CHAPTER 1
INTRODUCTION

1.1 Background of the Study

1.1.1 Efforts to Upgrade the Standard of Mathematics

One subject which has always been a concern among educators, parents and students is Mathematics. During the launching of Tables Efficiency (*Bijak Sifir*) programme, the Prime Minister of Malaysia, Datuk Seri Dr. Mahathir Mohamad remarked that Mathematics being a compulsory subject, was also the basis for fields such as, accountancy, investment, trade and entrepreneurship (Utusan Malaysia, 1994, p.8). A total of 10,400 Standard Five pupils located in the most remote areas and urban peripheries will benefit from the programme.

Another attempt to enhance the Mathematical ability of the students is the revival of the abacus. According to Professor Ungku Aziz: “If you master the rules of calculation on abacus, it will develop both sides of your mind. It will develop your awareness about numbers and your ability to manipulate numbers in your mind. All these will have a beneficial effect on your thinking about arithmetic” (The Sun Magazine, 1994, p.13). The usage of abacus which cost the Education Ministry about RM1.5 million to implement was introduced as a supplementary tool in Mathematics for Standard Four pupils (The Star, 1994, p.4).

One other method to enhance the ability of Mathematical skills among students which had caught the attention of the former Education Minister Datuk Amar Dr. Sulaiman Daud was the five-finger Shi Fengshou Rapid Calculation (SRC) method. Dr. Sulaiman
said: "...This method would especially benefit our bumiputra children who find Mathematics difficult and a mystery" (The Star, 1994, p.8).

From the many programmes mentioned above, it appears that teachers and educators are always on the look out for alternative approaches to learning Mathematics. One such programme which was a component of the Project -'Alternative Education for Marginalized Children' funded under Intensified Research for Priority Areas (IRPA) was conducted to provide alternative instructions for a sample of marginalized Form One students (Chiam & Lee, 1997). Using the idea of the Immersion Programme, students were exposed to various approaches on topics like Time-tabling, Whole Numbers, Decimal Numbers, Fractions, and Negative Numbers. Students' Mathematics performance has improved at the end of the programme.

The Secondary School Mathematics (*Sijil Peperiksaan Malaysia, SPM*) pass rate had for years been discouragingly low (The New Sunday Times, 1996, p.13). Its deterioration is a concern to many parties (Chin, 1994: Toh 1995). Many strategies and programmes have been implemented. The latest being the Shock Tactics (*Gerak Gempur*) programme which was launched in April 1995. The strategy was an intensive programme to reteach the basics of Mathematics to weak students with an emphasis on a mastery of those skills. As a result of such efforts, the overall performance of Mathematics in 1995 SPM examination showed a significantly higher pass rate compared to the year before (The New Straits Times, 1996, p.1).
1.1.2 Shortage of Qualified Teachers in Malaysia

Malaysia faces a shortage of 14,000 teachers, of whom 9,300 are for national-type schools and 3,000 for Chinese schools (The Sun, 1996, p.6). This shortage is viewed seriously by the Education Ministry as this affects the teacher-student ratio.

To lure eligible applicants and to encourage experienced teachers to stay on in the teaching profession, the Ministry has come up with several new programmes. One of which is targetted at the Science and Mathematics teachers in primary schools who have served a minimum of three years (The Star, 1996, p.4).

The problem of unqualified Mathematics teachers in the country was noted by Nik Azis & Ng (1991). Nik Azis & Ng reported that lower secondary students have problems with certain Mathematical topics. According to the report, the teachers themselves have insufficient knowledge of the same topics.

A possible solution to the crisis of shortage of qualified teachers is the contribution of carefully sequenced self-instructional materials. These self-instructional materials have shown promise in the face of similar problems in other countries (Thomas, 1963). In the light of this situation, this study on the effectiveness of programmed instructional materials is relevant.

1.1.3 Rural Schools

Efforts have been put in to increase the competence of Mathematical skills among pupils from the rural and the urban peripheries. The Bijak Sifir programme is one such effort. Besides this, other projects like The Langkawi Project aims to eliminate any major
differences in the examination results between schools in urban and rural areas (The Star, 1994, p.6).

The Education Ministry planned to transfer some trained and experienced teachers from the urban schools to the rural schools in an attempt to improve the quality of education among students in the rural areas (The New Straits Times, 1994, p.9). Special incentive scheme for senior teachers who volunteer to work in rural areas was being worked out (The Star, 1994, p.4).

