CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will explain briefly about the study in eight sections, which are background of the study, problem statement, conceptual framework, purpose of the study, hypothesis, significance and limitations of the study, and operational definitions.

1.2 Background of the Study

The first shift in Malaysia Education Blueprint (PPPM) 2013-2025 is providing an equal access to quality education of an international standard. In this case, government had increased the investment in physical and teaching resources for pupils with specific needs. Besides being provided with the facilities and equipment needed to create a conducive and supportive learning environment, these pupils would

be also taught by teachers who have received additional training to help them understand their pupils' specific contexts and challenges, and the teaching strategies required to address them.

In the year of 2009, Malaysia first participated in the Programme for International Student Assessment (PISA). Based on the mean score for year 2012, Malaysia is still placed in the bottom third, ranking 52 out of 65 countries and 55 out of 74 countries in the year 2009 survey (Kang, S.C., 2013). The average Malaysia pupil performance in all three areas was well below both the international and the Organisation for Economic Co-operation and Development (OECD) averages. This statistic indicated that we have to put harder effort in Mathematics education as it is one of the major skills to be mastered by our generation.

Through the Educational Transformation, Literacy and Numeracy Screening (LINUS) was introduced in August 2009. LINUS programme as an educational part of National Key Result Areas (NKRA) in Government Transformation Programme (GTP) is continuity from the existing programmes to overcome the challenges in mastering basic skills of reading, writing, and arithmetic (3M) systematically. The implementation of LINUS programme targeted 100% of Year Three pupils to master in literacy and numeracy before enter Year Four starting in year 2013, except for pupils with special needs.

Mathematics is a compulsory subject in primary and secondary school curriculum in Malaysia. Even though it is important and needed in our everyday life, yet there are many pupils who are afraid of this subject, especially during tests and

examination. This happened among the Mathematics low achievers, as they have not mastered the basic arithmetic skills as required. Thus, actions have to be taken by the educators so that the low achievers are able to improve their basic arithmetic skills in classroom and their daily life.

1.3 Problem Statement

Mathematics is the mother of Science and is also often applied in our daily lives. However, many pupils always have difficulties in studying it and are little interested in it (Chang, R.C. & Yang, C.Y., 2016). Research found that many pupils failed to master Mathematics beyond the primary grades because they never master mathematical facts (Johnson & Street, 2013). Furthermore, declines in Mathematics enrolments at high school are worldwide and extend beyond cultural and national borders. Educator must develop strategies that are underpinned by theories that address the obstacles imposed by the global declines in numeracy skills (Everingham, Gyuris, & Conolly, 2017).

As one of the four basic mathematical operations, multiplication is an important skill learnt in primary education. Especially mastery of the single-digit multiplication table is an important aim of primary education, as it forms the basis for other operations such as division and multi-digit multiplication (van der Ven, Straatemeier, Jansen, Klinkenberg, & van der Maas, 2015). The teaching of multiplication provides some particular challenges for teachers in order to help pupils develop a conceptual understanding of these operations (Bicknell, Young-Loveridge

& Nguyen, 2016). Pupils' problem in learning Mathematics especially in the operation of the basic multiplication facts started since they were in Year Two where they need to learn the multiplication tables from one to five and the tables from six to nine when they were in Year Three (Norhayati Ahmat, Nurul Huda Mohamed, Nor Afzalina Azmee, & Sarah Mohd Adham, 2017).

Chinese fourth and fifth grade pupils were likely to treat multiplication facts as language-based tasks because they had received systematic instruction of multiplication through their Mathematics curriculum. Over practice and emphasis on drills in Chinese Mathematics curriculum might train these children to rely more on phonological codes for retrieval (Liu, R.D., Ding, Y., Xu, L., & Wang, J., 2016). Self-guided learning and teamwork with an appropriate tool and minimalist instruction increased pupils' intrinsic motivation towards learning Mathematics, whereas the traditional Mathematics lessons, in which the motivation is more extrinsic due to the teacher's active role, were less appealing to them (Eronen & Karna, 2017). According to which pupils recognize that they know less about multiplication and division than addition and subtraction, and therefore are less confident in their multiplication and division judgement (Lortie-Forgues & Siegler, 2016).

The traditional method of teaching multiplication used to be memorization methods. The traditional Mathematics teaching interprets logic training by forcedly memorizing formulas and definition composed by abstract symbols. This cramming way of learning has led to a result that pupils lack of interest in learning Mathematics (Chang, R.C. & Yang, C.Y., 2016). It is undeniable that memorization method is good for multiplication learning. However, the concept of multiplication should be

understood by the pupils before memorization occurred (Yoong, S.M. & Noor Aini Ahmad, 2018).

In twenty first century, digital game-based learning has become a form of new teaching and learning activity yet it has not been practiced in the formal education system in Malaysia (Sayed Yusoff Syed Hussain, Tan, W.H., & Muhammad Zaffwan Idris, 2014). The design and development of a computer game could be utilized as an adaptable tool for the educational process (Katmada, Mavridis, & Tsiatsos, 2014). Meantime, combination of computer and video games with a variety of educational content may also achieve as good or better results as though traditional learning methods in the process (Prensky, 2007).

In Malaysia, teachers use remedial modules supplied by the Ministry of Education in teaching and learning activity for pupils who are recognized as weak in Mathematics. However, the previous research showed that the time delay in distributing the LINUS module to schools had become a challenge faced by LINUS teachers (Mohd Razak Mohd Nordin, Shaharuddin Shaari, & Normah Kamarodzan, 2014). The implementation of LINUS programme targeted 100% of Year Three pupils to master in literacy and numeracy before enter Year Four. Since LINUS targeted pupils from Year One to Year Three, so the Year Four low achievers are often left out. The researchers also found out that most SJKC schools in Manjung district did not provide LINUS programme or remedial class for the Year Four low achievers.

Based on the source from Manjung District Education Office (PPD), the pass rate of Mathematics subject results in year 2017 are Year One (81.22%), Year Two (89.4%), Year Three (83.19%), Year Four (65.47%), Year Five (65.93%), and Year Six (91.34%), whereas their Grade Point Averages are 2.73, 2.03, 2.58, 3.35, 3.23, and 2.43 respectively. This data showed that Year Four obtained the lowest pass rate (65.47%) and the highest Grade Point Average (3.35) among all.

Therefore, it is clear that researches on identifying effective teaching and learning strategies are needed in Malaysia especially for the Year Four low achievers who have not mastered in multiplication skills. Once the low achievers enter Year Four, they might be left out as the teacher will focus on teaching of operational facts instead of basic facts. Hence, this study will be carried out to develop and evaluate the effectiveness of DoCtor WoRM's Module in multiplication skills among Year Four low achievers.

1.4 Theoretical Framework

Figure 1.1 shows the theoretical framework of this study. This study is experimental in nature, so the variables that could affect the study outcome have to be determined. Two types of variables identified are independent variable and dependent variable. The independent variable is controlled and manipulated by the researcher and does not depend on another variable. In this study, the independent variable refers to DoCtor WoRM's Module. This module used /D/, /C/, /W/, /R/, and /M/ as the

acronym for Draw, Count, Write, Read, and Memorize. It is expected that this variable will have some effect on the dependent variables.

Meanwhile, the dependent variable is the factor measured in a research. It depends on the independent variables. In this study, the dependent variable is achievement of Year Four low achievers in multiplication skills. The achievement of the pupils will be measured by pre-test and post-test. The researcher will measure the pupils' improvement by comparing the results between pre-test and post-test.

The theoretical underpinning of the module is based on Bruner's Constructivist Theory. Bruner's Theory of Constructivism was influenced by the earlier theoretical research of Vygotsky and Piaget. His theoretical framework supports the belief that learners construct new ideas or concepts based upon existing knowledge (Cherry & Overbaugh, 2004). The theory described by Piaget and Vygotsky is very important because knowledge is increased based on construction of learning and learners, instead of something that is fed from the others (Hayati, Fauzan, Iswari, & Khairdir, 2018).

Regarding to this, teachers should help the pupils to build their basic concepts from concrete thinking to the utilization of more conceptually adequate modes of thought (Bruner, 2006). The process of learning is an active construction. This means that students construct their knowledge through the selective experience to create a conceptual structure that forms the basis of their knowledge (Matanluk, Baharom Mohammad, Kiflee, & Imbug, 2013).

On the other hand, the learning models used in designing this module are game-based learning and mastery learning. Game-based learning is a type of learning by playing game and has defined learning outcomes. Generally, game-based learning is designed to balance the subject with game play and the ability of player to apply the learning into the real world. Games offer a unique structure to complement traditional teaching strategies and infuse teaching with energy, spark innovative thinking, and provide diversity in teaching methods (Boyle, 2011). Games are also a unique activity to implement existing learning models, and playfulness adds a dimension to these existing models. This creates a learning experience that can make games a preferable activity compared to other traditional activities (Plass, Homer, & Kinzer, 2015).

Mastery learning is a method of instruction where the focus is on the role of feedback in learning (Motamedi, 2001). In mastery learning, pupils must master the content of a unit before moving on to the next unit. The model is being applied into DoCtor WoRM's Module by which the pupils are required to master multiplication facts for a certain single-digit before they can proceed to the next multiplication facts. This module has also offer enrichment activities in form of digital games for the pupils that have mastered a certain multiplication facts. The integration of mastery learning strategies with game-based learning provides greater benefits for pupils when learning Mathematics (Lin, C.H. et al., 2013).

Mathematics is the foundation of Science, technology, intellectual development, and an index of civilization evolution (Chang, R.C. & Yang, C.Y., 2016). Mathematics contains of few domains, which include whole numbers, fractions, decimals, percentages, and ratios. Meanwhile in primary school, arithmetic becomes

one of the most important skills as it contains four basic skills in Mathematics subject. Arithmetic skills refer to the ability to combine numbers. Simple arithmetic refers to operations of addition, subtraction, multiplication, and division with smaller values of number (Andin, Ronnberg, & Rudner, 2013). In this study, the researcher focused on multiplication skills.

This study had evaluated the effectiveness of DoCtor WoRM's Module towards the achievement of Year Four low achievers in multiplication skills. After three months of intervention, the pupils in the treatment group are able to improve in their achievement. The researcher had evaluated the effectiveness of this module by using pre-test and post-test. The differences between the results of pre-test and post-test showed that there is an improvement on the pupils' achievement in multiplication skills.

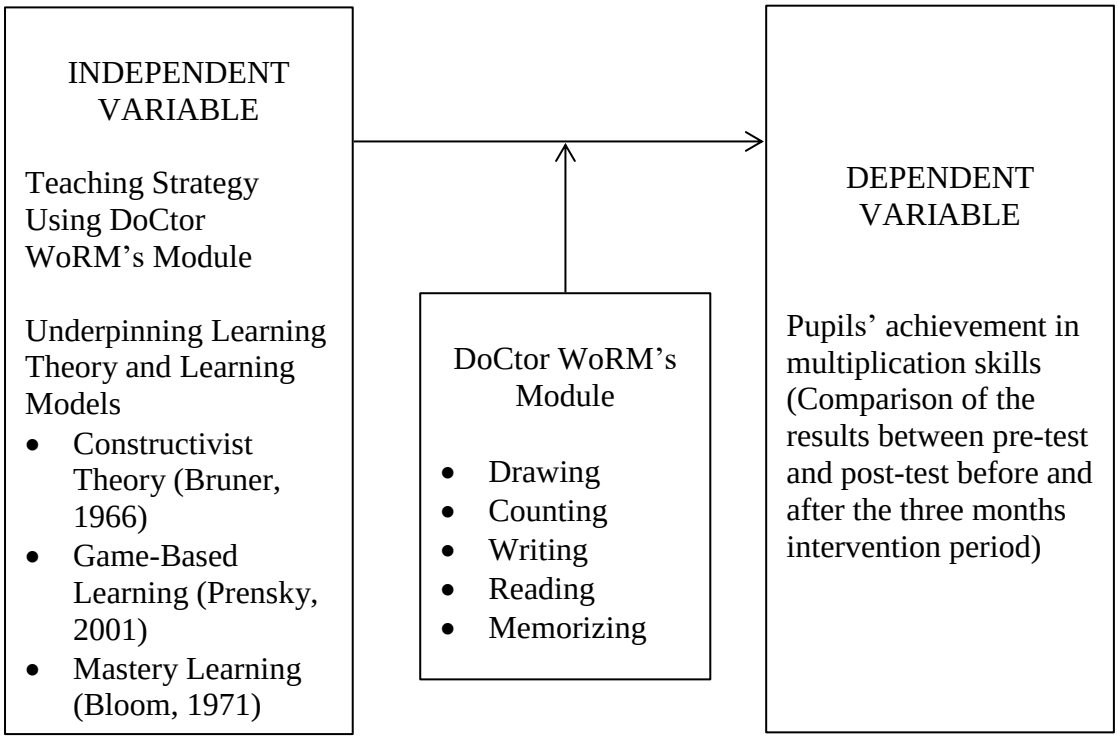

Figure 1.1 Theoretical Framework

1.5 Conceptual Framework

Figure 1.2 shows the conceptual framework in this study. There are two phases in this study, which are Module Developmental Phase and Module Evaluation Phase. During Module Developmental Phase, the researcher had designed DoCtor WoRM's Module based on Constructivist Theory, game-based learning, and mastery learning.

Bruner's three modes of representation are enactive, iconic, and symbolic. Firstly, enactive mode involves encoding action based on information and storing it in our memory. Secondly, iconic mode is where information stored visually in the form of images as a mental picture in the mind's eye. Thirdly, symbolic mode is where information stored in the form of a code or symbol, such as language (McLeod, 2008).

The activities in DoCtor WoRM's Module are in line with Bruner's three modes of representation. During enactive mode, the pupils are exposed to a story as an introduction. Story is used in the beginning of this module as it is easier for pupils to comprehend and store in the memory. Next, during iconic mode, the pupils need to draw and count the intersection points of the caterpillars. These activities enable pupils to visualize and form a mental image in their mind. Lastly, it comes to symbolic mode. During this mode, the pupils need to write and read, and memorize the multiplication sentences, so the information is stored in the form of language.

During Module Evaluation Phase, the samples are selected from the population of Year Four low achievers. Then, the pupils in the treatment group will learn multiplication skills by using DoCtor WoRM's Module. Five important steps in

DoCtor WoRM's Module are /D/ drawing, /C/ counting, /W/ writing, /R/ reading, and /M/ memorizing. After the three months intervention, the pupils are able to master in single-digit multiplication.

Computer and videogames are potentially the most engaging pastime in the history of mankind. This is due to a combination of twelve elements; (1) games are a form of fun; (2) games are form of play; (3) games have rules; (4) games have goals; (5) games are interactive; (6) games are adaptive; (7) games have outcomes and feedback; (8) games have win states; (9) games have challenge; (10) games have problem solving; (11) games have interaction; and (12) games have representation and story (Prensky, 2001).

Bloom taxonomy is associated with mastery learning, because it is the same Benjamin Bloom who is famous for both. The taxonomy, edited by Bloom, was developed by a committee and published in 1956 to expand teaching and testing beyond the lowest levels of rote learning that were considered to dominate teaching in those days. By 1968, Bloom had launched his version of mastery learning, based on John Carroll's model of school learning (Bloom, 1971 in Gentile & Lalley, 2003). In mastery learning, teachers set an objective based on pupils' level. The pupils went through learning process so that they can achieve the first objective. Formative assessment is given to the pupils in every lesson. This is to see whether the pupils acquired the knowledge along the intervention taking place. Next, enrichment activity is carried out. If the pupils does not show mastery in the skill, then correction need to be done until the pupils solve at least 80% of the items correctly. After the pupils achieved the unit, then they will proceed to the next unit with the second objective.

Module Evaluation Phase begins after DoCtor WoRM's Module is completed. The researcher had selected Year Four low achievers using purposive sampling. The researcher had also divided these low achievers into control group and treatment group. The treatment group went through an intervention using DoCtor WoRM's Module. After three months period, the pupils in the treatment group are able to master in single-digit multiplication.

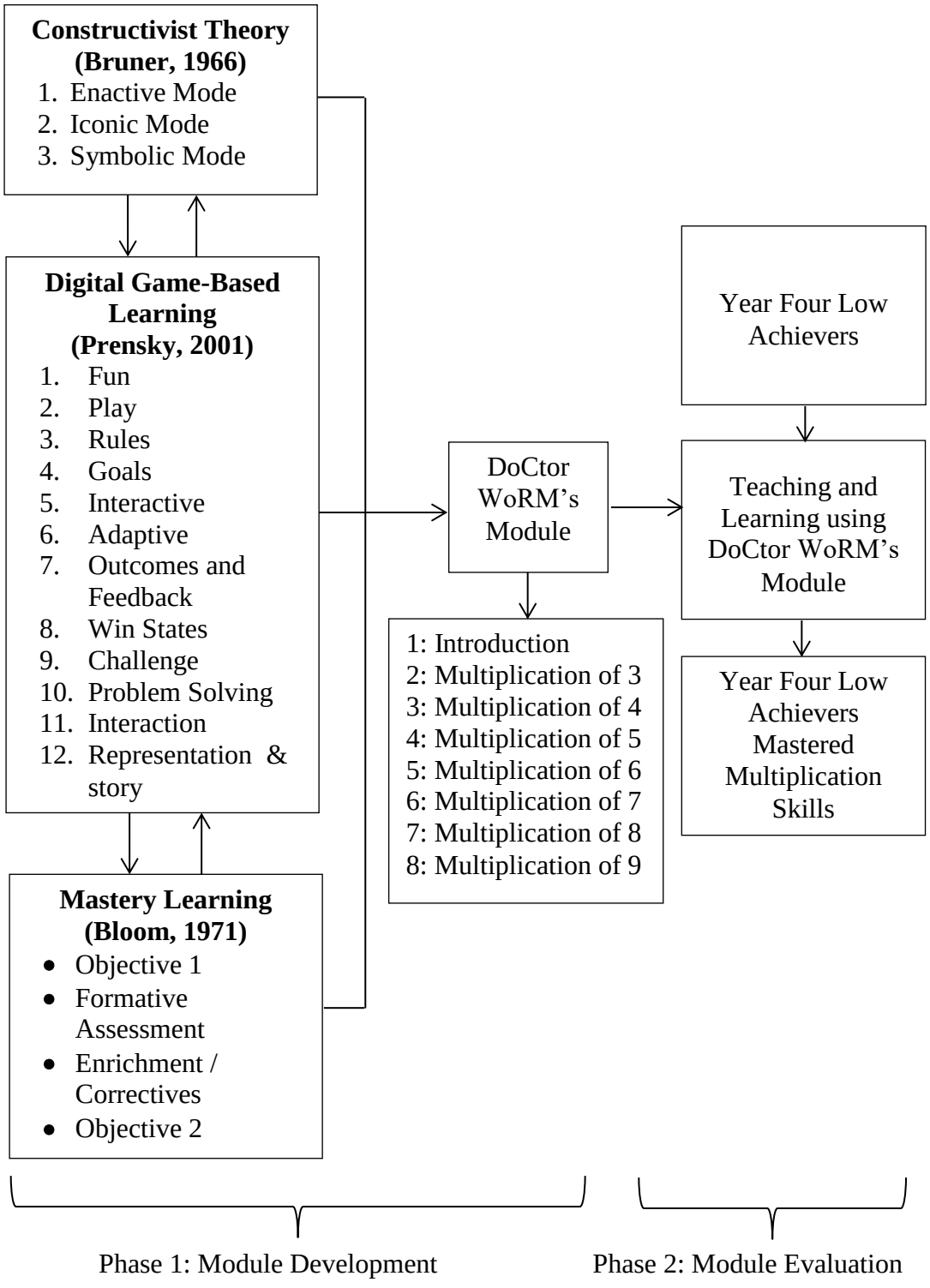

Figure 1.2 Conceptual Framework

1.6 Purpose of the Study

The purpose of the study is to develop and evaluate the effectiveness of DoCtor WoRM's Module in the teaching of multiplication skills among Year Four low achievers.

1.6.1 Objectives

The five objectives to achieve the main purpose are identified as follow:

1. To identify the module needs in multiplication skills for Year Four low achievers in SJKC.

2. To measure the content validity of DoCtor WoRM's Module among Year Four low achievers in multiplication skills.

3. To measure the reliability of DoCtor WoRM's Module among Year Four low achievers in multiplication skills.

4. To measure the improvement in multiplication skills among Year Four low achievers after using DoCtor WoRM's Module.

5. To measure the effectiveness of DoCtor WoRM's Module in improving multiplication skills among Year Four low achievers.

1.6.2 Research Questions

According to the objectives, five research questions are listed below:

1. Is there a need for module in multiplication skills among Year Four low achievers in SJKC?

2. What is the content validity of DoCtor WoRM's Module among Year Four low achievers in multiplication skills?

3. What is the reliability of DoCtor WoRM's Module among Year Four low achievers in multiplication skills?

4. Is there any improvement in multiplication skills among Year Four low achievers after using DoCtor WoRM's Module?

5. Is DoCtor WoRM's Module effective in improving multiplication skills among Year Four low achievers?

1.7 Hypothesis

Hypothesis is the temporary conclusion for problem statements to be tested and depended on the researcher's understanding towards the previous researches that had been made on the research title (Raja, Noraini Mohamed Hassan, & Chong, W.L., 2016). A null hypothesis states that the test mean score of students taught by discussion method is equal to the test mean score of students taught by lecture method (Lay, Y.F. & Khoo, C.H., 2016). In this study, the researcher states null hypothesis instead of alternative hypothesis because null hypothesis is the focus of hypothesis testing since the null hypothesis will be tested directly, not the alternative hypothesis. Two null hypotheses in this study are:

H_{o1} : There is no significant difference between the means of the pre-test and the post-test for the treatment group.

H_{o2} : There is no significant difference between the means of the post-test for the treatment and control groups.

1.8 Significance of the Study

There are four basic skills in the arithmetic, which are addition, subtraction, multiplication, and division. Multiplication became one of the toughest skills to be mastered and it is also very important in our daily lives. It is important to carry out the study and the significance for the study can be viewed from different perspectives.

The introduction of DoCtor WoRM is a modification from the line multiplication. It could be placed in the syllabus as a fun way to learn multiplication. The visualisation of the abstract arithmetic skills could raise the pupils' interest in the learning activities. Traditional memorization method on multiplication can be helpful but above all, the pupils must understand the concept of multiplication and this can be explained by the lines' intersection points. Hence, the construction of this module is believed to give a helping hand for the teachers in order to help the low achievers to understand the concept of multiplication in an easier way.

For the policy makers, the findings could give some suggestions in revising the syllabus by adding alternative method on multiplication in the textbooks. Refer to Primary School Standard Curriculum (KSSR) Mathematics textbook, pupils are encouraged to used creative and critical thinking when solving the problems. The pupils can obtain the solution not by only one method, but more than one method can be accepted. Additionally, findings on the contribution of DoCtor WoRM's Module from this study can be utilised by the Curriculum Development Division, Ministry of Education in helping them to objectively select the right and suitable technology tools as critical enablers to improve the delivery of the Mathematics curriculum.

On the other hand, the syllabus of Mathematics in KSSR is also claimed to be tougher if compare to the syllabus of Mathematics in Integrated Curriculum for Primary School (KBSR). This is due to the integrating of secondary school elements into the primary school syllabus. Higher order thinking skills (HOTS) are highlighted in the curriculum caused the low achievers to lost their interest in this subject. In order

to prevent the consequences as mentioned, educators should implement the basic arithmetic skills among the pupils at the same time fulfil their desire and motivation to learn in an interesting way. In this case, DoCtor WoRM's Module provides a step-by-step learning to make sure pupils are able to understand about the abstract concept of multiplication skills.

1.9 Limitations of the Study

Limitations are matters and occurrences that arise in a study which are out of the researcher's control (Simon & Goes, 2013). In this research, limitations of the study are made to ensure its validity. There are 11 National-Type Chinese Primary Schools (SJKC) in Manjung district involved in this study. As such, the results obtained do not generalise the population of the Malaysian pupils especially in other districts or states, nor can the results be a fair representation of pupils from other school types.

