Faculty of Cognitive Sciences and Human Development

STUDENTS' DIFFICULTIES WITH RESPECT TO THE LANGUAGE OF MATHEMATICS IN THE MATHEMATICS CLASSROOM

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Statement of Originality

The work described in this Final Year Project, entitled
"Students' Difficulties with respect to the Language of Mathematics in the Mathematics Classroom"
is to the best of the author's knowledge that of the author except where due reference is made.

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The project entitled 'Students' Difficulties with respect to the Language of Mathematics in the Mathematics Classroom' was prepared by Ummi Kalsum binti Hakim and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Education (Honours) Mathematics.

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ABSTRACT

The aim of this study is to investigate the difficulties faced by the secondary school students in mathematics classroom specifically focusing on the difficulties of the language of mathematics. This study will identify the students' difficulties in learning and understanding the language of mathematics, the causes of the difficulties and suggested strategies to overcome the difficulties. Six students from a secondary school in Kuching district participated in this study. The data that was obtained from a short assessment and interview had been analysed and tabulated. The result revealed that the major difficulties in understanding the language of mathematics is vocabulary of mathematics and the causes is the mathematics itself. The most popular strategy in overcoming the difficulties in understanding the language of mathematics is group discussion. The result of this study also suggested that students should increase their vocabulary of mathematics by playing mathematics puzzles.

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji masalah-masalah yang dihadapi oleh pelajar sekolah menengah dalam kelas matematik yang berfokus kepada masalah dalam Bahasa Matematik. Kajian ini mengenalpasti masalah-masalah pelajar dalam mempelajari dan memahami bahasa Matematik, punca-punca masalah dan cadangan strategi dalam mengatasi masalah yang dihadapi. Enam orang pelajar dari salah sebuah sekolah menengah di kawasan Kuching terlibat dalam kajian ini. Data yang telah diperolehi melalui penilaian ringkas dan temubual telah dianalisis dan dipersembahkan dalam bentuk jadual. Keputusan kajian mendedahkan masalah utama dalam memahami bahasa Matematik adalah perbendaharaan kata Matematik dan puncanya ialah Matematik itu sendiri. Strategi yang paling popular dalam mengatasi masalah dalam memahami bahasa Matematik ialah perbincangan dalam kumpulan. Hasil kajian ini juga mencadangkan supaya para pelajar menambahkan pengetahuan dalam perbendaharaan kata Matematik dengan permainan Matematik silang kata.

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter consists of seven sections. It begins with a brief description on the background of the study. This is followed by the problem statement and the objectives of the study. The research questions, the significance of the study, limitation and conceptual and operational definition of key terms are also provided. Finally, this chapter concludes with a summary.

1.1 Background of the study

The language of mathematics appears as a factor that effect mathematics achievement among students. This study will investigate on the challenges faced by students in secondary school in learning the language of mathematics. Language can be inferred as signs, symbols, sound and other methods of communicating

information or ideas, including the language of mathematics (Macmillan English Dictionary, 2002). By this definition, mathematics is a language whereas mathematical symbols are the means by which we write mathematics and communicate mathematical meaning.

In order to investigate the students' challenges in the mathematics classroom in term of the language of mathematics, it is necessary to understand the concept of mathematical language. According to Adanur, Yagiz and Isik (2004), mathematics is perceived as a language that uses symbols of which senses and its way of use are certain and limited. Everyday language is used in mathematics to express mathematical symbols such as '+', '=', '<', '>' and etc. In everyday language, the symbol '<' is spelled out as a small, which is the opposite meaning of big that can be expressed by the symbol '>'. Thus, there also exists a similar opposite meaning in mathematical symbols (Adanur et al, 2004).

According to Yushau and Bokhari (2005), mathematical term is often complex and the words used therein are endowed with meanings, which mostly are completely different from their normal usage. The words in mathematics are ambiguous and difficult to understand since the meaning is different from our everyday language. Students get confuse when answering mathematics questions because they cannot understand the instruction of mathematical question. For instance, given a range of numbers from 1 to 20, the question will ask to allocate even and odd number in different set. Some students did not know the meaning of odd and even number mathematically. Besides, they will be confused on the meaning of the words used in mathematics and the words in everyday language.

People who learn and teach mathematics should know the language very well since the language of mathematics is believed to influence students' achievement in mathematics (Yushau and Bokhari, 2005). Therefore, understanding the language of

mathematics is important to learn mathematics effectively. Thus, the researcher will seek for effective learning techniques for students to minimize their difficulties in learning the language of mathematics. At the end of this research, the researcher will present the solutions for the problem in understanding the mathematical language.

1.2 Problem Statements

Secondary school students face the challenges in understanding the language of mathematics. A research done by Yushau and Bokhari (2005) revealed that the language of mathematics itself become the source of difficulty and confusion in mathematics classroom. Problems emerge among students when sitting for mathematics exam, in which they cannot understand the instructions of mathematics. This problem will contribute to poor performance in mathematics.

In addition, students have difficulty in learning to understand the special terminology and syntax or grammar of mathematics. Every words used in mathematics sentences are present tense, such as 'is' and 'are'. Besides, students also get confused between the use of mathematical language and everyday language. According to Yushau and Bokhari (2005), mathematical term is often complex and the words used therein are endowed with meanings, where most are completely different from their normal usage.

For instance, the words such as if else, point, odd and even have different meanings with the everyday language. Mathematically, even is defined as the numbers that are divisible by two, while, naturally, even is used for emphasis mainly before a word, a phrase, or a clause (Macmillan English Dictionary, 2002). This problem has affected students' achievement in mathematics. Thus, there is a need to

minimize this difficulty among students in order to produce effective and high mathematical performance.

1.3 Objectives

1.3.1 General Objective

The general objective of this study is to investigate the challenges faced by the secondary school students in mathematics classroom whereas in particular on the difficulties of the language of mathematics which is often believed as complex and ambiguous.

1.3.2 Specific Objectives

This study is conducted with the following objectives in mind:

1.3.2.1 To assess the difficulties face by the students in using the language of mathematics.

1.3.2.2 To inquire about the causes of the difficulties among students in learning the language of mathematics in secondary school.

1.3.2.3 To seek the ways for students to overcome the problem of the mathematical language in their learning.

1.4 Research questions

This study seeks to the answer the following research questions:

1.4.1 What kinds of difficulties do the students face while learning the language of mathematics in the classroom?

1.4.2 What are the causes of the difficulties in learning the language of mathematics among secondary school students?

1.4.3 In what ways do students overcome the problems of the language of mathematics in their learning?

1.5 Significance of the study

The significance of this study can be categorized into four parts which are teaching implications, learning implications, implication to research and teacher training or development. Besides, all of the implications are interrelated to each other.

In teaching, this research will help mathematics teachers to understand students' problems in learning the language of mathematics. Therefore, the teacher can figure out the difficulties and find a way to assist their students in learning the language of mathematics. Hence, it will allow the teacher to seek for a new teaching technique fits with the students' problems. Also, it will improve the mathematics teachers' techniques in conducting mathematics classroom.

Since this research focus on the language of mathematics, enormously, it gives much impact in learning whereas it provides effective learning and improvement in students' achievement in mathematics. The increase in students' achievement in the subject will promote motivation in their self and others to learn

mathematics, and hence lead to the development of successful school. The other implications are reducing failure in mathematics subject as the students' success in overcoming the problems in learning the language of mathematics.

In the aspect of research implications, this study is significant in gaining more information and source for researchers who are interested in investigating the challenges faced by the students in the mathematics classroom. It provides the source for research on the language of mathematics among mathematics' users who include teachers and students. Besides, this research is well-suited for us since we are mathematics' students as well as mathematics teachers in which we could have in-depth knowledge of mathematics.

1.6 Limitation of the study

There are two limitations in conducting this study. Time is the primary limitation of this study. As this study is conducted for the purpose of Final Year Project and has to be completed within the timeframe given, the researcher could not obtain large amount of data to be presented in the finding. To improve this study, the researcher should stay and observe the students for a year to make continuous observation of their learning development and achievement in mathematics.

Secondly the study's limitation is in the methodology of this study. In order to obtain accurate result, an experiment could have been conducted. However, the procedures are complex where more time is needed to establish and manage the experiments. Therefore, this present study relies on questionnaires, short test and interviews.

1.7 Conceptual and operational definitions of terms

1.7.0 Overview

There are two terms considered in this study. The terms are 'language' and 'language of mathematics'. These terms will be defined based on conceptual and operational definition. As primary knowledge, Mathematics refers to the sciences or branch of knowledge dealing with measurements, numbers and quantities. It involves the study of the measurement, properties, and relationships of quantities and sets, using numbers and symbols.

1.7.1 Conceptual definition:

A language is defined as the method of human communication using spoken or written words (Macmillan English Dictionary, 2002). It is considered to be a system of communicating with other people using sounds, symbols and words in expressing a meaning, idea or thought. The language can be used in many forms, primarily through oral and written communications as well as using expressions through body language.

Conceptual definition for the language of mathematics is the common language of science that the whole world can understand (Adanur at el, 2004). This refer to the signs, symbols, sounds, and other methods of communicating information, feeling or ideas (Macmillan English Dictionary, 2002).

1.7.2 Operational definition:

Language considered in this study is a medium through which mathematical and scientific ideas are developed and exchanged (Michelle and Nerida, 2003). It has been stated that language plays an important role in the teaching and learning of mathematics.

Language of mathematics in this study is defined as the type of formal language which comprises the organization of symbols, sound and gestures that are socially used by its members to communicate and create mathematical ideas (Michelle and Nerida, 2003). Obviously, there exist interactions of changing and sharing ideas in mathematics classroom.

