
**UNIVERSITI PUTRA MALAYSIA**

***EFFECTIVENESS OF SCIENTIFIC CALCULATOR FOR SELECTED TOPICS IN SOLVING MATHEMATICS PROBLEM FOR LOW ACHIEVING STUDENTS***

**FATIMAH SALIHAH BINTI RADZUAN**

**FPP 2021 20**

# EFFECTIVENESS OF SCIENTIFIC CALCULATOR FOR SELECTED TOPICS IN SOLVING MATHEMATICS PROBLEM FOR LOW ACHIEVING STUDENTS

By

**FATIMAH SALIHAH BINTI RADZUAN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science**

**July 2020**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**EFFECTIVENESS OF SCIENTIFIC CALCULATOR FOR SELECTED TOPICS IN SOLVING MATHEMATICS PROBLEM FOR LOW ACHIEVING STUDENTS**

By

**FATIMAH SALIHAH BINTI RADZUAN**

**July 2020**

**Chairman : Nurzatulshima binti Kamarudin, PhD**
**Faculty : Educational Studies**

The National Council of Teachers of Mathematics (NCTM) supported the use of technological aids in teaching and the approach utilized in learning Mathematics. In the approaches used to teach and to learn Mathematics, the use of technological aids such as a scientific calculator was greatly emphasised. This study proposed a guideline on how to use a scientific calculator to solve problems in Solid Geometry II and Statistics (GSC), which are taught in Malaysian high schools. The aim of this research was to help low achieving Mathematics students improve their performance in the subject. The research methodology adapted in this research was quasi experimental. The target group in this research was low achieving Mathematics students who are currently in Form 2 from a public secondary school in Kuala Lumpur. There were 50 low achieving Mathematics students who were involved in this research. The pre-test and post-test results were analysed to determine the effectiveness of using a scientific calculator with GSC guidelines in solving problems for the selected topics in Mathematics for the low achieving students. Based on the analysis of the responses, it shows that the evaluation level of respondents based on variables are moderate among the low achieving Mathematics students except for the perceived usefulness of the scientific calculator, which is high. Then, there are five relationships between the relevant variables that were determined in this research: 1) a strong, positive relationship between the perceived ease of use and the perceived usefulness of use of the scientific calculator 2) a strong, positive relationship between the perceived ease of use the scientific calculator and the attitude towards the scientific calculator 3) a medium, positive relationship between the perceived usefulness of the scientific calculator and the attitude towards the scientific calculator 4) no relationship between the perceived usefulness and the behaviour of intention to use the scientific calculator and 5) a strong, positive relationship between the attitude towards the scientific calculator and the behaviour of intention to use the scientific calculator. There are four hypotheses stated in this research. The first hypothesis is that there is a significant difference in the students' performances in Mathematics between the pre-test and the post-test of the control group with an increase in the mean score of students' achievements from 3.63 to 11.88. The second hypothesis

is that there is a significant difference in the students' performances between the pre-test and the post-test of the treatment group with an increase in the mean score of the students' achievements from 3.68 to 29.40. The third hypothesis is that there is a significant difference in the students' performances of the pre-test between the control group using traditional teaching and learning approaches and the treatment group using a scientific calculator guided by GSC guidelines. There was no significant difference in students' achievements for the treatment group (M=3.68) and the control group (M=3.63). The last hypothesis is that there is a significant difference in the students' performances of the post-test between the control group and the treatment group that used a scientific calculator. There was a significant difference in the students' achievements for the treatment group (M=29.40) and the control group (M=11.88). Therefore, the researcher could conclude that a teaching and learning approach to Mathematics in solving problems with a scientific calculator and GSC guidelines can better improve students' mathematical achievements as compared to without a scientific calculator.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**KEBERKESANAN KALKULATOR SAINTIFIK UNTUK TOPIK TERTENTU DALAM MENYELESAIKAN MASALAH MATEMATIK BAGI PELAJAR PENCAPAIAN RENDAH**

Oleh

**FATIMAH SALIHAH BINTI RADZUAN**

**Julai 2020**

**Pengerusi : Nurzatulshima binti Kamarudin, PhD**
**Fakulti : Pengajian Pendidikan**

*National Council of Teachers of Mathematics (NCTM)* menyokong penggunaan alat bantu teknologi dalam pendekatan pengajaran dan pembelajaran Matematik. Dalam pendekatan pengajaran dan pembelajaran Matematik, penggunaan alat bantu teknologi seperti kalkulator saintifik sangat dititikberatkan. Kajian ini mencadangkan sebuah buku panduan bagaimana menggunakan kalkulator saintifik untuk menyelesaikan masalah dalam topik Geometri Pepejal II dan Statistik (GSC) yang diajar di sekolah menengah Malaysia. Tujuan penyelidikan ini adalah untuk membantu meningkatkan pencapaian pelajar berprestasi rendah dalam mata pelajaran Matematik. Metodologi kajian yang diadaptasi dalam penyelidikan ini adalah reka bentuk kajian kuasi-eksperimental. Kumpulan sasaran dalam penyelidikan ini adalah pelajar matematik yang berpencapaian rendah dari Tingkatan 2 di sebuah sekolah menengah kebangsaan di Kuala Lumpur. Terdapat 50 pelajar matematik berpencapaian rendah yang terlibat dalam penyelidikan ini. Hasil ujian pra dan ujian pasca dianalisis untuk menentukan keberkesanan kalkulator saintifik dengan buku panduan GSC bagi pelajar berpencapaian rendah untuk topik tertentu dalam penyelesaian masalah Matematik. Analisis respon menunjukkan bahawa tahap penilaian yang dirasakan pada penggunaan mudah, sikap dan tingkah laku yang digunakan adalah sederhana di kalangan pelajar matematik lemah yang rendah kecuali kegunaan kalkulator saintifik yang dianggap tinggi. Terdapat lima perhubungan antara pembolehubah yang telah ditentukan dalam kajian ini 1) hubungan yang kuat dan positif antara penggunaan yang dirasakan dan penggunaan kalkulator saintifik 2) hubungan yang kuat dan positif antara penggunaan mudah menggunakan kalkulator saintifik dan sikap ke arah kalkulator saintifik 3) hubungan sederhana dan positif antara kegunaan kalkulator saintifik dan sikap ke arah kalkulator saintifik 4) tiada hubungan antara kegunaan dan niat tingkah laku untuk menggunakan kalkulator saintifik 5) hubungan positif yang kuat antara sikap terhadap kalkulator saintifik dan niat tingkah laku untuk menggunakan kalkulator saintifik. Terdapat empat hipotesis dalam kajian ini. Hipotesis pertama adalah terdapat perbezaan yang signifikan dalam prestasi Matematik pelajar antara ujian pra dan ujian pasca kumpulan kawalan dengan peningkatan min skor

