mathematics Education – Universitas Negeri Yogyakarta  
and SEAMEO QITEP in Mathematics**

**2020**

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# CHAPTER I

## INTRODUCTION

### 1.1. Background

At the moment, people facing the 21<sup>st</sup>-century era, they need to develop their skills to compete globally and to survive in the competition. So do Indonesian students to succeed in the 21<sup>st</sup>-century society. One of the competencies in the 21<sup>st</sup>-century era is technology and media literacy skills. The Indonesian Ministry of Industry (KPRI) released a document 'Making Indonesia 4.0' in 2018 with setting out the ten national priorities for future development and number seven aims to redesign the education curriculum and create a professional talent mobility program. Thus, teachers can play their roles in reaching this national priority by helping their students to improve their skills and knowledge to help them face the world's problems.

Moreover, in this era, the use of technology is developing and rapidly increasing. As mentioned in NCTM (National Council of Teachers of Mathematics, 2000), technology is one of the six principles which have to be considered by teachers in school mathematics. In teaching mathematics, the use of technology has to be integrated into daily mathematics practices. Previous studies have reported that by incorporating technology into everyday teaching practices, teachers can facilitate creative opportunities and support learning environments which help to foster mathematics knowledge and skills (Hohenwarter, Hohenwarter, & Lavicza, 2008). It is intended school mathematics help students to be able to become a part of a productive society. Teaching mathematics meaningfully can be used as a bridge to succeed in modern society or also often called as the 21<sup>st</sup>-century, and help students become a part of a productive community.

From international assessments such as PISA (Programme for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Studies) can be understood the link between mathematics and problem solving skills. The purpose of PISA is to assess 15-year-old students' mathematical literacy (OECD, 2010, 2014, 2018). Additionally, TIMSS as an international students' assessment also examines a range of

problem solving skills which can be seen the most items of TIMSS requiring students to know apply, and reason as the cognitive domain (Mullis, Martin, Foy, & Hooper, 2016).

Over twenty years ago, NCTM (1989) stated that meaningful learning could contribute towards achieving mathematical literacy, giving all students the same opportunity to learn, and encouraging long-life learning. However, the use of technology will be the most appropriate opportunity to learn when combined with effective instruction. Technology becomes crucial in mathematics teaching and learning as it can improve students' learning and give significant impacts on the learning process (NCTM, 2000). The technology integration provides the valuable opportunities and active interaction among various mathematical objects at different levels of understanding and learning in different ways in the mathematics learning (Hollebrands (2007); Saha, Ayub, & Tarmizi, 2010).

Also, another benefit is technology can help students learn in different ways by using (Saha, Ayub, & Tarmizi, 2010). However, to see these benefits, teachers first have to prepare their students to use technology effectively. In mathematics learning, it can be done by using the integration of scientific calculator. It is clear that teachers must prepare their student to face the 21<sup>st</sup> century through the teaching and learning process. According to the definition provided by Duffy and McDonald (2010), learning can be explained as a complex activity that depends on why and how students do what they do.

Primary longitudinal research coming from Singapore has revealed that experienced and successful teachers continually vary their approach where they 'weave' several different pedagogical strategies into their classroom (Luke, 2005). Thus, the integration of scientific calculator will be contributed to experience students learning with technology, mainly. Demana & Waits (1992) compared the use of the calculator gives more benefit than a computer such as its portability and inexpensiveness so that more students could afford it. Instead, the features of the calculator are quite different and lesser than computer.

Several studies provide evidence on the benefits of calculator usage in the mathematics classroom. Kastberg and Leatham (2005) stated the positive effect on the students' achievement by integrating graphing calculator in the curricula. Furthermore, not only impacts on the calculator expertise but also in their mathematical understanding. Then, Ellington (2003), conducted a meta-analysis study of calculator effects on students' mathematics achievement and attitude. After analyzing 54 research studies, she found the use of calculator in the learning process and assessment developed students' operational skills and problem solving skills. Additionally, the use of a calculator makes better students' attitudes toward mathematics than the other which not used.

According to the studies mentioned above, the objective of this proposed study is to investigate the effect of the integration of mathematics book using scientific calculator into mathematics learning. Moreover, this proposed study considers the impact of the book usage on problem solving skills, students' mathematics achievement, and attitudes toward mathematics. It is almost sure that through teaching and learning process, teachers can help the student to succeed in the 21<sup>st</sup>-century workplace (Care, Kim, Anderson, & Gustafsson-Wright, 2017), but there are several factors to be taken into consideration, includes problem solving skills. Then, students' mathematics achievement is chosen to be considered in this research because of the importance of this aspect as the primary goal of learning in general. The students' attitudes toward mathematics are included in this study due to its contribution in influencing students' achievement. As reported by Verešová and Malá (2016), students attitudes give positive impacts and become a critical predictor on students' achievement.

