UNIVERSITI PUTRA MALAYSIA

FACTORS INFLUENCING THE ACHIEVEMENT IN MATHEMATICS OF MALAY SECONDARY SCHOOL STUDENTS

CHE A. HALIM BIN CHE DAUD

FEP 2001 15

FACTORS INFLUENCING THE ACHIEVEMENT IN MATHEMATICS OF MALAY SECONDARY SCHOOL STUDENTS

By

CHE A. HALIM BIN CHE DAUD

Thesis Submitted in Fulfilment of the Requirements
for the Degree of Master of Science in the
Faculty of Management and Economics
Universiti Putra Malaysia

May 2001

DEDICATION

This work is dedicated to all mathematics teachers who have been working hard in helping their students succeed in learning mathematics.

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

FACTORS INFLUENCING THE ACHIEVEMENT IN MATHEMATICS OF MALAY SECONDARY SCHOOL STUDENTS

By

CHE A. HALIM BIN CHE DAUD

MAY 2001

Chairman : Associate Professor Mohd Salleh bin Lebar, M. Sc

Faculty : Management and Economics (Department of Education)

The present situation of many secondary school students having difficulty in learning mathematics needs to be thoroughly investigated. Various factors need to be studied in order to determine why these students failed to perform satisfactorily in mathematics. For this research, a group of three hundred secondary school students were studied in order to determine the influence of students' internal characteristics on achievements in mathematics. This research focused on the following seven internal characteristics: Attitudes towards mathematics, mathematics anxiety, motivation to study mathematics, personality and behavioural characteristics, cognitive readiness, learning strategies, and learning styles.

For learning styles, Kolb's Learning Style Inventory (1985) was used. Cognitive readiness test consisted of questions involving abstract reasoning, logical thinking, and numerical computation. For the other variables, the tests consisted of questionnaires using likert scale from one to five. Mathematics achievements were determined by the scores that the students got for mathematics in the Trial SPM Examination, 1999.

The research findings showed that mathematics achievements were significantly and positively correlated with attitudes towards mathematics, motivation to study mathematics, and personality and behavioural characteristics. Mathematics anxiety, on the other hand, had negative influence on achievements in mathematics. The result suggested that efforts must be made to reduce the level of mathematics anxiety in order to raise the students' performance in mathematics.

Mathematics achievements were found to correlate strongly with abstract reasoning, logical thinking, and numerical computational abilities. As for learning strategies, higher achievers were found to be more oriented towards meaningful learning, as opposed to rote memorising. The findings for learning styles indicated that higher achievers were more oriented towards abstract conceptualisation and active experimentation modes of learning. Convergence was found to be the dominant learning style of students who were excellent in mathematics.

In the inter-groups comparison analyses, the findings showed that weak students did not have positive attitudes and strong motivation to succeed in learning mathematics. Their levels of mathematics anxiety were relatively high, and their personality and behavioural characteristics were relatively unfavourable. Weak students also had a relatively lower level of ability in abstract reasoning, logical thinking, and numerical computation. Weak students were more oriented towards rote memorising and concrete experiencing mode of learning.

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

FAKTOR-FAKTOR YANG MEMPENGARUHI PENCAPAIAN DALAM MATEMATIK OLEH PELAJAR-PELAJAR MELAYU SEKOLAH MENENGAH

Oleh

CHE A. HALIM BIN CHE DAUD

MEI 2001

Pengerusi: Profesor Madya Mohd Salleh bin Lebar, M. Sc

Fakulti: Pengurusan dan Ekonomi (Jabatan Pendidikan)

Keadaan sekarang di mana ramai pelajar sekolah menengah mengalami kesukaran mempelajari matematik memerlukan penyiasatan yang rapi. Pelbagai faktor perlu dikaji untuk menentukan kenapa pelajar-pelajar ini gagal mencapai prestasi yang memuaskan dalam matematik. Untuk kajian ini, sekumpulan tiga ratus orang pelajar sekolah menengah telah dikaji untuk menentukan pengaruh ciri-ciri dalaman pelajar ke atas pencapaian dalam matematik. Kajian ini menumpukan kepada tujuh ciri-ciri dalaman berikut: Sikap terhadap matematik, kerisauan terhadap matematik, motivasi untuk belajar matematik, sahsiah dan ciri-ciri tingkah laku, kesediaan kognitif, strategi pembelajaran, dan gaya pembelajaran.

