INTRODUCTION

CHAPTER I

INTRODUCTION

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INTRODUCTION

Man has always been concerned with overall and complete development of all his fellow men. Through the process of education he has been aiming at the optimum realization and fullest development of individual potentialities. From the earliest records of history we know that man has been pooling and investigating all the various kinds of resources at its command to educate his child in the best possible way so that he may develop as a well educated person and as a responsible citizen. In spite of the available efforts and educational inputs to the teaching-learning situation, we find that children are unable to show educational performance up to the level that is expected of their age and grade in the school.

Each year educationalists, politicians and social activists expound on the problems of present education. The world is becoming more and more competitive and the quality of performance has become the key factor for personal progress. India is now facing challenges from the continuing revolution in the field of science and technology and many other problems relating to the quality and security of life. The National Policy of Education (1986) has envisaged many changes to provide contemporary relevance and futuristic outlook to prepare the students for the twenty first century. Education enables the individuals to acquire knowledge, skills and values that can help to build a dynamic, vibrant and cohesive nation capable of providing its people with better and more purposeful life (Mohanty, Jaganath, 1988).

Mathematics is the subject which indisputedly forms the very basis of entire world’s scientific, technological and commercial system. Mathematics has not only been useful in its own right, but also in the development of other fields of Knowledge. There is no science, no art and no profession where
Mathematics does not hold a key position. According to Young (1961) if Mathematics is removed the whole material civilisation would inevitably collapse.

In October of 1957 when the Soviets launched “Sputnik”, the first space capsule, the reaction of many American educators, especially those in the field of Science and Mathematics was one of dismay. The general conclusion was that Russians were able to be the “first in space” because of the superiority of their educational system. American method of instruction especially of mathematical skills, which are basic to all aspects of technology and research was pointed to as very below standard. The difficulty with mathematics instruction, the reasoning went, was due to the traditional mathematics curriculum in the elementary schools which was a hodgepodge of concepts and skills that gave students no real understanding of the logic of quantity and served as a very poor foundation of Algebra and higher mathematics. In short, Mathematics is the corner-stone of modern scientific and technological development and mathematical methods and mathematical style of thinking and problem solving are penetrating every walk of life. Moreover, Mathematics is a man-made science. The new approaches to mathematical concepts, principles, facts and ideas are emerged according to the need of the situation.

This points out that utmost care should be given to impart up to date learning to such an indispensable subject as Mathematics, which calls for substantive school renewal and redesign from the inside out and policy formation at national, community and school levels. It also looks for transformational change in learning, that is curricular reconceptualisation that goes beyond the cognitive and into meta cognitive realm, in which the uses, applications and creative transfer of learning become the most significant outcomes. So, what is necessary today is, to bring about the optimal
development of the whole individual by way of quality education. A sound mathematics education can have a profound effect upon the development of rationality and which, in turn, may influence the total development of the learner to proceed much farther.

Therefore, within the system as it exists today, the learning of mathematics can gear to satisfy the needs and hopes of the present generation only if the educators and researchers find out the various factors influencing the overall performance of the children particularly, in the scholastic achievement of the subject.

NEED AND SIGNIFICANCE

The period of secondary education is the actual take off age in one's life. By imparting primary and elementary education, we will perform our constitutional duty but it is not adequate to prepare or equip the child to face the realities of life and meet newer challenges. Rao, the then Prime minister of India, in one of the seminars of NCERT (1991) emphasised the burning need of a transformation in the secondary education system prevailing in India. According to him the base of the educational pyramid comprising primary education has been made strong and at present there is need to strengthen the secondary education which is the back bone of real education so that it leads to excellence in higher education. The importance of scholastic or academic achievement has raised several important questions for educational researchers. What factors promote achievement in students? How far do those different factors contribute towards academic achievement? Researchers have come out with varied results, at times complementing each other but at other times, contradicting each other. A complete and comprehensive picture of academic achievement still seems to be eluding the researchers. Educational researchers
all over the world are still seeking a break through in elucidating this phenomenon.

Mathematics is known to be one of the important subjects in secondary school curriculum since the skills used in the learning of the subject are known to have a carry over value for learning other subjects. At the same time Mathematics is considered as one of the most tough subjects by most of the school students of Kerala. A good number of teachers also accept it to as a difficult subject. The complexity has further increased due to the fact that Mathematics curriculum has been up-dated a number of times in the recent past to include new content areas and new organisational principles. Many teachers find it difficult to catch up with the new content areas included from time to time. Also vast majority of them consider it difficult to improve the performance of pupils in Mathematics. Moreover, as Kunnunkal & Others (1992), reported, the educational system in our country has, by and large shown resistance to the adoption of innovations and the teachers who understand the importance of such innovations are few.