pencapaian murid dari 3.63 hingga 11.88. Hipotesis kedua adalah terdapat perbezaan yang signifikan dalam prestasi Matematik pelajar antara ujian pra dan ujian pasca rawatan kumpulan dengan peningkatan min skor pencapaian murid dari 3.68 hingga 29.40. Hipotesis ketiga adalah terdapat perbezaan yang signifikan dalam prestasi pelajar ujian pra antara kumpulan kawalan dengan menggunakan pendekatan pengajaran dan pembelajaran tradisional dan kumpulan rawatan menggunakan pendekatan pengajaran dan pembelajaran dengan penggunaan kalkulator saintifik yang dibimbing oleh sebuah buku panduan GSC. Tidak terdapat perbezaan yang signifikan dalam pencapaian pelajar untuk kumpulan rawatan (M=3.68) dan kumpulan kawalan (M=3.63). Hipotesis terakhir adalah terdapat perbezaan yang signifikan dalam prestasi pelajar ujian pasca antara kumpulan kawalan menggunakan pendekatan pengajaran dan pembelajaran tradisional dan kumpulan rawatan menggunakan pendekatan pengajaran dan pembelajaran dengan penggunaan kalkulator saintifik yang dibimbing oleh buku panduan GSC. Terdapat perbezaan yang signifikan dalam pencapaian pelajar untuk kumpulan rawatan (M=29.40) dan kumpulan kawalan (M=11.88). Oleh itu, penyelidik dapat membuat kesimpulan bahawa pendekatan pengajaran dan pembelajaran Matematik untuk menyelesaikan masalah dengan kalkulator saintifik dan buku panduan GSC dapat meningkatkan pencapaian matematik pelajar kepada tahap yang lebih baik berbanding tanpa penggunaan kalkulator saintifik.

**ACKNOWLEDGEMENTS**

It would be impossible to complete this research without the guidance and supervision, support and cooperation, of a host of individuals and organizations. I am therefore deeply thankful to my project supervisor, Dr Nurzatulshima Kamarudin and my co-supervisor, Dr. Mas Nida Md. Khambari, for their effort, advice, patience, intellectual support, encouragement and willingness to spend time in guiding me. Without Dr. Nurzatulshima Kamarudin and Dr. Mas Nida Md. Khambari, it would be difficult for me to complete and produce this work. I am grateful and appreciate the cooperation willingness of the principal of a public secondary school in Kuala Lumpur that allowed me to do my Master's program. Without her approval, it would have hard for me to obtain my Master's Degree. Finally, I would like to acknowledge my family, especially my mother, Izah Binti Ibrahim, my father, Radzuan Bin Naim, and my daughter, Dewi Hana Delisha, who have encouraged and supported me throughout my studies, and in the process of completing this work. This research has been completed with all of your effort and contribution. Thank you all

.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Nurzatulshima binti Kamarudin, PhD**
Senior Lecturer
Faculty of Educational Studies
Universiti Putra Malaysia
(Chairman)

**Mas Nida binti Md Khambari, PhD**
Senior Lecturer
Faculty of Educational Studies
Universiti Putra Malaysia
(Member)

**ZALILAH MOHD SHARIFF, PhD**
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 11 February 2021

**TABLE OF CONTENTS**

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Study

In the last five decades, Malaysian mathematics curriculum has experienced several significant modifications (Asmawi & Jaladin, 2018). The fairly short history of mathematics education can be said to have begun with traditional mathematics highlighting mainly on basic skills, predominantly computational. In high school, a like traditional approach in the teaching and learning of mathematics was used. Arithmetic, Geometry, and Algebra were drawn separately in the syllabus with narrow attempt to treat mathematics as an integrated subject. This is supported by Costley (2015) when he defined integration as the association of teaching matter to bring subjects together that are usually educated separately. In the early '70s, the "Modern Mathematics Program" (MMP) was launched to both the primary and high schools. The core aim of the programme was to introduce some "modern topics" such as simplified essentials in set theory, statistics, and vectors into the curriculum. At the same period, the aim was to change the "traditional" approach in the teaching and learning of mathematics (Hassan-Nejad, Behzadi, Shahvarani & Rostamy, 2015).

Mathematics curriculum is based on the idea that mathematics is a dynamic subject, coherently linked within it and with almost all other fields of study, and that the most important purpose of its study is to solve problems. Also, mathematics has a rich historical experience and its discovery is a response to human challenges (Darling-Hammond, 2019). In Malaysia's education system, mathematical basic knowledge acquired in lower levels is vigorous for a student to development to higher classes in secondary schools (Malaysia Education Blueprint, 2013). However, not all students can master mathematics syllabus in school. There is a group of students that cannot progress in learning math as compared to other students.

Students who are low achieving in mathematics can easily be detected during their lower secondary school in Malaysia based on their low performance in the subject. The deeper and more advanced syllabus during secondary school makes these students become more left behind among their peers. For this study, a public secondary school in Kuala Lumpur was selected. The students that were selected were in Form 2 and were chosen based on their final mathematics results in Form 1 to undergo this research because of the need to help them improve their progress in secondary school.

There are many topics taught in Form 2 mathematic syllabus such as Directed Numbers, Algebraic Expressions II, Linear Equations, Pythagoras' Equations, Geometrical Constructions, Coordinates, Loci in Two Dimensions, Circles, Solid Geometry II, and Statistics. However, for this research, the researcher chose to focus only on Solid

Geometry II and Statistics. Johnson and Kuennen (2006) stated that Solid Geometry II and Statistics involve a lot of calculations that require the student to master the basic skill of mathematics. Therefore, Solid Geometry II and Statistics is suitable topic to test scientific calculator and its' guidelines for improving the performance of low achieving students.

According to Parrot and Leong (2018), many handy devices can be used as a technology tools in teaching and learning mathematics such as the four functions calculator, scientific calculators, graphic calculators and interactive devices. The scientific calculator is a popular device that is usually used in secondary schools, thereby making it the most suitable technology device and aid to be used in this research because it is allowed to use scientific calculator in Mathematics for high school students.

## 1.2 Problem Statement

The Ikhtisas Circular Letter No.3/2002 stated that scientific calculators can be used at secondary schools for teaching and learning mathematics and additional mathematics. For years, secondary school students have been using scientific calculators in their mathematics classes to solve mathematic problems. So, scientific calculator is a common tool for secondary school students in learning mathematics.

Malaysia aims to achieve above the worldwide standard and be in the top one-third of countries joining in PISA and Trends in Interpublic Mathematics and Science Study (TIMSS) by 2025, in link with the Malaysia Education Blueprint 2013-2025. However, Haron (2019) stated that mathematics is often associated as one of the most difficult and boring subjects for a few students, especially those who are not interested in learning mathematics. Therefore, this study is fundamental in studying technology aids such a scientific calculator with guidelines and its usefulness, as well to determine whether it can indeed help low achieving students to enhance their results in mathematic.

Hott (2014) noted that students with disabilities or low achieving in solving mathematical problems can have problems on understanding students in learning. So, something should be done to help low achieving students to increase their understanding and skills in mathematical concepts. Abdullah (2017) argued that scientific calculators can give a positive impact on students in their mathematical assessments. Abdullah also noted that students with disabilities who work hard with doing mathematical computations or remembering basic facts should not be rejected the use of scientific calculators and guidelines because it can assist students with low achievements in mathematics.

Several believe that technology can help students understand concepts by allowing them to check their work out and guide them in the right way to solve problems (Costley, 2015). This can make low achieving students more confident to explore mathematical

problems and have more time to check their answers after solving them. This research investigates whether scientific calculators can reduce errors when solving mathematics problems among low achieving mathematics students by seeing their achievement results after they use a scientific calculator and guidelines to solve mathematic problems in teaching and learning.