1.8 Summary

In conclusion, this chapter covered briefly the idea on the research study that will be carried out. The background of the study described the previous related researches that had been done regarding the topic of the challenges in the language of mathematics. This chapter also revealed the significance of this research study for future readers so they can gain benefits from it. Some of the particular terms are defined in order to provide a clear view for the reader to have better understanding of the research. Therefore, in depth discussion on the previous studies on these issues will be presented in the next chapter which is the literature review.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter comprises several sections. It describes in-depth the language of mathematics and the challenges for students in learning the mathematical language in mathematics classroom. It begins by presenting the overview of the language of mathematics and how it challenges students in the mathematics classroom. Finally, the contents will be summarized in the chapter 's closure.

2.1 The Language and Mathematics

To begin with, it is necessary to understand the terms language, mathematics and the language of mathematics. It appears that there are doubts in believing mathematics as a language. Therefore, this section provides the explanation of why mathematics can become a language.

2.1.1 Language

A language is described as the method of human communication using spoken or written words (Macmillan English Dictionary, 2002). According to Michelle and Nerida (2003), language is a medium through which mathematical and scientific ideas are developed and exchanged. It is considered to be a system of communicating with other people using sounds, symbols and words to express a meaning, idea or thought.

2.1.2 Mathematics

Jarmila and Marie (1999) describes mathematics as a discipline where non-verbal communication, visual and graphic materials are used to a considerable extent. The language of mathematics has a typical grammatical structure and is rich in words that are only found in this specific field. In addition, mathematical vocabulary is similar across many languages.

2.1.3 Language of Mathematics

Language of mathematics is described as a type of formal language which consists of the organization of symbols, sound and gestures that are socially used by its members to communicate and create mathematical ideas (Michelle & Nerida, 2003). Pimm and Keynes (1994) interpreted the language of mathematics in variety of meaning, "The spoken language of the mathematical classroom including both teacher and students talk, the use of particular words for mathematical ends which often referred to the mathematics register, the language of texts and the language of written symbolic forms"(Jarmila & Marie, 1999).

2.2 Language of Mathematics in the Mathematics Classroom

Ellerton and Clarkson (1996) had stated that the importance of language factors in mathematics learning and teaching has widely been accepted (cited in Michelle & Nerida, 2003). In this circumstance, there is a need to conduct further investigation in the language of mathematics. Mathematical language is the common language of science that can be understood by the whole world and is rich in words that are only found in particular field (Adanur, Yagiz & Isik, 2004).

Mathematics deals with abstract concepts which consist of symbols and a typical grammatical structure which forms a unique world to itself (Adanur et al, 2004). According to Kasule and Mapolelo (2005), mathematics is only about "solving this equation" or "simplifying". Mathematics believed as to have its' own mathematical terms including words, phrases, symbols, abbreviations, ways of speaking, reading, writing, and arguing (Kasule & Mapolelo, 2005). As a consequence, emerge differences between the language of mathematics and natural language.

Based on research done by Michelle and Nerida (2003), language genre in mathematics such as "math talk" represents a language form that is agreed and employed within classroom discourse communities. Language genre of math talk became special because of the community involvement within which are the mathematics students and teachers. In addition, mathematics discourse only occurs in the mathematics classroom.

Mathematics is defined as a type of formal language which refers to an organization of symbols, sounds and gestures that are socially used by its members to communicate and create mathematical ideas (Michelle & Nerida, 2003). Clearly, the communication used in the mathematics classrooms shares characteristics with the

definition of a language. Ellerton and Clarkson (1996) have emphasized communicating mathematical ideas which are considered to be essential for being successful in mathematics teaching and learning (cited in Isikhan, 2007). If changing and sharing ideas in mathematics classroom occurs, it can increase students understanding in both mathematics and its' language.

Mathematics challenge teachers and students from several aspects, such as difficulties in terms of the language of mathematics. These difficulties have affected students' achievement as well as a cause for poor performance in mathematics education. Pimm (1987) found that some writers believed that the language of mathematics is a metaphor for examining mathematics teaching and learning (cited in Michelle & Nerida, 2003) whereas through metaphor one can attribute many characteristics of the mathematical language. Olivares (1996, cited in Cheah, 2001) stated that there exist two main fundamental components in mathematical language proficiency which are the communicative competence in mathematics and the mathematical knowledge and behaviors of the discipline. Obviously, discipline also counted in learning the language of mathematics effectively. Gardella and Tong (1999) argue that the learning of mathematics can be seen as a process that are parallel to the way children gain language skills as well as developing structure in oral ability (cited in Jarmila & Marie, 1999).

2.3 The Role of the Language of Mathematics

The role of language in the teaching and learning of school mathematics is crucial. The previous researchers have identified several aspects of language which are important in the learning of mathematics. The description of language genre developed in this study is based on literature from the previous research regarding mathematical language. More specifically, this study is vested with interest to

investigate the difficulties faced by students in learning the language of mathematics. According to Secada(1992); Barton and Borton(2003), the language problem is one of the major factors contributing toward the poor performance of many students in mathematics (cited in Yushau & Bokhari, 2005).

Additionally, the language of science and technology which is slowly narrowing down to a few languages had also contributed to this problem (Yushau & Bokhari, 2005). The language of mathematics itself becomes the source of difficulty and confusion in mathematics classroom (Yushau & Bokhari, 2005; Noraishiyah Abdullah, 2006). As a conclusion, future research is needed in order to address the problem of language in mathematics classroom.

2.4 Difficulties in Learning Mathematics

The interaction and communication in mathematics classroom can become extremely difficult if the students have no knowledge base of mathematics construct. According to Viliami (2004), the students will have difficulties on the task of reading a mathematics textbook, interpreting teachers' instructional explanation, solving a word problem, communicating ideas and own knowledge about mathematics. As stated in the research done by Yushau and Bokhari (2005), mathematical term is often complex and the words used therein are endowed with meanings, which almost completely different from the everyday usage. For instance, the words: if else, odd and point have a different meaning within the natural human language. Mathematically, odd is defined as the numbers that are not divisible by two, while, naturally, odd means as something strange. Based on the previous research, there are three problems that exist in learning mathematics which will be described in the following subsections.

2.4.1 Lexical ambiguity

Cheah (2003, cited in Durkin & Shire, 1991) state that lexical ambiguity exist in mathematics since most of mathematical terms are also used in everyday language. Mathematical terms such as 'acute angle', 'square root' and 'closed figure' all contain words that carry different meaning in everyday context. This problem raises the ambiguity among learner as they attempt to grab with the mathematical meaning of the words. Durkin and Shire (1991) found that a boy whom when asked about the mathematical meaning of the word 'volume', said it was a knob on the radio (Cheah, 2001). Lexical ambiguity that exist could lead to the difficulties in understanding mathematics words and letters, interpreting mathematics instructions and understanding the process of problem solving.

2.4.2 Long Instruction

The students also faced difficulties when they encounter long instructions for a new mathematical element (Jarmila & Marie, 1999). This is especially so, since the language used in mathematics is English which is the second language for most of the students, hence shorter and simpler sentences for mathematics instruction are required. The students that are found to be very weak in the language of instruction have the tendency toward poor comprehension in mathematics learning (Setati, 2003 cited in Yushau & Bokhari, 2005). For example, 20 – 8 =. This question can be asked in several ways.

(a) "Take 8 from 20"

(b) "Subtract 8 from 20"

(c) "Find the difference between 20 and 8."

The students may easily understand the first two phrases, since it is direct questions. However, the last phrases may be hard to interpret. The keyword in the last phrase is 'difference' which mathematically means to find the subtraction between given numbers. If the students have no basic knowledge on the mathematical language instruction, then, they will appear to have difficulty in accomplishing the question. In addition, long instruction problem often encountered when face with new mathematics element learnt. The students need time to adapt with the sort of mathematics question.

2.4.3 Solving word problems

Another problem that emerges in learning mathematics language is solving word problems. Problem solving questions often developed in a variety ways. For instance, the simple addition operation may appear in many different semantic form such as:

(a) Change problem: Mimi has two cats, Nino gave her three more. How many does Mimi have now?
(b) Combine problem: Aiman has four tortoises. Iman has two tortoises. How many do they have altogether?
(c) Compare problem: Ina has three chocolates, George has two chocolates more than Alice. How many chocolates does Ina has?

These word problems can be solved by using the same arithmetic operation. However, the different semantic form of question have posed not only the level of difficulty, but the student may use varying ways to solve the problems (Cheah, 2001).

According to Allan (2005), students mistake in solving word problem associated with these classification of errors:

Table 2.4.3: Classification of Error in Solving Word Problem

Types of Error	Description
Reading Error	The student could not read a keyword in the written problem
Comprehension Error	The student may be able to read all the words in the question, but is unable to grasp the overall meaning of the words
Transformation Error	The student had understood what the question wanted he/she to solve but unable to identify the operation or sequence of operations
Process Skills Error	The student is able to identify the operation or sequence of operations, but do not know the appropriate procedure to carry out these operations
Encoding Error	The student is able to work out the solution, but is unable to express the solution in correct form

2.5 The Causes of Difficulties in Learning the Language of Mathematics

Radatz(1979) classified mistakes in doing mathematics into difficulty of mathematical language, difficulty to visualize information, disability in basic skills, facts and concept and usage of wrong strategy (cited in Noraishiyah Abdullah, 2006). In this study, the researcher only focuses the mistakes in the aspect of the language of mathematics. Noraishiyah Abdullah (2006) stated that mistakes in mathematics may be caused by the difficulty of mathematics itself.

The previous research found that the practices of mathematical language in mathematics teaching and learning usually focus on words, symbols and isolated special grammatical forms (O'Halloran & Morgan, 2000 cited in Isikhan, 2007). In this study, the researcher is seeking for the possible causes of the difficulties in learning the language of mathematics. The causes were grouped into two categories which are the student related and teacher related (Dante, Milagros, Cesar & Robert, 2006).

2.5.1 Student-related

The student-related group difficulties consisted mental ability, habits, interest and attitudes towards mathematics, learning style, self regulatory skills and reading comprehension skills (Dante et al, 2006). Habits, interest and attitude are behavioral manifestation of the changes taking place in an individual in which it could be positive or negative. Lovitt and Clarke (1989) emphasize that quality teaching in mathematics teaching is characterized by a learning environment that responds to the interest, concerns and personal world of the students and also one that encourages students to expand their modes of communicating mathematical ideas (cited in Chan, 2003). From the student's point of view, their motivation and interest in mathematics appears to be the factor that influence in learning the language of mathematics.