The SJKC schools in Manjung district are chosen, instead of all other districts available in Malaysia. The reason for choosing the sample from this certain schools is because there are pupils who meet the criteria for the research. The researcher targeted Year Four low achievers which had failed in the previous Mathematics assessment, and have not mastered in single-digit multiplication. Hence, the researcher had done a needs survey in Manjung district and found that there are a need to carry out the research in this district in order to enhance the multiplication skills among the Year Four low achievers.

The sample is confined to Year Four low achievers, thus the small sample size of the purposive sampling does not generalize the population of the Malaysian pupils. In Malaysia, the learning of multiplication skills begins since pre-school level or in Year One. According to KSSR syllabus, pupils are required to understand and learn multiplication facts of two, five, ten, four, one, and zero since Year Two. In Year Three syllabus, the pupils continue to learn about the multiplication facts of three, six, seven, eight, and nine. During these two years period, the pupils learn multiplication skills with some different methods, one of them is memorization of multiplication table. In other words, the pupils need to master in multiplication facts from one to nine by Year Four, or else they will be left out. Thus, the researcher limited the sample of this study to Year Four low achievers to help these pupils to master the basic skills of multiplication facts.

The scope of the module contents is limited to the multiplication facts of three to nine. Single-digit multiplication facts are being chosen because they are the basic facts for all the other multiplication facts with any larger multiplicand. For example 9 x 12, if pupils have the basic knowledge as in the scope of this module, they are able to do the algorithms by separating it into two steps, which are 9 x 2 and 9 x 10. Then, the pupils have to add 18 and 90 to get the final answer of 108. This has shown that the single-digit multiplication facts are vital for the pupils in order to solve the multiplication facts with any larger multiplicands.

The intervention in this study requires pupils to draw the intersecting lines, count the intersection points, then write the multiplication sentences. The researcher chose Mathematics sentence instead of vertical algorithm because it is an easier form

for the pupils to read and memorize the multiplication facts. Pupils in primary school are taught to memorize the multiplication facts until the task become automatic. In this case, Mathematics sentences are more suitable instead of the vertical algorithms.

Last but not least, the research targeted SJKC in this study, despite of Malay-Medium National Schools (SK), National-Type Tamil Primary School (SJKT), and other school types. The researcher is teaching in SJKC and encounter the problems in this school type, hence it urge the researcher to find out the solution. Besides, the researcher also has more understanding about the culture and background of SJKC compare to the other school types, which is useful in designing the module suitable for the target group. Thus, the findings of this study do not generalise the population of Malaysian pupils especially in the other school types.

1.10 Operational Definitions

An operational definition outlines a metric for quantifying something of interest (Church, 2004). There were variety definitions of the terms from the experts. However, the key terms used in this study are most appropriate for the content of this study were listed out. The operational definitions of the five key terms to be listed out in this study are Mathematics as a subject, arithmetic skills, multiplication skills, low achievers, and traditional teaching.

1.10.1 Mathematics as a Subject

Mathematics has always been among the pre-requisites for the many technical courses (Rohaiza Ramli, 2015). In education, Mathematics has become one of the most important subjects to be learnt in school. If the pupils do not learn Mathematics, then they will struggle to calculate and to solve problems in everyday life. Due of the reasons, the researcher thought it is crucial that innovative ways should be explored in the teaching of Mathematics. Memorization of multiplication facts without the understanding of the concept caused the pupils to face difficulties when applying the knowledge in the different problem context. Another reason for choosing this skill is the fact that pupils need to master the skill in order to get a better result in Mathematics examination, especially in the Primary School Evaluation Test (UPSR) that they will soon facing in Year Six.

In the context of this study, Mathematics as a subject indicates that it is one of the core subjects in SJKC. Considering that the KSSR syllabus had been introduced since year 2011, the emphasis on HOTS questions had caused many pupils to obtain low marks in the examinations, especially the low achievers. In this case, four basic arithmetic skills must be mastered by the pupils in order for them to solve the higher level problems in Mathematics subject. Hence, the researcher had selected Mathematics in this study as to improve the Year Four low achievers' achievement in the subject.

1.10.2 Arithmetic Skills

Interval arithmetic operations included addition, subtraction, multiplication, and division. Thus, it can be concluded that the Mathematics subject that are being taught in primary school are mainly arithmetic skills (Hickey, Ju, & Van Emden, 2001). Arithmetic skills can be trained by means of game play, especially with young children (Castellar, All, Marez, & Looy, 2015). More training time may be needed to master subtraction and division than to master addition and multiplication. Follow-up research on the specificity of children's arithmetic learning is needed to further evaluate these possibilities (Walker, Bajic, Mickes, Kwak, & Rickard, 2013).

In the context of this study, arithmetic is a branch of Mathematics that consists of four basic skills, which are addition, subtraction, multiplication, and division. The researcher had selected arithmetic skills because these four operations are the basic mathematical operations for the pupils in primary school, in order to solve the complex problems in the other topics or real life problems. Besides, the pupils in primary school are learning the same arithmetic skills in their every year Mathematics syllabus. In KSSR, pupils learn about addition and subtraction skills since Year One. Consequently in Year Two, the pupils learn about simple multiplication and division skills. The contents of arithmetic skills are continually integrated in Year Three until Year Six syllabus, with the gradually increase of difficulty levels. In this study, the researcher focused only in multiplication skills, which will be discussed in the next section.

1.10.3 Multiplication Skills

Multiplication is a mathematical operation of adding an integer to a specific number of times, solving problems about equal groups, or making an arrangement of objects, pictures or numbers in columns and rows which is called array. Multiplication is an abstract concept. It is hardly interpreted by the learners, especially low achievers. Regard to this, the researcher thinks it is better to visualize the concept by using some teaching methods and animations to make the concept easier for the pupils. Hence, the researcher designed DoCtor WoRM's Module using five systematic steps to assist the low achievers. In short, the five steps are /D/ drawing, /C/ counting, /W/ writing, /R/ reading, and /M/ memorizing.

In the context of this study, multiplication skills are an ability to solve an equation by following the five steps in DoCtor WoRM's Module. After completing the module, the pupils should be able to obtain the correct answers for multiplication items by drawing intersecting lines, counting the intersection points, writing the multiplication sentences, reading the multiplication sentences, and memorize the multiplication facts. In short, multiplication skills in this study contains five important steps, which are drawing, counting, writing, reading, and memorizing, that represented by the alphabets of /D/, /C/, /W/, /R/, and /M/ in DoCtor WoRM's Module.

In fact, this method is a modification of Japanese Multiplication, which is an interesting method to visualize multiplication that reduces it to simple counting. According to Hale (2015), kids in Japan learn how to multiply completely differently

to how they do in the West. Without the stress of memorizing multiplication table, all this method requires the pupils to do is counting lines and dots. To modify the Japanese Multiplication into a more interesting and attractive way, the researcher designed DoCtor WoRM's Module by creating Betty Butterfly and Dr. Worm as the main characters. By counting the intersection points of the intersecting caterpillars, it became a simpler way for the low achievers to master the abstract multiplication skills.

In this module, teachers carried out the teaching and learning activities based on the lesson plans in Teacher's Manual. The pupils are given a Pupil's Activity Book so they can do the activities on multiplication facts during every lesson. Then, they are also given time to play with the interactive game so that they can learn multiplication skills through the animation and multimedia. Overall, these activities led the pupils with a sequence of drawing the intersecting lines, counting the intersection points, writing the multiplication sentence, reading the multiplication sentence, and memorizing the multiplication facts.

1.10.4 Low Achievers

Low achievers are pupils who have difficulty in meeting educational standards. These pupils failed in their learning subjects and meets difficulty to understand the content in the normal classrooms. However, the low achievers are yet not qualified for special education services, so the regular teachers are responsible for teaching them in the mainstream classrooms. In the context of this study, the researcher targeted low achievers in Mathematics subject only. Besides, the Mathematics low achievers in this

study are the Year Four pupils in SJKC. These pupils failed in their Mathematics assessment, in which they obtained the marks below 40.

Since the focus of this study is on multiplication skills, the researcher needs to specify these Year Four Mathematics low achievers into those who have not mastered multiplication skills even though they have been taught during Year Two and Year Three using other methods. Therefore, the pupils are screened through a pre-test, to ensure that they have not acquired the skills of single-digit multiplication. As a result, these low achievers needed guidance from the teachers by using an alternative method, technique or materials which are more suitable with their learning level. Hence, the researcher had designed a module to increase the achievement of these Year Four low achievers in multiplication skills.

1.10.5 Traditional Teaching

In experimental research, the researcher could perform a new teaching approach with one group of participants and perform the traditional teaching approach with another group of participants (Johnson & Christensen, 2014). The traditional teaching is teacher-centered instead of pupils-centered. The pupils in traditional teaching classroom are usually passive as the teachers are using one-way communication. Hence, in Information and Communication Technology era, traditional teaching and learning methods are less attractive to the young generation as they have been exposed to all kinds of technologies (Muhamad Hafizhuddin Abdul Rahman, 2016).

In the context of this study, traditional teaching for control group is the teaching of multiplication skills using a traditional method. The method used in teaching single-digit multiplication for control group is by grouping method. For example, the item of 3 x 4 = 12 is explained by three groups of four equal to twelve. The teachers in the control group demonstrated the solution by drawing three big circles and four objects in each circle. Then, the pupils are required to count the objects and the sum of the objects is the answer for the question. All the teachers involved in control group were reminded to teach the same content of single-digit multiplication, which are multiplication facts from three until nine in the given time. In short, this is to control the extraneous variables and to ensure that both treatment and control groups had learnt the same content within the three months intervention period.

1.11 Summary

Teachers have to encounter with different challenges and problems in everyday life. In Mathematics subject, pupils may undergo difficulties if they have not mastered the four basic arithmetic skills in their learning. The teachers must find or develop a new strategy or method in order to improve the abilities and skills of the pupils. This study targeted the Year Four Mathematics low achievers because this category of pupils is often being left out. In the school, these pupils are usually being labelled as stupid or lazy as they cannot perform as the normal children at the same age and class.

Mathematics has become one of the most important subjects as it helps us to solve our daily problems. A good achievement in Mathematics is a requirement for every pupil in the schools. In this case, pupils need to master the four basic arithmetic skills during primary education. The researcher designed DoCtor WoRM's Module in order to help the Year Four low achievers in learning multiplication skills in a systematic way. The pupils will be divided into treatment group and control group. Traditional teaching is conducted towards the control group. Meanwhile, intervention using DoCtor WoRM's Module is conducted towards the treatment group. After the intervention using this module, the pupils should be able to master in multiplication skills involving single-digit multiplication facts.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This study aims to develop and evaluate the effectiveness of DoCtor WoRM's Module towards the achievement of Year Four low achievers in multiplication skills. This chapter will explain about seven concepts in the study, which are Remedial Education, theory of constructivism, game-based learning, mastery learning, arithmetic, multiplication, and Mathematics module for low achievers. The explanations are contributed by the experts in this field. The literature reviews based on the concepts were made to give a clearer picture of the concepts to be discussed in the research.

2.2 Remedial Education

According to the preliminary report of Malaysia Education Blueprint (PPPM) 2013-2025, only one percent of the population has been identified as having special needs and is enrolled in suitable special education programmes. This figure is likely to be an underestimate of the number of children in the country who actually have special needs, primarily because people with disabilities rarely come forward to register themselves. According to Tan Sri Dato' Haji Muhyiddin (2012) in Preliminary Report of PPPM 2013-2025, the inclusiveness of the system will also be improved with additional opportunities and resources for gifted, special needs, indigenous and other minority groups, and other groups with specific needs.

It is imperative that elementary teachers to have necessary knowledge of the structure of language and the alphabetic writing system in order to provide remedial instruction as needed (Lee, L.W. & Low, H.M., 2014). An adaptive remedial teaching system had been developed to automatically searches for relevant learning concepts and remedial teaching for learners to engage in Remedial Education (Hsieh, T.C., Lee, M.C., & Su, C.Y., 2013). An adequate remedial support should be offered during kindergarten to meet the needs of the low achievers (Toll & Van Luit, 2014).

Remedial Education is introduced in line with National Education Philosophy to emphasize in the mastery of literacy and numeracy among the pupils at the early stage so that they are able to communicate and to gain knowledge (Mohd Asnorhisham Adam & Abdul Rahim Hamdan, 2017). Among the strategies aimed at

increasing access to and persistence in tertiary education, one of the most commonly discussed is remediation (Paola & Scoppa, 2014).

Intervention at an early stage may give Mathematics low achievers the opportunity to catch up with their typically achieving peers, thereby allowing them to obtain sufficient basic mathematical knowledge by the start of first grade (Toll & Van Luit, 2013). There are specific group of children merits special attention because they are at high risk of developing severe problems with numerical or mathematical challenges (Van Luit & Toll, 2014). Hence, we should continue efforts to improve remedial Mathematics (Bahr, 2013).

There was a study conducted to evaluate the effectiveness of the workshop on student's success and retention in remedial Mathematics. In this study, the students were encouraged to in small groups to practice mathematical concepts in relevant problems gave the group members more confidence. They benefited from a collective pool of knowledge and skills to improve their own subject experience (Dabkowska & Sosnovski, 2016).

In summary, Remedial Education is very important to every stages of learning, begin with kindergarten until high education (Yoong, S.M. & Noor Aini Ahmad, 2018). For pupils with lower academic achievement, Remedial Education may improve their learning and draw them to the similar level with the other pupils. In Malaysia, Remedial Education is not classified as Special Education. However, the pupils under remedial education are considered in special needs. Hence, this study

will focus on Remedial Education for low achievers in order to improve their Mathematics achievement.

2.3 Theory of Constructivism

Constructivism is an epistemology of learning fixed on the basis that reflection on experiences while constructing our own understanding of the world allows learners to formulate a more concrete meaning of subject matter (Cherry & Overbaugh, 2004). Constructivism can be used in many disciplines. However, constructivism as educational theory comprises of ideas about how human learning occurs, the factors that tend to channel learning, ideas about how curriculum and instruction should be designed to best respond to educational purposes, given what is understood about learning (Taber, 2011).

In soft constructivist pedagogy, less emphasis is placed on the control and dissemination of knowledge by educators and there is more investment on the part of the learner in hands-on, active problem-solving, and knowledge construction (Loveless & Williamson, 2013). The main theorists in Constructivism included Dewey, Bruner, Piaget, and Vygotsky. Among all, Bruner is thought of as one of the founding fathers of Constructivism and his particular theory is one of many that lay inside of the constructivist framework (Cherry & Overbaugh, 2004).

According to Bruner (1960) in Weibell (2011), an effective spiral curriculum in summary should be; (1) begins with the basic and simple ideas that underlie that

which is more complex; (2) emphasizes the intuitive grasp of ideas and the use of those basic ideas in the early teaching of any subject; (3) revisits the basic ideas repeatedly; and (4) enables continual deepening of understanding by facilitating the use of basic ideas in progressively more complex form.

In constructivism, students are trained and guided to be able to construct their own knowledge on the basis of the initial knowledge that they have before (Handayani, Herman, Fatimah, Setyowidodo, & Katminingsih, 2018). The constructivist approach to education has influenced teaching, learning, and assessment of Mathematics. Besides, the constructivist approach with emphasis on the affective dimension of learning, on fostering positive motivation, with an emphasis on solving concrete, authentic tasks may also increase pupils' interest in Mathematics (Voinea & Purcaru, 2013). To effectively use games to support constructivist learning, it is important to understand how to engage learners, to support the inquiry process, and to provide feedback and assessment opportunities (Kirkley, Duffy, Kirkley, & Kremer, 2011).

Some researchers had applied constructivism as one of the important components in designing Holistic Mathematics Education Model for low grade elementary schools students. Based on this component, the teachers must be able to construct the pupil's knowledge of prior knowledge that has been held, so that the pupils are more familiar with the material being studied (Hayati, Fauzan, Iswari, & Khairdir, 2018). However, implementing and sustaining constructivism in Ghanaian Mathematics classrooms is problematic because the cultural orientations of the country do not encourage teamwork and acknowledgement of individual contributions

in the teaching and learning process (Ampadu & Danso, 2018). Meanwhile, there were researchers who found out that constructivism may not be effective for low achieving pupils in Mathematics instruction as it requires pupils to construct their own knowledge (Kroesbergen, Van Luit, & Maas, 2014).

In summary, theory of Constructivism is a theory that supports pupils to learn by doing. It is suitable to be applied in the classroom today as it supports pupils-centered activities. In this theory, pupils learn by constructing their own knowledge while doing the hands-on activities. Every pupil may achieve different level of learning based on the level they involve and construction of knowledge that occurs in their mind set. Teachers play a role as facilitator and design lessons activities that are enable to inject new ideas to the pupils. In this study, the pupils apply five steps in DoCtor WoRM's Module by solving the multiplication items in Pupil's Activity Book. Meantime, the interactive game of DoCtor WoRM's Module is able to engage the pupils and increase their interest in Mathematics.

2.4 Game-Based Learning

Games are a unique genre to implement existing models of learning, and playfulness adds a dimension to these existing models (Plass et al., 2015). The motivational psychology involved in game-based learning allows pupils to engage with educational materials in a playful and dynamic way. Game-based learning is not just creating games for pupils to play, it is designing learning activities that can incrementally introduce concepts, and guide users towards an end goal (Pho & Dinscore, 2015).

Games are artificial environments that are rule-based, responsive, challenging, and cumulative. All of these characteristics can contribute to a sense of fun, satisfaction in learning how to get around in a new environment, a feeling of self-importance to be in an environment that responds to one's actions, a feeling of self-efficacy to be able to accomplish difficult goals, and a feeling of competitive success in seeing oneself move forward in the game (Mayer, 2011). A motivational approach to game-based learning emphasizes that games are able to engage and motivate players by providing experiences that they enjoy and want to continue (Plass et al., 2015).

Digital games as a form of new media are especially of concern since they are attractive to young children (Chuang, T.Y. & Tsai, C.M., 2015). Games are the children's world so it would be relevant with the pupils who had young ages (Agustina Sri Hafidah, 2016). Games can provide a context for engagement and inquiry, immerse learners in problem solving, and provide feedback to support learning and performance (Kirkley et al., 2011). Games also make learning concepts more palatable for pupils and supply learners with a platform for their creative thoughts to bounce around. Research shows that games have a special role in building pupils' self-confidence and they can reduce the gap between quicker and slower learners (Boyle, 2011).

Educational games must be based on appropriate instructional theory and integrate suitable teaching strategies to ensure the effectiveness of the games in the promotion of learning (Lin, C.H. et al., 2013). An alternative to increase the pupils'

interest is to develop game software as the pupils love to learn in a fun and relaxing situation (Maimun Aqsha Lubis & Hanis Najwa Shaharuddin, 2016). Transfer of knowledge, skills, and attitudes from games to tasks in school or to activities in life generally, is of central significance for the effectiveness of games in delivering instruction (Tobias, Fletcher, Dai, & Wind, 2011).

The computer-assisted mathematical learning system can also serve as a supplementary tool that helps teachers with remedial instruction and enhances the problem-solving ability of low achievers (Huang, T.H., Liu, Y.C., & Chang, H.C., 2012). Computer games, much like prior innovations associated with educational technology, hold promise for delivering instruction (Tobias & Fletcher, 2011). In line with this, educational computer game without appropriate learning strategies was found to be insufficient in helping pupils improve their learning. This means that when teachers want to use educational computer games to assist pupils in improving their learning, they should pay more attention to the choice of these games in order to make sure that these games have been embedded appropriate learning strategies. Otherwise, pupils tend to easily give up learning when they faced with frustration, especially for low achievers (Huang, Y.M. & Huang Y.M., 2015).

Since game has become an effective way to improve learning, especially for children who love to play in nature, so the researcher decided to apply game-based learning in the intervention of DoCtor WoRM's Module. Besides having fun, the pupils are expected to build their knowledge and skills from the interactive game. This interactive game will act as reinforcement in the lesson for the pupils to

understand the steps to solve multiplication and to complete some activities for multiplication facts from three until nine.

2.5 Mastery Learning

Mastery learning is an instructional method which allows pupils to take their time to achieve the learning goals. In mastery learning, the learning content would be broken down into several small learning units, and only the pupils acquire the prerequisite knowledge or skills can move to the next learning unit (Lin, C.H. et al., 2013). In other words, mastery learning means readiness to proceed to the next phase of instruction (Lineberry, Park, Cook, & Yudkowsky, 2015). Mastery learning is following a sequence of steps through curricular units that culminate in demonstrated skills and knowledge of a topic before progression to the next unit (Sinner, 2015).

Learning for Mastery, based on Benjamin Bloom's interpretations and adaptations of John Carroll's model of school learning, in which initial instruction is provided through a variety of methods to the whole class, with individualized instruction provided as needed following a mastery test (Gentile & Lalley, 2003). Content areas that have using mastery learning approach the most are reading and Mathematics. It is because the reading and mathematical skills are sequential and build on one another (Holt & Kysilka, 2006).

Mastery learning is an innovative method providing the opportunity to all the pupils who are taking Mathematics subject with a plenty of time to understand any

particular topic in a particular Mathematics course based on the pupils' ability and capability to learn Mathematics at a comfortable pace within the realm of the pupils' aptitude (Norazzila Shafie, Tengku Norainun Tengku Shahdan, & Mohd Shahir Liew, 2010). Mastery learning is a very effective method of teaching and better than the conventional teaching method (Mitee & Obaitan, 2015). A digital game is an ideal tool for implementing mastery learning theory as it can manage individual learning pace of each student and provide immediate feedback (Yang, K.H., 2017). It is also of more advantage to weaker students (McCane, Ott, Meek, & Robins, 2017).

In short, mastery learning is a method which breaks the learning into smaller units so that the pupils are able to master the skills according to their own pace. It is an approach suitable to low achievers in Mathematics subject. Hence, the researcher applied mastery learning in DoCtor WoRM's Module by breaking learning into smaller units, and the pupils are require to master a multiplication fact before they move to the next unit. Mastery learning is suitable for low achievers because the pupils learn according to their own level.

2.6 Arithmetic

Arithmetic skills refer to the ability to combine numbers. Simple arithmetic refers to operations of addition, subtraction, multiplication, and division with smaller values of numbers (Andin, Ronnberg, & Rudner, 2013). Arithmetic fluency is the speed and efficiency with which correct solutions to numerical computations are generated. It is thought to represent a scaffold upon which higher-level mathematical skills are built.

Thus, the early arithmetic ability is important as it supports the acquisition of higher mathematical competence (Price, Mazocco, & Ansari, 2013). Since these skills are very important, effective ways need to be designed to improve the children's conceptual understanding at critical points in development by delineating the boundaries of their arithmetic intuition (McCrink, Shafto, & Barth, 2016).

Children's mental representations may be more tied to specifics such as problem format and arithmetic operation than are those for adults (Walker et al., 2013). To engage young children into practicing their arithmetic skills, game could be an excellent candidate (van der Ven, Segers, Takashima, & Verhoeven, 2017). Besides, most pupils enjoyed earning stickers, and this use appeared to help pupils gain arithmetic fluency (Paul & Vaidya, 2013). It is important to mention that mental arithmetic plays an important role in elementary Mathematics education in both China and the United States (Ding, Y., Liu, R.D., Xu, L., Wang, J., & Zhang, D., 2016).

In summary, arithmetic skills play a very important role in the teaching and learning of Mathematics subject in primary school. It involves four basic mathematical operations, which are addition, subtraction, multiplication, and division. Pupils need to master the basic arithmetic skills before they achieved a higher level of arithmetic fluency. Hence, the researcher had designed a module involving an interactive game as it is a suitable tool to help pupils in practicing their arithmetic skills.

2.7 Multiplication

Learning multiplication is an essential part of our child's primary education. Early multiplication problems involve discrete quantities, and instead of a student being exposed to multiplication such as 4 x 5, the word problem provides a context where the size of the group (multiplicand) and the number of groups (multiplier) are made explicit within the word problem (Bicknell, Young-Loveridge, & Nguyen, 2016). Multiplication could be solved by repetitive additions, but these strategies put high demands on verbal working memory and increase the risk of mistakes (Clercq-Quaegebeur, Casalis, Vilette, Lemaitre, & Vallee, 2017).