Based on the observation of ~~s~~econdary mathematic texts book contents, the instructions the use of scientific calculator are spread unevenly depending on the topic in the textbooks. Instructions on using a scientific calculator should be combined as a module or guidelines to ease students with low achievements to learn and study mathematics. Idris (2007) also proved that most of teachers and students do not understand how to use up scientific calculators well. Secondary schools that involve technology guidelines in the classroom have an effect on the students' achievements in a positive way (Schindler, Burkholder, Morad & Marsh, 2017). Hence, a comprehensive guideline or GSC guidelines on using a scientific calculator is needed to make sure its usefulness and ease of use of scientific calculator in solving mathematic problems can be determined in teaching and learning sessions.

There are also no special class for students to learns on how to use scientific calculator in Malaysia mathematic syllabus in high school. Technology such as a scientific calculator can enhance teaching and learning of low achieving students and students who struggle in mathematics (Darling-Hammond, 2019). However, they noted that schools and education systems often ignore importance of providing professional advancement that will let teachers and students to know why they need the tools, what they will accomplish with the tool, how to use up the tools, and whether the tools are easy to use.

Past study on the use of technology in mathematics classes in secondary schools shared two differing views. The initial view is that technology is vital for teaching and learning development (Darling-Hammond, 2019). The second view is that the usage of technology tools such as scientific calculator is utilized to overcome the teaching and learning procedure, thus having these tools to do the work for the students so that they do not need to understand math concepts (Kissane & Mcconey, 2015). The National Council of Teachers of Mathematics (NCTM, 2000) published requirements for mathematical teaching which reflects this discussion. They said that technology such as a scientific calculator is vital in teaching and learning mathematics. It also affects the mathematics that is tutored and improves student learning. However, in the same publication, they also warn that scientific calculators do not substitute fluency with basic number permutations, conceptual knowledge, or the capability to formulate and use effective and precise methods for computing. They also stated that technology such as a scientific calculator should not be used as a substitute for basic conceptions and calculation.

Solid Geometry II and Statistic are topics in Form 2 mathematic syllabus that involve lots of calculations. Solid Geometry II is involved with three-D shapes. Examples of three-D shapes are cubes, rectangular solids, prisms, cylinders, spheres, cones and pyramids (Yean, 2015). This topic involve calculation on volume and surface area of

the solids. Statistics is a department of mathematics trade with the collection, analysis, interpretation, and presentation of multitudes of numerical data, so it also involves lot of calculations (Ridgway, 2016). Hence, a specific study should be done on both topic whether scientific calculator and guidelines can improve low achieving students' performances in mathematic especially in problem solving.

It can be concluded that students with low achievements can be assisted with teaching aid such as a scientific calculator and proper guidelines in teaching and learning mathematics. However, we cannot make prior assumptions without further study on this issue.

## 1.3 Research Objectives

The study focused on the implementation of teaching and learning approach of Mathematics with the use of scientific calculator guided by a GSC guidelines as a tool for learning mathematics at secondary schools in helping low achievement students to improve their performance in mathematics. Thus, the specific objectives of the study are as follows:

a) To identify perceived usefulness, perceived ease of use, attitude and behaviour intention of scientific calculator use amongst low achieving students.
b) To identify the relationships amongst perceived ease of use, perceived usefulness, attitude, and behaviour intention of low achieving students.
c) To determine whether there are differences in students' performance between pre-test and post-test.
d) To determine the effectiveness of scientific calculator with GSC guidelines for selected topics in Mathematics problem solving for low achieving students.

## 1.4 Research Questions

The research questions will focus on perceived usefulness, perceived ease of use, attitudes and behaviour to use scientific calculator. The evaluation level of respondent and relationships between above variables will be determined. Therefore, the research questions of the study are as follows:

RQ1: What is the perceived usefulness of scientific calculator amongst low achieving students?

RQ2: What is the perceived ease of use of scientific calculator amongst low achieving students?

RQ3: What is the attitude towards the scientific calculator amongst low achieving students?

RQ4: What is the behaviour intention to use scientific calculator amongst low achieving students?

RQ5: What is the relationship between perceived ease of use and perceived usefulness amongst low achieving students?

RQ6: What is the relationship between perceived ease of use and attitude toward scientific calculator use amongst low achieving students?

RQ7: What is the relationship between perceived usefulness and attitude toward scientific calculator use amongst low achieving students?

RQ8: What is the relationship between perceived usefulness and behaviour intention of scientific calculator amongst low achieving students?

RQ9: What is the relationship between attitude and behaviour intention of scientific calculator use amongst low achieving students?

## 1.5 Hypotheses for Experimental Design

In order to achieve the research objective three and four, four hypotheses were created to test whether the process of learning took place the effectiveness of teaching and learning approach of Mathematics to solve problem solving using scientific calculator and guideline GSC guidelines.

$H_{o1}$: There is no significant difference in students' performance between pre-test and post-test of control group.

$H_{o2}$: There is no significant difference in students' performance between pre-test and post-test of treatment group.

$H_{o3}$: There is no significant difference in students' performance of pre-test between control group using traditional teaching and learning approaches and treatment group using teaching and learning approach of Mathematics to solve problems with the use of scientific calculator guided by a GSC guidelines.

$H_{o4}$: There is no significant difference in students' performance of post-test between control group using traditional teaching and learning approaches and treatment group using teaching and learning approach of Mathematics to solve problems with the use of scientific calculator guided by a GSC guidelines.

## 1.6 Significance of the Study

The importance of this research for mathematic education in secondary schools is to improve the grades and performances of low achieving students by using a scientific calculator, which is allowed as a learning tool in secondary schools. Thus, the significance of this study can be beneficial to students, teachers, schools, and the Ministry of Education as a whole, in achieving outstanding progress in mathematics.

The crucial part of this study is to improve students' understanding and the acceptance of learning mathematics using a scientific calculator as a technology tool and aid. Besides that, the application of learning mathematics using a scientific calculator can promote low achieving students to become more positive in learning mathematics so that they can improve what they have learned in their mathematics examination. Also, the use of a scientific calculator with a GSC guidelines or module is easy to follow and it will make low achieving students more confident in solving mathematics problems.

Since the scientific calculator is allowed to use in high school, it is an advantage for teachers and students to use it to the fullest without any worries. This study also contributes to the improvements in the students' skills and will make learning mathematics more interesting.

This research can also encourage students to become more creative and innovative to solve mathematical problems. It also can reduce those who have low self-esteem in answering mathematical problems because they can check back their calculations with a scientific calculator. It can promote an innovative approach of answering, thus making the students enjoy learning mathematics.

## 1.7 Scope and Limitations

This study focuses on improving secondary school students' achievement in mathematics. Those who have low grades in mathematics were targeted so that the problems can be solved from the root cause of the problem. Form 2 students were selected based on their low grades in mathematics in their final examination in Form 1. One of the technology accommodations, which is the scientific calculator, can be used in secondary schools to test whether it can help low achieving mathematics students to catch up with the nation's mathematics syllabus.

This study scope more in helping low achieving students to improve mathematic performance using scientific calculator and GSC guidelines. This research focuses on experimental research and the experimental group was guided with a scientific calculator and GSC guidelines. Then, the control group underwent learning sessions without a scientific calculator. More focus was on improving their calculation skills while catching up with the syllabus.

The limitations the researcher faced are is the problem of not being able to measure the relationship between the perceived usefulness and perceived ease of using the scientific calculator, and the actual usage of the tool because this is an experimental research. Experimental research only focuses on certain groups, in which this study focuses on low achieving mathematics' students.