2.5.2 Teacher-related

The teacher related factors are associated with the teachers' attitude, academic preparation, behavior, beliefs and practices and teaching styles (Dante et al, 2006). Significantly, teachers affect students with their attitude and behavior. Every teacher has different teaching styles preferences such as lecture, discussion, cooperative learning, research and use of Computer-Assisted Instruction (CAI) materials and mentoring. These influence the effectiveness of learning such that when the teaching

styles match the students' learning style, the students can learn comfortably in the particular subject.

According to Jarmila and Marie (1999), there is the difference between the language used by the teacher and students in mathematics classroom whereas the level of challenge in teacher talk should be appropriate to the age and level of learners. If the level of language that the teacher used gets ahead of the student's level of thought too much, it will become meaningless to the student. Instead, if the level of language used is below the student's level of thought, it has a deforming influence on the development of their mathematical language as well as cognitive structure (Jarmila & Marie, 1999).

2.6 Ways Used to Overcome the Difficulties

The previous research had suggested several ways useful to help the students to cope with their problem regarding learning the language of mathematics. The most common way to overcome the difficulties in teaching the language of mathematics is the use of mathematics terminology references or dictionary (Cheah, 2001). Another strategy that has been composed by Kasule and Mapolelo (2005) is using jigsaw puzzles for learning the language of mathematics. By implementing jigsaw puzzles, students will learn and increase their mathematics vocabulary. This activity will enrich their knowledge in numerous words or phrases of mathematics. In addition, this strategy provides variety in learning method and class activities.

Other than that, Yushau and Bokhari (2005) also had suggested a strategy which is discussion, in which it requires students to involve actively when working out a problem on the board. For this strategy, the students will convert numbers to develop a story problem. Teachers play an important role to assist students to

minimize the problems with a variety of methods of teaching. One of the suggested strategies proposed by Yushau and Bokhari (2005) is the use of variety phrase with the same meaning in the mathematics lesson.

2.7 Summary

In summary, the perception and definition of the language of mathematics vary according to one's own beliefs. This chapter has discussed briefly on the difficulties faced by students in learning the language of mathematics in the mathematics classroom. The possible causes of students' difficulty in learning the language of mathematics had been obtained from the previous research. Finally, several teaching strategies also have being presented in order to assist students in learning the language of mathematics.

CHAPTER 3
METHODOLOGY

3.0 Introduction

This chapter presents the research design, research location, sampling, instrument of research, data collection techniques, data analysis techniques and limitation of research. This study was conducted by using qualitative research approach. The primary aim of conducting this research is to investigate on how the language of mathematics takes responsibility in challenging the students in the mathematics classroom. Besides, the researcher assessed the difficulties faced by the students in using and learning the language of mathematics. This research concern how the language of mathematics has influenced students' achievement in learning mathematics in secondary school. Significantly, this research provides benefit to the participants where in the end, the researcher presents the effective strategies to overcome the problem in learning the language of mathematics. This chapter elaborates on how the researcher conduct and implement investigation in the selected research location with a variety of methods and efforts.

3.1 Research Design

The type of design that is used for this research is a case study. In this research, the researcher focuses on a crucial issue within education which is the difficulties in learning the language of mathematics. The advantage of using this type of research is it is suitable to examine a particular issue that has not been extensively covered and briefly studied. It is able to investigate individuals or programs change affected by certain circumstances or interventions. Besides, it is useful to provide preliminary support to develop research questions.

Yin (1994) define case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. Merriam (1998) prescribes four characteristics to support a qualitative case study which are particularistic, descriptive, heuristic and inductive (cited in Youseff, 2002). The characteristic of particularistic study is the case study focus on a particular phenomenon such as investigates the challenges students faced in learning the language of mathematics in secondary school.

Descriptive case study is the study in question that provides the rich, in depth explanation of the context studied and the effective strategies in learning mathematical language. While, heuristic case study aimed at understanding two sub-sections in the case study which are students' difficulties in learning the language of mathematics and the case study on students' techniques in overcoming the problems involved in mathematical language. Finally, the characteristic of inductive case study is rested upon the assumption that empirical materials are positioned in the studied context. The aim of this study is not to verify predetermined hypothesis regarding difficulties students faced in learning the language of mathematics in secondary school but to describe and interpret the phenomenon in question.

In this research, data was gathered via documents and interviews. Since this research is conducted in a secondary school therefore, the researcher must obtain consent from the principal of the school to conduct investigation and interview with the participants.

3.2 Research Location

This study was conducted in a secondary school in Sarawak which is near Kuching district. The researcher is interested in selecting this secondary school as the location for the study because the school is located near to the researcher's place of stay. Besides, it facilitates the researcher in term of time and budget in conducting this research. With less cost, the investigation can be accomplished with variety of methods in an effective way. Since the location of research is within means, the researcher can save the time of traveling to and from the school. Additionally, the researcher can use the extra time wisely in conducting the study.

3.3 Sampling

The researcher is interested in investigating the difficulties faced by students in mathematics classroom whereby the focus is on the difficulties of the language of mathematics which is often believed to be complex and ambiguous. For this purpose, six form two students from the secondary school will be selected to be the participants in this study. The researcher is concerned in investigating the difficulties in learning mathematics because of the researcher's desire to find the reasons of many failures and less interest among students in mathematics. Based on the previous research, learning mathematics is difficult and one of the causes is the mathematical language, which is often seen as complex and ambiguous.

Other than that, the use of some of the words in mathematics is the same with everyday language, but has different interpretation. For example, 'volume', in everyday language is defined as the loudness of a sound from an electrical media such as radio and television (Macmillan English Dictionary, 2002), while in mathematics it is defined as the product of length, width and height of an object. This scenario provides confusion among students in learning mathematics. Thus, this study is interested in seeking the solutions to overcome the problem in learning the language of mathematics. Secondary school level is selected because there are more challenges than the elementary and primary schools. At the end of this study, the participants can gain the benefits such as evaluating their difficulties in learning mathematics, understand their needs in improving their performance in mathematics and implement the suggested techniques by the researcher in the learning of mathematical language.

3.4 Research Instruments

There are two instruments of this research, documents and interviews. Documents in this study consist of a short assessment consist of six mathematics questions to identify students' difficulties in the language of mathematics. An interview was conducted to investigate and obtain further information from the participants.

3.4.1 Pilot Test

Pilot test is conducted at one of the secondary school in Sarawak, where six form two students are involved in accomplishing the test and interview sessions. The purpose of conducting the pilot test is to test the validity of the instruments.

3.5. Data Collection Techniques

In this study, the researcher use qualitative data collection methods which are documents of students' work and interview. In the next sub- section, the application of these methods will be described.

3.5.1 Document

The researcher will conduct a short assessment for the students which include six questions of mathematics, examining their understanding and knowledge in the language of mathematics. 30 minutes of time has been allocated to finish the assessment. The assessment was designed based on the three major difficulties students' faced in learning the language of mathematics which are lexical ambiguity, solving words problems and long instruction. Each item in the assessment evaluate student's difficulties in the aspect of lexical ambiguity. Every words used in the assessment contain two types of mathematics words. There are mathematics words that exist only in mathematics and mathematics words that exist in both mathematics and everyday language. The sample of the test is shown in Appendix B.

The students' answer sheets had been used by the researcher to analyze and make interpretation of their difficulties in answering the mathematical questions. The assessment is conducted before interview session. The reason is to allow the researcher to identify the students' difficulties in learning the language of mathematics, gaining information on each participant and then, utilizing the information to communicate with them during interview. This information is valuable while conducting the interview in which it facilitates interview process since the researcher already has background knowledge of the participants.

Six items in the short assessment was adapted from several research related with the language of mathematics. Item 1 and 2 were adapted from Noraini Idris(2003). Some of the words have been modified according to the respondents' level which is early stage of form two. Item 3 and 4 were adapted from Allan(2005), while, item 5 and 6 were adapted from Cheah(2003). The following table show the rational of each designed item in the assessment.

Table 3.5.1: Items in the short assessment which is reflective with the three major difficulties in learning the language of mathematics.

Item	Purpose
1	Assess students' knowledge on the mathematics words that exist in both everyday and mathematics language.
2	Assess students' knowledge on the mathematics words that exist only in mathematics language.
3	Assess students' understanding associated with direct instruction.
4	Assess students' understanding associated with long instruction.
5 and 6	Assess students' understanding in solving words problem.

3.5.2 Interviews

Interview allows the researcher to collect empirical data regarding the phenomenon being studied. The interview questions in this study were adapted from several research regarding difficulties in learning mathematics. The empirical materials are of importance and act as the key to be focused in the inquiry of question.

They are:

1. The students' views of learning mathematics and its language.
2. The problems or difficulties in understanding the language of mathematics.
3. The causes of the difficulties in understanding the language of mathematics.
4. How they overcome the problem to understand the language of mathematics.

In order to conduct the interview with the participants, firstly, the researcher made appointment with the participants. The researcher set a time and location of the interviews. The time and duration of the interview should not disrupt participants' class time and their daily routine. The reason is to make the interviewee feel at ease and allow them to provide richness and detail information.

In this research, semi-structured interview is selected as the method of conducting interviews with the participants. A semi-structured interview consists of open ended questions which enable the participants to elaborate and clarify their explanations. In addition, the researcher had established interview schedule which contain a list of questions that will be asked to the participants. The content of the questions are related to the research questions of the study. Before beginning the interview sessions, the participants will be reminded about the topic of the interview. Therefore, the participants will have the readiness during the interviews. This will allow the participants to provide detail information.