## **1.2. Statement of the Problem**

Polya (1981) and Sutherland (2007) together states that mathematics learning is related to solve problems, to communicate the ideas, and to understand the mathematical concept in the real-life situation. Then, it will develop through experience (Minton, 2005). Moreover, many studies provide evidence of how teaching practice influencing students' achievement. (Brewer & Stasz, 1996; Grouws & Cebulla, 2000; Hiebert & Grouws, 2007; Wijaya, van den Heuvel-Panhuizen, & Doorman, 2015). To give an appropriate opportunity to learn, teachers have to facilitate students with effective learning. An effective instructional is influenced by

learning material and resources, students' condition, and the learning environment (Moore, 2009).

Meanwhile, providing the right learning resources is an excellent way to allow students to learn. It can be one of the ways to provide students with the book using a scientific calculator. The calculator usage in the classroom potentially creates several benefits, such as the opportunity to experience new mathematics explorations. On the other hand, a study called TIMSS reported that calculator usage as a tool to help students (Mullis & Martin, 2019).

In sum, the situation could raise questions focusing on the effects of the book usage with the integration of scientific calculator. Also, considering the importance of students' attitudes in mathematics learning allow investigating how they are influenced by the book usage. Finally, it will be examined the relationships among problem solving skills, mathematics achievement, attitudes toward mathematics, and the book usage.

### **1.3. The objective of the Study**

The proposed research aims to investigate the effectiveness of the scientific calculator on the improvement of students' problem solving skills, mathematics achievement, and attitudes towards mathematics. Notably, this research project aims to:

- a. investigate the effectiveness of calculator integration into mathematics learning from the perspectives of students' problem solving skills, mathematics achievement, and attitudes towards mathematics;
- b. examine the effectiveness of calculator integration into mathematics learning from the viewpoint of students' problem solving skills, mathematics achievement, and attitudes towards mathematics by gender;
- c. investigate the relationships among problem solving skills, mathematics achievement, attitude towards mathematics, and the fx991 ID PLUS scientific calculator integration.

### **1.4. Research Questions**

The proposed research will investigate the following research questions:

- a. Is there any significant effect of calculator integration into mathematics learning on students' problem solving skills?

addition to understanding and mastering how to use the technology itself (Thomas, Bosley, Hong, & Delos Santos, 2008). Surely, the teacher must be mastering concepts and content of mathematics so then they have a better understanding of mathematical principles and teaching techniques using calculators.

Eventually, the application of calculator in learning mathematics in elementary schools should be addressed to develop students' understanding and basic mathematical abilities and intuition (NCTM, 2000). In a sense, as the usage of calculators in the learning process, students are supposed to be focusing on decision making, reasoning, problem-solving, and reflecting what they did through in thinking activities, by giving them HOTS items instead of LOTS items only. Furthermore, although the results of this study indicate that students' attitude towards mathematics is quite good by now, it should be maintained or developed more, the same case with students' attitudes towards calculator. And yet, students who had better performance tend to have a positive attitude towards calculator rather than students who have a negative attitude towards calculator Munger and Loyd (1989).

## **CHAPTER IV CONCLUSION**

### **5.1. CONCLUSION**

The conclusion of research result was presented below.

- 5.1.1. Student achievement increased by 11.08 points after using a calculator in mathematics learning and there was a significant difference in students' achievement before and after using a calculator in mathematics learning.
- 5.1.2. The problem solving of students had increased by 6.51 points after using a calculator in mathematics learning and there was a significant difference in the problem solving skills before and after using a calculator in mathematics learning.
- 5.1.3. The students' attitude towards mathematics had increased by 1.26 points after using a calculator in mathematics learning and there was a significant difference in students' attitude before and after using a calculator in mathematics learning.
- 5.1.4. There are significant differences between male and female students based on achievement, problem solving, and attitude toward mathematics.

### **5.2. RECOMMENDATION**

Base on the research results, it can be recommended that utilizing technology especially calculator in teaching and learning mathematics in elementary schools. The competencies of elementary school teachers need to be improved, so that the implementation of teaching and learning process can be used better, so that in the future, students' competencies can be further enhanced. In relation with the importance of utilization *Bahasa* in the classroom by students, support in educational policy to improve students' literacy competencies is needed. Some future research to improve students' achievement and to enhance students' problem solving skill should be conducted. Teaching materials that utilize calculator also need to be developed for all materials in grade 4,5, and 6 of elementary schools, that make teachers implement mathematics teaching and learning easily.



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