Bagi gaya pembelajaran, Inventori Gaya Pembelajaran Kolb (1985) telah digunakan. Ujian kesediaan kognitif mengandungi soalan-soalan mengenai keupayaan berhujah secara abstrak, berfikir secara logikal, dan kemahiran mengira. Bagi pembolehubah-pembolehubah yang lain, ujian-ujian mengandungi soalan-soalan yang menggunakan skala likert dari satu hingga lima. Pencapaian dalam matematik ditentukan oleh markah yang pelajar-pelajar perolehi bagi matematik dalam Peperiksaan Percubaan SPM 1999.

Hasil kajian menunjukkan bahawa pencapaian dalam matematik mempunyai korelasi yang signifikan dan positif dengan sikap terhadap matematik, motivasi untuk belajar matermatik, sahsiah dan ciri-ciri tingkah laku. Kerisauan terhadap matematik, di sebaliknya, mempunyai pengaruh yang negatif ke atas pencapaian dalam matematik. Hasil kajian mencadangkan usaha perlu dibuat bagi mengurangkan tahap kerisauan terhadap matematik agar pencapaian dalam matematik dapat ditingkatkan.

Pencapaian dalam matematik mempunyai korelasi yang kuat dengan kebolehan berhujah secara abstrak, berfikir secara logikal, dan mengira. Bagi strategi pembelajaran, pelajar-pelajar yang mempunyai pencapaian tinggi dalam matematik didapati lebih cenderung kepada pembelajaran yang bermakna. dan bukan pembelajaran secara hafalan. Hasil kajian bagi gaya pembelajaran menunjukkan bahawa pelajar-pelajar yang mempunyai pencapaian tinggi dalam matematik lebih cenderung kepada kaedah belajar yang menekankan konseptualisasi abstrak dan pengkajian aktif. Konvergen telah didapati sebagai

gaya pembelajaran yang dominan di kalangan pelajar-pelajar yang cemerlang dalam matematik.

Dalam analisis perbandingan antara kumpulan, hasil kajian menunjukkan bahawa mereka tidak mempunyai sikap yang positif dan motivasi yang kuat untuk berjaya dalam pembelajaran matematik. Mereka mempunyai tahap kerisauan yang lebih tinggi terhadap matematik, dan sahsiah dan ciri-ciri tingkah laku yang kurang memuaskan. Pelajar-pelajar lemah mempunyai tahap keupayaan yang lebih rendah dalam penghujahan abstrak, pemikiran logikal, dan kemahiran mengira. Pelajar-pelajar lemah lebih cenderung kepada menghafal dan mengalami secara konkrit sebagai kaedah pembelajaran mereka.

ACKNOWLEDGEMENTS

I would like to thank and express my deep gratitude to both of my former and present chairman of the supervisory committee, Associate Professor Dr. Mohd Khalid bin Mohd Nor and Associate Professor Salleh bin Lebar for their invaluable contribution, inputs and supervision of my Master programme in Kolej University Terengganu, University Putra Malaysia. Without their guidance and encouragement, the study would not have succeeded and this thesis would not have been written.

I would like to express my sincere heartfelt thanks to Associate Professor Dr. Mohd Khalid bin Mohd Nor for his willingness to supervise this study as a member of the supervisory committee after his transfer to University Putra Malaysia, Serdang in June 2000. I am very much indebted to him for his invaluable contribution and inputs in the study while he was the chairman of the supervisory committee from January 1999 to June 2000. I would like to extend my appreciation and gratitude to Associate Professor Salleh bin Lebar for his guidance and contribution as chairman of the supervisory committee from June 2000 until the completion of the writing of this thesis.