In line with the country’s efforts to increase the competence of Mathematical skills among pupils from the rural schools, this study is intended to gain some understanding in the effectiveness of programmed instructional material in the teaching of a topic of Mathematics in a rural school. Specifically, the Mathematical topic in this study will be the topic of Reflection to Form Two students.

1.1.4 Printed Texts: Prospects

Computer-based intelligent tutoring systems hold the promise of individualizing instruction on a scale not seen since the emergence of the printed book (Mueller, 1994). Therefore, is there a place for the usage of programmed instructional materials in the printed form today? Unlike the computer, the text in the printed form can be used almost anywhere. Below are some of the problems faced by computer users in schools.

State Industrial Development Minister Datuk Abang Haji Johari Tun Openg said it would be a waste of money to give computers to schools which did not use them (The Star, 1997, p.12). According to the article, some rural schools are keeping the computers donated by the government in store rooms because there is neither power supply nor
qualified teachers to conduct the computer lessons. Datuk Abang Johari, who oversees state educational matters, said there had also been reports that computers were damaged due to poor storage.

Chuah (1988) was of the opinion that millions of dollars spent for many massive projects, in computer-based instruction, for example, have thus far left little tangible impact on what actually goes on in institutions of higher learning. He was of the opinion that more efforts should be aimed at the development of supplementary remediation systems and enrichment systems. It is not to be denied that in terms of potential for learning assistance, the computer assisted instructional programmes are superior to programmed text. However, the programmed text does have several advantages too. Chuah (1988) was of the opinion that the most significant of these is its relative cheapness. Programmed texts can be carried around and used on a decentralised basis.

Frequent power interruptions in the country make it difficult for schools to depend solely on computers as a means of individualized instruction. The Energy, Telecommunications and Posts Minister Datuk Leo Moggie reported that there were 16,086 power interruptions nationwide between August 4 1996 and September 30 1996 (The Star, 1996, p.4). Datuk Leo said that these were mainly caused by tree branches falling on power lines (25.5 per cent), inferior equipment (20 per cent) and lightning (10.5 per cent). It was reported that hundreds of students and teachers had been depending on daylight for a week to begin classes at three new schools in Klang (The Star, 1997, p.4).

Local problems with power supply and shortage of teachers who are able to use and teach with the computer warrant the usage of the programmed text in the printed form. Elsewhere in the world, Wright (1993) is of the opinion that no matter how rosy the future
of electronic information may be, books as printed books permit greater stability and a preservation of textual authority. Bettex (1995) is also of the opinion that textbooks will survive despite competition from new technological inventions. Likewise, Mueller (1994) thinks that the electronic media will not supplant print technology.

Needless to say, the above are reasons enough that programmed instructional texts in the printed form still have a part to play in this computer age.

1.1.5 Helping students learn through Programmed Instructional Materials

The concerns as stated above suggest that computer-assisted-learning alone is not sufficient to solve our current problems. It is in situations like these that the programmed instructional materials have a positive contribution to make to our educational problems.

Different researchers have used different terms to mean *programmed instructional materials*. Naidu (1993) refers to *programmed instruction* as a planned and sequenced set of instructional procedures, with the teacher or instructor present with the learners. However, he stated that *programmed learning* is a situation as when the student learns on his own, that is, when the teacher is absent. Koh (1977) and Vanitchayapong (1988) have used *self-instructional materials* and *self-instructional programme* respectively to mean programmed learning. Chuah (1988), Nazareno, Mohamad, Rahardja and Srijareon (1986) and Dunn (1965) have used *paper programmed instructions, instructional materials, programmed instruction and programmed instructional materials* respectively to mean programmed learning in the printed form. In this study, *programmed instructional materials* and *programmed text* will be used to mean programmed learning in the printed form.
In programmed instructional materials, the contents to be learnt are presented in small and easy steps. It requires the student to work through these steps, make active responses and receive immediate feedback as to his progress. This allows for self-paced learning and is an added advantage to slow-learners. Nik Azis & Ng (1991) reported the majority of the Form One Mathematics teachers strongly feel that they are tied up with lesson-planning, homework grading, and extracurricular activities. This leaves them with little time to make the connections of good theory and effective practical teaching in the classroom situations. As programmed instructional materials require maximum pupil effort and participation, and minimal immediate teacher help, this may reduce some of the teacher's workload like marking pupils' work or homework grading and to some extent lesson-planning. This will make it possible for the teacher to devote more time to other aspects of teaching like guidance and concept formation. The well sequenced programmed instructional materials then become important teaching tools.