The type of questions that will be used in the interviews is open-ended questions. This type of questions will allow the interviewees to respond on how they wish and to what length they wish to elaborate on the issues being asked. Wimmer and Dominick (1997) stated that open-ended interview questions are useful since the researcher is desired to obtain breadth and depth of responds (cited in Oatey, 1999). There are many advantages of using open-ended interview questions such as making the interviewees at ease, provides richness of details and provides more interest for

the interviewees. Since this type of question could put the interviewee at ease, it will allow more spontaneity and reveals avenues of further questioning that may have gone untapped. Besides, open-ended interview questions allow the researcher to pick up on the interviewees' vocabulary and makes phrasing easier for the researcher.

Before concluding the interviews, the researcher will always ask if there are anything else the interviewee would like to add. Then, the researcher can summarize and provide feedback on the researcher's own impression on the interviews. The information and data collected from the interview will be transcribed as soon as possible. The sample of the interview questions is shown in Appendix C.

Table 3.5.2: Items in the semi-structured interview which is reflective on the Research Questions.

Research Questions	Items
What kinds of difficulties do the students face while learning mathematics in the classroom?	3, 5
What are the causes of the difficulties in learning the language of mathematics among secondary school students?	1, 2, 4, 7, 8
In what ways do students overcome the problems of the language of mathematics in their learning?	6, 7, 9, 10, 11

3.6 Data Analysis Technique

In this study, the data had been analyzed by using qualitative research approach. Document of students' answer sheets were used to identify the students' difficulties and their level of knowledge in understanding the language of mathematics. Then, the information had been utilized to communicate with them during the interview.

3.6.1 Documents

The investigation begins with conducting a short assessment to evaluate the participants' knowledge and difficulties in understanding mathematical language. Document of students' answers are evaluated and analysed to obtain their information on the difficulties in the language of mathematics.

Each item in the assessment had been analysed using Otterbum and Nicholson's Classification (cited in Noraini Idris, 2003). There are three codes in analyzing the answer which are correct, blank and confused. Each item will be analysed by counting the percentage of each correct, confused and blank codes. Finally, these data will be tabulated. Table 3.6.1 showed the description of the codes.

In addition, the causes of difficulty in understanding the language of mathematics could be analysed from the results of the assessment. These information are valuable in conducting interview session.

Table 3.6.1: Otterbum and Nicholson's Classification

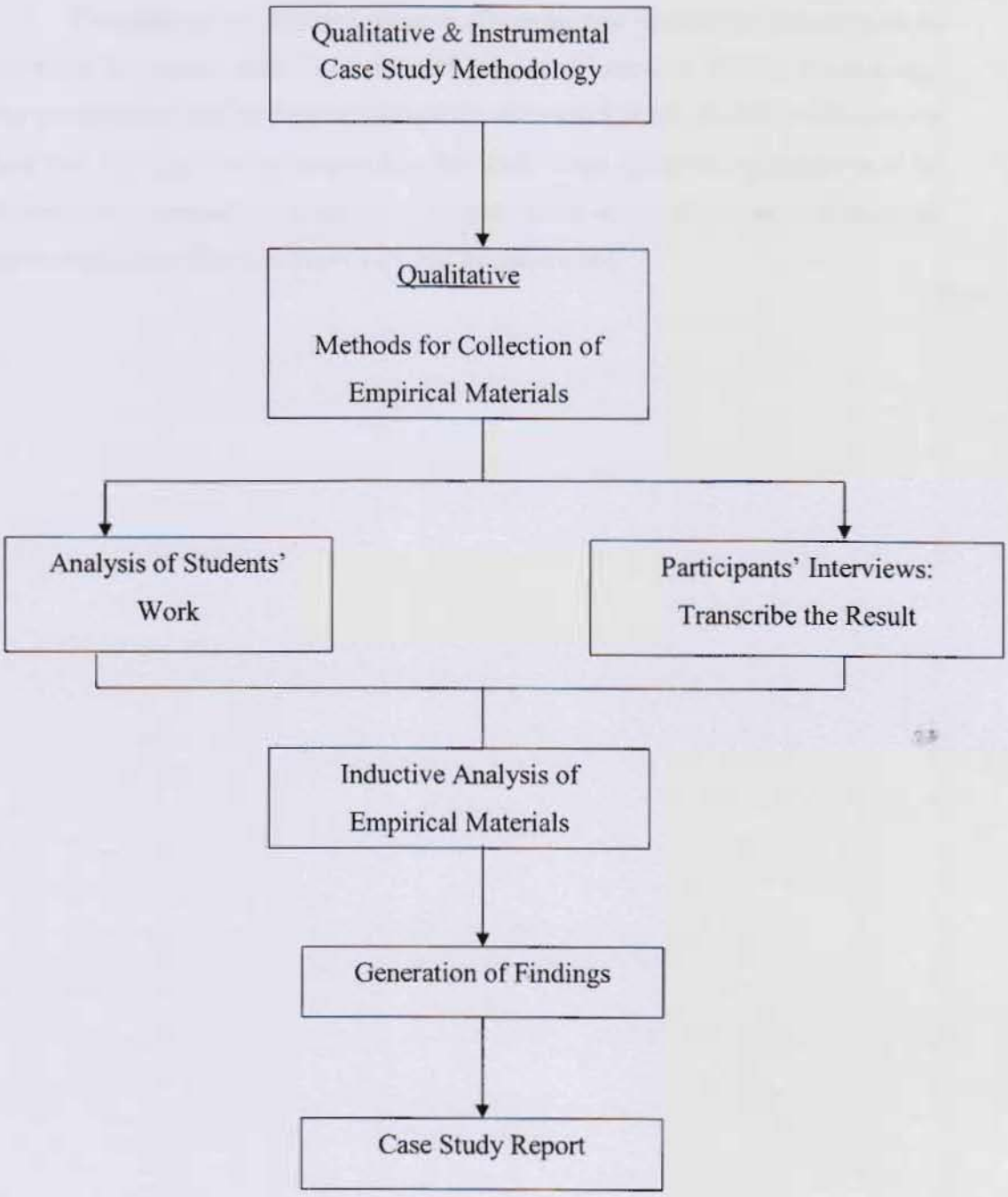
Classification	Description
Correct (/)	Demonstrates clear knowledge of what the words mean
Confused (X)	Has a generally muddle comprehension
Blank ( )	The student does not give any indication that he/she knows the word

3.6.2 Interview

The interviews was conducted to obtain the participants' information including difficulties in learning the language of mathematics, ideas and opinion regarding the techniques to overcome their difficulties in learning mathematics. Data analysis for the interview was implemented through four steps. Firstly, the data obtained from the interviews is transcribed to allow the researcher to analyze and interpret meaning from the information.

Second, determining and describing major themes which are the main variables. The researcher established categories of the data according to the types of difficulties, the causes and the techniques to overcome the difficulties in learning mathematical language. The third step is making a constant comparison by examining similar patterns of response. Then, assessing the pattern in relation to the literature reviewed earlier. Lastly, the researcher would assess the pattern of relationship between variables to obtain the answer of research questions, research objectives and research problems.

Figure 3.6: Flowchart of the study



3.7 Summary

This study is a qualitative research. There are two approaches that are used in the study, documents analysis of students' work and interview. This is a case study. The investigation will be held in a secondary school in Kuching district. There are six form two students who participated in this study. Data collection technique is to be implemented cautiously in order to get accurate result and to avoid biases. Finally, all the data collected from the interviews will be transcribed.

CHAPTER 4

FINDING AND DISCUSSION

4.0 Introduction

This chapter presents and discusses the findings which are based on responses collected through short test and interview. The analysis and discussion of the findings are also based on the three research objectives as follows:

a) To assess the difficulties faced by the students in using the language of mathematics.
b) To inquire about the causes of the difficulties among students in learning the language of mathematics in secondary school.
c) To seek the ways for students to overcome the problem of the mathematical language in their learning.

4.1 Analysis of Findings

4.1.1 Findings from Short Assessment

A short assessment consist of six questions were conducted to assess the students' difficulties in using the language of mathematics. The assessment had been categorized into three parts which would assess students' difficulties in understanding long instruction, solving words problems and students' knowledge in vocabulary of mathematics.

In assessing students' understanding in the language of mathematics associated with mathematical words, the researcher adapted Otterbum and Nicholson(1979) classification of students responses (cited in Noraini Idris, 2003). The Otterbum and Nicholson's Classification is shown in the following table.

Table 4.1.1: Otterbum and Nicholson's Classification

Classification	Description
Correct(/)	Demonstrates clear knowledge of what the words mean
Confused(X)	Has a generally muddle comprehension
Blank( )	The student does not give any indication the he/she knows the word

4.1.1.1 Item 1 and 2: Mathematics Words

Cheah (2003, cited in Durkin and Shire, 1991) expect that the students are likely to encounter the lexical word ambiguities in the language of mathematics. These are some examples of ambiguous words extracted from the test conducted in the study. Mathematics symbols can be described by different words in different contexts. For example, '=' can denotes as equals, means, makes, leaves, the same as, gives, and results. Therefore, items 1 and 2 were established to assess the students' knowledge and understanding of mathematical words. The analysis of the respondents' performance had been visualized in the following table. Table 4.1.1.1(a) presents the percentage of students' understanding of mathematical words that exist in both everyday and mathematics language.

Table 4.1.1.1(a): Percentage of Students' Understanding of Mathematical Words

List of words	Description/ Definition		
	Correct (%)	Confused (%)	Blank (%)
Difference	66.67	0	33.33
Equal	100	0	0
Multiply	83.33	16.67	0
Product	16.67	50	33.33
Sum	66.67	0	33.33
Addition	100	0	0
More	16.67	66.67	16.67
Less	16.67	66.67	16.67

Based on the table 4.1.1.1(a), the students have mastery of basic knowledge in mathematics whereas 100% of respondents answer correctly for the word 'equal' and 'addition'. Following with the word 'multiply', 83.33% of respondents provide

answer correctly. About 66.67% of respondents answer correctly for the words 'different' and 'sum'. While, 33.33% of respondent leaves the space blank because they did not know the definition of the words mathematically.