Generally, children are presented with the viewpoint that multiplication is more challenging than addition. For example, multiplication facts are more likely to be taught in a memorized, rote way than addition facts and addition concepts are introduced several years before multiplication concepts in the course of early schooling (McCrink et al., 2016). For multiplication and division, the direction of effect varies with the size of the operands. Multiplying numbers above one always yields a product greater than either multiplicand, but multiplying numbers between zero and one never does (Lortie-Forgues & Siegler, 2016).

Arithmetic facts, in particular multiplication tables to be organized in an interrelated network in long-term memory, which allows individuals to quickly retrieve the answers to simple arithmetic problems such as 3 x 4 (Visscher, Noel, & Smedt, 2016). Single-digit multiplication mental calculation is considered important, as in most countries children learn to memorize the multiplication tables (ven der Ven

et al., 2015). Multiplication facts are stored in a verbal form and the retrieval of multiplication facts relies more on verbal modality. So, the better verbal working memory a child has, the faster the child can respond to mental multiplication problems (Liu, R.D. et al., 2016). Regarding to this, the research also shows that low achievers must rely on other strategies to solve multiplication problems, until they have attained full automaticity (Kroesbergen, Van Luit, & Maas, 2004).

As a conclusion, multiplication is an important skill, and one of the fastest ways to solve multiplication is memorization of multiplication facts, especially for the Chinese pupils in SJKC. In order for the low achievers to achieve the memorization of multiplication facts, effective strategies which are suitable to their level should be developed. Hence, memorization of multiplication facts becomes the last step in DoCtor WoRM's Module, among the five steps as abbreviated in /D/ drawing, /C/ counting, /W/ writing, /R/ reading, and /M/ memorizing.

2.8 Mathematics Module for Low Achievers

Mathematics is the abstract study of topics such as quantity, numbers, structure, space, and change. Through the use of abstraction and logic, Mathematics developed from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects (Ziegler & Loos, 2014). Mathematics provides countless opportunities to build tool and component skills that enable performance on composite skills (Johnson & Street, 2013).

A chief aim of Mathematics education in this age of uncertainty must be to convince the pupils that they can learn Mathematics, in the hope that they will continue to learn, to adapt to the mathematical challenges with which their future lives will present them (Sullivan, 2011). Basic operations in Mathematics, such as addition, subtraction, multiplication, and division are all facts that can be taught using Mastery Learning (Holt & Kysilka, 2006).

However, a critical requirement in the Mathematics classroom is that teachers offer Mathematics as a learning subject, not a performance subject. For pupils to see Mathematics as a subject of learning, not performing, they need tasks and questions in Mathematics class that have space to learn built in (Boaler, 2014). Teaching Mathematics needs to be developed through a continuing, collaborative inquiry of teaching practices (Lin, P.J. & Acosta-Tello, 2017). Teaching Mathematics is a challenge at all grade levels, but technology has some specific attributes that support the learning of Mathematics in new and exciting ways (Schrum & Levin, 2015).

Low achievers are pupils who attain low academic achievement yet they are not qualified for special educational services (Yoong, S.M. & Noor Aini Ahmad, 2018). They are the pupils who are slower to make academic achievement (VanAuker-Ergle, 2003). The low achievers are a special group of non-disabilities children who have difficulties to acquire fundamental knowledge during learning process in class (Siti Zulaiha Ahmad & Ariffin Abdul Mutalib, 2016).

Children with lower mathematical skills may concentrate more on basic procedures rather than on general concepts (Madamurk, Kikas, & Palu, 2016). They

are having low motivation level in Mathematics learning (Muhamad Hafizhuddin Abdul Rahman, 2016). In other words, low achievers are less effective or less knowledgeable learners who needed to learn gradually and progressively with proper guidance (Hsieh, T.C., Lee, M.C., & Su, C.Y., 2013).

In Malaysia, pupils' academic achievement is a significant concern of most parents, teachers, and school administrators, especially for those who are involved with educating the low achievers whose numbers are on the rise (Noriah Mohd Ishak, Melor Md Yunus, Saemah Abdul Rahman, & Zuria Mahmud, 2010). The low achievers who do not achieve early school success are thought to gradually withdraw from active participation in school activities. Over time, pupils' lack of participation in school weakens their identification with school, debilitates their academic self-esteem and self-concept, erodes affiliations with prosocial peers, and eventually reduces their chances of completing high school (Lawson & Lawson, 2013). On the other hand, the basic comprehension of Mathematics skills among the low achievers in school were seldom recognized hence these low achievers continue to develop negative attitude towards Mathematics (Davrajoo et al., 2010).

In fact, these low achievers are capable of meaningful learning in Mathematics. They even have the potential for much more, and should not be neglected (Broza & Kolikant, 2015). Hence, how to help the low achievers to learn has become an important issue (Hsiao, I.Y.T., Yang, S.J.H., Wei, Y.H., Chang, T.L. & Lan, Y.J., 2016). Low achievers may need additional and perhaps explicit pedagogical approaches to inspire more complex representational thinking in Mathematics and

ways in which this thinking can be made visible through verbalizations (Kotsopoulos, Cordy, & Langemeyer, 2015).

The lack of interest in Mathematics occurs in group of low achievers. Pupils' interest in Mathematics is determined by the way in which the teaching, learning, and assessment of mathematical knowledge are done (Voinea & Purcaru, 2013). The findings of the researches show that, even though Mathematics is a very important subject for pupils, but some may face difficulties in learning it. This also happens among Mathematics low achievers, which have lack of interest in this subject. A good method or technique needs to be developed because it can stimulate pupils' thought or cognitive to understand the basic mathematical concepts (Norhayati Ahmat et al., 2017).

Module is a teaching aid which had been organised systematically with simple and understandable language, suitable level for the pupils so that they can learn by themselves with the minimum guidance from the educator (Prastowo, 2012). Learning modules are also an alternative for educators in carrying out teaching activities to improve the pupils' achievement (Mohini Mohamed, Ili Zarifah Zainudin, & Muhamad Hasanul Ilmu Mohd Shukri, 2012). Module learning activities are more systematic and organised because teaching and learning aid had been divided into smaller topics, and being constructed sequentially so that it is more understandable and applicable to the learners (Zakiah Mohamad Ashari, Azlina Mohd Kosnin, & Yeo, K.J., 2014).

The low achievers have preference to use module an aid in learning (Davrajoo, Rohani Ahmad Tarmizi, Mokhtar Nawawi, & Aminuddin Hassan, 2010). In Malaysia, LINUS module is introduce to low achievers. It consists of materials namely teacher's note, worksheets, and teaching aids (Rosseliiah Bokhari, Sabariah Md Rashid, & Chan, S.H., 2015). LINUS module consists of module in literacy and numeracy. Teachers used LINUS module in numeracy to assist low achievers from Year One until Year Three in learning basic arithmetic skills in Mathematics subject. In short, module is a simple and systematically organised teaching aid which can be an alternative for teachers to carry out teaching and learning activities. Hence, the researcher designed a module by breaking the learning into smaller units and introducing an interactive game in this module in order to improve the low achievers' achievement in Mathematics subject.

2.9 Summary

Remedial Education is very important as it may improve the low achievers' learning by drawing them to learn together with the similar level of pupils. Low achievers are special needs pupils who do not included for special education services. They become a significant problem that has never been satisfactorily measured or understood in terms of its extent and the social costs to the school, to the larger community, and ultimately to the economy and the life of the nation. It is undeniable that many low achievers are not being identified in our country. Hence, teachers should do something to help the pupils with special needs, especially the low achievers.

Mathematics is very important to every pupil. Arithmetic operations include addition, subtraction, multiplication, and division. Pupils usually view multiplication skills as a challenging task, especially low achievers. In order to improve the multiplication skills among the low achievers, Constructivist Theory, mastery learning, and game-based learning should be implemented while designing into the teaching and learning activities. Hence in this study, the researcher had designed a module to improve the achievement of the Year Four low achievers in multiplication skills.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Every study needs methodology as a way to obtain the findings. The method or methodology section consists of skeleton of the study (Perry & Nichols, 2015). The methodology carried out should be a series of systematically techniques in order to fulfil the requirements of the study. Based on the research questions, the nature of this study is quasi-experimental. Because of this, the researcher had divided the participants into control group and treatment group. This chapter will discuss about module development model, research design, sample, instruments, research procedures, data collection procedures, and data analysis.

3.2 Module Development Model

The learning module should be able to portray the function and its role in the effective learning. Design is the first step in the development of the module itself (Zuhrita Ariefiani, Djoko Kustono, & Syaad Pathmantara, 2016). The content of the module should be well-planned and systematic. Module consists of a series of activities which is written according to the objective of the group. There are four types of module; (1) teaching module; (2) motivation module; (3) training module; and (4) academic module (Amalia Madihie & Sidek Mohd Noah, 2012). In this study, DoCtor WoRM's Module is a teaching module because it focused on teaching and learning in primary school, and assisted the pupils who are weak in academic.

This is in accordance with the definition of teaching module in Sidek Mohd Noah and Jamaludin Ahmad (2005) that stated teaching module focused on teaching and learning in primary schools, secondary schools, college, or university. This type of module is to assist pupils who are weak in academic. In this study, the researcher applied Sidek's Module Development Model (2001) in constructing DoCtor WoRM's Module.

3.2.1 Sidek's Module Development Model

Figure 3.1 shows the flowchart of Sidek's Module Development Model. This model consists of two stages with different purposes. The first stage is about preparation of draft module, whereas the second stage is about testing and evaluation of module. The first stage includes nine steps, which are; (1) aim of module setting; (2) identify a theory, rationale, philosophy, concept, target groups, and time allocation; (3) research needs; (4) goal setting; (5) content selection; (6) strategy selection; (7) logistic selection; (8) media selection; and (9) module combination process. It is called a draft because this module has not proven its validity and reliability.

The second stage is the trial and evaluation of module. This stage consists of three steps, which are; (1) pilot study to evaluate the module; (2) to test validity and reliability; and (3) effectiveness evaluation. After the effectiveness evaluation, the researcher can determine whether the draft module is a quality module or not quality module. If it is a quality module, then the module is completed and ready for use. However, if it is not a quality module, then the researcher needs to re-assess and repeat the steps from stage one.

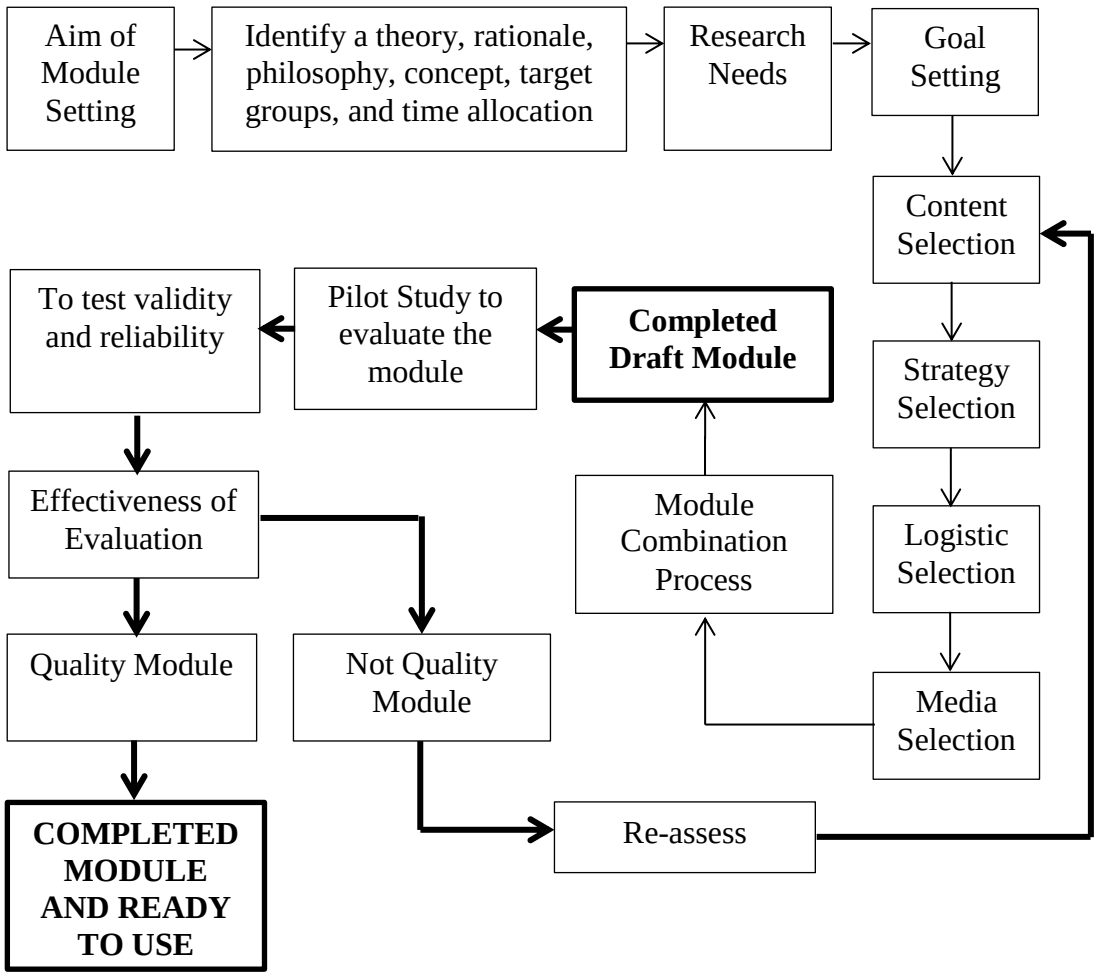

Figure 3.1 Sidek's Module Development Model

3.2.2 Development of DoCtor WoRM's Module

The researcher had constructed DoCtor WoRM's Module based on Sidek's Module Development Model. The first stage in this model is preparation of draft module. The aim of this module is to improve the multiplication skills among Year Four low achievers. The basic framework of DoCtor WoRM's Module is based on Constructivist Theory, game-based learning, and mastery learning. The target groups in this module are Year Four low achievers. The duration to complete this module is three months.

Constructivist Theory involves building of new schemata which is gathered through various activities or experience to achieve balance. The learners accommodate and assimilate new knowledge to perform the balancing processes. This means the new knowledge formed by fitting new information together with assisting knowledge and co-related it with the old schemata. It permits and facilitates the learner to learn inductively through discovering new things on their own (Azwin Arif et al., 2014). Hence, every lesson in DoCtor WoRM's Module intervention began with the induction session which focused on the previous learnt knowledge.

Meanwhile, the approach of mastery learning is used to divide the sub topic into three levels, namely repetition, completion, and enrichment. Completion is the main part of learning to achieve objective, the repetition is the learning activities to help reach the objective, and the enrichment is to develop knowledge of students (Purbohadi, Nugroho, Santosa, & Kumara, 2013). In this case, the completion involves the teaching of multiplication facts using the five important steps, the

repetition involves the different activities used to learn the same multiplication facts, whereas the interactive game is used to reinforce the learning in a certain unit. If the pupils do not answer more than six items correctly, then they need to repeat the learning process again.

Generally, game-based learning is designed to balance subject matter with game play and the player's ability (Cojocariu & Boghian, 2014). Games have some special qualities which are particularly appropriate and well suited for learning (Prensky, 2001). The motivational properties of games may induce students with limited prior knowledge to persist longer than they normally would on the task, thereby increasing the processing of the content and improving their learning (Tobias et al., 2011). Hence, an interactive game in DoCtor WoRM's Module had been designed to engage the low achievers in learning of multiplication facts from three to nine.

Next, the researcher had carried out Module Needs Assessment Survey. Module Needs Assessment Survey Questionnaire was distributed to ensure whether there is a need to develop the module. After identified the needs, module development process went on. Then, the researcher had set the goal for this module. Eight learning objectives for each unit in the module had determined. According to Sidek Mohd Noah and Jamaludin Ahmad (2005), the objective of module must be behaviour that can be seen and measured at the end of the module implementation. In this case, the pupils should be able to follow the five steps in DoCtor WoRM's Module and solve at least seven out of nine items for each multiplication facts.

Henceforth, the researcher had selected the content, strategy, logistic, and media for the module. The content of this module is single-digit multiplication, from multiplication facts of three until nine. The strategies and learning activities are stated in the lesson plans. They are designed in accordance with the 21st century learning. Five important steps in DoCtor WoRM's Module are /D/ draw the intersecting lines, /C/ count the intersection points, /W/ write the multiplication sentences, /R/ read the multiplication sentences, and /M/ memorize the multiplication facts. The materials in this module are Teacher's Manual, Pupil's Activity Book, and interactive game. Teacher acted as a facilitator and guides the pupils in the learning activities. Besides, the multimedia interactive game is able to motivate and attract the pupils' attention in learning. The last step in this stage is combining draft module. Then, the draft module went through the second stage, which is trial and evaluation of the module.

Subsequently, the researcher had carried out a pilot test to obtain the information about the quality of module especially in terms of content suitability, activities, language suitability, language level, and mistakes in written language. Next, the researcher had determined the validity and reliability of the module. The results of pilot study had determined the reliability, whereas Module Content Validity Questionnaire had determined the content validity of the module. Lastly, the researcher had measured the improvement among the pupils and evaluated the effectiveness of the whole module by using pre-test and post-test. If the module is able to improve the multiplication skills among the Year Four low achievers significantly, then the module is a quality module. At the end of this stage, DoCtor WoRM's Module is completed and ready for use.

3.3 Research Design

Research design is the blue print of research, a plan that guides the researcher in the process of collecting, analysing, and interpreting data. In other words, research design is an action plan to show the way in details about how to carry out the research. It explains the overall structural design in the study (Perry & Nichols, 2015). To prove that a treatment causes some positive effects or changes to a particular group of pupils, a researcher needs to control factors that may contribute to the changes. Hence, experimental research design is the best method to prove the effectiveness of a treatment (Lay, Y.F. & Khoo, C.H., 2016).

The purpose of this study is to develop and evaluate the effectiveness of DoCtor WoRM's Module in improving multiplication skills among Year Four low achievers. Based on the purpose of the study, this research employed a quasi-experimental design. There are two groups taken as the investigated groups in this research, which are control group and treatment group.

Table 3.1

Quasi-Experimental Design

Group	Pre-test	Teaching Method	Post-test
Treatment Group	T1	DoCtor WoRM's Module	T2
Control Group	T1	Traditional	T2

Table 3.1 shows the model of quasi-experimental design to evaluate the effectiveness of DoCtor WoRM's Module in the teaching of multiplication skills among Year Four low achievers. The low achievers went through a pre-test, then a

treatment for the treatment group, whereas the traditional method for the control group. After that, both groups went through a post-test. The purpose of pre-test is to ensure the two groups are equivalent before the intervention is taking place. In addition, the researcher had compared the results between pre-test and post-test to determine the changes that occur in a group. If the intervention is effective, then there is a significant difference in the post-test results between the control group and treatment group.

The treatment in this study is DoCtor WoRM's Module, stands from acronyms /D/ draw, /C/ count, /W/ write, /R/ read, and /M/ memorize. The researcher designed this module for the treatment group. The control group went through the traditional teaching. The treatment had been carried out for three months. The independent variable in this study is the teaching of multiplication skills using DoCtor WoRM's Module and the dependent variable is the achievement of Year Four low achievers.

Figure 3.2 shows the flowchart of the research process in this study. The researcher had enrolled Year Four low achievers who obtained less than 40 marks in the previous Mathematics assessment. This is identical to the selection of low achievers by Davrajoo et al. (2010), which the researchers listed down the low achievers from midyear examination score with a cut-off point ±40, as the first step in the working process of study. Subsequently, the low achievers went through a pre-test to select those who have not mastered multiplication skills as the participants in this study. Then, the researcher had analysed the data from the pre-test and divided the low achievers into two equivalent groups, which are treatment group and control group.

In the three months period, both groups had gone through teaching and learning lessons on multiplication skills. The treatment group had undergone the teaching and learning process using DoCtor WoRM's Module as intervention, whereas the control group had teaching and learning process using the traditional method. After three months, both groups had taken a post-test to evaluate the effectiveness of DoCtor WoRM's Module in teaching and learning multiplication skills. The purpose of the post-test is to compare the achievement of control group and treatment group.

The researcher had also compared the results between pre-test and post-test to determine the improvement in a group. After the data analysis, the researcher had continued with the results and discussion to decide whether the module is able to improve the achievement of Year Four low achievers in multiplication skills. Meanwhile, the researcher had carried out a workshop for the low achievers in control group in order to learn multiplication skills using the treatment of DoCtor WoRM's Module. This is as an ethic in doing researches with quasi-experimental design, so that the samples in control group were not just used in the study without receives any benefits from the treatment.

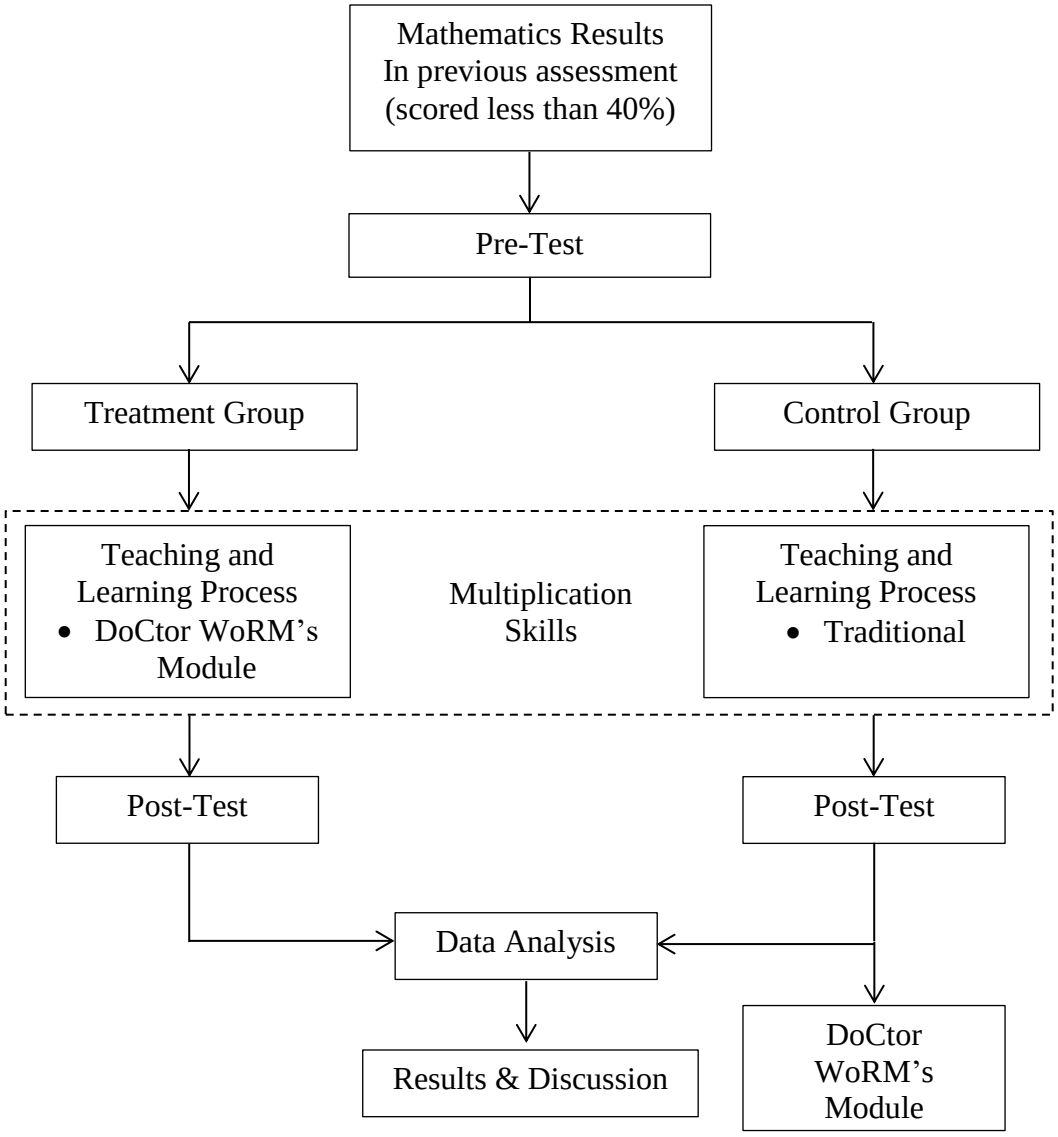

Figure 3.2 Flowchart of Research Process

3.4 Population and Sample

Sample describes the participants, subjects or the objects of the study for the researcher to gather the data (Perry & Nichols, 2015). Population in this study are all Year Four low achievers in Manjung district in year 2018. Based on the statistics obtained from Manjung District Office, there are a total number of 160 Year Three pupils failed in Mathematics Assessment in year 2017. So, this study focused on this size of population as these pupils categorized as Year Four low achievers in year 2018.