Various committees and commissions have taken measures to improve the instructional efficiency of Mathematics in Kerala. But in actual class room practice, the curriculum place a premium on bookish knowledge and rote learning. The development of useful skills and the inculcation of the right kind of interests, attitudes and values are not given sufficient emphasis. Moreover, it is completely examination centered and does not cater for individual differences. Another drawback is that, it does not provide a strategic plan for tracking students’ transfer of learning.

The statistics relating to the Secondary School Leaving Certificate (SSLC) examinations show that the failure rate in Mathematics is one of the highest in comparison to other subjects. The average marks of students in the
state for Mathematics during the years 1996 to 1998 are 33 percent, 34 percent & 30 percent respectively which is below the percentage of marks fixed for a pass in the subject. This indicates that proper instructional strategies are not followed for the teaching of the subject and so special attention should be underlined for its teaching and learning.

Questions have been asked as to who really is responsible for the poor educational programme. People usually find fault with wrong government policies, incompetency of the teachers, lack of learning facilities in the school, absence of proper care at home etc. The investigator is of the opinion that each party mentioned above has a part to play. A great deal of recent attention has been focused on providing adequate training to the teachers, parents and others concerned with the learning process, to help the pupils to modify their learning by inculcating in them good attitudes and also by providing a better environment in the school and at home. Kilpatrick (1976) is of the opinion that all individuals are capable of obtaining secondary school education, capable of mastering the school material within the limits of curriculum; and the teacher should see to it that all pupils do so.

The educational achievement of children begins from the home itself. The members of the family can set a better background for learning Mathematics at home. There is no denying the fact that the education does not commence with the alphabet; it begins with a mother’s look, with a father’s nod of approbation or a sign of reproof, with a sister’s gentle pressure of the hand or a brother’s noble act of forbearance. Home factors such as parental involvement and participation of members of the family in the learning process, the care and considerations received at home by children, the practices and habits they acquire at home etc. play the key role in their achievement.
In the past cognitive variables were supposed to be the decisive factors in learning and even among these factors, main thrust was on intelligence. However, information processing skills, which were inherent among the individual students were rarely considered. Cairns (1931) considers that mathematical ability is a separate ability running through all the branches of the subject and closely connected with other mental ability. In our school, most of the pupils who are backward in Mathematics are either normal or sometimes superior in other subjects. Hence if educational programmes are to be effective, it is essential that the students learning styles are matched to instructional elements.

A wide range of educational application of cognitive style and achievement have stemmed from a number of investigations. There are a number of studies of cognitive style and academic achievement which yielded in conclusive results (Ritchey, Lashier, 1981; Lamka, 1983; Ballard, 1985; Verma and Qudr, 1992). There are studies which substantiated the existence of sex difference in cognitive style with regard to school achievement (O’Brien, 1991) and at the same time, point out the similarity of both the sex groups in school achievement (Lamka, 1983; Brennan, 1984). Despite the fact that the research has been carried on about the relationship of cognitive style and achievement, in India and abroad, empirical data have not been sufficient enough to establish the relationship of the variable (Verma, Qudr, 1992).

The factors affecting scholastic achievement have been classified differently by researchers. But most of these variables can be classified into two major categories, the cognitive and non-cognitive factors. The publication of educational objectives by Bloom et al. (1956) and Krawthwohl (1964) has opened a new dimension about the expected outcomes of education by grouping them into three domains and this division also made clear, the presence of two categories of variables: cognitive and non-cognitive.
The overlap between educational outcome and non-cognitive variables has been fairly well established by recent researchers. This has great educational significance in view of the implied possibility of using non-cognitive changes as a method of producing desired cognitive outcomes. A vast review of the research in this field points out the inadequacy of the existing studies, in identifying a group of non-cognitive variables that correlate significantly with achievement in Mathematics.

Thus the above considerations motivated the investigator to conduct study comprising cognitive style and selected non-cognitive variables in relation to achievement in Mathematics of the pupils of standard X.

STATEMENT OF THE PROBLEM

The problem of the present study entitled as “cognitive style and selected non-cognitive variables in relation to achievement in mathematics of pupils of standard X”.