The words 'product', 'more' and 'less' provides low percentage of correct answer which is 16.67%. 50% of the respondent were mistaken with the definition of 'product' by giving the symbol for the words 'equal'. While, equal percentage of respondents (66.67%) are confused by the definition of the words 'less' and 'more'. Only 16.67% of respondents leave the space blank which gives the indication that they did not know the words. The following figures showed the solution provided by the respondents.

More	>
Less	<

Figure 4.1.1.1(i): Correct Answer

More	<	Less	>

Figure 4.1.1.1(ii): Incorrect Answer

The answer written in Figure 4.1.1.1(ii) is taken from R2. She appeared to be confused by the definition of "more" and "less" by giving contradicting answers. It indicates that she has general muddles comprehension of the words.

More	+	Less	-

Figure 4.1.1.1(iii): Incorrect Answer

While, Figure 4.1.1.1(iii) showed the answer given by R3. He gave the symbol for "addition" and "subtraction" instead of the correct symbol for "more" and "less". It indicates that he did not know the correct symbol for the words instead he provided the symbols based on his knowledge of everyday language.

The following table showed the students' answer that corresponds with Item 2 which contain mathematical words that exist only in mathematics language.

Table 4.1.1.1(b): Percentage of Students' Understanding of Mathematical Words

List of words	Description/ Definition		
	Correct (%)	Confused (%)	Blank (%)
Equilateral triangle	33.33	50	16.67
Right angle triangle	50	33.33	16.67
Pie chart	83.33	0	16.67
Square number	50	33.33	16.67
Square root	50	33.33	16.67
Cubic root	16.67	33.33	50

Item 2 assess students' knowledge of the words that exist only in mathematics language. For this part, the word 'pie chart' has the highest percentage of correct answer which is 83.33%. It indicates that 'pie chart' is well known than the other five words. This followed with 50% of respondent score correctly for the words 'right angle triangle', 'square number' and 'square root'. For these mathematics terms, 33.33% of respondents were confused and have generally muddles comprehension of the words. 'Cubic root' presents the lowest percentage of correct answers which is

16.67%. 33.33% of respondents were mistaken by the definition between cubic root and square root. While, 50% of respondents give the indication that they did not know the word. Overall, the students involved in this study have moderate knowledge of words that exist only in the mathematics language.

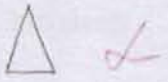
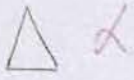
List of Words	Mathematics Symbols/ Diagram	List of Words	Mathematics Symbols/ Diagram
Equilateral triangle		Right angle triangle	

Figure 4.1.1.1(iv): Incorrect Answer

The solution shown in Figure 4.1.1.1(i) is taken from R3 answer's sheet. R3 provided the same diagrams for each "equilateral triangle" and "right angle triangle" which is incorrect. It indicates that he only answer the question based on his basic knowledge of triangle. The following figure show the correct diagram for "equilateral triangle" and "right angle triangle".

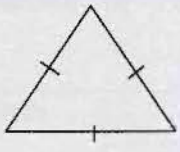
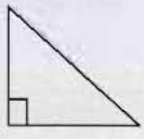
Equilateral triangle		Right angle triangle	

Figure 4.1.1.1(v): Correct Answer

4.1.1.2 Item 3 and 4: Long Instruction

In this test, the respondents also were assessed with the questions involving direct instruction and long instruction. Item 3 represents direct instruction while item 4 represents long instruction. Item 4 required students to identify and understand the key word of the instruction. If the students have no basic knowledge on the mathematical language instruction, then, they will have difficulty in accomplishing the question. These items were taken from topic of fraction, which is a new mathematic element for Form 2 students.

A research done by Jarmila and Marie (1999) stated that the students faced difficulties when they encounter long instructions for a new mathematical element. Therefore, these items were established as intended to observe the performance of students using direct and long instruction in Mathematics. Based on the test conducted, students seem to get more correct answer while answering the items with direct instruction. The following table shows the comparison of respondents' result between items with direct and long instruction.

Table 4.1.1.2: Comparison of Percentage for Direct Instruction and Long Instruction

Types of Instruction	Item	Description/Definition		
		Correct (%)	Confused (%)	Blank (%)
Direct Instruction	Item 3	100	0	0
Long Instruction	Item 4	33.33	50	16.67

As expected, all of the respondents (100%) could answer correctly for item 3 which involve direct instruction. Meanwhile, only 33.33% of respondents are able to provide correct answer for item 4 which are long instruction. About 50% of respondent were not able to provide the intended solution and only 16.67% of

respondent leaves the space blank. This clearly proves that, long instruction poses difficulty for students in answering mathematics questions.

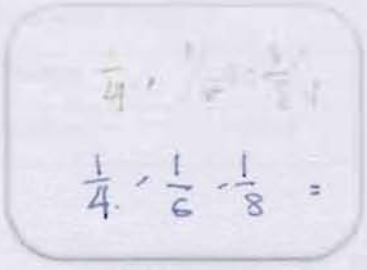


Figure 4.1.1.2(i): Incorrect Answer

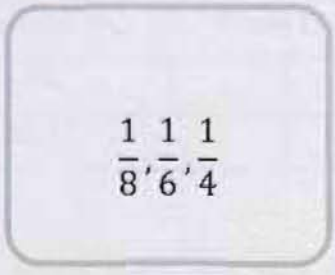


Figure 4.1.1.2(ii): Correct Answer

Figure 4.1.1.2(i) show the solution given by R4 for item 4 which ask to arrange the given fraction in order from smaller to larger. The solution given by R4 contradict from the actual answer which is from larger to smaller. It indicates that the respondent have general muddles comprehension of fractions.

4.1.1.3 Item 5 and 6: Solving Words Problem

Mathematics question often develop in variety ways. In this test, item 5 and 6 were presented in two semantic forms which are change and combine problems. These items are adapted from Cheah (2003), which would assess students' ability in solving mathematical words problem. Although the questions appear differently, it can be solved by using the same arithmetic operation. The following table represents the percentage of respondents' results in answering items 5 and 6 which involved change and combine semantics forms of questions.

Table 4.1.1.3: Percentage of Students Understanding Solving Words Problems

Types of Semantic forms	Items	Description/Definition		
		Correct (%)	Confused (%)	Blank (%)
Change	Item 5	50	50	0
Combine	Item 6	33.33	66.67	0

Analysis based on the respondents' answer sheets show that they have attempted a variety of ways how to solve the words problem. This category provides high challenge for students to think creatively in understanding the questions. Only 33.33% and 50% of respondents are able to solve the words problems correspondingly for items 5 and 6. While, 66.67% and 50% of respondents indicate that they are confused and have generally muddles comprehension of the items. This result have shown that majority of the students have great difficulty in dealing with solving words problems.

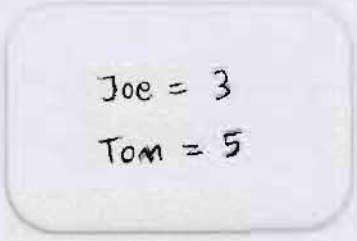


Figure 4.1.1.3(i): Incorrect answer

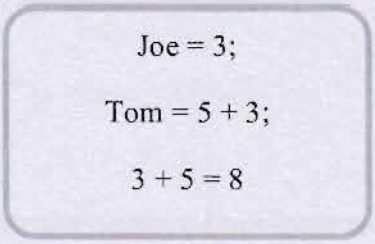


Figure 4.1.1.3(ii): Correct answer

The solution shown in Figure 4.1.1.3(i) is taken from R4 answer sheet for item 6. The figure indicate that the respondent had been able to read all the words in the question, but did not grasp the overall meaning of the words. This situation prevented him from proceeding to identify the operation, worked out the operation and express the solution of the problem.

4.1.2 Findings from Interview

Interview is a follow up of test session, where the researcher conducted the interview responding to the respondents' performance on their test. A total of six form two students took part in the interview sessions. They were referred as R1, R2, R3, R4, R5 and R6 for the purpose of anonymity.

4.1.2.1 Students' Interest in Learning the Language of Mathematics

Majority of the respondents stated that they are interested in learning mathematics and the language of mathematics. The excerpts below asserted that the respondents have positive attitudes towards the language of mathematics.

> *"Yes. It's fun because we can use it in our everyday lives..we can apply math in our everyday lives like in 'jubin'. Besides that..we can understand the meaning of the symbol."*
>
> (R1)

> *"Yes...because mathematics is an interesting subject. I can learn many symbol and shape in mathematics..it's very interesting language to learn."*
>
> (R2)

"It's interesting. I like learning mathematical language..because we can play with it..like 'sudoku' game. Besides..we can draw shape..such as pie chart, square, triangle."

(R4)

However, there are two respondents (33.33%) that are not interested in learning the language of mathematics. This is clearly reflected from the statement given by the respondents as shown in the excerpts below.

"Little..if I know the way to solve the questions, I like it (mathematical language)..I did not best in math..just moderate..interested actually,..but depends on the topic and questions."

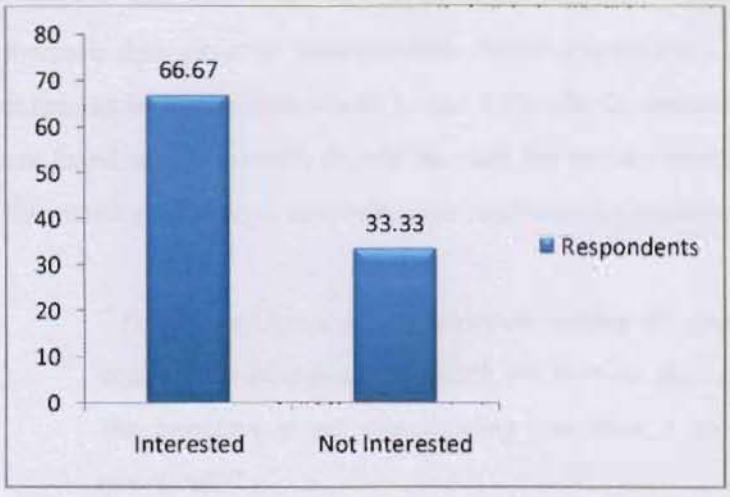
(R3)

"I did not like mathematics..because there are so many mathematical terms that I got confused."