There are 12 schools involved in this study. For pilot study, seven schools that involved are SJKC PM, SJKC UI, SJKC CN, SJKC CH, SJKC PG, SJKC HL, and SJKC KS. On the other hand, four schools that are involved in field study are SJKC MT, SJKC TB, SJKC CC, and SJKC KJ. The number of sample in the pilot study is 60, which is the same amount of sample in the field study.

Table 3.2

Number of Samples in Pilot Study

Control Group	**Number of Samples (N)**	**Treatment Group**	**Number of Samples (N)**
SJKC PM	10	SJKC CH	6
SJKC UI	10	SJKC PG	6
SJKC CN	10	SJKC HL	12
		SJKC KS	6
Total	**30**	**Total**	**30**

Table 3.2 shows the numbers of sample involved in the pilot test. There are a total of seven schools participated in the pilot study. The samples in control

group are pupils from SJKC PM, SJKC UI, and SJKC CN. Meanwhile, the samples in treatment group are pupils from SJKC CH, SJKC PG, SJKC HL, and SJKC KS.

Table 3.3

Number of Samples in Field Study

Control Group	**Number of Samples (N)**	**Treatment Group**	**Number of Samples (N)**
SJKC MT	15	SJKC CC	20
SJKC TB	15	SJKC KJ	10
Total	**30**	**Total**	**30**

Table 3.3 shows the number of samples in control and treatment groups. The sampling method in this study is purposive sampling. Purposive sampling is the most suitable sampling technique when a researcher intends to select the most typical samples to represent a population. According to Lay, Y.C. & Khoo, C.H. (2016), the samples selected using purposive sampling will fulfil the criteria predetermined by the researcher and at the same time provide the best information to achieve the research objectives and research questions identified.

Table 3.4

Number of Samples Based on Gender

Gender	**Control Group**	**Treatment Group**
Male	16	16
Female	14	14

Table 3.4 shows the number of samples based on gender in control group and treatment group. There were 16 males and 14 females in control group. The treatment group is also contains the same amount of gender, which are 16 males and 14 females. This means that the male and female pupils are equally distributed in both groups. In

this matter, the researcher had carried out an Analysis of Covariate (ANCOVA) test to investigate the significant difference between achievements of pupils in both groups based on gender. Besides, an independent *t*-test had been carried out to ensure that both groups are equivalent before the intervention is carried out.

The researcher had chosen these schools in Manjung district because there were pupils who fulfil the criteria as the participants according to the specific purpose of the research. The criteria of choosing the sample are; (1) studying in SJKC, (2) Year Four; and (3) scored less than 40 marks in previous Mathematics assessment. The researcher had obtained the statistics of Mathematics results for Manjung SJKC schools in year 2017 from Zulkifli Zakaria, the Manjung District Education Office Officer in Primary Science and Mathematics.

Figure 3.3 shows the samples selection in the study. According to Manjung district final examination analysis for Mathematics subject, there was a total of 160 Year Three pupil that failed in the final examination in year 2017. To select the samples that have not mastered in multiplication skills, the researcher had distributed 160 sets of pre-test to 20 SJKC schools in Manjung district. Among these 160 low achievers, the researcher had finally selected 120 samples that have not mastered in multiplication skills. These samples were then divided into pilot study and real study equally. Then, these 60 pupils were again divided into control group and treatment groups equally. Lastly, the same process took place in the real study. This means 30 samples were selected into control group and 30 samples were selected into treatment group.

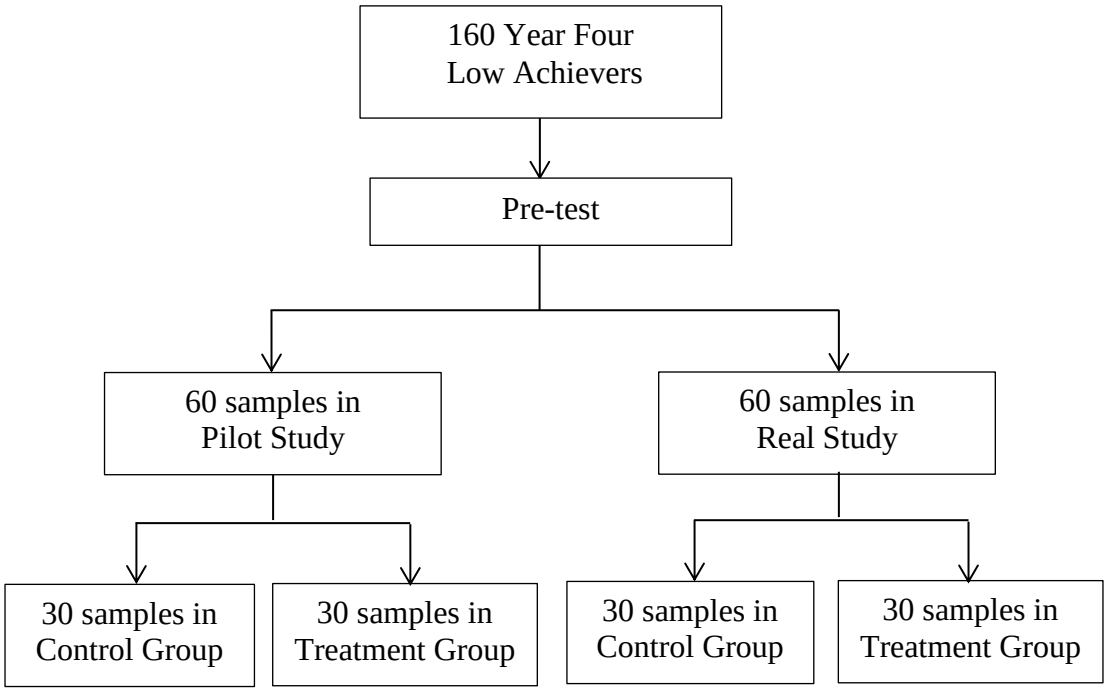

Figure 3.3 Samples Selection in the Study

3.5 Instruments

An instrument is a tool or procedure to collect data systematically (Lay, Y.F. & Khoo, C.H., 2016). Research instrument refers to any method to obtain data for the study, for example, observation form, interview schedule, questionnaire, and interview guidelines (Kumar, 2011). The two phases in the study design are Module Developmental Phase and Module Evaluation Phase. Two questionnaires during Module Developmental Phase are; (1) Module Needs Assessment Survey Questionnaire; and (2) Module Content Validity Questionnaire. On the other hand, the instruments during Module Evaluation Phase are; (1) pre-test and post-test; and (2) DoCtor WoRM's Module.

3.5.1 Module Developmental Phase

Module Developmental Phase is a stage where the researcher collects the data in order to design the module. Questionnaires are the instrument to collect the data in this phase. Two questionnaires in this phase are Module Needs Assessment Survey Questionnaire and Module Content Validity Questionnaire.

3.5.1.1 Module Needs Assessment Survey Questionnaire

The purpose of this survey is to study the problems among Year Four low achievers in Chinese National Type School (SJKC) and to assess the requirements for the module design in order to improve the multiplication skills among them. This survey contains three parts; (1) demographic data; (2) teaching and learning; and (3) module structure and design. The researcher had distributed this survey questionnaire to 50 teachers. The participants in this survey must be either Special Education or Remedial or Mathematics teachers in Manjung district.

Table 3.5

Item Analysis Summary of Module Needs Assessment Survey Questionnaire

No.	Item List	Year	Source
Part A: Demographic Data			
1	Gender	2015	Norehan Ali
2	Location		
3	Teaching Experiences	2013	Muhamad Fazli
4	Age		Mansor
5	Academic Achievement		
6	Specialization	-	-
Part B: Teaching and Learning			
1	I have inadequate skills to handle/ teach low achievers.	2014	Sullivan et al.
2	I faced problems in planning activities for low achievers.	2015	Broza & Kolikant
3	I faced problems when teaching low achievers.		
4	I think that module as a teaching aid can enhance the multiplication skills among low achievers.	2010	Davrajoo et al.
5	Teaching multiplication skills is relevant for Year Four low achievers.	2016	Ding et al.
6	Mastery of the single-digit multiplication is an important skill in Mathematics.	2015	van der Ven et al.
7	Low achievers faced difficulty in solving the following multiplication facts: - multiplication facts of 1 - multiplication facts of 2 - multiplication facts of 3 - multiplication facts of 4 - multiplication facts of 5 - multiplication facts of 6 - multiplication facts of 7 - multiplication facts of 8 - multiplication facts of 9	2015	van der Ven et al.
Part C: Module Development and Design			
1	Game-based learning should be an element in the module.	2014	Sayed Yusoff Syed Hussain et al.
2	Mastery learning should be applied in the learning of low achievers.	2006	Holt & Kysilka
3	The following activities are suitable for low achievers to master multiplication skills: - Drawing intersecting lines. - Counting intersecting points. - Writing multiplication sentences. - Reading multiplication sentences. - Memorizing multiplication facts.	2011 2015	West Soltanlou, Pixner, & Nuerk.
4	A module should contain the following materials: - Guidance and lesson plans for teachers. - Exercise worksheets for pupils. - Multimedia interaction game.	2013	Muhamad Fazli Mansor
5	Choose ONE basic skill to master single-digit multiplication facts. - Multiplication sentences - Vertical algorithm for multiplication	2015	Taylan

Table 3.5 shows the item analysis summary of Module Needs Assessment Survey Questionnaire. Part A is about demographic data of the participants participated in this study. This part contains a total of six multiple choices items. Item number one until six are gender, location, teaching experiences, age, academic achievement, and specialization. The participants have to tick (✓) in the space provided.

Next, Part B is about the problems that teachers might face in teaching and learning involving Year Four low achievers. In this part, the participants need to choose [YES] or [NO] for the statements and tick (✓) in the space provided. This part contains a total of seven items. The items in this part are; (1) I have inadequate skills to handle/ teach low achievers; (2) I faced problems in planning activities for low achievers; (3) I faced problems when teaching low achievers; (4) I think that module as a teaching aid can enhance the multiplication skills among low achievers; (5) teaching multiplication skills is relevant for Year Four low achievers; (6) mastery of single-digit multiplication is an important skills in Mathematics; and (7) low achievers faced difficulty in solving the following multiplication facts. This part plays a crucial role in this study because it gives support and reasons for the researcher to design a module and carry out the experiments.

Part C is about the module development and design suitable for teaching and learning of multiplication skills among Year Four Low Achievers. This is also the part for the researcher to study about the feasibility of the module. Identical to part B, the participants are required to choose [YES] or [NO] for the statements and tick (✓) in the space provided. This part contains five questions, which are; (1) game-based

learning should be an element in the module; (2) mastery learning should be applied towards low achievers; (3) the following activities are suitable for low achievers to master multiplication skills; (4) a module should contains the following materials; and (5) choose one basic skills to master single-digit multiplication facts. For the fifth item, the participants need to choose only one between two choices of Mathematics sentences or vertical algorithms for multiplication.

Last but not least, Part D is about the suggestion on module development and design suitable in teaching and learning of multiplication skills among Year Four low achievers. The participants are required to write down any suggestion in the space provided. In short, Part C and Part D are important in shaping the module to be built. The researcher will then start to develop and design the module so that it meets the needs and requirements based on data from this questionnaire. Overall, this survey questionnaire support the needs to carry out the research and at the mean time strengthen the idea to construct and design the module entitled DoCtor WoRM's Module.

Three mains focuses when the researcher designs this survey are; (1) the existence of problem; (2) module needs and factors that contributed to the needs; and (3) the module design. The items about the existence of problems are in Part B Teaching and Learning, from the first item until the third item. The items are; (1) I have inadequate skills to handle/ teach low achievers; (2) I faced problems in planning activities for low achievers; and (3) I faced problem when teaching low achievers.

Next, the second focus is module needs and factors that contributed to the needs. The researcher used four items in Part B to survey module needs and factors that contributed to the needs. The items are; (1) I think that module as a teaching aid can enhance the multiplication skills among low achievers; (2) teaching multiplication skills is relevant for Year Four low achievers; (3) mastery of single-digit multiplication is an important skill in Mathematics; and (4) low achievers faced difficulty in solving multiplication facts from one until nine. For the last item in Part B, the participants need to tick (✓) in the boxes for any multiplication facts that they think are required by low achievers.

The third focus is about the module design. Five items in Part C Module Development and Design is regarding this focus. The items to survey about the module design are; (1) game-based learning should be an element in the module; (2) mastery learning should be applied in the learning of low achievers; (3) the following activities are suitable for low achievers to master multiplication skills (drawing the intersecting lines, counting the intersection points, writing the multiplication sentences, reading the multiplication sentences, memorizing the multiplication facts); (4) a module should contain the following materials (guidance and lesson plans for teachers, exercise worksheets for pupils, multimedia interaction game); and (5) choose one basic skill to master single-digit multiplication (multiplication sentence, vertical algorithm for multiplication).

Last but not least, the researcher adds on Part D Suggestion in this questionnaire. In this part, the participants need to write down any suggestion on module development and design suitable in teaching and learning of multiplication

skills among Year Four low achievers in the space provided. As a conclusion, this needs assessment survey is important for the researcher to learn about the needs and develop a module according to the needs and suggestions.

3.5.1.2 Module Content Validity Questionnaire

Validity refers to the level of trueness of the research findings. In another word, it shows whether the collected data is representative of and gives a true picture of the phenomena under investigation (Lay, Y.F. & Khoo, C.H., 2016). Meanwhile, content validity is the property of a test such that the test items sample the universe of items for which the test is designed (Salkind, 2017).

Seven experts had received the Module Content Validity Questionnaire for DoCtor WoRM's Module. The expert panel included one expert in module, three experts in Remedial, and three experts in Mathematics. Among the experts, four of them are teachers with more than 10 years teaching experiences in either Mathematics subject or Remedial class, one lecturer in university which are expert in module, one Remedial teacher with the title of Global Teacher Prize Finalist, one SISC+ officer in Manjung District Education Office.

The researcher had designed a questionnaire to ensure the content validity of the module. This instrument is adapted from the Module Content Validity Questionnaire by Mohammad Aziz Shah Mohamed Arip (2010). In this case, the researcher had met Professor Mohammad Aziz Shah Mohamed Arip in person and

showed him the content validity questionnaire that had been modified. After that, the researcher had provided the experts with a set of module and a questionnaire and they had completed the questionnaire after study the module.

Table 3.6

Differences between Original Questionnaire and Adapted Questionnaire

Original Questionnaire	Adapted Questionnaire	Rational
The title is [Session and Activity Suitability Content Validity Questionnaire for Higher Order Thinking Skills (HOTS) Module in Science Subject among the Secondary School Students in Malaysia].	The title is [Content Validity Questionnaire for DoCtor WoRM's Module among Year Four Low Achievers].	In this study, the questionnaire is to measure the content validity of DoCtor WoRM's Module instead of HOTS Module.
Items are arranged according to eight sessions.	Items are arranged according to three materials, Part A for Teacher's Manual, Part B for Pupil's Activity Book, Part C for interactive game, and Part D for whole DoCtor WoRM's Module.	The adapted questionnaire is designed based on the three materials in the module, instead of session and activity suitability.
A total of eight items.	A total of 33 items.	The adapted questionnaire has more items to evaluate the content of every subtopic in each material in a more precise and detail way.
One item in each session.	Part A has 11 items, Part B has 8 items, Part C has 10 items, and Part D has 4 items.	The items are designed for every subtopic in the Teacher's Manual, Pupil's Activity Book, interactive game, and whole DoCtor WoRM's Module.

Table 3.6 shows the differences between the original questionnaire and the adapted questionnaire, along with the rational of the changes made by the researcher. This questionnaire contains brief information about module background, objectives, and theoretical basis of the research. So, the experts have a clear image about the module before they are evaluating about it. There are a total of eight sessions in this module. The teaching and learning had carried out in the sequence of; (1) introduction of DoCtor WoRM's Module; (2) multiplication of 3; (3) multiplication of 4; (4) multiplication of 5; (5) multiplication of 6; (6) multiplication of 7; (7) multiplication of 8; and (8) multiplication of 9.

The objective of this survey is to measure the content validity of DoCtor WoRM's Module among Year Four low achievers. The experts need to circle the number that represent their answer based on the approval level, from 0 (strongly disagree) until 10 (strongly agree). There are four parts in Module Content Validity Questionnaire; (1) Part A Teacher's Manual; (2) Part B Pupil's Activity Book; (3) Part C Interactive Game; and (4) Part D Whole DoCtor WoRM's Module.

Part A is about content validity of Teacher's Manual. There are 11 statements in Part A. These statements are; (1) introduction of DoCtor WoRM's Module is clearly stated; (2) eight objectives of the units are clearly stated; (3) five important steps in DoCtor WoRM's Module are clearly explained; (4) the content of Unit 1 is able to introduce the five steps in DoCtor WoRM's Module to Year Four low achievers clearly; (5) the content of Unit 2 is able to improve multiplication of 3 among Year Four low achievers; (6) the content of Unit 3 is able to improve multiplication of 4 among Year Four low achievers; (7) the content of Unit 4 is able to

improve multiplication of 5 among Year Four low achievers; (8) the content of Unit 5 is able to improve multiplication of 6 among Year Four low achievers; (9) the content of Unit 6 is able to improve multiplication of 7 among Year Four low achievers; (10) the content of Unit 7 is able to improve multiplication of 8 among Year Four low achievers; (11) the content of Unit 8 is able to improve multiplication of 9 among Year Four low achievers.

Next, Part B is about the content validity for Pupil's Activity Book. There are eight statements in Part B. These statements are; (1) the content of Unit 1 is able to introduce five steps in DoCtor WoRM's Module to Year Four low achievers clearly; (2) the content of Unit 2 is able to improve multiplication of 3 among Year Four low achievers; (3) the content of Unit 3 is able to improve multiplication of 4 among Year Four low achievers; (4) the content of Unit 4 is able to improve multiplication of 5 among Year Four low achievers; (5) the content of Unit 5 is able to improve multiplication of 6 among Year Four low achievers; (6) the content of Unit 6 is able to improve multiplication of 7 among Year Four low achievers; (7) the content of Unit 7 is able to improve multiplication of 8 among Year Four low achievers; (8) the content of Unit 8 is able to improve multiplication of 9 among Year Four low achievers.

Then, Part C is about content validity for interactive game. There are ten statements in this part. The statements are; (1) the four characters used are attractive to Year Four low achievers; (2) the five steps in DoCtor WoRM's Module are clearly explained; (3) the storyboard is able to attract pupils attention in learning; (4) The content of [3] is able to improve the multiplication of 3 among Year Four low achievers; (5) the content of [4] is able to improve the multiplication of 4 among Year

Four low achievers; (6) the content of [5] is able to improve the multiplication of 5 among Year Four low achievers; (7) the content of [6] is able to improve the multiplication of 6 among Year Four low achievers; (8) the content of [7] is able to improve the multiplication of 7 among Year Four low achievers; (9) the content of [8] is able to improve the multiplication of 8 among Year Four low achievers; (10) the content of [9] is able to improve the multiplication of 9 among Year Four low achievers.

Part D is the last part in this questionnaire. It is about the content validity of whole DoCtor WoRM's Module. There are only four statements in Part D. The statements are; (1) the content of Teacher's Manual is able to improve multiplication skills among Year Four low achievers; (2) the content of Pupil's Activity Book is able to improve multiplication skills among Year Four low achievers; (3) the content of interactive game is able to improve multiplication skills among Year Four low achievers; and (4) the content of DoCtor WoRM's Module is appropriate with the time allocated in three months period. By the end of each part in the questionnaire, the expert could write any suggestion relevant to the content in the space provided.

3.5.2 Module Evaluation Phase

Two instruments during Module Evaluation Phase are; (1) pre-test and post-test; (2) and DoCtor WoRM's Module. There are three materials in DoCtor WoRM's Module; (1) Teacher's Manual; (2) Pupil's Activity Book; and (3) interactive game.

3.5.2.1 Pre-Test and Post-Test

The purpose of pre-test and post-test as an instrument is to test the pupils' achievement level before and after the teaching and learning process. All of the 60 respondents from control group and treatment group had participated in the pre-test and post-test. The scope of the pre-test and post-test is the multiplication facts from three to nine.

Part A in the pre-test is pupil's information form. It is to collect the background information of the pupils. There are five questions about the pupil's personal information and one question related the pupil's academic information in this form. The pupils need to answer two closed-ended questions by ticking at the answers. These close-ended questions include gender and races. Besides, the pupils also need to answer four open-ended questions by writing their name, school, age, and Mathematics result in previous assessment. All items are built by the researcher according to the demography needs in this study.

Table 3.7

Table of Specification for Pupil's Information Form

Item	Question	Question Type
1	Name & Class	Open-ended
2	School	Open-ended
3	Gender	Close-ended
4	Age	Open-ended
5	Race	Close-ended
6	Mathematics Result in Previous Assessment	Open-ended

Table 3.7 shows the description of the pupil's information form. First, all of the respondents had taken a pre-test before the teaching and learning process. The purpose of pre-test is to ensure the achievement level or existing knowledge of that control group and treatment group are both equivalent before teaching and learning takes place. It is also used as a control instrument to determine the achievement level or the existing knowledge of the pupils. In contrarily, post-test is the test given to the respondents after the teaching and learning process. Then, the researcher had compared and tested the results of pre-test and post-test scientifically to determine whether there is an improvement of the pupils' achievement in multiplication skills among the control and treatment groups. It is also to evaluate the effectiveness of DoCtor WoRM's Module towards the achievement of Year Four low achievers in multiplication skills.

The researcher built the pre-test and post-test items according to the teaching objectives. The contents of the pre-test and post-test are the multiplication skills similar with the teaching and learning in DoCtor WoRM's Module. The sequence of multiplication facts is starting from the smallest digit to the largest digit, which are three, four, five, six, seven, eight, and nine. The pre-test and post-test can prove the effectiveness of this module through a systematically way with the achievement of the pupils.

Table 3.8

Parallel Items in Pre-Test and Post-Test

	Pre-Test	Post-Test
1	3 x 3	1 x 3
2	4 x 3	2 x 3
3	6 x 3	5 x 3
4	7 x 3	8 x 3
5	9 x 3	9 x 3
6	2 x 4	1 x 4
7	3 x 4	4 x 4
8	5 x 4	6 x 4
9	8 x 4	7 x 4
10	9 x 4	8 x 4
11	1 x 5	2 x 5
12	4 x 5	3 x 5
13	6 x 5	5 x 5
14	7 x 5	7 x 5
15	8 x 5	9 x 5
16	2 x 6	1 x 6
17	3 x 6	2 x 6
18	5 x 6	4 x 6
19	7 x 6	6 x 6
20	9 x 6	9 x 6
21	1 x 7	3 x 7
22	2 x 7	4 x 7
23	4 x 7	5 x 7
24	6 x 7	7 x 7
25	9 x 7	8 x 7
26	1 x 8	2 x 8
27	3 x 8	4 x 8
28	5 x 8	5 x 8
29	7 x 8	6 x 8
30	8 x 8	9 x 8
31	2 x 9	1 x 9
32	4 x 9	3 x 9
33	5 x 9	6 x 9
34	6 x 9	7 x 9
35	9 x 9	8 x 9

Table 3.8 shows the items of pre-test and post-test. There are five items for each multiplication facts. The total number of items in each test is 35, which are all open-ended questions. Besides, both pre-test and post-test are using the parallel items which are not repetitive. This means the items in the post-test have the identical

multiplier or factor with their paired-items in the pre-test. The rational of parallel items being used instead of similar items is to prevent the pupils from memorizing the answers according to the sequence. Lastly, the items built are the multiplication facts from three until nine.