The second limitation of this study is cannot control the use of scientific calculator amongst the control group outside the experiment study. However, the control group is not exposed to the proper instruction of using a scientific calculator and its' guidelines, which are use amongst the treatment group in this study. The control group's scientific calculator has been taken during this experiment study.

The third limitation is number of participants involve in this study. Although this is a qualitative and quantitative study. There are only 75 low achieving mathematics students that are agreed to participate in this study. The 75 students are amongst the students that have marks below than 50 in Final Form 1 Mathematics Examinations Paper.

Then, the technology devices that are used in this study is only limited to scientific calculators because secondary students in Malaysia can use a scientific calculator during lessons and examination. Therefore, making it the most suitable device to focus on. Scientific calculator also handy and easy to bring to school for students and most of secondary schools' students have the device.

Lastly, the limitation of this study is the topics covered, which are Solid Geometry II and Statistics. Based on all topics in the Form 2 syllabus, only Solid Geometry II and Statistics require students to have better skill it. These topics involve a lot of complex calculations when solving problems related to both topics (Pardimin & Widodo, 2016). So, a proper study covered on both topics suitable to determine the effectiveness of scientific calculator with GSC guidelines amongst low achieving students.

## 1.8 Definitions of Terms

The terms and variables that are related in this research will be explained more in detail so that it is easily understood what the research is all about.

### 1.8.1 Teaching and Learning Mathematics

Mathematics teaching involves the concept of chance for students to understand mathematics (Abramovich, Grinshpan, & Milligan, 2019). The elements included are offering a supportive learning environment, presenting appropriate mathematical challenge, developing processes and strategies which promote learning in mathematics. Then, mathematics learning can be generally defined as the achievement of new knowledge, skills, and influences that are related to quantity, space, and structure (Kaiser & Presmeg, 2019). The capability to learn mathematics is acquired by humans and the knowledge of mathematics is needed to solve daily problems. In this study, teaching and learning is a process that includes many variables. These variables interact as students work toward their goals to improve their mathematic performance and incorporate new knowledge and skills knowledge with the use of scientific calculator and its' guidelines that add to their range of learning experiences for Solid Geometry II and Statistics.

### 1.8.2 Low Achieving Students

Low achieving students can be defined as students who are struggling academically or performing below proficiency (Jönsson, 2018). In Mathematics, low achieving students can be easily identified by their low grades and the lack of confidence in answering the questions in class (Al-Zoubi & Younes, 2015). Al-Zoubi and Younes also stated that the students' low academic achievement in the test can be identified as their low achieving in the subject level acts as a result of a range of reasons, which is including those linked to the student himself, family issues, social and academic atmosphere. Similarly, (Thomson (2018) stated that low achievement is considered as a multidimensional problem. Therefore, the issue of students' low achievements in mathematics will become worse once they enter secondary school because the Malaysian secondary school syllabus is not as easy as the primary school syllabus. They usually have negative feedback in learning mathematics such as refusal to pass mathematics tasks for various reasons.

### 1.8.3 Perceived Usefulness

Usefulness is the excellence of consuming utility and particularly practical value or applicability (Yoon C. Cho, 2015). Davis (1989) also defines usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance". In this study, the perceived usefulness is well-defined as the practical use of scientific calculator in teaching and learning for helping low achieving mathematics students to progress their performance in the subject.

### 1.8.4 Perceived Ease of Use

The ease of use is well-defined as the usability and the ability of a human-made object such as a tool or device such as a scientific calculator (Yoon C. Cho, 2015). In the mathematic field, the ease of use is the degree to which a tool can be used by a stated learner or student to solve mathematical problems effectively. Davis (1989) also defined the ease of use as "the degree to which a person believes that using a particular system or technology tool would be free from effort". In this research, the perceived ease of use means that the tool that can make a task simpler and easier, such as how a scientific calculator can help students in solving mathematical problems during teaching and learning process.

### 1.8.5 Attitude towards Technology

Attitude can be well-defined as a student's tendency to respond in reliably favourable or unfavourable circumstances for a given object such as a scientific calculator in learning mathematics (Banks, 2011). Also, Osman, Alwi & Khan (2009) well-defined attitude as the base of compatibility, which includes, for order, the liking for self-service, technology, and lifestyle. Technology in this study can be defined as something that can be used by students to apply in learning mathematics to extend their potential in learning mathematics (Suzzy, 2015). In this study, their attitude toward technology is the preference of low achieving mathematics students to use a scientific calculator to learn mathematics so that they can improve their skills and understanding in mathematics.

### 1.8.6 Behaviour Intentions

Behaviour intentions to use technology can be well-defined as a person's perceived probability or "subjective probability that he or she will engage in a given behaviour to use the technology" (Committee on Communication for Behaviour Change in the 21st Century, 2002). Moreover, Kwok and Yang (2017) stated that behaviour intention to use technology such as a scientific calculator can reflect how hard a person is eager to try, and how interested he or she is, to achieve the behaviour in using the scientific calculator for learning mathematics. Thus, in this study, behaviour intentions to use the tool are the students' willingness to use the scientific calculator in teaching and learning mathematic so that they can improve their achievements.

### 1.8.7 Problem Solving Skill in Mathematics

Problem solving skills implies to the ability to solve problems in an efficient and timely manner with no any impediments (Mulyati, Wahyudin, Herman & Mulyana, 2016). It involves being able to identify and define the problem, creating alternative solutions, evaluating and choosing the best alternative, and applying the selected solution. Therefore, mathematical problem solving has viewed as an important part of

mathematics, the teaching of mathematics, and the learning of mathematics (Voskoglou, 2008). Mastering problems solving skill in mathematics is important in promoting improvement in mathematic achievements especially in low achieving mathematic students. Problem solving skills can be measure using pre-test and post-test (Khashi'Ie, Said, Zainal, & Miswan, 2016). Apriyani, Ramalis & Suwarma (2019) stated that pre-test are used by teachers to gather information about students' level performance and knowledge before experimental study. Then, post-tests are used to certify students' performance after experimental study. Both test results are a key component used to monitor the performance of low achieving students in this study.

## REFERENCES


Abdullah, A. H., Ahmed, S., Abd Rahman, S. N. S., Mun, S. H., & Mokhtar, M. (2017). Metacognitive behaviour of Malaysian students while solving mathematical problems of Form Three Assessment (PT3). *Bolema - Mathematics Education Bulletin*, *31*(59), 907–927. https://doi.org/10.1590/1980-4415v31n59a03

Abramovich, S., Grinshpan, A. Z., & Milligan, D. L. (2019). Teaching Mathematics through Concept Motivation and Action Learning. *Education Research Interpublic*, *2019*. https://doi.org/10.1155/2019/3745406

Adelabu, F. M., Makgato, M., & Ramaligela, M. S. (2019). The Importance of Dynamic Geometry Computer Software on Learners' Performance in Geometry. *Electronic Journal of E-Learning*, *17*(1), 52–63.

Adolphus, T. (2011). Problems of Teaching and Learning of Geometry in Secondary Schools in Rivers State , Nigeria. *Interpublic Journal of Emerging Sciences*, *1*(2), 143–152.