(R6)

These proved that the respondents felt positive and enjoy learning mathematics and its language. The conclusion of this finding is shown in Figure 4.1.2.1.

Figure 4.1.2.1: Respondents' interest towards learning the language of mathematics.



	Interested	Not Interested
No. of respondents (n = 6)	4	2
Percentage (%)	66.67	33.33

4.1.2.2 Research Question 1: What kind of difficulties do the students face while learning the language of mathematics in the classroom?

All of the respondents claimed that they had experienced difficulties in understanding the language of mathematics. The excerpts below show the difficulties faced by the students in the mathematics classroom.

> *"Sometime..there are certain mathematics terms that are hard to be understood. For example,..acute angle, isosceles triangle, rhombus, congruent..and there are also many formula to remember..it made me confused."*
>
> (R2)

It appears that R2 have difficulty with some mathematical terms which are complex and exist only in mathematics language. She is also confused by many formula that exist in mathematics. Other respondents also agreed that too many formulas in mathematics lead to the difficulty in answering the questions. They are confused which formula should be used for certain questions. Due to this confusion, they need guidance in answering the mathematics question as stated by R3.

> *"Yes. I don't know how to start answering the question..except if there is someone else lead me..teach me how to start and the way to solve the question..if no one leading me..then I can't move (solve the question)."*
>
> (R3)

Based on the above excerpt, R3 exclaimed that he does not know how to start solving the questions. Therefore, he needs someone to direct him to solve the questions. R3 has difficulty in reading text in his own learning. This difficulty also are admitted by R4, R5 and R6. Other than that, R4 had stated her difficulty as the following excerpt.

> *"Often. It's difficult to learn the language of mathematics.. For example..in calculation.. the questions that involve multiply and division in bracket..I don't know which one should be calculate first.. Other than that, I'm trouble in choosing the right way to solving words problem..because..sometime, there are many ways to solve it."*
>
> (R4)

It cannot be denied that there are a variety ways in solving mathematics questions. This had provided great impact for R4 where she becomes confused on the steps of solving the questions. The other respondents such as R3, R5 and R6 also responded that the language used in Mathematics whereas English had provided great difficulty for them who have weak English. The following excerpt shows the respond of R6 associated with this problem.

> *"Yes. since, we learn mathematics in English. For me, who have very weak level in English..it's hard for me to learn and understand mathematics. I'm not good in solving question that have long instruction..but, i can do if the question is short and simple."*
>
> *(R6)*

All of the respondents have experienced difficulties in learning the language of mathematics as shown as above excerpts. The conclusion of this finding is summarized in the following table.

Table 4.1.2.2: Difficulties in Understanding the Language of Mathematics

Respondents	Difficulties
R1	difficulty with vocabulary of math
	too many formula to remember
	not knowing when irrelevant information is included
R2	some of mathematics terms are complex
	too many formula to remember
R3	have difficulty reading texts to direct their own learning
	confused by language in words problem
	not know when information is given out of sequence
R4	too many ways in solving a questions that lead confusing
	have difficulty in understanding directions
R5	too many complex mathematical words to remember
	lack vocabulary of math
	weak English
R6	have difficulties in understanding the instructions
	weak English

4.1.2.3 Research Question 2: What are the causes of the difficulties in learning the language of mathematics among secondary school students?

As a follow up to the second question, the respondents were asked about the possible causes of difficulties they faced in learning the language of mathematics. The following excerpts show their responds regarding the causes of the difficulties.

> *"Because it has many formulas. For example, angle..we need to remember various formula to get certain angle for different shapes.. besides, the mathematical terms often complex..it is hard to be remember and understood."*
>
> (R1)

Based on the respond by R1, mathematics term appeared as the causes of difficulties in learning the language of mathematics. Besides R1, the other respondents also claimed that mathematical term itself are the major causes of difficulties in mathematics. R3 also claimed that the instruction or question in mathematics is the cause of difficulties. He does not know the direction and the main idea of the question. The following excerpt show the response by R3 regarding the causes of his difficulties.

> *"I think the cause is the mathematics instruction because..there are long instruction which is hard to be understood..moreover, it often involved complex mathematical words that made me confused."*
>
> (R3)

Other respondents such as R4, R5 and R6 also felt the same as R3 regarding difficulties of long mathematics instruction. In addition, the instructions were written in English, which is the second language for most of the respondents. They are having difficulties in communicating mathematics in English. R6 had stated his response as the following excerpts.

> *"I think English language used in mathematics is the causes of poor achievement in my mathematics..since I have difficult in understanding English. It's hard for me to learn mathematics. Especially, when it comes to solving words problems."*
>
> (R6)

Based on the interview conducted about the causes in learning the language of mathematics, the respondents have given a variety of answers. However, most of the respondents felt the same causes of their problem. The conclusion of this finding has been summarized in the following table.

Table 4.1.2.3: Causes of the Difficulties in Learning the Language of Mathematics

Respondents	Causes
R1	complex mathematical terms
	language used in mathematics is complicated
R2	too many steps in solving mathematics question
	never had asked the teacher about mathematics problem
	complex mathematical terms
R3	lack interest in mathematics
	lack doing exercises and revision
	complex and long instruction in mathematics
R4	too many formula
	teacher teach too fast
R5	lack of vocabulary in mathematics
	teacher talk and teach in English
	too many formula
R6	are not interested in Mathematics
	did not have enough revision before exam
	teacher use complicated words in talking
	low English language proficiency

4.1.2.4 Research Question 3: In what ways do students overcome the problems of the language of mathematics in their learning?

Lastly, the respondents were asked about the actions they have taken in overcoming their difficulties in learning the language of mathematics. The respondents have taken various ways to overcome the difficulties they had faced. The excerpts below show their efforts in learning the language of mathematics in the best way.

> *"I will ask my teacher or do more exercises..approach the teacher during class or recess time..asking him about the math problems and..guided to understand the concept..as well as solve the exercises. Sometimes it's successful and sometimes don't..I don't fully understand what the teacher explained..If I do the revision myself..sometimes I didn't really understand what I'm reading."*
>
> (R1)

> *"I have a group discussion with my friends..3 person in a group. It's comfortable study that way. I can ask my friends about my problems regarding math..and we can share our knowledge. Other than that, we have specified questions for everyone..and everyone need to solve it..then, teach the others on how to solve that question (as presentation)."*
>
> (R5)

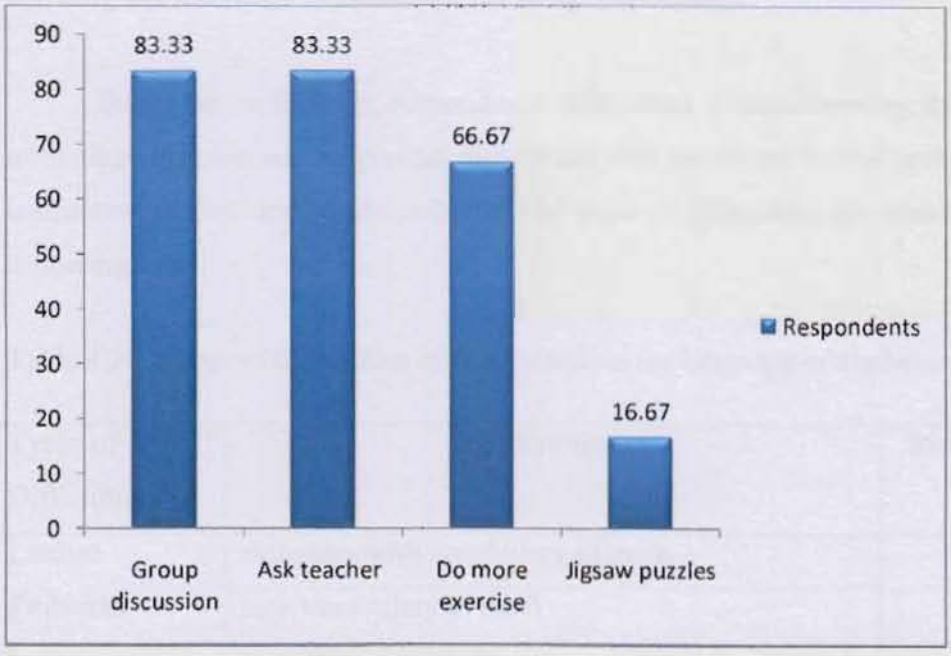
Based on the above excerpts, R1 has stated his variety of ways in overcoming his difficulties such as asking the teacher and doing more exercises. However, these strategies were barely successful. While, R5 claimed that group discussion is the best

way in overcoming difficulties in mathematics. It is because they can share knowledge among group members. The other respondents such as R3, R4 and R6 also prefer group discussion as their ways in overcoming their difficulties. Other strategy suggest by R4 is by playing mathematics game by which one can enrich their knowledge in mathematics words. The following excerpt show the respond by R4 regarding her strategy in overcoming difficulty in learning the language of mathematics.

> *"Playing game.. such as mathematics puzzles. By using playing this game often, I can remember more mathematical terms especially the complex one."*
>
> (R4)

Based on the interview, only one respondent used the method of playing game to improve their knowledge in learning the language of mathematics. The conclusion of this finding is shown in Figure 4.1.2.4.

Figure 4.1.2.4: Respondents Suggestions Strategies in Overcome the Difficulties



	Strategies	Respondents (%)
1	Group discussion	83.33
2	Ask teacher	83.33
3	Do more exercise	66.67
4	Jigsaw puzzles	16.67

4.2 Discussion of the Findings

The results from finding show that majority of the students involves in this study are interested in learning the language of mathematics. It proved that they have positive attitude and are motivated towards mathematics. Students attitude towards the language of mathematics are recognized as determining success in learning Mathematics (Aziz, 2006).

4.2.1 Research Question 1: What kinds of difficulties do the students face while learning the language of mathematics in the classroom?