3.5.2.2 DoCtor WoRM's Module

DoCtor WoRM's Module consisted of three materials, which are Teacher's Manual, Pupil's Activity Book, and interactive game. These three materials are complementary to each other. First, the researcher had given a briefing about the process to carry out intervention to the teachers. The teachers in the treatment group had received a Teacher's Manual in order to carry out the teaching and learning activities according to the lesson plans.

Next, every respondent in the treatment group had received a Pupil's Activity Book so that they can complete the exercises during every lesson. The worksheets in the Pupil's Activity Book are complementary to the lesson takes place in the classroom. DoCtor WoRM's Module also included an interactive game. Pupils used the DoCtor WoRM's interactive game to revise their learning in that lesson. The contents of the Teacher's Manual, Pupil's Activity Book, and interactive game will be discussed in the next sections.

3.5.2.2.1 Teacher's Manual

The researcher had carried out a session of introduction to DoCtor WoRM's Module before the intervention takes place. Every teacher in the treatment group received a Teacher's Manual. In this case, the researcher had selected the teachers that shared some common criteria, such as teaching experiences. This is to control the external factors and to ensure the reliability of the results.

Teacher's Manual contained the introduction, objectives, and background of DoCtor WoRM's Module. Hence, the teachers are able to read through it before carry out the lessons. Besides, Teacher's Manual also provided lessons plans on how to implement this module and learning tools in the teaching and learning activities. Five steps in the lessons include drawing, counting, writing, reading, and memorizing. The teachers in the treatment group had carried out their lessons according to the lesson plans.

Mastery learning is a method of instruction that separates content into units, with an expected level of student performance for each unit. The unit contains goals with broad statements about what is to be accomplished and daily lesson plans with measurable objectives (Holt & Kysilka, 2006). In this Teacher's Manual, the teachers had carried out the lessons of multiplication skills according on the pupil's level. The teacher had identified the pupils by the results of pre-test. The sequence of multiplication facts start from the smallest digit, which are multiplication facts of three, four, five, six, seven, eight, and nine. The Teacher's Manual and lesson plans

are not only act as a teacher's guidance, but it is also to ensure the reliability of the data in this study.

The major theme in Constructivist Theory of Bruner is that the learning is an active process in which learners construct new ideas or concepts based upon their current or past knowledge (Kearns, 2010). Every lesson begins with the revision of previous learnt knowledge during the set induction as stated in Teacher's Manual. Hence, the learners are able to build new knowledge based on the existing schemata. For example, the pupils are required to revise the multiplication of three before starting the lesson on multiplication of four.

3.5.2.2.2 Pupil's Activity Book

There are a total of 60 samples in this study, which included 30 pupils in control group and 30 pupils in treatment group. In this case, every pupil from the treatment group had received a Pupil's Activity Book. The scope of the exercises is the multiplication facts from three until nine. The researcher designed the activities according to the mastery learning model, which means it began with the simpler multiplication facts to the harder ones. The pupils had completed the activities in this module after every teaching and learning activity.

The pupils need to learn about five important steps in DoCtor WoRM's Module, which are drawing, counting, writing, reading, and memorizing. First, they have to draw the intersecting lines according to the multiplication problem. Then, they

need to count the intersection points among the lines. Next, the pupils need to write and read the multiplication sentences. After the pupils can write and read the multiplication sentences correctly, they have to memorize the multiplication facts.

This activity book acts as a reinforcement activity for the skills that had been learnt in that particular lesson. For example, if the teaching and learning activity of that day is about multiplication facts of three, then the pupils will have to complete the activities in their Pupil's Activity Book in that unit. The same goes to the other lessons. The Pupil's Activity Book is able to construct pupils' knowledge using the hands-on activities. Hence, the pupils are able to improve their achievement with the assistance of this Pupil's Activity Book.

3.5.2.2.3 Interactive Game

DoCtor WoRM's Module consists of a multimedia interactive game. The researcher designed this game using Scratch program version 2.0. The interactive game begins with a picture of rainbow and two clouds. A butterfly and a caterpillar are in each of the cloud respectively. The title of this module [DoCtor WoRM's Module] is shown above the rainbow. Figure 3.4 shows the first image of the interactive game.

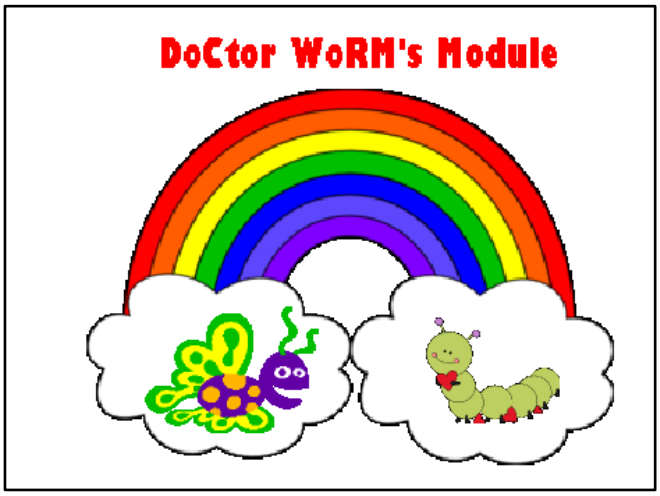

Figure 3.4 The First Image in the Interactive Game

The user can click on the title [DoCtor WoRM's Module] in order to proceed to the next image. There are four choices which are; (1) characters; (2) five steps; (3) story; and (4) game appeared on the four leaves respectively. The user can choose among the four choices to proceed to the next image. Figure 3.5 shows the four choices appeared in the second image.

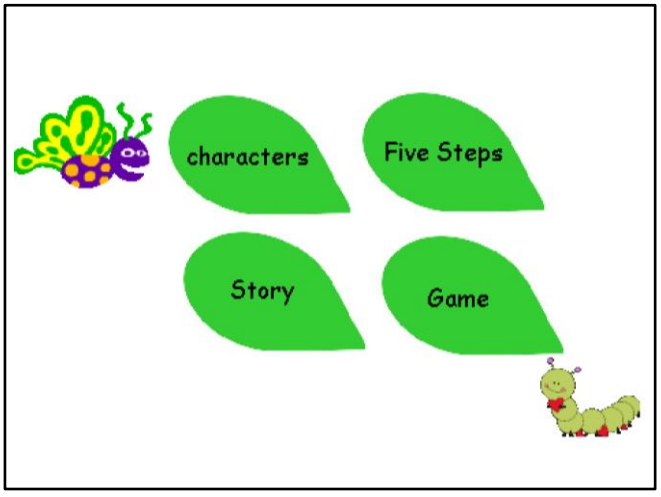

Figure 3.5 Four Choices Appeared in the Second Image

The introduction of four characters will be shown if the user clicked on the leaf of [characters]. There are four characters in this interactive game, which are; (1)

Betty Butterfly; (2) Cody Caterpillar; (3) red caterpillar; and (4) blue caterpillar. The user can click on the each character at a time so that it appears in the middle of the screen and introduce about itself. It contained sound effect to attract pupils' attention. After all of the characters had being clicked, the user can click on the [home] icon to go back to the second image. Figure 3.6 shows the image on the four characters.

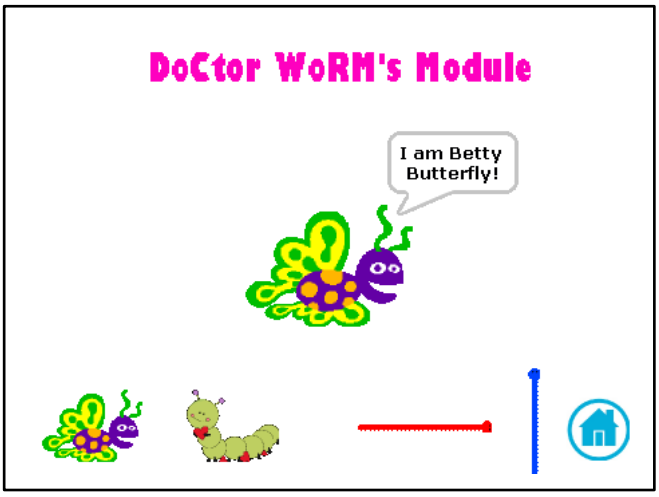

Figure 3.6 The Image on the Four Characters

If the user clicked on the leaf of [Five Steps], then the image on the five steps will appeared. Number buttons from one until five are shown on the top on the image. The user can click on each number button to learn about each step in DoCtor WoRM's Module. Step one is drawing the intersecting lines, step two is counting the intersection points, step three is writing the multiplication sentences, step four is reading the multiplication sentences, and step five is memorizing the multiplication facts. After that, the user can click on the [home] icon to go back to the second image. Figure 3.7 shows the image on the five steps.

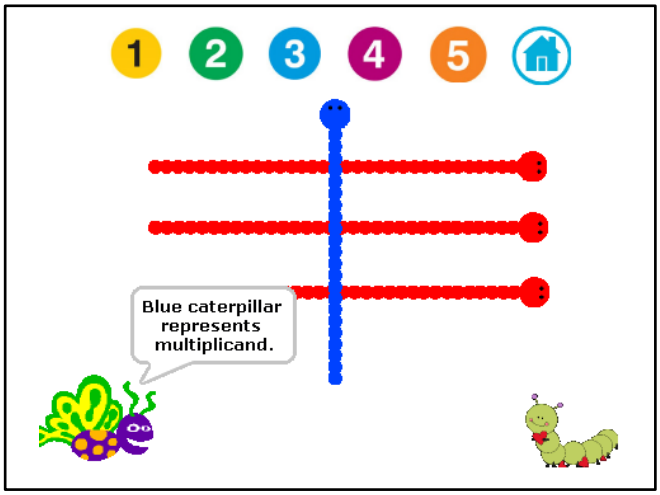

Figure 3.7 The Image on the Five Steps

If the user clicked on the leaf of [Story], then the story between Betty Butterfly and Dr. Worm is started. In this story, Betty Butterfly does not know how to multiply, so Dr. Worm wanted to help her. Then, they went to find Dr. Worm's friends, which are red caterpillars and blue caterpillars to help to solve some multiplication problems. Figure 3.8 shows the conversation between Betty Butterfly and Dr. Worm.

Figure 3.8 The Conversation between Betty Butterfly and Dr. Worm

When the user clicked on the leaf of [Game], the next image appeared required the pupils to choose among the multiplication facts from three to nine. The teacher should guide the pupils for choosing the multiplication facts they have learnt on that day. A background music entitled [cute cat band] will be playing while the player is making choice. There will be a [pop] sound when the player clicked on the number buttons. A score board will be appeared at the top-left corner of the image. Figure 3.9 shows the image of [Choose Multiplication Facts].

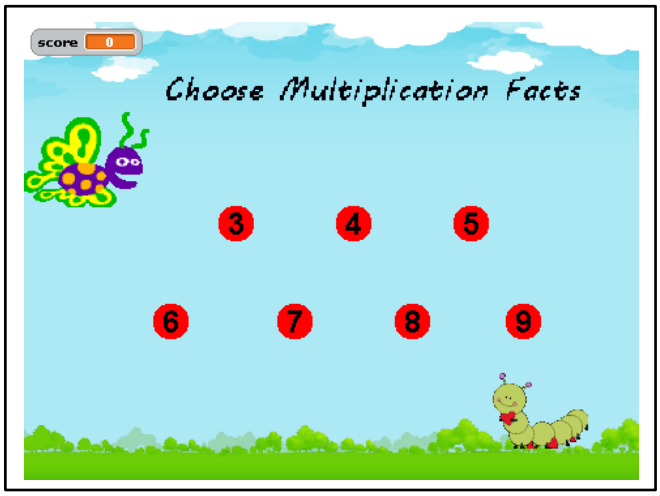

Figure 3.9 The Image of [Choose Multiplication Facts]

When the player clicked on the number button, Dr. Worm's friends, which are the red caterpillars and blue caterpillars start moving into the screen. Betty Butterfly will ask a multiplication questions while the caterpillars move onto the leaf according to the question. The number of red caterpillars represents the multiplier, whereas the number of the blue caterpillars represents the multiplicands. The red caterpillars move horizontally from left to right, while the blue caterpillars move vertically from bottom to top. All of the red caterpillars and blue caterpillars will stop in the middle of the leaf, and the pupils need to write the answer for the multiplication questions. The

players may count the intersection points among the intersecting caterpillars in order to obtain the correct answers. Figure 3.10 shows the sample questions for multiplication facts of three.

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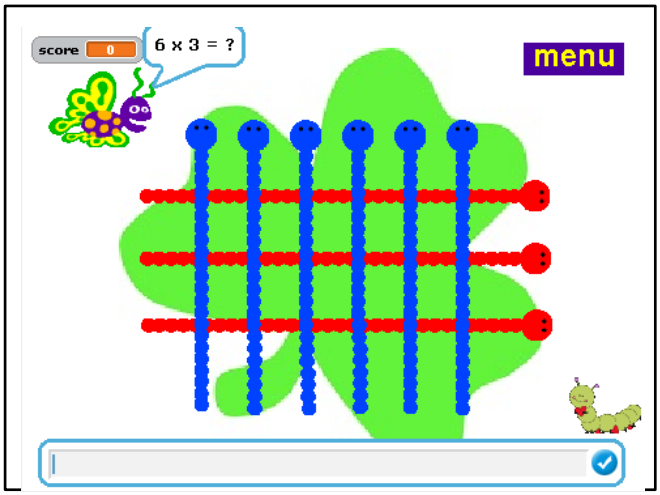

Figure 3.10 Sample Questions for Multiplication Facts of Three

Betty Butterfly will pose a multiplication question, and Dr. Worm will remind the player to count the intersection points. With the guidance given, the player needs to type in the answer in the empty space. Then, the player may press [enter] key or the blue [✓] button at the right-bottom corner of the image. If the player gives a correct answer, Betty Butterfly will response [Correct!] and one score will be given. Conversely, if the player gives a wrong answer, Betty Butterfly will response [Incorrect!] and no score will be given. During this session, the teacher acts as a facilitator and guides the pupils when they need assistance or explanations. If the player obtained the score of seven or above, then the image of [congratulations] will be shown. Figure 3.11 shows the image of congratulations for the player who achieved the target score.

Figure 3.11 The Image of [Congratulations]

Then, the player can click on the [menu] button to go back to the image of [Choose Multiplication Facts]. However, if the player obtained a score less than seven, then the image of a big caterpillar crying will be appeared. The player needs to click on the [menu] button, back to the image of [Choose Multiplication Facts], click on the same multiplication facts, then try again to achieve the target score of seven or above. Figure 3.12 shows the image of [Try Again].

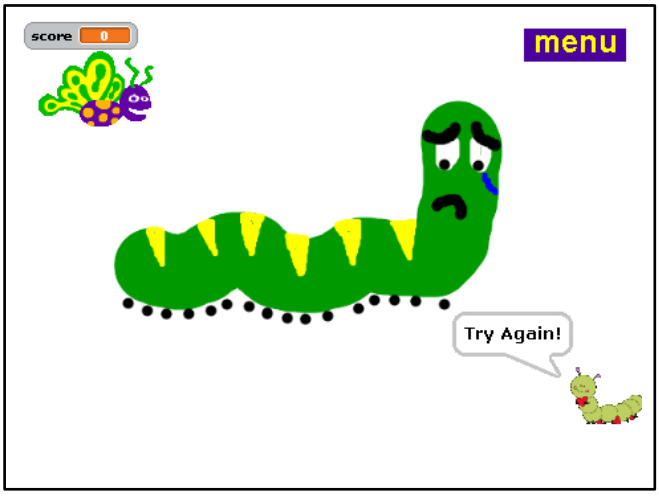

Figure 3.12 The Image of [Try Again]

Teachers used this interactive game for pupils in the treatment group. The pupils played this interactive game after the learning activity on a certain multiplication facts. The low achievers are able to gain their confidence in solving multiplication problems with the assistance of Dr. Worm and his friends. The learning occurs when pupils try to obtain the correct answer by counting the intersection points of the caterpillars. Teacher's Manual, Pupil's Activity Book, and interactive game are three important materials in DoCtor WoRM's Module to improve the achievement of Year Four low achievers in multiplication skills.

3.6 Research Procedures

The procedures in this research included organizing teaching procedures, administering pilot test, conducting the treatment, administering pre-test and post-test, and administering questionnaire.

3.6.1 Organizing Teaching Procedures

Organizing teaching procedures is important to ensure the reliability of this research. It is also to ensure that both the results will not be affected by other factors. First, the teachers in the treatment group should have the similar teaching experience in this field. They also have to share some similar characteristics such as patience, good tempered, and kindness.

The teachers in treatment group received a Teacher's Manual. Teachers should follow the lesson plans and activities in this manual. Five important steps in DoCtor WoRM's Module are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts. The teachers selected had been given a briefing about how to implement DoCtor WoRM's Module in the teaching and learning process for the treatment group. Hence, the teachers are able to implement these steps during the intervention sessions with the pupils.

In educational research, treatment research strategy involves two groups of participants, which are control group and treatment group. Treatment group will receive an intervention, whereas control group will not receive any intervention in the study (Ramlee Ismail, Jamal @ Nordin Yunus, & Marinah Awang, 2016). Hence, the pupils in the control group had learnt multiplication skills using traditional methods without the implementation of DoCtor WoRM's Module.

3.6.2 Administering Pilot Study

Pilot study is a small scale study that is implemented before the real study is conducted (Chua, Y.P., 2014). Pilot study is a pre-study before the actual study is carried out. Pilot test is also a trial study to ensure the reliability or to verify the suitability of questionnaire or instruments and the actual implementation procedure towards the study environment (Fauzi Hussin, Jamal Ali, & Mohd Saifoul Zamzuri Noor, 2014). The purpose of pilot study is to measure the reliability of the instruments.

Besides, it is also to obtain the additional information such as the timeframe needed, test items, and pupils' understanding on the items. Lastly, the pilot study is also to evaluate the feasibility of the real study.

In this study, the researcher had carried out a pilot study in seven of the SJKC schools in Manjung district. These schools are chosen because they shared the same criteria as the field study. The researcher had selected a total of 60 pupils among Year Four low achievers. Purposive sampling method is used to select pupils according to their Mathematics results. Year Four low achievers who failed in the Mathematics assessment had gone through a pre-test on multiplication skills. The pre-test took a period of 30 minutes. The researcher had analysed the data from the pre-test. After that, the researcher had divided the pupils into control group and treatment group. There were 30 pupils in control group and 30 pupils in treatment group.

According to the data in Module Needs Survey Assessment, the researcher had developed DoCtor WoRM's Module which contains Teacher's Manual, Pupil's Activity Book, and interactive game. Seven experts had validated the content of DoCtor WoRM's Module. This is to ensure the content validity of the module. The researcher had carried out the pilot study on DoCtor WoRM's Module by requesting four teachers to teach multiplication skills using DoCtor WoRM's Module, whereas three other teachers will be teaching multiplication skills using traditional method.

Teacher's Manual contains lesson plans which acts as input, Pupil's Activity Book contains exercises which acts as activity, and the interactive game contains evaluation which acts as output. In this module, the learning of multiplication skills

are arranged into five simple steps, which are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts.

The results of this pilot study gave a chance for the researcher to modify and improve DoCtor WoRM's Module. The responses from the teachers and pupils who had used the module provided useful information for the researcher. The users' responses are vital to ensure that DoCtor WoRM's Module can achieve the research objective. The pilot study allowed the researcher to concern on the aspects of research instruments, respondents of the study, duration of intervention, and arrangement of activities. Last but not least, administering of pilot test had given the researcher experience and a clearer image about the field study so that it can be run in a smoother and a more effective way.

3.6.3 Conducting the Treatment

In an experimental sresearch, besides the treatment as the independent variable which will be measured in terms of its effectiveness, there are some extraneous variables which may influence the dependent variable. A researcher needs to identify these extraneous variables and then control or make them constant during the research process (Lay, Y.F. & Khoo, C.H., 2016).

In this study, DoCtor WoRM's Module is the independent variable. The researcher had measured its effectiveness in improving the achievement of Year Four low achievers in multiplication skills. To control the extraneous variables which may influence the results, the researcher had set some inclusion criteria for the teachers in this experiment. Hence, the teachers selected in both control group and treatment group must share the similar teaching experience and good characteristics such as patience, kind, and good temper. The researcher did not involve directly in this experiment as it will create experimenter effects. This means the researcher might unconsciously give special attention to the research subjects in the treatment group.

The intervention had involved 30 Year Four low achievers in the treatment group. This intervention implemented DoCtor WoRM's Module in the teaching and learning of multiplication skills. The teachers followed the lesson plans in Teacher's Manual in carrying out teaching and learning activities. On the other hand, the pupils need to complete the exercises in the Pupil's Activity Book according to the lesson on the particular multiplication facts. Lastly, the pupils played the interactive game as reinforcement for the learning of that day. Five main steps in the learning of multiplication skills according to DoCtor WoRM's Module are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts. After three months of intervention, the pupils had gone through a post-test, which will be discussed next.

3.6.4 Administering Pre-Test and Post-Test

Before the intervention took place, the researcher had conducted an informal interview with the Mathematics subject teachers. The Year Four Mathematics teachers listed out the name of pupils who had failed in previous Mathematics assessment. Henceforth, the selected pupils had gone through a pre-test. The pupils are given 30 minutes to complete the pre-test. The teacher-in-charge played a role as the examiner and explained the instructions to the pupils. The pupils may use any type of calculation to obtain the answer for the multiplication items.

After the pre-test, the researcher had collected the instruments from the examiners. Then, the researchers marked all the test papers and selected the pupils who fulfilled the criteria of this study. For every multiplication facts, if a pupil answers less than four questions correctly, then the teacher may analyse the pupils as not master in that multiplication fact. This 80% standard is based on mastery learning which required pupils to achieve 80% or above on the criterion-referenced test in order to proceed to the next unit (Holt & Kysilka, 2006).

Then, the researcher analysed the data from the pre-test. The researcher had divided the low achievers into two equivalent groups, which means 30 pupils in control group, and 30 pupils in treatment group. The intervention took three months period. On the twelfth week, the researcher had carried out a post-test. The items of post-test are identical with those in the pre-test. In this post-test, the pupils are given 30 minutes to complete 35 items. The researcher marked the test papers and analysed

the results. If a pupil is able to obtain a score of four or five for each multiplication facts, then the pupil is considered mastered in it.

3.6.5 Administering Questionnaire

Questionnaire is often used due to the fact it is cost-effective, easy to prepare, and to administer to a large group of respondents' responses on a set of items (Lay, Y.F. & Khoo, C.H., 2016). Two questionnaires in this research are Module Needs Assessment Survey Questionnaire and Module Content Validity Questionnaire.

Firstly, the researcher had administered Module Needs Assessment Survey Questionnaire to 50 participants. The participants in this survey are Special Education, Remedial or Mathematics teacher. They must be teaching in SJKC in Manjung district. The researcher had carried out this survey for one week from 13th until 17th November 2017. The data obtained from this survey is the consideration to build a module on multiplication skills.

Then, the researcher had administered Module Content Validity Questionnaire. The administration of this questionnaire involves the consensus of a panel of experts in the relevant field consisting of one expert in module, three experts in Remedial Education, and three experts in Mathematics. Three materials in DoCtor WoRM's Module included Teacher's Manual, Pupil's Activity Book, and interactive game are shown to the experts.

3.7 Data Collection Procedures

Two phases in the data collection procedures in this research are; (1) Module Developmental Phase; and (2) Module Evaluation Phase.

3.7.1 Module Developmental Phase

Before developing the module, the researcher had carried out a Module Needs Assessment Survey to study the problems among Year Four low achievers in SJKC. The participants involved in this survey are Remedial Education or Mathematics subject teachers. The participants of this survey are also being limited to SJKC teachers who are teaching in Manjung district. The SJKC schools involved in this survey are SJKC UD, SJKC UI, SJKC CC, SJKC PM, and SJKC SB. The researcher had conducted this survey within one week period, which is from 13th until 17th November 2017.

Besides the opinion and suggestion from the participants, the data also included the problems that teacher may face in teaching and learning involving Year Four low achievers. On the other hand, the questionnaire also contained the module development and design suitable for teaching and learning of multiplication skills among Year Four low achievers. Since there is a need but no specific module available for Year Four low achievers in multiplication skills, the researcher had decided to develop a module based on the data analysis results from Module Needs Assessment Survey.