Akib, E. (2015). The Validity and Reliability of Assessment for Learning (AfL). *Education Journal*, *4*(2), 64. https://doi.org/10.11648/j.edu.20150402.13

Al-Zoubi, S. M., & Younes, M. A. B. (2015). Low Academic Achievement: Causes and Results. *Theory and Practice in Language Studies*, *5*(11), 2262. https://doi.org/10.17507/tpls.0511.09

Amanyi, C. K., Sigme, B. B., & Lloyd, A.-O. (2016). Teachers' Perception of Usage of Calculators in the Teaching and Learning of Mathematics at the Junior High School level in Ghana. *European Journal of Educational and Development Psychology*, *4*(2), 33–52. www.eajournals.org

Anderman, E. M., & Sinatra, G. M. (2012). 1 The Challenges of Teaching and Learning about Science in the 21. *ERIC Serach*, *48*(1), 1–50.

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives*.*41*(4),352.http://books.google.com/books?id=JPkXAQAAMAAJ&pgis=1

Andrew, M., Taylorson, J., Langille, D. J., Grange, A., & Williams, N. (2018). Student attitudes towards technology and their preferences for learning tools/devices at two universities in the UAE. *Journal of Information Technology Education: Research*, *17*, 309–344. https://doi.org/10.28945/4111

Apriyani, R., Ramalis, T. R., & Suwarma, I. R. (2019). Analyzing Student's Problem Solving Abilities of Direct Current Electricity in STEM-based Learning. *Journal of Science Learning*, *2*(3), 85–91. https://doi.org/10.17509/jsl.v2i3.17559

Asmawi, A., & Jaladin, R. A. M. (2018). Higher education system in Malaysia: Exploring strategic trends and challenges in policy implementation for new Malaysia. *Malaysian Online Journal of Educational Management*, *6*(4), 56–77. https://doi.org/10.22452/mojem.vol6no4.4

Bankov, K., Becker, A., & Brese, F. (2013). *The Teacher Education and Development Study in Mathematics (TEDS-M): Policy, Practice, and Readiness to Teach Primary and Secondary Mathematics in 17 Countries. Technical Report*. http://proxy.library.vcu.edu/login?url=http://search.proquest.com/docview/1651827260?accountid=14780

Banks, S. (2011). A Historical Analysis of Attitudes Toward the Use of Calculators in Junior High and High School Math Classrooms in the United States Since 1975. *A Historical Analysis of Attitudes Toward the Use of Calculators in Junior High and High School Math Classrooms in the United States Since 1975*. https://doi.org/10.15385/tmed.2011.1

Binyamin, S. S., Rutter, M. J., & Smith, S. (2019). Extending the technology acceptance model to understand students' use of learning management systems in Saudi higher education. *Interpublic Journal of Emerging Technologies in Learning*, *14*(3), 4–21. https://doi.org/10.3991/ijet.v14i03.9732

Cahit, K. (2015). Internal Validity: A Must in Research Designs. *Educational Research and Reviews*, *10*(2), 111–118. https://doi.org/10.5897/ERR2014.1835

Chao, C. M. (2019). Factors determining the behavioral intention to use mobile learning: An application and extension of the UTAUT model. *Frontiers in Psychology*, *10*(JULY), 1–14. https://doi.org/10.3389/fpsyg.2019.01652

Chao, T., Chen, J., Star, J. R., & Dede, C. (2016). Using Digital Resources for Motivation and Engagement in Learning Mathematics: Reflections from Teachers and Students. *Digital Experiences in Mathematics Education*, *2*(3), 253–277. https://doi.org/10.1007/s40751-016-0024-6

Chauhan, S. (2017). A meta-analysis of the impact of technology on learning effectiveness of elementary students. *Computers and Education*, *105*, 14–30. https://doi.org/10.1016/j.compedu.2016.11.005

Chiu, M. S., Yeh, H. M., & Whitebread, D. (2014). Student constructs of mathematical problems: Problem types, achievement and gender. *Cogent Education*, *1*(1). https://doi.org/10.1080/2331186X.2014.961252

Clark, J. (2011). Mathematical Connections: A Study of Effective Calculator Use in Secondary Mathematics Classrooms. *Online Submission*, 1–22.

Close, S., Oldham, E., Shiel, G., Dooley, T., Hackett, D., & O'Leary, M. (2008). *The effects of calculator use on mathematics in schools and in the certificate examinations: Final report on phase I*.

Costley, K. (2015). Research Supporting Integrated Curriculum: Evidence for Using This Method of Instruction in Public School Classrooms. *Online Submission*, 1–11.

Creswell, John & Guetterman, Timothy. (2018). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research, 6th Edition. 56-110*

Davis, F. D. (1989).Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989).User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982-1003

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992).Extrinsic and intrinsic motivation to use com

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2019). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *0*(0), 1–44. https://doi.org/10.1080/10888691.2018.1537791

Dejene, W., & Chen, D. (2019). The practice of modularized curriculum in higher education institution: Active learning and continuous assessment in focus. *Cogent Education*, *6*(1), 1–17. https://doi.org/10.1080/2331186X.2019.1611052

Drijvers, P., Monaghan, J., Thomas, M., Trouche, L., Drijvers, P., Monaghan, J., Thomas, M., Trouche, L., & Monaghan, J. (2017). *Use of Technology in Secondary Mathematics To cite this version : HAL Id : hal-01546747 Use of Technology in Secondary Mathematics Final Report for the Interpublic Baccalaureate*.

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model. *Information Systems Frontiers*, *21*(3), 719–734. https://doi.org/10.1007/s10796-017-9774-y

Fang, W. T., Ng, E., Wang, C. M., & Hsu, M. L. (2017). Normative beliefs, attitudes, and social norms: People reduce waste as an index of social relationships when spending leisure time. *Sustainability (Switzerland)*, *9*(10). 1-28.https://doi.org/10.3390/su9101696

Feng, J. (2017). Effects of Ability Grouping on Math Achievement of Third Grade Students. *Mathematics Education Trends and Research*, *85*(1), 2071–2079. https://doi.org/10.1016/j.bbapap.2013.06.007

Flanagan, J. L. (2008). Technology: The positive and negative effects on student achievement. *Education And Human Development Master's Theses*, 1–254.

Fred D. Davis. (2010). *Perceived Usefulness , Perceived Ease of Use , Attitude and Actual Usage of a New Financial Management System : Requirements for the Award of a Masters Degree of Science*. *June*.

Ghavifekr, S., Kunjappan, T., & Ramasamy, L. (2016). Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions. *Malaysian Online Journal of Educational Technology*, *4*(2), 38–57.

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools. *Interpublic Journal of Research in Education and Science*, *1*(2), 175. https://doi.org/10.21890/ijres.23596

Grayson, R. (2013). *Research summary – A brief review of employer s ' views on numeracy*. *February*, 1–5.

Haladyna, T. M. (2006). Testing Concerns Perils of Standardized Achievement Testing. *Educational Horizons*, *85*(1), 30–43.

Hansson, S. O. (2020). Technology and Mathematics. *Philosophy and Technology*, *33*(1), 117–139. https://doi.org/10.1007/s13347-019-00348-9

Harlen, W., & Deakin Crick, R. (2002). A systematic review of the impact of summative assessment and tests on students ' motivation for learning (EPPI-Centre Review, version 1.1*). *Research Evidence in Education Library*, *1*, 151.