I also would like to express sincere heartfelt thanks and gratitude to the committee members of the supervisory committee, Associate Professor Dr. Shamsuddin bin Hussin and Mr. Mohd Nordin bin Mohd Abdullah for their invaluable contribution in the study. Associate Professor Dr. Shamsuddin bin Hussin was not able to supervise this study until the completion of this thesis because of his retirement

from the university in May 2000. However, I am greatly indebted to him for giving me invaluable contribution and inputs from the beginning of my Master programme in Kolej University Terengganu, University Putra Malaysia.

I also would like to extend my deep appreciation and heartfelt thanks to Associate Professor Dr. Sakri bin Ibrahim and Mr. Abdul Rahim bin Ibrahim for giving me assistance, guidance and encouragement during my study at the university.

I wish to acknowledge and express my deep gratitude to my employer, Majlis Amanah Rakyat (MARA) for giving me study leave and financial assistance which has enabled me to carry out this research for Master programme.

Finally, I would like to express my deepest gratitude to my parents. my wife and my sons and daughters. Words are not enough to express my heartfelt feelings to my parents for providing me guidance, support and encouragement since childhood. Last but not least, a very special note of sincere thanks is due to my wife, Faudziah, for her patience to bear with me throughout the course of my study. and for the inspiration, enthusiasm and encouragement which she has always given me.

This thesis is submitted to the Senate of Universiti Putra Malaysia and was accepted as fulfillment of the requirements for the degree of Master of Science.

.....

NORHAYATI BT. MOHD TAHIR, Ph.D.
Associate Professor
Dean of Graduate School
University College of Science
and Technology Malaysia

Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background of Research

Many students in secondary schools have shown great difficulty in learning mathematics. Results in standardised examinations such as the standard six Ujian Penilaian Sekolah Rendah (UPSR), form three Penilaian Menengah Rendah (PMR) and form five Sijil Pelajaran Malaysia (SPM), have shown that majority of these students failed to score good grades in mathematics. Parents, teachers and others involved in education have expressed their great concern to this situation. Mathematics teachers are very much aware of this situation, and they are under intense pressure to raise the achievement level of their students in mathematics. Efforts have been made to remedy the situation, but many mathematics teachers have found that this task is not easy. Most of their efforts have not produced significant improvement in the performance of students in mathematics.

Mathematics teachers are indeed facing a challenging task in raising the ability of these students to learn mathematics. As a mathematics teacher, who has been teaching mathematics for a number of years at Maktab Rendah Sains MARA (MRSM), which is a fully residential school, the researcher finds the situation

very disturbing. Only good students who have performed well in form three PMR Examination, with at least 6As including mathematics and science, are selected to study in MRSM. Among these good selected students, there exists a large number of students who have difficulty in learning mathematics, especially additional mathematics. Even though they are highly motivated, and have given effort and shown interest towards the subject, a large number of them have shown great difficulty in learning mathematics, and subsequently, failed in tests given by their teachers.

In the end of the semester or end of the year examinations, it is normal to see the majority of these students failed in additional mathematics. Figures in table 1.1 give an example of how poorly the majority of these students performed in additional mathematics test. In non-residential schools, especially in the rural areas, we can expect to see a much more disappointing performance in additional mathematics.