After that, the researcher had developed a module entitled DoCtor WoRM's Module. The purpose of DoCtor WoRM's Module is to improve the achievement of Year Four low achievers in multiplication skills. Module Content Validity Questionnaire had been given to seven experts, which are one expert in module, three experts in Remedial Education, and three experts in Mathematics. The data from this questionnaire is to ensure the validity of the module content.

Before the module is being evaluated, the researcher had applied for permission to carry out the experiment in SJKC in Manjung District. In accordance to this, three letters of transmittal requesting official permission had been applied from Ministry of Education Malaysia (KPM), Perak State Education Department (JPN), and Manjung District Education Office (PPD). Corresponding with this, the approvals had been attained on 7th December 2017 from KPM, on 14th February 2018 from JPN, and on 23th February 2018 from PPD. After all of these letters had been received, the researcher had been visited to the SJKC schools in Manjung District in order to acquire the permission from headmasters to carry out the experiments in the schools. Henceforth, DoCtor WoRM's Module is being evaluated starting in the month of March 2018.

3.7.2 Module Evaluation Phase

During the Module Evaluation Phase, the researcher had obtained a list of SJKC schools in Manjung district through the portal of Manjung PPD. There is a total of 26 SJKC in Manjung district. Then, the researcher had obtained the statistics of Mathematics results for Manjung SJKC schools in year 2017 from Zulkifli Zakaria, the Manjung District Education Office Officer in Primary Science and Mathematics. Based on the statistics, there were 160 Year Three pupils in SJKC in Manjung district had failed in Mathematics year end assessment in year 2017.

Henceforth, 160 sets of pre-test had been sent to the SJKC schools, eleven of them had sent back the instruments to the researcher after one week period. So, the researcher had selected the eleven SJKC schools to be involved in this study. Seven schools involved in the pilot study are SJKC PM, SJKC UI, SJKC CN, SJKC CH, SJKC PG, SJKC HL, and SJKC KS. The researcher had been visited to these schools to obtain the permission to carry out the experiments. The participants included the headmasters, teachers and pupils had given their consent to be involved in this study.

The researcher had carried out a pilot study to measure the reliability of this study. The pilot study took a three weeks period for the implementation of DoCtor WoRM's Module for the treatment group, whereas the control group was taught by using traditional method. There were 30 pupils in the control group and 30 pupils in the treatment group. A pre-test and a post-test had been carried out to both groups before and after the intervention took place.

Table 3.9

Results of Pilot Study

Control Group	Pre-Test (%)	Post-Test (%)	Treatment Group	Pre-Test (%)	Post-Test (%)
CTRL/01	60	69	TR/01	40	80
CTRL/02	51	80	TR/02	20	51
CTRL/03	0	29	TR/03	40	80
CTRL/04	37	51	TR/04	0	66
CTRL/05	40	49	TR/05	71	100
CTRL/06	66	80	TR/06	40	80
CTRL/07	54	77	TR/07	17	49
CTRL/08	40	54	TR/08	3	63
CTRL/09	71	83	TR/09	34	74
CTRL/10	57	71	TR/10	43	77
CTRL/11	3	31	TR/11	34	80
CTRL/12	43	51	TR/12	69	97
CTRL/13	69	80	TR/13	43	83
CTRL/14	37	51	TR/14	0	63
CTRL/15	51	80	TR/15	23	54
CTRL/16	40	49	TR/16	71	97
CTRL/17	0	26	TR/17	46	86
CTRL/18	60	69	TR/18	37	77
CTRL/19	6	34	TR/19	37	74
CTRL/20	37	46	TR/20	69	100
CTRL/21	57	66	TR/21	43	80
CTRL/22	40	54	TR/22	9	66
CTRL/23	71	80	TR/23	43	86
CTRL/24	49	77	TR/24	17	49
CTRL/25	37	51	TR/25	3	60
CTRL/26	51	80	TR/26	23	54
CTRL/27	69	80	TR/27	37	83
CTRL/28	40	49	TR/28	71	100
CTRL/29	60	69	TR/29	46	86
CTRL/30	6	29	TR/30	49	89

Table 3.9 shows the results of pilot study. There are 30 pupils in control group and 30 pupils in treatment group. The teaching and learning on single-digit multiplication was carried out to both groups using different methods. After three weeks, a post-test had been carried out to the control group and the treatment group.

H_{o1} in this study is [there is no significant difference between the means of the pre-test and the post-test for the treatment group]. A dependent *t*-test analysis was carried out by using SPSS. The results showed that the mean of pre-test for treatment group is 35.93, with a standard deviation of 21.409, and a standard error mean of 3.909. On the other hand, the mean of post-test for treatment group is 76.13, with a standard deviation of 15.66, and a standard error mean of 2.859. The *p*-value for this dependent *t*-test is less than .001. Since $p < .05$, so the null hypothesis is rejected. In summary, there is a significant difference between the means of the pre-test and the post-test for the treatment group. The result shows that DoCtor WoRM's Module is able to improve multiplication skills among Year Four low achievers.

H_{o2} in this study is [there is no significant difference between the means of the post-test for the treatment and control groups]. An independent *t*-test analysis was carried out by using SPSS. The results showed that the mean of post-test for control group is 59.83, with a standard deviation of 18.436, and a standard error mean of 3.366. On the other hand, the mean of post-test for treatment group is 76.13, with a standard deviation of 15.66, and a standard error mean of 2.859. The *p*-value for this independent *t*-test is less than .001. Since $p < .05$, so the null hypothesis is rejected. As a conclusion, there is a significant difference between the mean of the post-test for the treatment and control groups. The inferential statistics analysed from this pilot study proved that DoCtor WoRM's Module is effective in improving multiplication skills among Year Four low achievers.

Besides, the data had also been collected through DoCtor WoRM's Module. This module consists of three materials, which are Teacher's Manual, Pupil's Activity

Book, and interactive game. Teachers in the treatment group must follow the lesson plans and activities in Teacher's Manual. After the lesson on the particular multiplication facts, the pupils need to complete the exercises in Pupil's Activity Book. After that, the pupils may proceed to the interactive game. The pupils have to complete nine multiplication questions within each unit. If they are able to answer at least seven out of nine multiplication questions correctly, then the pupil is considered as mastered in the multiplication facts. Further, the pupils also need to memorize the multiplication facts after the lesson. Before the next lesson starts on another day, the pupils should be able to memorize the multiplication facts again. This action of recalling and revising the previous multiplication facts is to ensure the pupils have kept the learning in the long term memory. The same procedures take place when teaching and learning of the next multiplication facts.

The field study had been carried out within three months period. The treatment group went through teaching and learning using DoCtor WoRM's Module, whereas the control group went through teaching and learning using traditional method. A pre-test had been carried out before the intervention. After three months of intervention, a post-test had been carried out to both groups in order to measure the improvement in multiplication skills and to evaluate the effectiveness of DoCtor WoRM's Module. Four schools involved in the study are SJKC MT, SJKC TB, SJKC CC, and SJKC KJ.

3.8 Data Analysis

Data is the main raw material needed in all kinds of research to enable the researchers to understand an event or phenomena studied (Lay, Y.F. & Khoo, C.H., 2016). The quantitative data in this research will be analysed by using descriptive and inferential statistics. The descriptive statistics in this study included frequencies, percentages, means, and standard deviations, whereas the inferential statistics in this study is *t*-test.

The responses to the open-ended items were grouped, frequency-counted and rank-ordered based on emerging categories. The information obtained had been encoded and analysed quantitatively by using Statistical Packages for The Social Science (SPSS) program version 23. The researcher had analysed three instruments by using descriptive and inferential analysis. These instruments are; (1) Module Needs Assessment Survey Questionnaire; (2) Module Content Validity Questionnaire; and (3) pre-test and post-test.

3.8.1 Module Needs Assessment Survey Questionnaire

There are a total of 32 items in Module Needs Assessment Survey Questionnaire. Part A contains six items, Part B contains fifteen items, and Part C contains eleven items. All the data in this instrument are nominal, which mean the data are presented in categories. The researcher had used frequency to view the data value. Generally, the researcher had reported about all the data by using descriptive statistics. The outputs

of the SPSS analysis are frequency tables which show about frequency, percent, valid percent, and cumulative percent.

3.8.2 Module Content Validity Questionnaire

There are a total of 33 items in Module Content Validity Questionnaire. The researcher had divided the items into four parts in accordance with the objectives of this questionnaire. There are eleven items about Teacher's Manual, eight items about Pupil's Activity Book, ten items about interactive game, and four items about whole DoCtor WoRM's Module. The data used ten-point scale to represent the level of agreement. The purpose for the researcher to use the ten-point scale is to provide more accurate response about the content validity.

Since the ten-point scale is an ordinal data, so the researcher had analysed the data by using descriptive statistics. The scale is from 1 (strongly disagree) until 10 (strongly agree). In this case, the researcher had reported the score of module content validity by showing the number of experts, minimum and maximum score, and mean score.

3.8.3 Pre-Test and Post-Test

The pre-test had been marked by the researcher. The marks had been rounded off to the percentage by the formula: score/35 x 100%. The researcher had analysed the

information by using SPSS. The pre-test analysis is to ensure that the achievement of the control and treatment groups is equivalent. The same analysis method had been applied to the post-test. The post-test analysis is to compare the results between pre-test and post-test, and also to compare the results of post-test between control group and treatment group.

On the other hand, the researcher had used dependent *t*-test to test the null hypotheses of H_{o1}. H_{o1} aims to compare the means between pre-test and post-test for the treatment group. Subsequently, H_{o2} aims to compare the means of the post-test between the treatment and control groups. It had been tested using independent *t*-test because it involves two different groups.

3.9 Summary

This is a quantitative research. It implemented quasi-experimental design to evaluate the effectiveness of DoCtor WoRM's Module in improving the achievement of multiplication skills among Year Four low achievers. The researcher had selected 60 Year Four low achievers to be involved in the pilot study. The low achievers had been divided into 30 pupils in the control group and 30 pupils in the treatment group. On the other hand, the researcher had also selected 60 Year Four low achievers by using purposive sampling method to be involved in the field study. Some of the criteria to select the sample are they must be studying in SJKC in Manjung district, and scored less than 40% in the previous Mathematics assessment.

The researcher had carried out Module Needs Assessment Survey to study the problems among Year Four low achievers in SJKC and to assess the needs for the module. Seven experts had received a Module Content Validity Questionnaire in order to validate the instrument. Meanwhile, the researcher had carried out a pilot study to obtain the reliability of the intervention. The intervention in the real study had taken three months period. The pupils in both groups had gone through a pre-test before the intervention and a post-test after it. After that, the researcher had analysed the data by using SPSS program. Last but not least, the researcher had also used dependent *t*-test and independent *t*-test to test the null hypotheses of the research.

CHAPTER 4

FINDINGS

4.1 Introduction

This chapter will discuss about the participants demography analysis and explain about findings of research questions through a quasi-experiment that had been done in line with five research objectives in this study. Then, the findings that had been analysed by using Statistical Packages for the Social Science (SPSS) program version 23 will also be discussed.

In descriptive statistics, the goal is to describe, summarize, or make sense of a particular set of data. Meanwhile, the goal of inferential statistics is to go beyond the immediate data and to infer the characteristics of populations based on samples (Johnson & Christensen, 2014). The research findings were arranged according to the sequence of research questions as stated. Descriptive statistics and inferential statistics are used to analyse the data in this study. Descriptive statistics involved percentage,

mean, and standard deviation, whereas inferential statistics involved dependent *t*-test and independent *t*-test.

4.2 Demography

The participants in the two phases of this research are different. So, the researcher will discuss the research participants' demography in two phases, which are Module Developmental Phase and Module Evaluation Phase.

4.2.1 Module Developmental Phase

At the stage of Module Developmental Phase, module needs analysis survey involved 50 teachers in Manjung district, Perak. The participants are teachers who are either teaching Remedial Education or Mathematics subject in National-Type Chinese Primary School (SJKC).

Table 4.1

Participants in Module Needs Assessment Survey

School Name	Number of Participants
SJKC PM	14
SJKC UD	13
SJKC UI	12
SJKC CC	11
Total	**50**

Table 4.1 shows the number of participants involved in Module Needs Assessment Survey. There are a total of 50 participants in four schools involved in this survey. Among the participants, there are 14 teachers from SJKC PM, 13 teachers from SJKC UD, 12 teachers from SJKC UI, and 11 teachers from SJKC CC.

Based on the demography data obtained, six teachers have within five years of teaching experiences, six teachers have six to ten years of teaching experiences, eight teachers have 11 to 15 years of teaching experiences, while 30 teachers have more than 16 years of teaching experiences. Figure 4.1 shows the teaching experiences of the participants in this study.

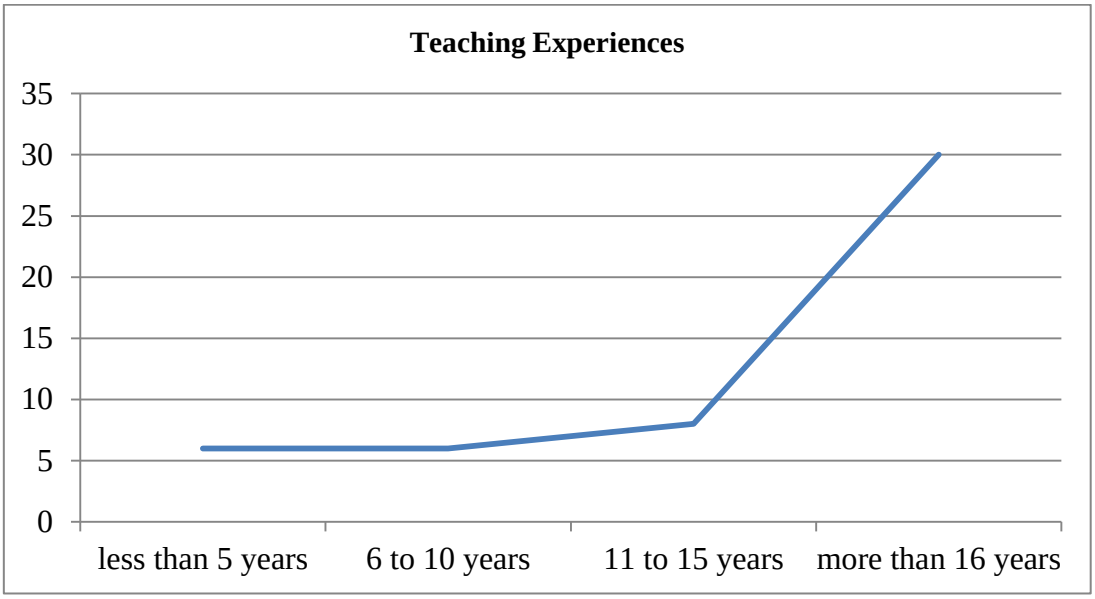

Figure 4.1 Teaching Experiences of the Participants

4.2.2 Module Evaluation Phase

There were two groups of participants involved in the Module Evaluation Phase. The first group of participants are expert panel to validate the content of DoCtor WoRM's Module, while another group of participants are the samples in the experimental study.

4.2.2.1 Module Content Validity

Content validity is how well the samples for the test items are able to represent the test content formed for the purpose of measurement (Fauzi Hussin, et al., 2014). The content validity of the module needs to be evaluated by the expert panel so that it can be used in the pilot study and the real experimental study. In this case, the researcher had adapted a content validity questionnaire from the one created by Dr Mohammad Aziz Shah Mohamed Arip. There are a total of 33 items in this questionnaire. To ensure that the instrument is relevant and suitable from the aspects of content and format, the researcher had met and obtained approval from Dr Mohammad Aziz Shah Mohamed Arip in person.

This questionnaire had been given to seven experts to evaluate the content validity of the module. This group of panels are experts in the field of Remedial, Mathematics, and Module. They are the four teachers with more than 10 years teaching experiences in Remedial or Mathematics, one Mathematics SISC+ Manjung District Officer, one Global Teacher Prize Finalist, and one lecturer from Sultan Idris

Education University (UPSI). Figure 4.2 shows the experts panel to evaluate the content validity of the module.

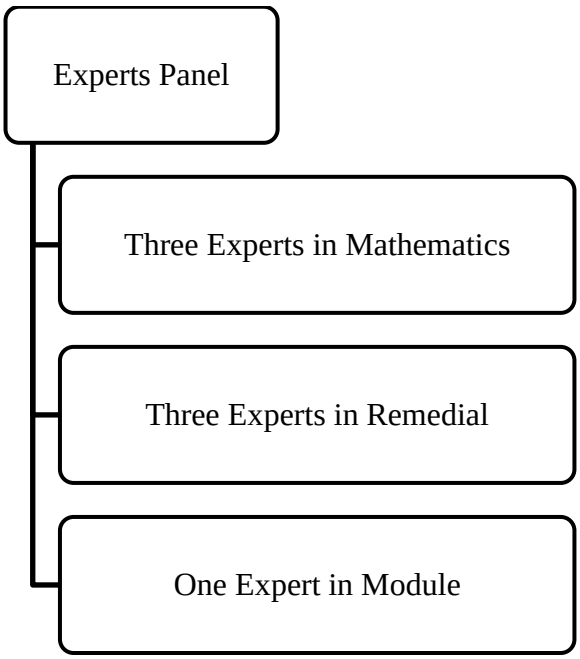

Figure 4.2 Experts Panel to Evaluate the Content Validity of the Module

4.2.2.2 Experimental Study

The sample size of this study is 60. The samples had been divided into two equivalent groups, which are 30 pupils in control group and 30 pupils in treatment group. The participants were selected with three criteria. Firstly, they must be in Year Four from SJKC school. Secondly, they failed in the previous Mathematics assessment. Thirdly, they have not mastered in single-digit multiplication skills.

There were four schools involved in this experimental study. They are SJKC MT, SJKC TB, SJKC CC, and SJKC KJ. All of them are located in Manjung District,

Perak State. The Year Four pupils who had failed in the previous examination were given a pre-test. Based on the pre-test analysis, 60 of them were selected to be involved in this experimental study. They were then divided into two equivalent groups, which are control group and treatment group. After three months of intervention, all of them were given a post-test.

Table 4.2

Gender and Score of Pre-Test for Treatment and Control Groups

Treatment	**Gender**	**Pre-Test**	**Control**	**Gender**	**Pre-Test**
TR/01	Male	94	CTRL/01	Male	49
TR/02	Male	77	CTRL/02	Male	71
TR/03	Male	77	CTRL/03	Male	91
TR/04	Female	26	CTRL/04	Female	74
TR/05	Female	89	CTRL/05	Male	91
TR/06	Female	74	CTRL/06	Female	94
TR/07	Female	89	CTRL/07	Female	83
TR/08	Male	57	CTRL/08	Female	77
TR/09	Female	60	CTRL/09	Male	46
TR/10	Male	71	CTRL/10	Female	77
TR/11	Female	86	CTRL/11	Male	91
TR/12	Female	71	CTRL/12	Male	3
TR/13	Male	83	CTRL/13	Female	40
TR/14	Male	43	CTRL/14	Male	31
TR/15	Female	74	CTRL/15	Male	77
TR/16	Male	49	CTRL/16	Male	80
TR/17	Female	63	CTRL/17	Female	74
TR/18	Male	66	CTRL/18	Female	3
TR/19	Female	69	CTRL/19	Male	77
TR/20	Male	77	CTRL/20	Female	86
TR/21	Female	91	CTRL/21	Male	77
TR/22	Female	3	CTRL/22	Female	60
TR/23	Male	29	CTRL/23	Female	83
TR/24	Male	20	CTRL/24	Female	40
TR/25	Male	9	CTRL/25	Male	77
TR/26	Male	0	CTRL/26	Female	57
TR/27	Male	40	CTRL/27	Male	54
TR/28	Female	89	CTRL/28	Female	80
TR/29	Male	54	CTRL/29	Male	80
TR/30	Female	54	CTRL/30	Male	91

Table 4.2 shows the gender and score of pre-test for treatment and control groups. For the treatment group, there are 16 males, which are TR/01, TR/02, TR/03, TR/08, TR/10, TR/13, TR/14, TR/16, TR/18, TR/20, TR/23, TR/24, TR/25, TR/26, TR/27, and TR/29. Meanwhile, there were 14 females in this group, which are TR/04, TR/05, TR/06, TR/07, TR/09, TR/11, TR/12, TR/15, TR/17, TR/19, TR/21, TR/22, TR/28, and TR/30. On the other hand, there are also 16 males in control groups, which are CTRL/01, CTRL/02, CTRL/03, CTRL/05, CTRL/09, CTRL/11, CTRL/12, CTRL/14, CTRL/15, CTRL/16, CTRL/19, CTRL/21, CTRL/25, CTRL/27 CTRL/29, and CTRL/30. At the same time, there are 14 females in control group, which are CTRL/04, CTRL/06, CTRL/07, CTRL/08, CTRL/10, CTRL/13, CTRL/17, CTRL/18, CTRL/20, CTRL/22, CTRL/23, CTRL/24, CTRL/26, and CTRL/28.

Analysis of Covariate (ANCOVA) is used to determine the effect of an independent variable on a dependent variable without the existence of any extraneous variables (Lay, Y.F. & Khoo, C.H., 2016). To minimize possible errors caused by individual differences in the samples, the researcher had carried out an ANCOVA test. The ANCOVA was used to investigate the significant difference between achievements of pupils in both groups based on gender. Since the *p*-value for the ANCOVA test is .612 > .05, so there is no significant difference in the mean score of achievement in treatment and control groups based on gender. In other words, gender in both groups does not affect the achievements of the pupils.

Subsequently, an independent *t*-test was carried out with pre-test scores for treatment and control groups. This is to ensure that both groups are equivalent before the intervention is carried out. Based on the results of independent *t*-test, the mean of

control group in pre-test is 43.40, with a standard deviation of 21.397, and standard error mean of 3.907. On the other hand, the mean of treatment group in pre-test is 35.93, with a standard deviation of 21.409, and standard error mean of 3.909. The difference between the means of pre-test for control and treatment groups is 7.47. Since the *p*-value is .182 > .05, hence null hypothesis is accepted. The results show that there is no significant difference between the pre-test of control group and treatment group. In short, both of the groups are equivalent and homogenous groups.

4.3 Module Needs in Multiplication Skills among Year Four Low Achievers

In this study, module needs in multiplication skills among Year Four low achievers had been acquired by the analysis of Module Needs Analysis Survey. Based on the data obtained, 48% of participants claimed that they have inadequate skills to handle or teach low achievers. 96% of the participants think that module as a teaching aid can enhance the multiplication skills among low achievers. It is worth to mention that, 100% of the participants chose [Yes] for two items, which are; (1) teaching multiplication skills is relevant for Year Four low achievers; and (2) mastery of single-digit multiplication is an important skill in Mathematics.

Table 4.3

Multiplication Facts that Low Achievers Might Face Difficulty In

Multiplication Facts of	**Percentage of Participants (%)**
1	8
2	8
3	30
4	30
5	36
6	76
7	90
8	94
9	96

Table 4.3 shows the multiplication facts that low achievers might face difficulty in. The participants had chosen [Yes] for the items that they think are required to be mastered by the low achievers. Based on the analysis, there are only eight percent of participants chosen multiplication facts of one and two. Among all, multiplication facts of nine are being selected by most participants, which is 96%. The percentage of participants that agreed on multiplication facts of three to eight are between the range from 30% to 94%, and the percentages increase gradually. Hence, the researcher had eliminated multiplication facts of one and two, and started design a module that consisted of multiplication facts from three until nine. Figure 4.3 shows the multiplication facts that low achievers might face difficulty in.