Haron, H. N., Kamaruddin, S. A., Harun, H., Abas, H., & Salim, K. R. (2019). Science, Technology, Engineering and Mathematics Initiatives at Rural Schools and Its Impact on Learning Motivation. *Journal of Physics: Conference Series*, *1174*(1). https://doi.org/10.1088/1742-6596/1174/1/012002

Harris, J. L., Al-Bataineh, M. T., & Al-Bataineh, A. (2016). One to One Technology and its Effect on Student Academic Achievement and Motivation. *Contemporary Educational Technology*, *7*(4), 368–381.

Hassan-Nejad, E., Behzadi, M. H., Shahvarani, A., & Rostamy-Malkhalifeh, M. (2015). A Comparison between Cooperation Learning Method and Traditional Teaching Method with the Aim to Improve the Ability of Solving Math Problems. *Mathematics Education Trends and Research*, *2015*(1), 43–49. https://doi.org/10.5899/2015/metr-00077

Hair, J., Black, W., Babin, Barry & Anderson, R. (2010). Multivariate data analysis. *Prentice Hall*. London, 2010(1) 59-67

Hembree, R., & Dessart, D. (1986). Effects of Hand-Held Calculators in Precollege Mathematics Education: A Meta-Analysis. *Journal for Research in Mathematics Education, 17*(2), 83-99. doi:10.2307/749255

Henriksen, D., Mishra, P., & Fisser, P. (2016). Infusing creativity and technology in 21st century education: A systemic view for change. *Educational Technology and Society*, *19*(3), 27–37.

Hinsen, K. (2016). *Scientific notations for the digital era*. 1–27. http://arxiv.org/abs/1605.02960

Hott, B. L., Isbell, L., & Montani, T. (2014). Strategies and Interventions to Support Students with Mathematics Disabilities. *Council for Lerning Disabilities*, *2*, 1–9. http://www.council-for-learning-disabilities.org/wpcontent/uploads/2014/12/ Math _Disabilities_Support.pdf

Isaac, O., Abdullah, Z., Ramayah, T., & Mutahar, A. M. (2017). Internet Usage within Government Institutions in Yemen: An Extended Technology Acceptance Model (TAM) with Internet Self-Efficacy and Performance Impact. *Science Interpublic*, *29*(4), 737–747

Jäder, J., Lithner, J., & Sidenvall, J. (2019). Mathematical problem solving in textbooks from twelve countries. *Interpublic Journal of Mathematical Education in Science and Technology*, *0*(0), 1–17. https://doi.org/10.1080/0020739X.2019.1656826

Jahangir, N., & Begum, N. (2008). The role of perceived usefulness, perceived ease of use, security and privacy, and customer attitude to engender customer adaptation in the context of electronic banking. *African Journal of Business Management*, *2*(2), 032–040.

Johnson, M., & Kuennen, E. (2006). Basic math skills and performance in an introductory statistics course. *Journal of Statistics Education*, *14*(2). https://doi.org/10.1080/10691898.2006.11910581

Jönsson, A. (2018). Meeting the Needs of Low-Achieving Students in Sweden: An Interview Study. *Frontiers in Education*, *3*(August), 1–16. https://doi.org/10.3389/feduc.2018.00063

Kaiser, G., & Presmeg, N. (2019). *ICME-13 Monographs Compendium for Early Career Researchers in Mathematics Education*. http://www.springer.com/series/15585

Kanuka, H. (2006). Instructional Design and eLearning: A Discussion of Pedagogical Content Knowledge as a Missing Construct. *E-Journal of Instructional Science and Technology*, *9*(2), 1–17.

Kevin C. Costley. (2014). The Positive Effects of Technology on Teaching and Student Learning. *Curriculum & Instruction*, *85*(1), 2071–2079. https://doi.org/10.1016/j.bbapap.2013.06.007

Khalil, M. K., & Elkhider, I. A. (2016). Applying learning theories and instructional design models for effective instruction. *Advances in Physiology Education*, *40*(2), 147–156. https://doi.org/10.1152/advan.00138.2015

Khashi'Ie, N. S., Said, R. M., Zainal, N. A., & Miswan, N. H. (2016). A Comparison Study of Students' Performance in Pre and Post Result of A Mathematics Competency Test. *MATEC Web of Conferences*, *87*. https://doi.org/10.1051/matecconf/20178704001

Kissane, B., Mcconney, A., & Ho, K. F. (2015). *Review of the use of technology in Mathematics education Prepared for the School Curriculum and Standards Authority, Western Australia*. *May*. http://www.scsa.wa.edu.au/__data/assets/pdf_file/0020/152633/SCSA-Final-Report-30-Nov-2015_Review-of-the-use-of-technology-in-Mathematics-education.PDF

Koparan, T. (2015). Difficulties in learning and teaching statistics: teacher views. *Interpublic Journal of Mathematical Education in Science and Technology*, *46*(1), 94–104. https://doi.org/10.1080/0020739X.2014.941425

Kuncoro, K. S., Junaedi, I., & Dwijanto. (2018). Analysis of problem solving on project based learning with resource based learning approach computer-aided program. *Journal of Physics: Conference Series*, *983*(1).

Kwok, D., & Yang, S. (2017). Evaluating the intention to use ICT collaborative tools in a social constructivist environment. *Interpublic Journal of Educational Technology in Higher Education*, *14*(1), 1–14. https://doi.org/10.1186/s41239-017-0070-1

LaCour, M., Cantu, N. G., & Davis, T. (2019). When calculators lie: A demonstration of uncritical calculator usage among college students and factors that improve performance.*PLoS ONE*, *14*(10), 1–18.

Lake, K. (1993). Integrated Curriculum. *School Improvement Research S Eries*. 1-11

Lattimer, H. (2012). Action Research in Pre-Service Teacher Education: Is There Value Added?. *I.E.: Inquiry in Education*, *3*(1).1-11

Lai, P. (2017). the Literature Review of Technology Adoption Models and Theories for the Novelty Technology. *Journal of Information Systems and Technology Management*, *14*(1), 21–38. https://doi.org/10.4301/s1807-17752017000100002

Leow, F. T., & Neo, M. (2014). Interactive multimedia learning: Innovating classroom education in a Malaysian university. *Turkish Online Journal of Educational Technology*, *13*(2), 99–110.

Lie, Kuek Meng & Harun, H. (2011). Malaysian Students ' Achievement in Solid Geometry. *Recent Researches in Education*, 141–147.

Liljedahl, P., Santos-Trigo, M., Malaspina, U., & Bruder, R. (2016). Problem Solving in Mathematics Education ICME-13 Topical Surveys. In *Icme 13*. https://doi.org/10.1007/978-3-319-40730-2

Lin, C. T. (2011). Analyzing the effect of imperfect debugging on software fault detection and correction processes via a simulation framework. *Mathematical and Computer Modelling*, *54*(11–12), 3046–3064.

Malaysia Education Blueprint, M. (2013). Malaysia Education Blueprint 2013 - 2025. *Education*, *27*(1), 1–268. https://doi.org/10.1016/j.tate.2010.08.007

Mangin, J.-P. L., Bourgault, N., León, J. A. M., & Guerrero, M. M. (2012). Testing Control, Innovation and Enjoy as External Variables to the Technology Acceptance Model in a North American French Banking Environment. *Interpublic Business Research*, *5*(2), 12–26.