Based on the findings, respondents' difficulties in understanding the language of mathematics can be categorized into three types which are lexical problems, long instruction and solving words problem. The types of difficulties are presented as the following table.

Table 4.2.1 Types of difficulties in understanding the language of mathematics

Types of Difficulties	Descriptions	Respondents (%)
Lexical Problems	difficulty with vocabulary of math	100
	lack vocabulary of math	33.33
Long Instructions	have difficulty reading texts to direct their own learning	50
	have difficulty communicating about math	66.67
Solving Words Problems	confused by language in words problem	83.33
	have difficulty understanding directions	66.67
	not know when irrelevant information is included	83.33

Based on the Table 4.2.1, all of the students have lexical problems, where they have difficulties with vocabulary of mathematics. Findings from the test show that the respondents are unable to provide correct mathematics symbol or diagram for complex mathematics terms such as 'equilateral triangle', 'right angle triangle', 'square number', 'square root' and 'cubic root'. However, they have master basic mathematics words such as 'addition', 'equal', 'difference', 'sum' and 'multiply'.

The second type of difficulty is long instruction, which included difficulty in reading texts in their own learning and difficult in communicating knowledge in mathematics. About 50% of respondents have difficulty in reading texts in their own and 66.67% have difficulty in communicating mathematics. This correspond with item 3 and 4 in the test, where involved direct and long instruction. As expected, the students are able to provide correct answer for the item with direct instruction. In the interview that had been conducted, three respondents stated that he cannot start answer the questions if there is no one leading him. Therefore, he needs someone who can guide him such as teacher and friends. However, another difficulty emerged when the students unable to communicate their mathematics problem. As stated by Viliami (2004), the students have difficulties on the task of reading a mathematics textbook, communicating mathematics idea and solving a word problem.

Another great difficulties that frequently faced by the students is solving words problem. Based on the test conducted, only half of the respondents are able to provide correct solutions for the items involving solving words problem. They appeared to be confused by the language in the words problem, difficult in understanding the direction of the question and not knowing when relevant information is included. They ended by giving variety ways of solution.

As a conclusion, most of the respondents experienced the same difficulties in learning the language of mathematics. Difficulties in vocabulary of mathematics appeared as the major difficulties among the respondents.

4.2.2 Research Question 2: What are the causes of the difficulties in learning the language of mathematics among secondary school students?

This study also seeks for the causes of difficulties in learning the language of mathematics among secondary school students. Based on the analysis of findings, the causes of difficulties in understanding the language of mathematics can be categorized into three types which are student related, teacher related and mathematics itself. These are shown in the following table.

Table 4.2.2 Causes of Difficulties in Learning the Language of Mathematics

Types of Causes	Descriptions	Respondents (%)
Student Related	Are not interested in Mathematics	33.33
	Low English proficiency	50
	Inappropriate learning habits	50
Teacher Related	Teacher used too high level language to talk	50
	Students' learning styles did not match teachers' teaching styles	33.33
Mathematics Itself	Too many formula	100
	Complex mathematical terms	100

Based on the table above, mathematics itself is considered as the major causes by the respondents. Analysis of findings on interview revealed that most of the respondents felt the words in mathematics itself cause the difficulties in understanding the language of mathematics. They stated that too many formula and steps in solving mathematics questions lead to confusing in mathematics. Besides, there are many complex mathematical terms. This fact creates difficulties for students in understanding and remembering the words. A research done by Noraishiyah

Abdullah (2006) stated that mistakes in mathematics may be caused by the difficulty of mathematics itself.

Another type of causes of difficulties associated with the language of mathematics is student related. Dante et al(2006) suggested that student related consisted of mental ability, habits, interest and attitudes towards mathematics, learning style, self regulatory skills and reading comprehension skills. Based on the findings, 33.33% of respondents did not interested in mathematics, 66.67% of respondents have low English proficiency and another 66.67% of respondents have inappropriate learning habits. One respondent stated that she very rarely asked teacher about mathematics problem. While, two respondents admit that they did not have do enough exercise and revision in mathematics before exam. These are inappropriate behavior in learning mathematics.

Finally, the cause of difficulties in understanding the language of mathematics is teacher related. 33.33% of responded stated that teacher's teaching style did not match their learning style, while 50% of respondents said that teacher used too high level of language in teaching. Based on the respondents answer during the interview sessions, they stated that teacher talk and teach too fast that the students cannot catch the lesson. Other than that, the teacher used high level language or too complex words in teaching. These are the great difficulty for students who have weak English proficiency in which they can not grab the meaning of what being communicate. This had been mention in the literature review, where Jarmila and Marie (1999) argued that teacher should use language that is appropriate with students' age and level of learner. If the level of language used gets ahead of students' level of thought too much, the communication become meaningless. Therefore, it leads to the difficulties in understanding the language of mathematics.

As a conclusion, six students who participated in this study strongly agree that mathematics itself is the major cause of difficulties in understanding the language of mathematics.

4.2.3 Research Question 3: In what ways do students overcome the problems of the language of mathematics in their learning?

Data obtained from six respondents during the test and interview show that all of the students from different class level are facing difficulties in learning the language of Mathematics. Due to this difficulties, they have attempted several strategy in overcoming the problems of the language of mathematics in their learning.

Based on figure 4.2.4, four strategies had been suggested in overcoming the difficulties. There are group discussion, ask teacher, do more exercises and playing mathematics puzzles. Group discussion and asking teacher for the mathematics problems are considered as the most preferred strategies by 83.33% of respondents. Followed by 66.67% of respondents had do more exercises as the strategies to improve their understanding in the language of mathematics.

While only 16.67% of respondent used jigsaw puzzles as the strategies to surpass their difficulties. The percentage of respondent using jigsaw puzzles is low because lack of resources. Kasule and Mapolelo (2005) argued that by using jigsaw puzzles, students can enrich their knowledge in the language of mathematics. It is suggested that school could provide the game because it seem to be a good strategy in enriching knowledge of mathematical terms.

83.33% of respondents who conducted group discussion stated that this is the best strategies in dealing with difficulty in understanding the language of mathematics. They said it allow sharing knowledge among group member. Besides, a respondent admitted that she is more preferred learning in a group because they can help each other if a member have problem. Yushau and Bokhari (2005) also had stated discussion as the strategies in minimizing the difficulties. However, this strategy is implemented in different ways, in which the setting is in the classroom involving students and teacher.

The other strategy that shared the same percentage is asking mathematics teacher. In the interview sessions, this is the first answer that come from most of the respondents. They said that they will directly ask thier teacher when they have difficulty in understanding mathematics. There are also respondents who prefer the teacher to teach her alone because afraid of being laugh by friends. In summary, all of the respondents had made their efforts in overcome their difficulties.

4.3 Summary

In conclusion, this chapter has covered the analysis of the findings and discussions with regards to the difficulties in learning the language of mathematics. It is shown from the findings that all of respondents experienced difficulties in dealing with the language of mathematics. This chapter also revealed the causes of the difficulties that had been obtained from the test and interview. Finally, the suggested strategies also had been collected to overcome the difficulty in the language of mathematics.

CHAPTER 5

SUMMARY, SUGGESTION AND RECOMMENDATION

5.0 Introduction

This chapter provides a summary of the study, conclusion derived from the findings in Chapter 4, suggestion for students in overcoming the difficulties in learning the language of mathematics and recommendation for further research on the same field.

5.1 Summary of the Study

This study was carried out to investigate the difficulties faced by secondary school students in understanding the language of mathematics. At the same time, this study aims to find out the causes of the difficulties regarding the language of mathematics, and also to seek the possible strategies that could be used to overcome

the problem in mathematics classroom. The respondents of this study involved six form two students from a secondary school in Kuching district. A short mathematics assessment and interview sessions have been conducted as the approach in achieving the objectives of this study.

From the literature review, it was found that several study were conducted in the same field. The previous researches done in investigating the difficulty in learning mathematics found that mathematics itself is the source of difficulties. Noraishiyah Abdullah (2006) and Yushau and Bokhari (2005) stated that mathematics terms is often complex and ambiguous. The language of mathematics did not only challenge students but also the teacher who teaches mathematics. The teacher is also said as the source of difficulties in learning mathematics. This fact associates with teachers' attitude, teaching styles and behavior towards teaching mathematics.

Language of mathematics had been admitted as a crucial factor that influence students' achievement in mathematics. The findings of this research are significant for us, becoming the teacher to understand difficulties that have been faced by the students in mathematics classroom. In the future research, these findings will be useful in developing appropriate teaching techniques in mathematics suitable with students' learning styles.

5.2 Summary of the Findings

Based on the analysis of the findings, it was found that majority of the students are interested and motivated in learning the language of mathematics. While, only two respondents have less interest in mathematics. There are two instruments in this study which are short assessment and interview. A short assessment had been conducted to identify respondents' difficulties in understanding mathematical

language as well as the causes of the difficulties. While, interview had been conducted to gather information about students' difficulties in learning the language of mathematics, the causes of the difficulties and the actions they took in order to overcome the difficulties faced.

Analysis from the test and interview show that the students have difficulties with vocabulary of mathematics. All of the respondents admitted that they have difficulties in understanding and remembering the complex mathematics words such as acute angle, equilateral triangle and fraction. This difficulty become more considerable for student who are weak in English. Additionally, too many formulas in mathematics often lead to confusing when sitting for mathematics exam or doing exercise.

The cause of these difficulties is said to be mathematics itself. Majority of the respondents agreed that the words in mathematics are complex and have too many formulas. Conscious of these problems, the students have taken variety strategies in overcoming their problems. The most popular strategies which are mostly used by the respondents are building group discussion and asking the teacher. These strategies have been said as the effective strategies by the respondents. The results of the findings have been summarized as the following table.