In view of the potential and benefits of programmed instructional materials for facilitating learning, it is needless to say that research on its effectiveness in Mathematics is important. The possible use of programmed instructional materials to help slow learners, particularly in the rural schools merits investigation because, if applied successfully on a large scale, it would definitely help our young people meet the country's quest of becoming an industrialised country - Vision 2020.
1.2 Purpose of the Study

1.2.1 Primary Aim and Operational Definitions

The primary aim of this study is to investigate the effectiveness of programmed instructional materials as complementary aids for the teaching of Reflection (a topic in Mathematics) at the Form Two level in a rural secondary Malaysian school. The key terms used in reporting this study are operationally defined as below.

'Programmed instructional materials' is used to mean programmed learning materials or texts in the printed form. In this study, the program done by the researcher is called 'Learn It Yourself Reflection' and is abbreviated as 'LIY Reflection'. Basically, Klaus (1961) and Rowntree (1966) have stated that programmed instructional materials have the following characteristics. Programmed instructional materials have the capability of effective instructions with minimal help or participation from teacher. The materials are arranged in small steps or units, each building on the preceding one, enabling pupils to proceed independently and with minimal errors. This is based on the psychological principle of proceeding from the known to the unknown. The pupil makes active and frequent responses throughout the learning experience. He is tested on each unit immediately. His responses are corrected or confirmed immediately. Reinforcements are immediate and precise. The pupil is aware of his own progress. Each pupil works at his own pace. Self-paced learning caters for the wide range of individual differences.

'Effectiveness' of the programmed instructional materials is measured in terms of the:

1. Gains in the post-test scores of the experimental groups compared to those in the control groups.

2. Gains in the post-test scores as compared to the pre-test scores of the experimental
3. Manifestations of positive and negative attitudes of both the teachers and the pupils toward programmed instructional materials as indicated in their responses to a feedback questionnaire.

'Complementary teaching aids' is used here to mean additional teaching materials used in conventional classroom materials such as prescribed workbooks and textbooks.

1.2.2 Objectives of the Study/Research Questions

This study attempts to answer the following specific questions about the effectiveness of programmed instructional materials in Reflection for Form Two students in a rural secondary Malaysian school.

1. To determine if there is a significant difference in performance between students with low performance in Mathematics using Programmed Instructional Materials and those receiving normal class instructions in Reflection.

2. To elicit the students' responses towards the use of Programmed Instructional Material on the topic of Reflection in the classroom.

3. Based on the findings, to propose the use of Programmed Instructional Material in the learning of Mathematics in secondary schools.

1.3 Significance of the Study

By using a systematic approach and based on research and learning theories, this present study hopes to produce an educationally and technically sound programmed instructional material which can facilitate the teaching and learning of Reflection to Form Two pupils in a rural secondary school.
With the programmed instructional material, teachers can assign pupils to learn directly from the program at their own pace. The teacher’s role can then be transformed to that of a facilitator, thus allowing her to devote more time to guiding pupils who may be weak in other concepts of Mathematics.

The availability of the programmed instructional material will enable pupils to review their lessons on Reflection as often as they like whether it is for extra practice or for revision purposes prior to examinations.

Programmed instruction offers the possibility of a solution to the problem of “gaps in knowledge” in that the pupil can be given a programme and encouraged to work by himself. These “gaps in knowledge” which the pupil has could be due to many reasons. Among which are attributed to change of school, change of teacher, inability to concentrate at a critical stage in the course owing to physiological changes, emotional upsets, or home difficulties. This problem of “gaps in knowledge” or discontinuity is common to all schools and it is a serious problem because the situation with the individual pupil will get worse because gaps beget gaps.

Programmed instruction helps to contribute towards the development of self-direction among pupils and a sense of responsibility for their own learning instead of being overly dependent on their teachers. On the basis of such a study, programmed instruction of similar nature can be developed also for other topics in the learning of Mathematics in secondary schools.
1.4 Limitations of the Study

This study is primarily interested in the effectiveness of programmed instructional material in the teaching of Reflection to Form Two pupils.

Like all other studies, this study has its limitations too. This programmed instructional material only covers a basic topic of Transformation (that is, Reflection) for Form Two pupils in the secondary school Mathematics curriculum. The sample group consisted of low achievers only. As the sample was taken from the extreme end of the population, regression to the mean is an intrinsic threat to the validity of the design. The pilot test, pre-test and the post-test of the study were conducted among students of rural schools. Therefore, findings were restricted to this sample only.