Marvasti, A. (2018). Research methods. *The Cambridge Handbook of Social Problems*, *1*(3), 23–37. https://doi.org/10.1017/9781108656184.003

Md Ghazali, N. H. (2016). A Reliability and Validity of an Instrument to Evaluate the School-Based Assessment System: A Pilot Study. *Interpublic Journal of Evaluation and Research in Education (IJERE)*, *5*(2), 148. https://doi.org/10.11591/ijere.v5i2.4533

Meehan, T. (2016). A Quantitative Quasi-Experimental Study of an Online High School Mathematics Remediation Program. *Walden Dissertations and Doctoral Studies Collections*, 1–110.

Mei, F. S. Y., Ramli, S. Bin, & Alhirtani, N. A. K. (2015). Application of Gagne's Nine Approaches to Teach Arabic Language for Non-Native Speakers: Experimental study at Sultan Idris Education University Malaysia (UPSI). *European Journal of Language and Literature*, *3*(1), 32. https://doi.org/10.26417/ejls.v3i1.p32-37

Mendenhall, A. M. (2013). Examining the use of first principles of instruction by instructional designers in a short-term, high volume, rapid production of online K-12 teacher professional development modules. *Dissertation Abstracts Interpublic Section A: Humanities and Social Sciences*, *74*(6-A(E)), No-Specified.

Miles, C. (2008). *The Use or Non-Use of Calculators Affects on Student ' s Ability to Perform Basic Mathematics Problems*. 1–60.

Mistretta, R. M. (2005). Intergrating Technology into the Mathematics Classroom: Role of the Teacher Preparation Programs. *Mathematics Educator*, *15*(1), 18–24.

Mohajan, H. K. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. *Annals of Spiru Haret University. Economic Series*, *17*(4), 59–82. https://doi.org/10.26458/1746

Mohd Majid Konting, (2005). Kaedah Penyelidikan Pendidikan (Edisi 7). *Dewan Bahasa & Pustaka,* Kuala Lumpur.

Mullis, Ina V. S., Ed.; Martin, Michael O., E. (2017). TIMSS 2019 Assessment Frameworks. In *Interpublic Association for the Evaluation of Educational Achievement*. https://doi.org/10.1002/9781119491774.ch8

Mulyati, T., Wahyudin, Herman, T., & Mulyana, T. (2016). Effect of integrating children ' s literature and SQRQCQ problem solving learning on elementary school student' s mathematical reading comprehension skill. *Interpublic Electronic Journal of Mathematics Education*, *12*(3), 217–232.

Mutsvangwa, S. B. (2016). *The influence of using a Scientific Calculator in learning fractions : A Case Study of One School in Gauteng Province* . *January*, 1–192.

National Council of Tearchers Mathematics . Launches New Publication for Educators Available to Members- Mathematics Teacher: Learning and Teaching PK-12. Dec 18, 2019. https://www.nctm.org

Nguyen, T. T. H., (2019). Investigating consumer attitude and intention towards online food purchasing in an emerging economy: An extended TAM approach. *Foods*, *8*(11), 1–15. https://doi.org/10.3390/foods8110576

Ochanda, J. P., & Indoshi, F. C. (2011). Challenges and benefits of using scientific calculators in the teaching and learning of Mathematics in secondary school education. *Journal of Media and Communication Studies*, *3*(3), 102–111.

Onibokun, J. a. (2012). Modelling the acceptance and behaviour of university students in relation to social-networking sites. *Phd Thesis*.

Osman, Z., Alwi, N. H., & Khan, B. N. A. (2009). *A Study of Mediating Effect of Attitude on Perceived Ease of Use and Students Intention to Use Online Learning Platform among Online Learning Institutions in Malaysia*. 1–6.

Pardimin, P., & Widodo, S. A. (2016). Increasing Skills of Student in Junior High School to Problem Solving in Geometry With Guided. *Journal of Education and Learning (EduLearn)*, *10*(4), 390. https://doi.org/10.11591/edulearn.v10i4.3929

Parrot, M. A. S., & Leong, K. E. (2018). Impact of Using Graphing Calculator in Problem Solving. *Interpublic Electronic Journal of Mathematics Education*, *13*(3), 139–148. https://doi.org/10.12973/iejme/2704

Pallant, J. (2016) SPSS Survival Manual?: A Step by Step Guide to Data Analysis Using SPSS Program. 6th Edition, *McGraw-Hill Ediucation*, London

Pautasso, M. (2013). Ten Simple Rules for Writing a Literature Review. *PLoS Computational Biology*, *9*(7), 7–10.

Phua, P. L., Wong, S. L., & Abu, R. (2012). Factors Influencing the Behavioural Intention to use the Internet as a Teaching-Learning Tool in Home Economics. *Procedia - Social and Behavioral Sciences*, *59*, 180–187. https://doi.org /10.1016/j.sbspro.2012.09.263

Quadri, L. K., Committee, R., Chairperson, C., Faculty, E., Member, C., Faculty, E., Faculty, E., Officer, C. A., & Riedel, E. (2014). *Walden University*.

Radović, S., Marić, M., & Passey, D. (2019). Technology enhancing mathematics learning behaviours: Shifting learning goals from "producing the right answer" to "understanding how to address current and future mathematical challenges." *Education and Information Technologies*, *24*(1), 103–126. https://doi.org/10.1007/s10639-018-9763-x

Ramli, N. F., & Talib, O. (2017). Can Education Institution Implement STEM? From Malaysian Teachers' View. *Interpublic Journal of Academic Research in Business and Social Sciences*, *7*(3), 2222–6990.

Reuter, T., Ziegelmann, J. P., Wiedemann, A. U., Geiser, C., Lippke, S., Schüz, B., & Schwarzer, R. (2010). Changes in intentions, planning, and self-efficacy predict changes in behaviors: An application of latent true change modeling. *Journal of Health Psychology*, *15*(6), 935–947. https://doi.org/10.1177/1359105309360071

Rhodes, R. E., & Yao, C. A. (2015). Models accounting for intention-behavior discordance in the physical activity domain: A user's guide, content overview, and review of current evidence. *Interpublic Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 1–14. https://doi.org/10.1186/s12966-015-0168-6

Ridgway, J. (2016). Implications of the Data Revolution for Statistics Education. *Interpublic Statistical Review*, *84*(3), 528–549. https://doi.org/10.1111/insr.12110

Ritt, M. (2016). *The Impact of High-stakes Testing on the Learning Environment*. 55. https://sophia.stkate.edu/msw_papers/658/

Rogers, E. M., Singhal, A., & Quinlan, M. M. (2019). Diffusion of innovations. In *An Integrated Approach to Communication Theory and Research, Third Edition*. https://doi.org/10.4324/9780203710753-35

Salman, A., Azul, M., Salleh, M., Yusof, M., Abdullah, H., Mustaffa, N., & Latiff, A. (2017). ICT acceptance among Malaysian urbanites: A study of additional variables in user acceptance of the new media. *Geografia-Malaysian Journal of Society and Space*, *10*(6), 86–96.

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature. *Interpublic Journal of Educational Technology in Higher Education*, *14*(1). https://doi.org/10.1186/s41239-017-0063-0

Serin, H., & Oz, Y. (2017). Technology-integrated Mathematics Education at the Secondary School Level. *Interpublic Journal of Social Sciences & Educational Studies*, *3*(4), 148–155. https://doi.org/10.23918/ijsses.v3i4p148

Serin, M. &. (2015). The Role of Technology in Whole-Class Teaching. *Education and Information Technologies*, *May*, 67–77. https://doi.org/10.1007/978-3-642-83301-4_11

Shabiralyani, G., Hasan, K. S., Hamad, N., & Iqbal, N. (2015). Impact of Visual Aids in Enhancing the Learning Process Case Research: District Dera Ghazi Khan. *Journal of Education and Practice*, *6*(19), 226–233.