Table 5.2 Summary of the Findings

Types of difficulties in learning the language of mathematics - Lexical problem : difficulty with vocabulary of mathematics - Long Instruction : difficulty communicating about mathematics - Solving words problems : confused by language in word problem : not knowing when relevant information is included
Causes of difficulties in learning the language of mathematics - Mathematics itself : complex mathematics terms : too many formula - Student related : low English proficiency : inappropriate learning habits - Teacher related : teacher use too high level to talk
Ways to overcome difficulties in learning the language of mathematics - Group discussion - Ask expert : teacher - Do more exercise - Jigsaw puzzles

5.3 Suggestion for Students in Overcoming the Difficulties in Learning the Language of Mathematics

As stated in the research questions, this study also seeks to find the strategies to overcome difficulties of the language of mathematics in learning. Based on the analysis done for research findings, there are several strategies that are considered useful and proved effective by the respondents. The most common method is by asking mathematics teacher and group discussion. The other research done by Yushau and Bokhari (2005) also suggest discussion in the mathematics classroom. For this strategy, the students will convert numbers to develop a story problem. It requires students' active participation in working out the problem on the board.

Cheah (2003) had suggested the use of mathematics terminology references or dictionary. By having a mathematics dictionary, it will help students minimize difficulties in understanding the language of mathematics. Another strategy has been composed by Kasule and Mapolelo (2005) is using jigsaw puzzles. By implementing this strategy, the students will learn and enrich their knowledge in mathematics vocabulary. This activity allows the students to learn numerous words or phrases in mathematics. These suggested strategies are easy to be applied by the students without required large efforts.

5.4 Recommendations for Further Study

This study has briefly investigated the difficulties faced by secondary school students in learning the language of mathematics. It also has revealed the causes of the difficulties regarding learning the language of mathematics and strategies to overcome the problems. Further research may also study the factor that influence students' learning habits in the language of mathematics. Since, students' learning habits are found to be the causes for difficulties in understanding language of mathematics.

In addition, teachers are also said to be the causes of difficulty in learning the language of mathematics. Therefore, further research may investigate the effective teaching strategy in mathematics specific in the language of mathematics. The other findings from this study revealed that teacher's teaching styles did not fit students' learning style. Further research may also consider in developing appropriate teaching techniques in mathematics suitable with students' learning styles.

In further research, this study could be enhanced by increasing the time span of the investigation. The purpose is to seek the effectiveness of the suggested strategies in overcoming the difficulties in the language of mathematics. Another enhancement for this study is to conduct experiment as the methodology of the study. Since, the procedure of experiment is quite complex and require more time, therefore it cannot be done in this study.

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APPENDIX A

BAHAGIAN PERANCANGAN DAN PENYELIDIKAN DASAR PENDIDIKAN
KEMENTERIAN PELAJARAN MALAYSIA
ARAS 1-4, BLOK E-8
KOMPLEKS KERAJAAN PARCEL E
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
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Ruj. Kami : **KP(BPPDP)603/5/JLD.2(317)**
Tarikh : **06 Februari 2009**

Ummi Kalsum Bt Hakim
Kampung Sayong
98700 Limbang
Sarawak

Tuan/Puan,

Kelulusan Untuk Menjalankan Kajian Di Sekolah, Institut Perguruan, Jabatan Pelajaran Negeri Dan Bahagian-Bahagian Di Bawah Kementerian Pelajaran Malaysia

Adalah saya dengan hormatnya diarah memaklumkan bahawa permohonan tuan /puan untuk menjalankan kajian bertajuk :

" **Student's Difficulties With Respect To The Language Of Mathematics In The Mathematics Classroom** " diluluskan.

2. Kelulusan ini adalah berdasarkan kepada cadangan penyelidikan dan instrumen kajian yang tuan/puan kemukakan ke Bahagian ini. **Kebenaran bagi menggunakan sampel kajian perlu diperolehi dari Ketua Bahagian/Pengarah Pelajaran Negeri yang berkenaan.**

3. Sila tuan/puan kemukakan ke Bahagian ini senaskah laporan akhir kajian setelah selesai kelak. Tuan/Puan juga diingatkan supaya **mendapat kebenaran terlebih dahulu** daripada Bahagian ini sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak dibentangkan di mana-mana forum atau seminar atau diumumkan kepada media massa.

Sekian untuk makluman dan tindakan tuan/puan selanjut nya. Terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(DR. SOON SENG THAH)
Ketua Sektor Penyelidikan dan Penilaian
b.p. Pengarah
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pelajaran Malaysia

s.k

Pengarah
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APPENDIX B

Short Assessment

Penilaian Ringkas

Students' Difficulties with respect to the Language of Mathematics in the Mathematics Classroom

I am Ummi Kalsum binti Hakim, a final year student from B.Ed Mathematics Education program at Faculty of Cognitive Sciences and Human Development, UNIMAS. I am conducting a study on the students' difficulties with respect to the language of mathematics. The purpose of this set of assessment is to identify the difficulties in using the language of mathematics.

You are assured that all information gathered from this assessment would be kept strictly confidential. It is solely used for academic purpose.

Thank you for your help and cooperation.

Saya, Ummi Kalsum binti Hakim, ialah seorang pelajar tahun akhir dari program B.Ed Pendidikan Matematik, Fakulti Sains Kognitif dan Pembangunan Manusia, UNIMAS. Saya sedang menjalankan satu kajian tentang masalah-masalah pelajar yang berkaitan dengan bahasa Matematik. Tujuan penilaian ini adalah untuk mengenalpasti masalah dalam menggunakan bahasa Matematik.

Saya memberi jaminan bahawa segala maklumat yang diperolehi dari penilaian ini akan dirahsiakan. Ia hanya akan digunakan untuk tujuan akademik.

Terima kasih di atas bantuan dan kerjasama anda.

SHORT ASSESSMENT

Mathematics Test (30 minutes) **Ref. no:**

Instruction: Answer **ALL** questions.

1. Write a mathematics symbol represented by the following listed words.

List of Words	**Mathematics Symbols**
More	
Difference	
Equal	
Multiply	
Product	
Sum	
Addition	
Less	

2. Write a mathematics symbol/ diagram represented by the following listed words.

List of Words	**Mathematics Symbols/ Diagram**	**List of Words**	**Mathematics Symbols/ Diagram**
Equilateral triangle		Right angle triangle	
Square number		Pie chart	
Cubic root		Square root	

3. Determine the largest among the following fractions:

$$\frac{1}{3}, \frac{1}{4}, \frac{1}{6}, and \frac{1}{10}$$

4. Given three fractions: $1/4, 1/6, 1/8$. Write these fractions in order of size, from the smallest to largest.

5. Joe has three marbles, Tom gave him five more marbles. How many marbles does Joe have?

6. Joe has three marbles, Tom has five marbles more than Joe. How many marbles does Tom have?

Sources: (Kgomotso, 2007; Jim Loy, 1997; Allan, 2005; Cheah, 2001)

APPENDIX C

Interview Session

Sesi Temu Bual

Students' Difficulties with respect to the Language of Mathematics in the Mathematics Classroom

I am Ummi Kalsum binti Hakim, a final year student from B.Ed Mathematics Education program at Faculty of Cognitive Sciences and Human Development, UNIMAS. I am conducting a study on the difficulties with respect to the language of mathematics. The purpose of this interview session is to seek your difficulties in understanding the language of mathematics and strategies to overcome the difficulties.

You are assured that all information gathered from this session would be kept strictly confidential. It is solely used for academic purpose.

Thank you for your help and cooperation.

Saya, Ummi Kalsum binti Hakim, ialah seorang pelajar tahun akhir dari program Bacelor Pendidikan (Matematik) dengan Kepujian, Fakulti Sains Kognitif dan Pembangunan Manusia, UNIMAS. Saya sedang menjalankan satu kajian tentang masalah-masalah yang berkaitan dengan bahasa Matematik. Tujuan sesi temu bual ini adalah untuk mengetahui masalah anda dalam memahami Bahasa Matematik dan strategi untuk mengatasi masalah tersebut.

Saya memberi jaminan bahawa segala maklumat yang diperolehi dari sesi temu bual ini akan dirahsiakan. Ia hanya akan digunakan untuk tujuan akademik.

Terima kasih di atas bantuan dan kerjasama anda.

Interview Schedule Guide

1. Do you find learning Mathematics interesting? Why?
   Adakah anda merasakan bahawa mempelajari Matematik itu menyeronokkan?Kenapa?

2. Do you find learning the language of Mathematics interesting? Why?
   Adakah anda merasakan mempelajari bahasa Matematik/istilah matematik itu menyeronokkan?Kenapa?

3. Do you find it difficult to understand the language of mathematics? Why?
   Adakah anda menghadapi kesukaran dalam memahami bahasa Matematik/istilah matematik?Kenapa?

4. Does your mathematics teacher explain the mathematical term clearly in the class? How?
   Adakah guru Matematik anda memberikan penjelasan yang baik mengenai istilah Matematik?Bagaimana?

5. What are some of the difficulties you have faced while learning the language of mathematics in the mathematics classroom?
   Apakah cabaran yang anda hadapi ketika mempelajari bahasa/ istilah Matematik di dalam kelas?

6. What are the actions you take in overcoming the stated difficulties faced? Are they successful?
   Apakah tindakan yang anda lakukan untuk mengatasi masalah yang dihadapi?Adakah ia berkesan?

7. Do you often discuss with your teacher about your mathematical problems?
   Adakah anda selalu berbincang dengan guru anda mengenai masalah matematik anda?

8. Does your mathematics teacher answer your questions clearly? How?
   Adakah guru Matematik anda menjawab pertanyaan anda dengan jelas? Bagaimana?

9. In your opinion, what possible solutions are there in overcoming the difficulties faced?
   Pada pandangan anda, apakah cara penyelesaian yang boleh diambil untuk mengatasi masalah yang dihadapi?

10. In your opinion, have you successfully minimized your problems in the stated difficulties?
    Pada pandangan anda, adakah anda berjaya mengatasi masalah yang dihadapi?

11. In your opinion, what do you like your teacher to do to improve the teaching strategy in teaching the language of mathematics?
    Pada pandangan anda, apakah perubahan yang perlu guru anda lakukan untuk meningkatkan cara pengajaran bahasa Matematik di dalam kelas?