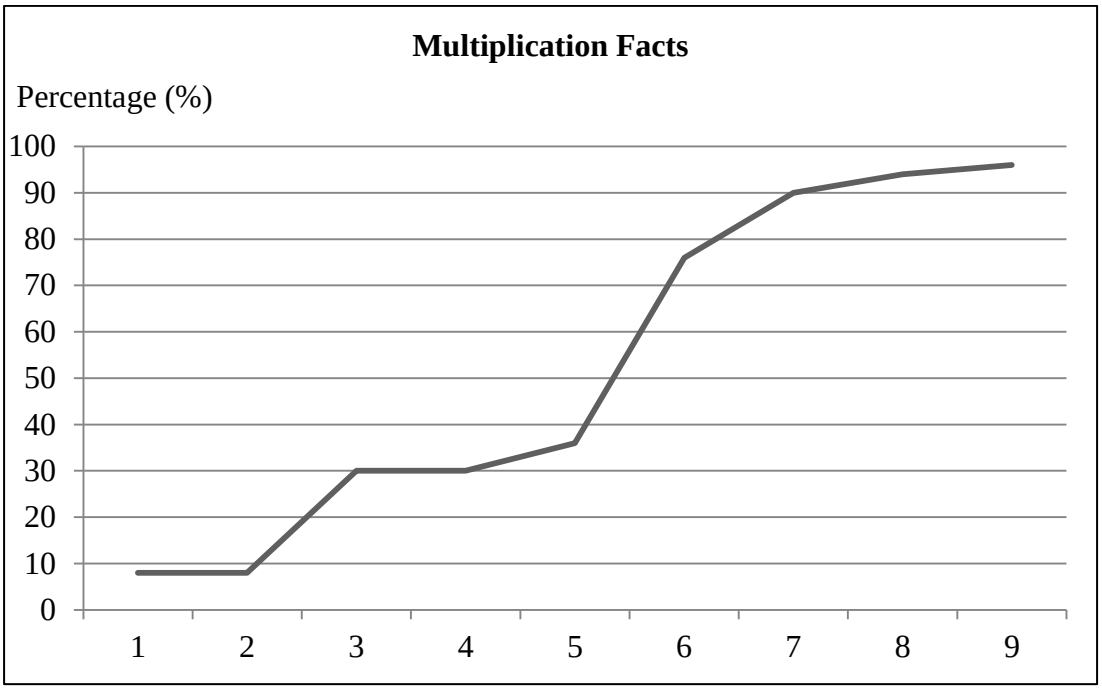

Figure 4.3 Multiplication Facts that Low Achievers Might Face Difficulty

Table 4.4

Participants that Agreed on the Five Steps in DoCtor WoRM's Module

Items	Percentage of Participants (%)
Step 1: Drawing the intersecting lines.	96
Step 2: Counting the intersection points.	92
Step 3: Writing the multiplication sentences.	88
Step 4: Reading the multiplication sentences.	90
Step 5: Memorizing the multiplication facts.	92

Table 4.4 shows the participants that agreed on the five steps in DoCtor WoRM's Module. The researcher had stated the five important steps in DoCtor WoRM's Module. Majority of the participants agreed on the five steps. 96% agreed on step one, 92% agreed on step two, 88% agreed on step three, 90% agreed on step four, and 92% agreed on step five. Thus, these five steps are accepted and applied in designing DoCtor WoRM's Module. Figure 4.4 shows the percentage of participants that agreed on five important steps in DoCtor WoRM's Module.

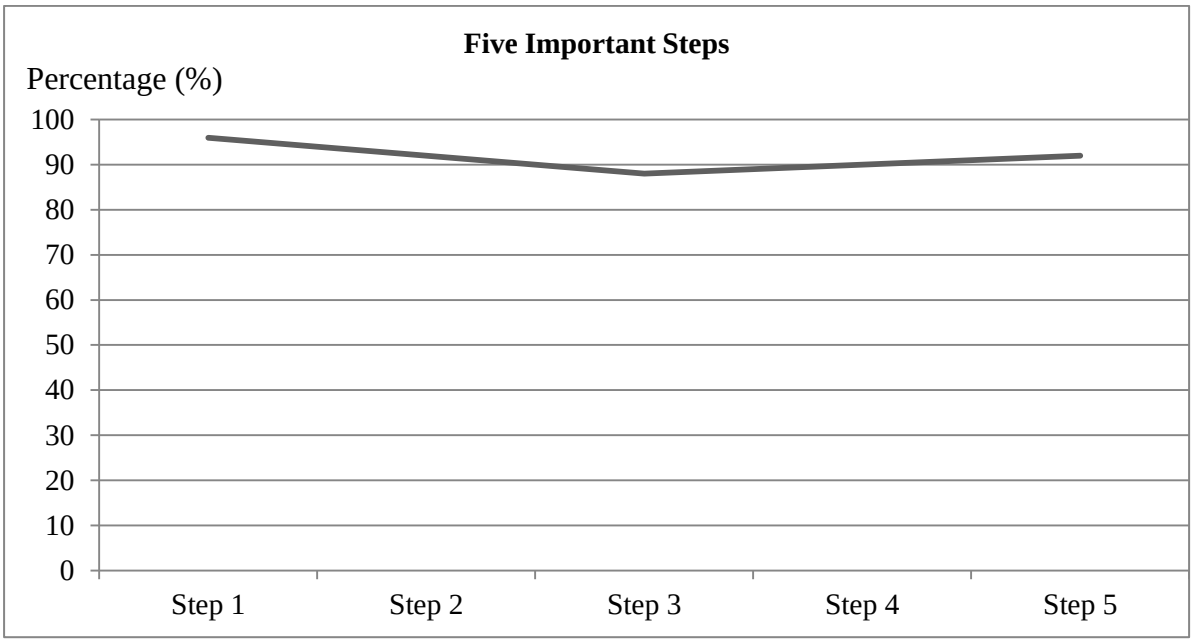

Figure 4.4 Five Important Steps in DoCtor WoRM's Module

Table 4.5

Participants that Agreed on the Three Materials in DoCtor WoRM's Module

Materials	Percentage of Participants (%)
Guidance and lesson plans for teachers.	96
Exercise worksheets for pupils.	92
Multimedia interactive game.	94

Table 4.5 shows the participants that agreed on the three materials in DoCtor WoRM's Module. When came to the item about the materials to be in the module, majority of the participants ticked [yes] for three materials that had been stated by the researcher. Based on the data, 96% of the participants agreed on the guidance and lesson plans for teachers, 92% of the participants agreed on the exercise worksheets for pupils, and 94% of them agreed on the multimedia interactive game. Hence, the researcher had designed a module that consisted of Teacher's Manual, Pupil's Activity Book, and interactive game.

In summary, there is a need for module in multiplication skills among Year Four low achievers in SJKC. The data shows that almost half (48%) of the participants have inadequate skills to teach low achievers, and most of them (96%) think that module can enhance multiplication skills among low achievers. Based on the analysis, the researcher had designed a module with five important steps and three materials are consisted in it. The first research question that sound [is there a need for module in multiplication skills among Year Four low achievers in multiplication skills] is answered.

4.4 Content Validity of DoCtor WoRM's Module

DoCtor WoRM's Module had been sent to seven experts in the field of Remedial, Mathematics, and Module to evaluate its content validity. The expert panel consisted of three experts in Remedial, three experts in Mathematics, and one expert in Module. The formula was followed as below.

$$\frac{\text{Total Score from Expert (x)}}{\text{Maximum Score (100)}} \times 100\% = \text{Content Validity Achievement}$$

Table 4.6

Score of Content Validity from Seven Experts

Part/Experts	E1	E2	E3	E4	E5	E6	E7
A	.90	.84	.81	.84	.77	.98	.97
B	.80	.83	.80	.86	.81	.99	.98
C	.83	.79	.82	.79	.73	1.00	.97
D	.90	.78	.78	.83	.80	1.00	.98

Table 4.6 shows the score of content validity from seven experts. Part A contains items about Teacher's Manual, Part B contains items about Pupil's Activity Book, Part C contains items about interactive game, and Part D contains items about whole DoCtor WoRM's Module. The lowest score is .73 from the fourth expert for Part C interactive game. Meanwhile, the highest scores are 1.00 from the sixth expert for Part C interactive game and Part D whole DoCtor WoRM's Module. Hence, the score of content validity from seven experts is within the range from .73 to 1.00.

Table 4.7

Content Validity for DoCtor WoRM's Module

Part	Component Module	Content Validity
A	Teacher's Manual	.88
B	Pupil's Activity Book	.87
C	Interactive Game	.85
D	Whole DoCtor WoRM Module	.86

Table 4.7 shows the content validity for DoCtor WoRM's Module according to four different parts. For all of the four parts, the validity percentage given by the experts is above satisfying level, which is above 80%. The content validity of Part A Teacher's Manual is .88, Part B Pupil's Activity Book is .87, Part C Interactive Game is .85, and Part D Whole DoCtor WoRM's Module is .86. Overall, the content validity for DoCtor WoRM's Module is .86.

A module is considered to have a high content validity if the level of content validity achieves .70 (Abu Bakar Nordin, 1995, in Sidek Mohd Noah & Jamaludin Ahmad, 2005; Tuckman & Waheed, 1981). Hence, DoCtor WoRM's Module had

achieved a high content validity because the content validity is .86. The second research question that sound [what is the content validity of DoCtor WoRM's Module among Year Four low achievers in multiplication skills] is answered.

4.5 Reliability of DoCtor WoRM's Module

Reliability refers to the consistency or stability of the scores of your measurement instrument (Christensen, Johnson, & Turner, 2011). In this study, the reliability of the data had been analysed from the aspects below; (1) the researcher acted as an observer in the study; (2) the researcher administered Module Content Validity Questionnaire to obtain the content validity value as one the module development procedure based on stages according to Sidek's Module Development Model; and (3) the researcher administered a pilot study to increase the reliability of the module.

Test-retest reliability refers to the consistency of scores over time (Christensen, Johnson, & Turner, 2011). The data of pilot study had been analysed by using SPSS version 23 to obtain the test-retest reliability. This test-retest reliability was measured using Pearson's correlation. The correlation coefficient, r is used to determine whether there is a linear relationship between the scores of pre-test and post-test. The null hypothesis for testing the statistical significance of a Pearson's correlation in this study is [there is no linear relationship between the two variables], whereas the alternative hypothesis is [there is a linear relationship between the two variables].

In this study, the analysis using Pearson's correlation coefficient indicated that there is a significant linear relationship between pre-test and post-test. The *p*-value reported in SPSS statistics is less than .001, hence this *p*-value for the one-sided test is < .05. Meanwhile, the correlation coefficient, r is equal to .877. According to Elliot and Woodward (2016), when r is greater than .50 the effect size is large. So, null hypothesis is rejected. Hence, DoCtor WoRM's Module has a significant reliability based on the results of this Pearson's correlation analysis. The third research question that sound [what is the reliability of DoCtor WoRM's Module among Year Four low achievers in multiplication skills] is answered.

4.6 Comparison between Pre-Test and Post-Test for Treatment Group

The improvement in multiplication skills after using DoCtor WoRM's Module had been measured. Data had been analysed by comparing pre-test and post-test for the treatment group. It is to ensure whether there is an improvement in the results of post-test if compared with the results in pre-test. To analyse this data, the researcher had recorded the scores of pre-test and post-test for all participants in the treatment group.

Table 4.8

Comparison between Pre-Test and Post-Test for the Treatment Group

Samples	Pre-Test (%)	Post-Test (%)	Gain Score (%)
TR/01	94	100	3
TR/02	77	94	17
TR/03	77	100	23
TR/04	26	97	71
TR/05	89	100	11
TR/06	74	100	26
TR/07	89	100	11
TR/08	57	74	17
TR/09	60	63	3
TR/10	71	100	29
TR/11	86	94	8
TR/12	71	100	29
TR/13	83	100	17
TR/14	43	100	57
TR/15	74	97	23
TR/16	49	89	40
TR/17	63	97	34
TR/18	66	89	23
TR/19	69	91	22
TR/20	77	94	17
TR/21	91	100	9
TR/22	3	100	97
TR/23	29	97	68
TR/24	20	91	71
TR/25	9	91	82
TR/26	0	97	97
TR/27	40	74	34
TR/28	89	97	8
TR/29	54	51	-3
TR/30	54	69	15
Means	**59**	**96**	**32**

Table 4.8 shows the comparison between pre-test and post-test for the treatment group. Participant TR/22 and TR/26 shows the highest improvement. TR/22 improved from 3% in pre-test to 100% in post-test, whereas TR/26 improved from 0% in pre-test to 97% in post-test. In another words, both participants had an increment of 97% after undergone the intervention of DoCtor WoRM's Module. On the contrary, only one participant shows decrease of scores from pre-test to post-test. The scores of

TR/29 decreases from 54% in pre-test to 51% in post-test. In another words, this participant had a decrease of 3% after the intervention. The average mean of improvement for treatment group is 32%. Figure 4.5 shows the score of pre-test and post-test for treatment group.

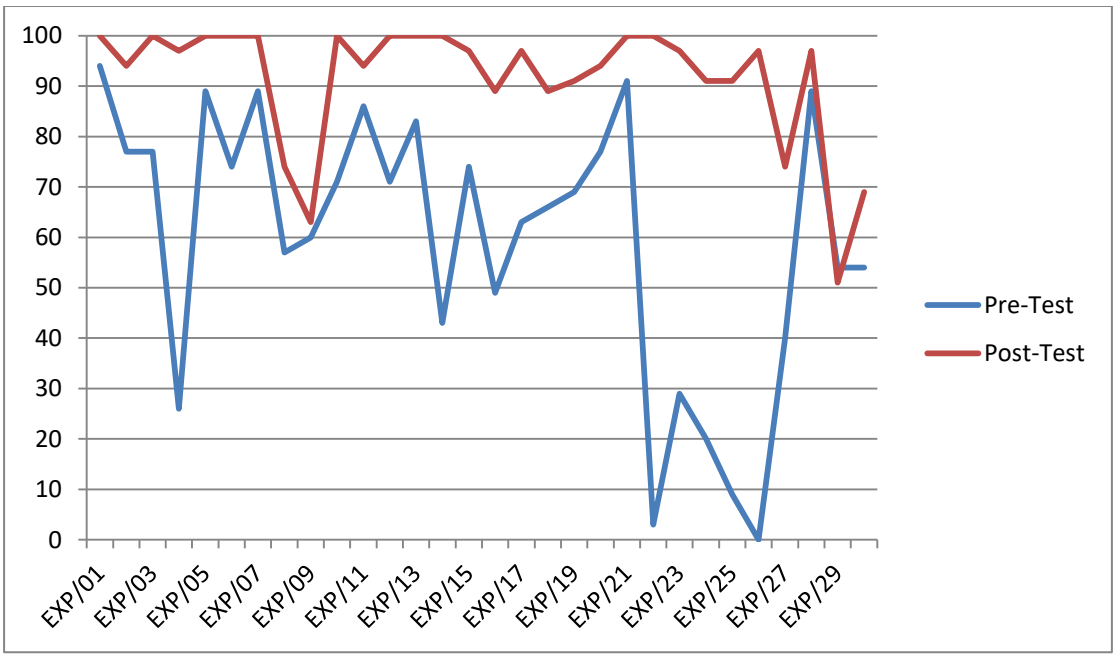

Figure 4.5 Score of Pre-Test and Post-Test for Treatment Group

Dependent *t*-test is appropriate for data in which the two samples are correlated or related in some way. This type of analysis is appropriate for the pairs consist of before and after measurements on a single group of subjects (Elliot & Woodward, 2016). In this study, the researcher had carried out a dependent *t*-test to determine whether there is a significant difference between the pre-test and post-test of treatment group. The null hypothesis is [there is no significant difference between the means of pre-test and post-test for the treatment group].

Table 4.9

Comparison between Pre-Test and Post-Test for Treatment Group

Test	Mean	N	Standard Deviation	Standard Error Mean
Pre-Test	59.47	30	27.242	4.974
Post-Test	91.53	30	12.566	2.294

Table 4.9 shows the comparison between pre-test and post-test for treatment group. All the samples in treatment group had been undergone both the pre-test and the post-test, N = 30. In this output, the mean of pre-test is 59.47%, with the standard deviation of 27.242 and standard error mean of 4.974. On the other hand, the mean of post-test is 91.53%, with the standard deviation of 12.566, and standard error mean of 2.294. Accordingly, the mean of post-test (91.53%) is higher than the mean of pre-test (59.47%), with a smaller standard deviation in post-test (12.566) than standard deviation in pre-test (27.242).

Table 4.10

Analysis of Dependent T-Test

Means	Standard Deviation	Standard Error Means	95% Confidence Interval of the Difference		T	df	Sig. (2-tailed)
			Lower	Upper			
32.067	28.086	5.128	-42.554	-21.579	-6.254	29	.000

Table 4.10 shows that analysis of dependent *t*-test. Based on the data analysed through SPSS, the mean improvement (M = 32.067, SD = 28.086, N = 30) was significantly greater than zero, t(29) = 6.254, $p < .001$. Since the *p*-value is less than .05, so we can conclude that there is a significant difference between the mean of pre-test and post-test for the treatment group. The results also revealed that the mean

of post-test (91.53%) is greater than the mean of pre-test (59.47%), so we can conclude that the samples had improved significantly after undergone the intervention of DoCtor WoRM's Module. Hence, the evidence shows that DoCtor WoRM's Module is able to improve multiplication skills among Year Four low achievers after three months of intervention. To calculate the Cohen's *d* effect size measure from the SPSS output for a dependent *t*-test, the researcher used this formula.

$$d = \text{Mean difference/Standard Deviation of the difference} = M/SD$$

For this data, $d = 32.067/28.086 = 1.142$. The interpretation for this number is based on Cohen (1988) where *d* from 0.2 to 0.5 is considered a small effect, *d* from 0.5 to 0.8 is considered a moderate effect, and *d* of 0.8 and above is considered a large effect (Elliot & Woodward, 2016). Thus, the observed difference would be considered large effect. Once again, the results of Cohen's *d* effect size of 1.142 proved that DoCtor WoRM's Module is effective in improving multiplication skills among Year Four low achievers. The fourth research question that sound [is there any improvement in multiplication skills among Year Four low achievers after using DoCtor WoRM's Module] is answered.

4.7 Comparison between Post-Test for Treatment and Control Groups

The comparison of the scores between pre-test and post-test within the same group is insufficient to prove the effectiveness of DoCtor WoRM's Module. It is because there might be some other external variables that controlled the improvement of the

achievement of the pupils. So, another comparison of means between the post-test of treatment and control groups had been carried out. It is to show that the improvement by the treatment group is more significant than the improvement by the control group.

Independent *t*-test is used to determine whether the unknown means of two populations are different from each other based on independent samples from each population (Elliot & Woodward, 2016). The null hypothesis for the comparison of the means in this independent *t*-test is [there is no significant difference between the means of the post-test for the treatment and control groups]. To analyse this data, the researcher had recorded the scores of post-test for all participants in treatment and control groups.

Table 4.11

Score of Post-Test for Treatment and Control Groups

Treatment	Post-Test (%)	Control	Post-Test (%)
TR/01	100	CTRL/01	80
TR/02	94	CTRL/02	94
TR/03	100	CTRL/03	100
TR/04	97	CTRL/04	100
TR/05	100	CTRL/05	100
TR/06	100	CTRL/06	100
TR/07	100	CTRL/07	100
TR/08	74	CTRL/08	97
TR/09	63	CTRL/09	74
TR/10	100	CTRL/10	100
TR/11	94	CTRL/11	80
TR/12	100	CTRL/12	51
TR/13	100	CTRL/13	37
TR/14	100	CTRL/14	40
TR/15	97	CTRL/15	83
TR/16	89	CTRL/16	66
TR/17	97	CTRL/17	100
TR/18	89	CTRL/18	23
TR/19	91	CTRL/19	91
TR/20	94	CTRL/20	91
TR/21	100	CTRL/21	77
TR/22	100	CTRL/22	51
TR/23	97	CTRL/23	69
TR/24	91	CTRL/24	43
TR/25	91	CTRL/25	80
TR/26	97	CTRL/26	71
TR/27	74	CTRL/27	80
TR/28	97	CTRL/28	100
TR/29	51	CTRL/29	97
TR/30	69	CTRL/30	100
Mean	**92**	**Mean**	**79**

Table 4.11 shows comparison between post-test for treatment and control groups. There are 60 samples in this study, and they have been divided into two equivalent groups, with 30 samples in treatment group and 30 samples in control group. In the treatment group, there are 11 samples achieved 100% in the post-test, which are TR/01, TR/03, TR/05, TR/06, TR/07, TR/10, TR/12, TR/13, TR/14, TR/21, and TR/22. Meanwhile, there are only nine samples in the control group had achieved

100% in the post-test, which are CTRL/03, CTRL/04, CTRL/05, CTRL/06, CTRL/07, CTRL/10, CTRL/17, CTRL/28, and CTRL/30. In the treatment group, participant TR/29 shows the lowest percentage, which is 51%. Meanwhile in the control group, participant CTRL/18 shows the lowest percentage of 23%. Figure 4.6 shows the score of post-test for treatment and control groups.

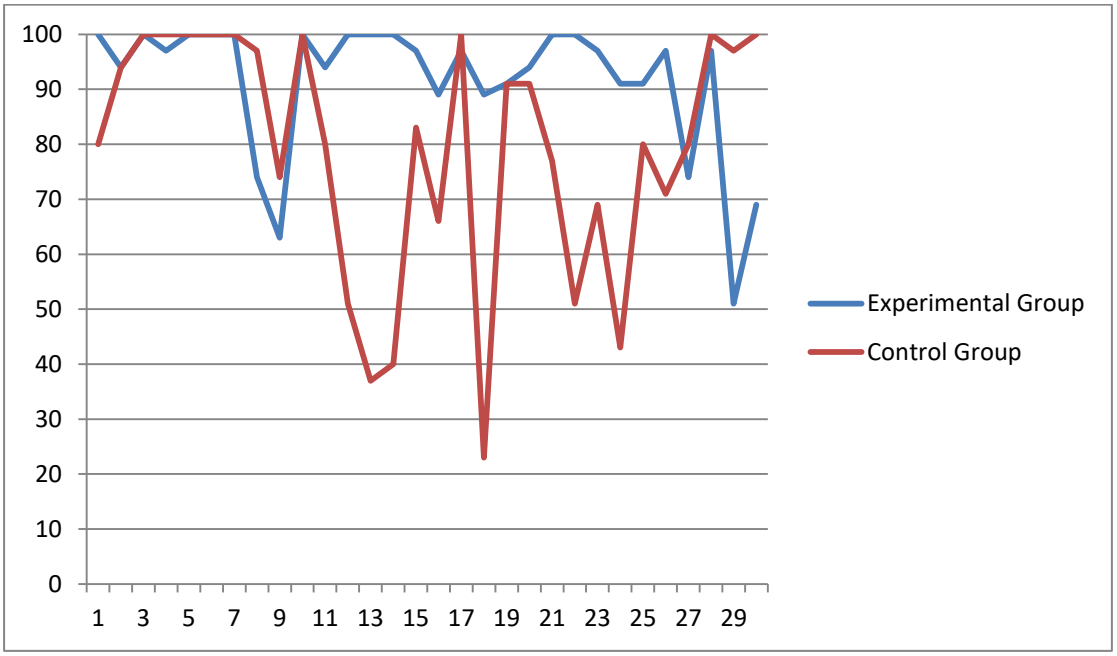

Figure 4.6 Score of Post-Test for Treatment and Control Groups

Table 4.12

Comparison between Post-Test of Treatment and Control Groups

Groups	Means	N	Standard Deviation	Standard Error Mean
Treatment	91.53	30	12.566	2.294
Control	79.17	30	22.588	4.124

Table 4.12 shows the comparison between the post-test of treatment and control groups using SPSS. All samples in both groups had been undergone the post-test, with N = 30 for each group. In this output, the mean for treatment group is

91.53%, with the standard deviation of 12.566, and standard error mean of 2.294. On the other hand, the mean for control group is 79.17%, with the standard deviation of 22.588, and standard error mean of 4.124. The difference between the mean of post-test for treatment and control groups is 12.36%.

Table 4.13

Analysis of Independent T-Test

	Levene's Test for Equality of variances		**t-test for Equality of Means**	**95% Confidence Interval of the Difference**	
	f	Sig.	Sig. (2-tailed)	Lower	Upper
Equal variances assumed	9.634	.003	.011	-21.813	-2.920
Equal variances not assumed			.012	-21.869	-2.864

Table 4.13 shows the analysis of independent *t*-test. Based on the independent *t*-test results, the *p*-value for the Levene's Test for equality of variances is .003. Since the *p*-value is less than .05, so equal variances not assumed is reported. The p-value of this independent *t*-test is .012. Since this *p*-value is less than .05, the null hypothesis is rejected. The decision would be that there is a significant variance difference between treatment and control groups. Thus, there is enough evidence to conclude that the mean scores are different. In short, the mean of post-test in treatment group (M = 91.53, SD = 12.566, N = 30) was significantly different from the means of post-test in control group (M = 79.19, SD = 22.588, N = 30), $p = .012$.