Shahid Iqbal, M., Ul Hassan, M., & Habibah, U. (2018). Impact of self-service technology (SST) service quality on customer loyalty and behavioral intention: The mediating role of customer satisfaction. *Cogent Business and Management*, *5*(1), 1–23. https://doi.org/10.1080/23311975.2018.1423770

Sheets, C. L., & Sheets, C. L. (2007). *DigitalCommons @ University of Nebraska - Lincoln Calculators in the Classroom : Help or Hindrance ? Calculators in the Classroom : Help or Hindrance ? Math in the Middle Institute Partnership*.

Sidek, N. (2015). *Determinants of Electronic Payment Adoption in Malaysia : The Stakeholders ' Perspectives*. 429. https://doi.org/10.14264/uql.2015.696

Simanca, S. R., & Sutherland, S. (2017). Mathematical Problem Solving with Computers. *Educational Mathematic Journal*, *15*(2016), 1115–1136.

Şimşit, Z. T., Günay, N. S., & Vayvay, Ö. (2014). Theory of Constraints: A Literature Review. *Procedia - Social and Behavioral Sciences*, *150*(231), 930–936. https://doi.org/10.1016/j.sbspro.2014.09.104

Singh, S. (2012). An Empirical Investigation of the Determinants of Users' Acceptance of E-banking in Singapore (A Technology Acceptance Model). *Interpublic Journal of Management and Business*, *2*(1), 69–84. http://www.sid.ir/en/VEWSSID/J_pdf/1022220120107.pdf

Steckler, A., & McLeroy, K. R. (2008). The importance of external validity. *American Journal of Public Health*, *98*(1), 9–10.

Suki, N. M., Campus, L. I., & Banking, I. (2010). Journal of Internet Banking and Commerce. *Journal of Internet Banking and Commerce*, *15*(2), 1–11.

Suzzy. (2015). *Primary School Learner's Attitudes on Mathematics Learning in Mathematics*. *February*.

Surat Pekeliling Ikhtisas Bil. 3/2002 Pelaksanaan Kalkulator Saintifik Di Sekolah Menengah Bagi Pengajaran.http://moe.gov.my/index.php/en/pekeliling/pekelilling-ikhtisas/category/kurikulum/3

Tambychik, T., & Meerah, T. S. M. (2010). Students' difficulties in mathematics problem-solving: What do they say? *Procedia - Social and Behavioral Sciences*, *8*(5), 142–151. https://doi.org/10.1016/j.sbspro.2010.12.020

Teo, T., & Milutinovic, V. (2015). Modelling the intention to use technology for teaching mathematics among pre-service teachers in Serbia. *Australasian Journal of Educational Technology*, *31*(4), 363–380. https://doi.org/10.14742/ajet.1668

Teo, T., & Zhou, M. (2015). Explaining the intention to use technology among university students: A structural equation modeling approach. *Journal of Computing in Higher Education*, *26*(2), 124–142.

Thakur, G. R. (2014). Training and effectivess of multimedia e-content prepared by student teachers in Economics for students of std.IX. *An Interpublic Peer Reviewed and Referred Scholarly Research Journal for Interdisciplinary Studies. ISSN 2278-8808 (E), ISSN 2319-4766 (P) Impact Factor- 4.194*, *2*(14), 1903–1911.

Thimbleby, H., & Cairns, P. (2010). Reducing number entry errors: Solving a widespread, serious problem. *Journal of the Royal Society Interface*, *7*(51), 1429–1439. https://doi.org/10.1098/rsif.2010.0112

Thomson, S. (2018). Achievement at school and socioeconomic background—an educational perspective. *Npj Science of Learning*, *3*(1).

Thongnin, P., Wongwanich, S., & Piromsombat, C. (2014). Multi-task Integration as a Strategy for Improving Teacher Performance and Student Learning. *Procedia - Social and Behavioral Sciences*, *116*, 1919–1924.

Voskoglou, M. (2008). Problem solving in mathematics education: Recent trends and development. In *Scienze Matematiche (Vol. 1, Issue 18)*. https://doi.org/10.1007/978-3-319-40730-2

Weng, F., Yang, R.-J., Ho, H.-J., & Su, H.-M. (2018). A TAM-Based Study of the Attitude towards Use Intention of Multimedia among School Teachers. *Applied System Innovation*, *1*(3), 36. https://doi.org/10.3390/asi1030036

Widyastuti, E., & Susiana. (2019). Using the ADDIE model to develop learning material for actuarial mathematics. *Journal of Physics: Conference Series*, *1188*(1), 1–9. https://doi.org/10.1088/1742-6596/1188/1/012052

Wilson, L. O. (2016). Anderson and Krathwohl Bloom's Taxonomy Revised Understanding the New Version of Bloom's Taxonomy. *The Second Principle*, 1–8.

Wong, S. L., & Wong, S. L. (2019). Relationship between interest and mathematics performance in a technology-enhanced learning context in Malaysia. *Research and Practice in Technology Enhanced Learning*, *14*(1). https://doi.org/10.1186/s41039-019-0114-3

Yean, G. S. (2015). M-learning application for PT3 Mathematics (Solid Geometry). *Science Interpublic*, *16*(1), 24–25. https://doi.org/10.30798/makuiibf.323102

Yoon C. Cho. (2015). Exploring Factors That Affect Usefulness, Ease Of Use, Trust, And Purchase Intention In The Online Environment. *Interpublic Journal of Management & Information Systems*, *57*(13), 7763–7769. https://doi.org/10.1021/acs.inorgchem.8b00815

Zamani, M. (2016). Cooperative learning: Homogeneous and heterogeneous grouping of Iranian EFL learners in a writing context. *Cogent Education*, *3*(1). https://doi.org/10.1080/2331186X.2016.1149959

Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through web sites: A critical review of extant knowledge. *Journal of the Academy of Marketing Science*, *30*(4), 362–375.

**BIODATA OF STUDENT**

Fatimah Salihah binti Radzuan was born on the 28th February 1986 in Kluang, Johor. She received her primary education at SK Tunku Mahmood (1), Kluang, Johor and continue her secondary education to two different schools, SMK Jalan Batu Pahat and Maktab Rendah Sains Mara Mersing.

In 2005, she furthered her undergraduate studies at Universit Sains Malaysia for the Honour Degree in Bachelor of Education (Mathematic). She started his profession as a teacher in Kuala Lumpur. During her time in Kuala Lumpur, she had taught at SMK Seri Saujana, Bandar Baru Seri Petaling, Kuala Lumpur for eleven years until now.

During her service span, she was actively involved with the curriculum development especially in Mathematics and Technology education. Even she is still working, she still further her study in Universiti Putra Malaysia for Master in Science. Her dream is to gain a lot of knowledge as she could so that she can share her knowledge to her students and community.

## PUBLICATION

Fatimah Salihah Radzuan, Nurzatulshima Kamarudin, Mas Nida Md Khambari & Nurazidawati Mohamad Arsad (2021). Impact of scientific calculators in mathematics among low-achieving students in a secondary school in Kajang, Selangor. *Pertanika Journal of Social Sciences and Humanities*, *29*, 199–214. https://doi.org/10.47836/pjssh.29.s1.11