DEFINITION OF KEY TERMS

A number of psychological and educational terms have been used in the problem. The key terms that require a definition are presented below.

Cognitive style

Cognitive style refers to a person’s preference for certain ways of receiving and processing information from the surroundings.

Witkin et al. (1977) defines cognitive style as characteristic self consistent mode of functioning which individuals show in their perceptual and intellectual activities.
Witkin *et al.* (1971), Messick (1976) and Kogan (1976) have classified different categories of cognitive style. For the present study, the Field dependent–Field independent dimensions, as measured by group Embedded Figures Test (Oltman *et al.* 1971) is considered.

**Non-Cognitive Variables**

The term ‘non-cognitive variables’ refers to the variables other than cognitive variables.

In the present study, it stands for a group of five selected non-cognitive variables which are

(i) Level of aspiration
(ii) Attitude towards Mathematics
(iii) Class room environment for Mathematics
(iv) Home environment for Mathematics
(v) Home practice for Mathematics

(i) **Level of aspiration**

Level of aspiration means the achievement target which an individual sets for himself to attain and which he/she feels is capable of achieving. This is an important motivational aspect on which educational performance is very much connected.

(ii) **Attitude towards Mathematics**

Attitude refers to a learned pre-disposition to react consistently in a given manner either positively or negatively to certain persons, objects or concepts. According to Augoustinos & Walker (1995), attitude denote a
person's orientation to some object or attitude reftent. All attitudes have a reftent, an object of thought.

According to Thurston and Chave (1957), "Attitude is the degree of positive or negative effect associated with some psychological objects. It is a personal response to an object developed through experience, which can be characterised as favourable or unfavourable.

In the present study the psychological object is Mathematics. The personal response to this object is measured in different dimensions such as the appreciation of the role of Mathematics, preference for Mathematics, extra learning in the field, devotion and commitment to Mathematical ideas and activities. For this a standardised scale of attitude towards Mathematics was used.

(iii) **Class room environment for Mathematics**

Class room environment refers to the environment prevailing in a class room when the process of teaching learning takes place. This includes the emotional, physical and intellectual climate set up by the teacher and students to create a wholesome learning situation.

For the present study class room environment refers to the environment for learning the subject Mathematics characterised by the conceptual and pedagogical approach, innovative practises, interpersonal relationships and other classroom facilities which is measured by a standardised inventory of classroom environment for Mathematics.
(iv) *Home environment for Mathematics*

All the objects, conditions and factors in the home of an individual which has the power to influence him, constitutes the home environment of the person.

In the present study the environment at home in terms of physical facilities cohesion, parental behaviour, achievement motivation and intellectual and cultural orientation related to the learning of Mathematics is measured by a standardised Inventory of Home Environment for Mathematics.

(v) *Home practice for Mathematics*

Home practice refers to the meaningful learning experiences related to school instruction which are planned, carried out outside the school and evaluated under the guidance of the parents tutoring by teachers or other adults etc.

For the present study home practice refers such practices related to the learning of Mathematics in the form of family interaction patterns, values parental control and parental cultural and social participation which is measured by Home Practices Inventory for Mathematics.

(vi) *Achievement in Mathematics*

Achievement in Mathematics refers to tangible accomplishment or proficiency of performance of students in Mathematics as measured using a standardised test.

In the present study achievement in Mathematics is confined to the curricular areas prescribed for the pupils of standard X and the test used has been confined to the objectives of cognitive domains of Bloom's taxonomy.
(vii) **Mathematics**

In this study the term ‘Mathematics’ stands for the content of mathematics text book prescribed for standard X of schools of Kerala.

(viii) **Students of standard X**

Students of standard X refers to the students attending standard X of the recognised schools of Kerala state.

**OBJECTIVES OF THE STUDY**

1. To find the extent of relationship between achievement in Mathematics and each of the selected independent variables, for the whole sample and relevant sub samples.

2. To examine whether equivalent correlations obtained for achievement in Mathematics with (i) cognitive style (ii) each of Field Dependent (FD), Intermediate (INT) and Field Independent (FI) orientations of cognitive style and (iii) selected non-cognitive variables for, sex groups (boys / girls) and locale (urban / rural), differ significantly.

3. To predict ‘Achievement in Mathematics’ using a few selected independent variables, by means of stepwise regression by ANOVA approach.