Table 1.1 Results of Trial SPM Examination 1996

Maktab Rendah Sains MARA, Kuala Terengganu

Subject: Additional Mathematics

Source: Examination Unit

Maktab Rendah Sains MARA, Kuala Terengganu (1997)

Score	No. of students	Percentage
0 ------ 10	7	2.24
11 ------ 20	28	8.95
21 ------ 30	73	23.32
31 ------ 40	86	27.48
41 ------ 50	61	19.49
51 ------ 60	33	10.54
61 ------ 70	17	5.43
71 ------ 80	7	2.24
81 ------ 90	1	0.32
91 ------ 100	0	0

Total number of students : 313

Min score : 37.63 %

Standard deviation : 15.25

Maktab Rendah Sains MARA, Kuala Terengganu is a fully residential school. From Table 1.1, we can see that even among these selected students, the majority

of them had not performed satisfactorily in additional mathematics. From the 313 students, 194 (62 %) scored less than 40 marks in the examination. Only one student was able to score more than 80 marks. The low min score of 37.63 % is a clear indication of how poorly this group of students performed in additional mathematics. With such an unsatisfactory performance in additional mathematics among selected students in a fully residential school, one should not be surprised to see much worse results among ordinary students in daily schools. Many of these students given up hope of succeeding in additional mathematics.

Situation like this is disheartening to mathematics teachers. Much time and effort have been given by both, the teachers and students involved, but not much success has been achieved. Many researchers in mathematics education have focussed their research on this problem. Richard R. Skemp (1986) expressed his concern with the problem of students who, though intelligent and hard-working, seemed to have a blockage about mathematics. This had led him to study and investigate the problems of learning mathematics. He suggested that there seemed to be a qualitative difference between two kinds of learning which he called habit learning or rote-memorising, and intelligent learning, which involves understanding. Because of the abstract nature of mathematical knowledge, which involves the formation of conceptual structures communicated and manipulated by means of symbols, the study of mathematics requires intelligent learning.

Gay and Cole (1967) studied mathematics learning difficulties of Kpelle pupils in Liberia. They concluded that there did not exist any inherent difficulties. What

happened in the classroom was that the contents did not make any sense from the point of view of Kpelle culture; moreover the methods used were primarily on rote memory and harsh discipline. In another study in Australia (Christie, 1985), it was found that the present approaches to mathematics education resulted in the Aboriginal children perceiving school mathematics more in terms of meaningless ritual than as a purposeful pursuit. Much of this unstable mathematical knowledge was soon forgotten.

Mathematics is abstract by nature, and abstractions take one away form a context, and knowledge learned without context is literally meaningless. Of course, mathematical ideas offer their own kind of context, so it is very possible to develop meanings within mathematics (Bishop, 1988). Mathematics involved the study of abstract objects : Facts, concepts, operations and principles (Begle, 1979). Because of its abstractness, it can be comprehended only by a few and with great difficulty.

Romberg (1992) contended that there needs to be a shift from the notion that mathematics is a set of rules and formalisms invented by experts, which everyone else is to memorise and use to obtain unique correct answers, to a view that learning mathematics involves processes of abstraction, inference and logical reasoning. From this perspective, learning mathematics should emphasise constructing mathematical meaning.

Currently, many educational researchers view learners as " architects building their own knowledge structures " (Wang, Haertel and Walberg, 1993). The learner is not a passive recipient of knowledge but an active constructor of knowledge. Learning is a process of knowledge construction, but not of knowledge recording or absorption. Current knowledge is used to construct a new knowledge. Learning is not a passive receiving of ready-made knowledge but it is a process of construction in which the students themselves have to be the primary actors (von Glasersfeld, 1991). The learner does not passively receive and record information, but he/she actively interprets and constructs meaning through the existing knowledge structures that he/she has earlier acquired.

The difficulty in learning mathematics is very much due to the highly abstract and conceptual nature of mathematical knowledge. This is further aggravated by the many symbols and notations which are used to communicate the knowledge. Many students face the problem of understanding mathematical lessons that are presented in the classrooms. They either fail to construct meaning or the meaning that they constructed is not consistent with what the teacher explains.

Learning and teaching strategies that are being practised in school very often do not promote intelligent learning. Much emphasis is put on rote-memorising and algorithmic learning. Drilling is highly practised, where students are required to solve a lot of problems with the hope that they will be able to solve similar problems in tests or examinations. A lot of emphasis is put on learning of