The 95% confidence intervals for the difference in means are associated with the assumption of equal variances is [-21.813 to -2.920], while the confidence interval when equal variances are not assumed is [-21.869 to -2.864]. Since these intervals are

all negative and does not include 0 (zero), we again conclude that there is a significant difference between the means using either assumption regarding the variances. Thus, null hypothesis is rejected. Both decisions as discussed based on *p*-value and 95% confidence interval show that there is a significant difference between the means of post-test for treatment and control groups. The fifth research question that sound [is DoCtor WoRM's Module effective in improving multiplication skills among Year Four low achievers] is answered.

4.8 Summary

Based on the findings above, it can be concluded that DoCtor WoRM's Module is effective in improving the multiplication skills among Year Four low achievers. Five research questions had been answered in this chapter. The researcher used SPSS version 23 to analyse the data. The finding shows that there is need for module in multiplication skills among Year Four low achievers in SJKC. The content validity of DoCtor WoRM's Module based on the evaluation of seven experts is .86. Next, the reliability of DoCtor WoRM's Module is .877. Hence, DoCtor WoRM's Module is considered to have high content validity and reliability.

Based on the data analysis of dependent *t*-test using SPSS, the *p*-value is less than .001 < .05. Null hypothesis is rejected. So, there is a significant difference between the means of pre-test and post-test for the treatment group. This result showed that there is an improvement in multiplication skills among Year Four low achievers after using DoCtor WoRM's Module.

On the other hand, the result of independent *t*-test showed the *p*-value of .012 < .05. Null hypothesis is rejected. So, there is a significant difference between the means of post-test for the treatment and control groups. As a conclusion, the finding proved that DoCtor WoRM's Module is effective in improving the multiplication skills among Year Four low achievers in SJKC.

CHAPTER 5

DISCUSSION, CONCLUSION & RECOMMENDATION

5.1 Introduction

There are four subtopics in this chapter, which are summary of the research, discussions, implications, and recommendations. The findings will be discussed based on the research questions, conclusion is about the implication of this study, and recommendation is about the future research relevant to this field.

5.2 Summary of the Research

Based on the research questions, the researcher had carried out a quantitative research with a quasi-experimental design. The first research question is about the module needs in multiplication skills among Year Four low achievers in SJKC. Module Needs Assessment Survey Questionnaire had been constructed related to this research question. This survey had been carried out in November for one week period.

The participants in the study were 50 teachers from National-Type Chinese Primary School (SJKC) in Manjung District, Perak State. The teachers were given a set of needs analysis questionnaires and were required to indicate their problems while teaching and learning involving Year Four low achievers, and the suitable module development and design. All of the participants in this study are teaching Remedial Education or Mathematics in SJKC. The data in this needs survey showed that there is a need to develop a module in multiplication skills for Year Four low achievers in SJKC. Based on this data, the researcher had designed and constructed a module entitled DoCtor WoRM's Module.

The second research question is about the content validity of DoCtor WoRM's Module. An expert panel consisted of seven experts had studied DoCtor WoRM's Module and completed Module Content Validity Questionnaire. The experts who had evaluated the content validity of the module are three experts in Remedial Education, three experts in Mathematics, and one expert in Module. The experts had validated the module based on Teacher's Manual, Pupil's Activity Book, and interactive game. Overall, the content validity for DoCtor WoRM's Module is high.

Next, the third research question is related to reliability of DoCtor WoRM's Module. A pilot study had been carried out for three weeks period. The researcher had obtained the reliability of this module by measuring the test-retest reliability. Pearson's Correlation coefficient is the test-retest reliability coefficient as it measures the test consistency. In other words, pre-test and post-test were given to all the

participants before and after the intervention to see if the scores are the same. In this case, DoCtor WoRM's Module has a significant reliability.

Subsequently, the fourth research question is related to the improvement in multiplication skills among Year Four low achievers after using DoCtor WoRM's Module. To answer this research question, the researcher had compared the mean between the pre-test and post-test of treatment group. The results of SPSS analysis showed that there is a significant difference between the mean of pre-test and post-test for treatment group. Since the mean of post-test is higher than the mean of pre-test in treatment group, so DoCtor WoRM's Module is able to improve the multiplication skills among Year Four low achievers after the intervention.

Finally, the fifth research question is related to the effectiveness of DoCtor WoRM's Module to improve the multiplication skills among Year Four low achievers. To evaluate the effectiveness of the module, the researcher had compared the means of post-test between control and treatment groups. The results of SPSS analysis showed that there is a significant difference between the mean of post-test between control and treatment groups. Since the mean of post-test for treatment group is significantly higher than the mean of post-test for control group, so DoCtor WoRM's Module is effective in improving the multiplication skills among Year Four low achievers.

This experimental study had been carried out from March 2018 to June 2018 for three months period. Letters of transmittal requesting official permission from Ministry of Education Malaysia (KPM), Perak State Education Department (JPN),

and Manjung District Education Office (PPD) had been obtained. Permission from the headmasters in the schools involved had been attained orally. Since this study employed quasi-experimental design, the samples are divided into control group and treatment group. The treatment group learnt multiplication facts from three to nine using DoCtor WoRM's Module whereas the control group learnt the same content using traditional method.

The samples in this study are 60 Year Four low achievers in SJKC in Manjung District. These pupils are selected based on purposive sampling method as they must fulfil the criteria of the study. The researcher had obtained the statistics of Mathematics results in year 2017 from Manjung PPD. A pre-test had been conducted to the Year Four pupils who had failed in their previous Mathematics assessment. Then, the researcher had selected the samples based on the results of the pre-test. The pupils who answer incorrectly for more than one item in each multiplication facts are included in this study.

Then, the pupils were divided into control and treatment groups. The treatment group went through teaching and learning of multiplication facts using DoCtor WoRM's Module, whereas the control group learnt the same content using the traditional method. A briefing had been given to the teachers in treatment group by the researcher. This is to ensure that the teachers are able to carry out the intervention using DoCtor WoRM's Module according to the instructions. After three months of intervention, a post-test had been conducted to all samples in both groups.

The variables in this study are DoCtor WoRM's Module and achievement of Year Four low achievers in multiplication skills. DoCtor WoRM's Module had been constructed based on Constructivist Theory, mastery learning, and game-based learning. The achievement of Year Four low achievers was measured by using pre-test and post-test. A pre-test had been carried out to treatment group and control group. After three months of intervention, a post-test had been carried out to both groups.

The results based on the research questions had been analysed using descriptive and inferential analysis. Mean and percentages were used to analyse the data from Module Needs Assessment Survey Questionnaire and Module Content Validity Questionnaire. Meanwhile, the data of reliability had been analysed using Pearson's Correlation in SPSS. Also, a dependent *t*-test is used to compare the means of pre-test and post-test for treatment group. Then, an independent *t*-test is used to compare the means of post-test between treatment and control groups.

5.3 Discussions

This part will discuss about the findings of five research questions which begins from Module Developmental Phase to Module Evaluation Phase. The findings are about module needs, content validity, reliability, and effectiveness of DoCtor WoRM's Module in multiplication skills among Year Four low achievers.

5.3.1 Module Needs in Multiplication Skills

Since the first research question discussed about module needs in multiplication skills, a questionnaire entitled Module Needs Assessment Survey Questionnaire had been used to obtain the data related to the needs for the module. The data of the survey showed that there is a need in module for single-digit multiplication from three to nine.

Based on the data obtained from Module Needs Analysis Survey, most of the participants claimed that they have inadequate skills to handle or teach low achievers. Almost all of the participants think that module as a teaching aid can enhance the multiplication skills among low achievers. It is worth to mention that, all of the participants agreed on teaching multiplication skill is relevant for Year Four low achievers, and also mastery of single-digit multiplication is an important skill in Mathematics. These are in line with the previous researches which had been done by Davrajoo et al. (2010); Ding et al. (2016); Sullivan et al. (2014); van der Ven et al. (2015); and Zakiah Mohamad Ashari, Azlina Mohd. Kosnin, and Yeo, K.J. (2013).

Next, the participants are requested to select the multiplication facts that have not mastered by the Year Four low achievers. Among all, multiplication facts of nine are being selected by most participants. The researcher had eliminated multiplication facts of one and two, since there are only few percent of participants voted for them. Meanwhile, there were more participants who had selected the multiplication facts from three to nine. This is in line with Norhayati Ahmat et al. (2017) who claimed that pupils faced problem in learning single-digit multiplication facts.

Besides, the researcher had stated five important steps in DoCtor WoRM's Module. Majority of the participants agreed on the five steps. The five steps in DoCtor WoRM's Module is an idea expanded from line multiplication or Japanese Multiplication. This line multiplication is an interesting method to visualize multiplication that reduces it to simple counting. Without the stress of memorizing multiplication table, all this method requires the pupils to do is counting lines and dots. This is how the kids in Japan learning to multiply as according to Hale (2015).

Regarding to the materials in DoCtor WoRM's Module, most of the participants agreed on the guidance and lesson plans for teachers, exercise worksheets for pupils, and multimedia interactive game. This is identical to LINUS module which consists of three materials namely teacher's note, worksheets, and teaching aids (Rosseliiah Bokhari et al., 2015). The researcher had substitute teaching aids with interactive game because computer game as an innovation associated with educational technology hold promise for delivering instruction (Tobias & Fletcher, 2011).

In short, the construction of a module is a need based on the data analysis and supports from previous researches. The researcher had designed and developed a module based on the results from Module Needs Assessment Survey Questionnaire with the content of multiplication facts from three to nine. The five important steps in this module are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts. Three materials consisted in this module are Teacher's Manual, Pupil's Activity Book, and interactive game. Lastly, this module is

entitled [DoCtor WoRM's Module] as the abbreviation for the five important steps represented by /D/, /C/, /W/, /R/, and /M/.

5.3.2 Content Validity of DoCtor WoRM's Module

Content validity refers to the degree to which the various items collectively cover the material that the instrument is supposed to cover (Huck, 2014). The content validity of DoCtor WoRM's Module is evaluated based on four parts of the module. The content validity of Teacher's Manual, Pupil's Activity Book, Interactive Game, and overall of the module are above satisfying level. The module is considered to have a high content validity if the level of content validity achieves .70 (Abu Bakar Nordin, 1995, in Sidek Mohd Noah & Jamaludin Ahmad, 2005; Jasmi Abu Talib, Zakaria Mohamad, & Norwaliza Abdul Wahab, 2015; Tuckman & Waheed, 1981). It is worth to mention that the more validity evidence a researcher provides, the more confidence you can place in the interpretations based on measurement scores (Christensen, Johnson, & Turner, 2011).

5.3.3 Reliability of DoCtor WoRM's Module

Test-retest reliability is the degree to which the same test score would be obtained on another occasion (White & McBurney, 2013). In this study, the analysis using Pearson's correlation coefficient indicated that there is a significant linear relationship

between pre-test and post-test. DoCtor WoRM's Module is proven to have a significant reliability based on the results of this Pearson's correlation analysis.

According to Sidek's Module Development Model, if the draft module is proved to have very high validity and reliability, then the process in developing a module is considered completed (Amalia Madihie & Sidek Mohd Noah, 2012). The test-retest reliability coefficient is frequently referred to as the coefficient of stability. As with other forms of reliability, coefficients of stability reflect high reliability to the extent that they are close to 1.00 (Huck, 2014).

5.3.4 Improvement after using DoCtor WoRM's Module

One of the considerations to design module is to improve the achievement of pupils (Syafari, 2017). In order to measure the improvement in multiplication skills, dependent *t*-test is used to determine whether there is a significant difference between pre-test and post-test of treatment group. The null hypothesis is [there is no significant difference between the means of the pre-test and post-test for the treatment group]. The results of SPSS analysis proved that DoCtor WoRM's Module had improved multiplication skills among Year Four low achievers significantly.

In short, the results for dependent *t*-test is [there is a significant difference between the means of the pre-test and post-test for the treatment group]. Since the mean of post-test is higher than the mean of pre-test, so the participants had achieved an improvement after using DoCtor WoRM's Module. The result of this inferential

analysis showed that module is also an effective tool for Year Four low achievers to improve their achievement (Mohini Mohamed et al., 2012).

5.3.5 Effectiveness of DoCtor WoRM's Module

In this study, effectiveness of DoCtor WoRM's Module is evaluated by comparing the mean between post-test for treatment and control groups. In order to compare the mean of post-test for treatment group and control group, independent *t*-test is used to determine whether the mean of these two groups are different from each other. A two-tailed test had been performed according to the design of this study. The null hypothesis for the comparison of the means in this independent *t*-test is [there is no significant difference between the mean of the post-test for the treatment and control groups].

The results of SPSS analysis showed that there is a significant variance difference between treatment and experimental groups. In short, the results for independent *t*-test is [there is a significant difference between the mean of post-test for treatment and control groups]. The inferential statistics proved that module is an effective teaching aid for Mathematics subject (Davrajoo et al., 2010).

5.4 Implications

In this section, the researcher will discuss about the implications of the research findings on four aspects, which are implication on Mathematics low achievers, implication on Remedial Education and Mathematics teachers, implication on Remedial Education in Ministry of Education Malaysia, and implication on teachers training.

5.4.1 Implication on Mathematics Low Achievers

This study showed that Mathematics low achievers are able to achieve better if the teaching and learning process is well-planned in a more systematic way. The intervention of DoCtor WoRM's Module integrated three materials, which are Teacher's Manual, Pupil's Activity Book, and interactive game, is able to assist the Mathematics low achievers to improve better than the traditional teaching and learning process. This is related to the characteristics of a module that is more systematic and organised because the learning content had been divided into smaller topics, and being constructed sequentially so that it is more understandable and applicable to the learners (Zakiah Mohamad Ashari et al., 2014).

DoCtor WoRM's Module was designed based on Constructivist Theory by Bruner. Some researchers claimed that constructivism may not be effective for Mathematics low achievers (Ampadu & Danso, 2018; Kroesbergen et al., 2014). However, the findings study proved that it is effective to improve the multiplication

skills among Year Four low achievers. This is because the researcher had implemented an interactive game which is able to support constructivist learning and able to engage the pupils in the learning process (Kirkley et al., 2011). These low achievers showed improvement as they engaged actively in the learning and constructed their own knowledge based on the previous knowledge.

Besides, the Mathematics low achievers are able to explore the teaching aids by themselves, with the minimum guidance from teachers, which acted as facilitator. Corresponding with this, teaching aids enable teacher to play a role as facilitator hence increase the effectiveness of pupils-centered learning with only 25% teacher's involvement in the class (Kamarul Azmi Jasmi, Mohd Faeez Ilias, Abdul Halim Tamuri, & Mohd Izham Mod Hamzah, 2011). This study showed that Mathematics low achievers are capable to learn by considering some modifications in teaching and learning (Broza & Kolikant, 2015). Additionally, intervention at an early stage may give Mathematics low achievers the opportunity to catch up with their typically achieving peers (Toll & Van Luit, 2013). As a conclusion, implementation of module in teaching and learning in Remedial Education had given a positive impact among the pupils. This is because module is able to be an effective tool for pupils especially low achievers.

5.4.2 Implication on Remedial Education and Mathematics Teachers

DoCtor WoRM's Module had been proven to be an effective tool in improving the achievement of multiplication skills among low achievers. Moreover, DoCtor

WoRM's Module should be implemented in primary schools in Malaysia as it brought benefits to Remedial Education and Mathematics teachers as well. Teachers can apply this module when teaching multiplication skills in Mathematics subjects towards the low achievers.

Nowadays, Remedial Education and Mathematics teachers had been exposed with LINUS module, which included literacy and numeracy. However, the teachers have been faced with certain challenges (Mohd Razak Mohd Nordin et al., 2014). The LINUS module is also not specified on multiplication skills, the teaching and learning activities in the module is basically traditional method, such as grouping method and memorization (Malaysia Education Ministry, 2014).

With the aids of DoCtor WoRM's Module, the teachers are able to apply a creative and innovative way in teaching the low achievers on multiplication skills. Teaching and learning of multiplication skills became systematic with the five important steps, which are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts. Remedial Education and Mathematics teachers are able to carry out the lessons with the assistance of three materials in the module, which are Teacher's Manual, Pupil's Activity Book, and interactive game.

In this study, the researcher had developed an interactive game by using Scratch program version 2.0. It is worth to mention that games are a unique media for pupils to learn by playing, in a fun and challenging context (Mayer, 2011; Plass et al.,

2015). This game enables pupils to be active and engage themselves in learning as they are learning in a fun and relaxing situation (Maimun Aqsha Lubis & Hanis Najwa Shaharuddin, 2016; Pho & Dinscore, 2015)

The development and implementation of DoCtor WoRM's Module should be a model for the Remedial Education and Mathematics teachers to carry out the suitable learning activities in a systematic way based on their pupils need. It also should be a motivation for the teachers to do researches and develop creative and innovative module and teaching aids for the low achievers.

5.4.3 Implication on Remedial Education in Ministry of Education Malaysia

Remedial Education is introduced in line with National Philosophy of Education (FPK) to emphasize in the mastery of literacy and numeracy among the pupils at the early stage (Mohd Asnorhisham Adam & Abdul Rahim Hamdan, 2017). The development of DoCtor WoRM's Module is designed for Year Four low achievers in SJKC. The purpose of the module is to improve the multiplication skills among these pupils. This module is an effort to reduce the gap among low achievers and the other pupils.

This is in line with the effort of Malaysia government that had increased the investment in physical and teaching resources for pupils with specific needs (Ministry of Education Malaysia, 2013). DoCtor WoRM's Module is developed and designed based on the needs analysis assessment survey. Implementation of DoCtor WoRM's

Module as the intervention had been carried out twice as in the pilot study and the field study. The pilot study involved seven SJKC schools in Manjung district, whereas the experimental study involved four SJKC schools in Manjung district. The study showed that DoCtor WoRM's Module is able to improve the achievement of Mathematics Year Four low achievers.

In addition, DoCtor WoRM's Module which had been developed in this study may be integrated as one of the qualified module in the Remedial Education. Although numeracy module had been developed and implemented in primary schools in Malaysia. However, the modules available are not specific in single-digit multiplication skills. DoCtor WoRM's Module consists of five systematics steps for low achievers to learn single-digit multiplication. The five steps are /D/ drawing the intersecting lines, /C/ counting the intersection points, /W/ writing the multiplication sentences, /R/ reading the multiplication sentences, and /M/ memorizing the multiplication facts. Thus, DoCtor WoRM's Module should be implemented in the Remedial Education in Malaysia in order to assist more low achievers to master in single-digit multiplication.

5.4.4 Implication on Teachers Training

One of the implications of this study is on teachers training especially for the future teachers in teachers training institution. It is very important to train the teachers in order to prepare them to face the pupils with different academic levels. The future teachers could be exposed to the teaching and learning module. Besides, the teachers

should also learn to design creative and innovative teaching aids or module in order to teach their pupils with different needs. In this matter, it is also important for the teachers to understand DoCtor WoRM's Module when they need to apply it to the low achievers. It is because the understanding of instructions in DoCtor WoRM's Module will ensure the teachers to carry out the module more effectively. Hence, workshops or briefing should be carried out to train the teachers in using the module.

Besides applying DoCtor WoRM's Module in the teaching and learning process of Year Four low achievers, this module is also able to act as reinforcement for the other pupils, especially the interactive game. Besides, teachers can also apply this module to the low achievers in other level. Teachers can carry out group discussion or courses for other teachers in school. They may discuss about the effect of DoCtor WoRM's Module towards pupils with different levels and suggest ways to improve the activities that had been done.

It is important for the educators to continue the efforts to improve remedial in Mathematics (Bahr, 2013). The teachers should be exposed with the implementation of this module, and practices to develop and design new modules. Lastly, these teachers can help each other to construct learning or teaching module that is effective in improving the basic arithmetic skills among low achievers.

5.5 Recommendations

This study involved the process of development and evaluation the effectiveness of DoCtor WoRM's Module. This module had been developed and focused in multiplication skills among Year Four low achievers. After this study had been carried out, the researcher had identified some issues to improve DoCtor WoRM's Module. Four recommendations that will be discussed in this section are recommendation on development of module, recommendation to involve all Mathematics low achievers in Malaysia, recommendation on modification in multiplication skills learning among low achievers, and recommendation to develop teaching and learning modules on other basic arithmetic skills.

There are some recommendations for the future studies on the development of module. The future studies may increase the activities that might help to improve the multiplication among low achievers, such as pair and group activities, variety of exercises, and 21st century learning activities. Since this module consisted only three materials of Teacher's Manual, Pupil's Activity Book, and interactive game, the future studies may increase the teaching aids in the module, such as concrete materials. Besides, the researchers may also improve the interactive game, such as integration of three dimensional animations to attract pupils in learning. Lastly, more practice may be provided to the teachers about DoCtor WoRM's Module so that they are clear about the whole process to carry out the module effectively.

Next, the future studies are suggested to involve all Mathematics low achievers in Malaysia to enlarge scope of the study. This is because involvement of

all Mathematics low achievers with different characteristics and attitudes may help the researchers to identify their problems in learning. So, this may provide space for the researchers to make decisions on more accurate strategies in dealing with them. As a consequence, DoCtor WoRM's Module will be more effective and suitable to be applied and implemented to all Mathematics low achievers in Malaysia.

Furthermore, the future researchers are suggested to improve or modify the existing traditional methods of multiplication skills learning. The five steps in DoCtor WoRM's Module is the modification of the Japanese Multiplication in which the pupils are able to obtain the answers for multiplication items by counting the intersection points. Modification and creative ways of teaching multiplication skills, such as lattice method, may be integrated in this module. The future studies may also modify the interactive game in DoCtor WoRM's Module in order to become more advance. For example, three dimensional animations may be added as an element in the game to attract low achievers to learn in a fun and interesting way.

Finally, the future studies are suggested to develop the teaching and learning modules on other basic arithmetic skills, such as addition, subtraction, and division. This is because these four basic arithmetic skills are complementary to each other. The future studies may carry out module needs analysis in order to identify the arithmetic skills needed by the low achievers in different level. The future researchers may develop the module based on the needs analysis survey. This is important to ensure the modules to be developed as based on the needs, suitable with the low achievers, and able to improve the achievements of the low achievers in different levels.

5.6 Summary

In this study, the researcher had developed DoCtor WoRM's Module based on the analysis from Module Needs Assessment Survey Questionnaire. The content validity had been assured by seven experts in the field of Remedial Education, Mathematics, and module. In addition, the reliability of DoCtor WoRM's Module had been analysed by SPSS using Pearson's Correlation coefficient

On the whole, DoCtor WoRM's Module is able to improve the achievement of Year Four low achievers in multiplication skills. A comparison between pre-test and post-test for treatment group had been analysed by using dependent *t*-test. Likewise, a comparison between post-test for treatment and control groups had been analysed by using independent *t*-test. In brief, DoCtor WoRM's Module is effective in improving the achievement of Year Four low achievers in multiplication skills.

Meanwhile, the implications of this study are implications on Mathematics low achievers, implication on Remedial Education and Mathematics teachers, implication on Remedial Education in Ministery of Education Malaysia, and implication on teachers training. In this study, development of DoCtor WoRM's Module is considered as an effort in line with PPPM (2013-2025) in order to reduce the gap between low achievers and their peers, and also to develop the teaching resources for pupils with specific needs. Besides, this study had proven that Mathematics low achievers are capable to learn by modification in teaching and learning done by the educators (Broza & Kolikant, 2015). The module which had

been systematically arranged and complemented with the three materials is able to attract the pupils to learn and achieve improvement in multiplication skills.

Then, the researcher had discussed the recommendations in four aspects, which are recommendations on development of module, to involve all Mathematics low achievers in Malaysia, to modify the methods in learning multiplication for low achievers, and to develop teaching and learning modules on other basic arithmetic skills. As a conclusion, DoCtor WoRM's Module should be implemented among Mathematics low achievers in Malaysia in order to help them master in multiplication skills, and achieve improvement in Mathematics subject.

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