**HYPOTHESES**

1. There will be significant and positive relationship between achievement in Mathematics and each of the selected independent variables for the whole sample and relevant sub samples.
II. There will be significant differences in the correlation between achievement in Mathematics and (i) cognitive style, (ii) each of Field Dependent (FD) Intermediate (INT) and Field Independent (FI) orientations of cognitive style and (iii) selected non-cognitive variables for, sex groups (boys/girls) and locale (urban/rural).

III. Achievement in Mathematics can be predicted with the help of certain selected independent variables.

VARIABLES

The study was conducted by treating achievement as dependent variable and cognitive style, and selected non-cognitive variables as independent variables. The details are presented below:

(a) Dependent variable:
Achievement in Mathematics of the students of standard X

(b) Independent variables:

(i) Cognitive style
(ii) Level of aspiration
(iii) Attitude towards Mathematics
(iv) Classroom environment for Mathematics
(v) Home environment for Mathematics
(vi) Home practice for Mathematics

METHODOLOGY

Sample

The study was conducted on a representative sample of 740 students of standard X, selected by proportionate stratified sampling method. While
selecting the sample due weightage was given to sex, locale, type of
management and efficiency level of schools. The sample covered the pupils
studying in the schools of three educational districts of Kottayam Revenue
district of Kerala state.

**Tools**

For the present study, the investigator used standardised tools of
accepted validity and reliability for measuring the variables. The tools used
were:

(i) Achievement test in Mathematics for standard X
(ii) Group Embedded Figures Test
(iii) Letter Cancellation Test
(iv) Scale of Attitude towards Mathematics
(v) Class room Environment Inventory for Mathematics
(vi) Home Environment Inventory for Mathematics
(vii) Home Practice Inventory for Mathematics

Of the above seven tools, Group Embedded Figure Test developed by
Oltman *et al.* (1971), and Letter Cancellation Test by Muthayya (1960) were
adapted. The remaining five tools were constructed by the investigator in
collaboration with her supervising teacher, Santhamma Raju.

**Statistical techniques used.**

The following statistical techniques were used for the analysis of the data.

(i) Pearson's product moment correlation coefficient
(ii) Fisher's test of significance for correlation coefficient
(iii) Shared variance of correlated variables.
(iv) Test of significance of the difference between correlations
(v) Stepwise regression by ANOVA approach
SCOPE AND LIMITATIONS

The present study is an attempt to reveal the relationship of cognitive style and selected non-cognitive variables with achievement in Mathematics of standard X pupils. The investigator selected one cognitive variable which is cognitive style and five non-cognitive variables, viz., level of aspiration, attitude towards Mathematics, classroom environment for Mathematics, home environment for Mathematics and home practice for Mathematics after a careful study of the factors affecting achievement of the students of standard X, with special reference to the achievement in the subject, Mathematics.

The investigator confined the study to a representative sample of students of standard X from Kottayam District of Kerala State. The selection of the sample need not be strictly representative of schools all over the state. But every precaution was taken to see that the most representative sample is obtained.

The tools of accepted validity and reliability were used to collect the data. The selection of independent variables was confined to a limited number considering the difficulty of measuring the variables and availability of the standardised tools. The selection of dependent variable was also restricted. For the present study, ‘Achievement in Mathematics’ only has been selected. The objectives included are those related to the cognitive domain of Bloom’s Taxonomy. The objectives related to other two domains-affective and psychomotor-are not measured through the present test.

The findings are valid and generalisable to the extent to which the sample, tool, variables and statistical methods are valid. All possible precautions were taken to attain the highest degree of accuracy in respect of these factors.
In spite of all these restrictions and limitations, the study obtained dependable results. It is hoped that the implications of the findings of the present study are of great help to the teachers, educators and parents for developing new trends and approaches in education.

ORGANISATION OF THE REPORT

The report has been presented in five chapters.

The first chapter comprises of a brief introduction-presenting the rationale for selecting the present problem, need and significance, statement of the problem, definitions of the key terms, variables of the study, objectives of the study, hypotheses, brief description of the procedure and scope and limitations of the study.

The second chapter presents the reviewed literature in the area, presented in two sections: viz; theoretical frame work of the selected variables and review of the related studies and a trend report of the studies reviewed.

The methodology of the study has been described in the third chapter. This chapter includes details of variables, objectives, hypotheses, design of the study, tools, sample, data collection procedure, scoring and statistical techniques used for the study.

The fourth chapter deals with the details of statistical analysis, taken up in the order of the objectives of the study. The analysis has been followed by an interpretation of the major results.

The fifth chapter presents a summary of the study, major findings, educational implications and suggestions for further research in the area.