Mathematics is one of the core subjects taught at the secondary school stage. It occupies an important place in the secondary school curriculum because of its utilitarian, disciplinary and cultural values. It is a matter of common experience of many secondary school teachers teaching mathematics that although many students have the capacity to learn mathematics well, their actual performance in mathematics examinations is poor. According to the Kothari Commission, it is a matter of concern to a developing country like India which cannot remain indifferent to this loss of potential man power.

As such, the present study is undertaken with a view to identify the causes this phenomenon (i.e. underachievement in mathematics) and offer suggestions to help them improve their achievement in mathematics.

6.1 The Problem

6.1.1 Objectives of the Study

The study was undertaken with the following two broad objectives.
i. To identify the causes of underachievement in secondary school mathematics, and

ii. To offer suggestions for the improvement of achievement of underachievers in mathematics in the light of identified causes of underachievement.

6.1.2 The Dependent and Independent Variables

The dependent and independent variables considered in the study were:

(a) Dependent Variable

Underachievement in mathematics.

(b) Independent Variables

i. Unfavourable attitude towards mathematics,

ii. Lack of confidence,

iii. High emotion,

iv. Poor study habits,

v. Poor achievement motivation,

vi. Poor educational adjustment,

vii. High general anxiety, and

viii. High examination anxiety.
The selection of the above mentioned independent variables is based on review of related literature and self experience.

6.1.3 **Specific Objectives of the Study**

The specific objectives of the study were:

i. To investigate if unfavourable attitude towards mathematics is the cause of underachievement in secondary school mathematics,

ii. To investigate if lack of self confidence is the cause of underachievement in secondary school mathematics,

iii. To investigate if high emotion is the cause of underachievement in secondary school mathematics,

iv. To investigate if 'poor study habits' is the cause of underachievement in secondary school mathematics,

v. To investigate if poor achievement motivation is the cause of underachievement in secondary school mathematics,

vi. To investigate if poor educational adjustment is the cause of underachievement in secondary school mathematics,

vii. To investigate if high general anxiety is the cause of underachievement in secondary school mathematics,
viii. To investigate if high examination anxiety is the cause of underachievement in secondary school mathematics, and

ix. To offer concrete suggestions in the form of -
   - Guidance and counselling programmes,
   - Instructional methodology, and
   - Psychological treatments

with a view to improve the achievement of underachievers in mathematics.

6.1.4 Hypotheses

In pursuance of the specific objectives of the present study, the following research hypotheses were formulated.

i. Unfavourable attitude towards mathematics is the cause of underachievement in mathematics.

ii. Lack of self-confidence is the cause of underachievement in mathematics.

iii. High emotion is the cause of underachievement in mathematics.

iv. 'Poor study habits' is the cause of underachievement in mathematics.

v. Poor achievement motivation is the cause of underachievement in mathematics.
vi. Poor educational adjustment is the cause of underachievement in mathematics.

vii. High general anxiety is the cause of underachievement in mathematics.

viii. High examination anxiety is the cause of underachievement in mathematics.

6.1.5 Scope of the Study

The study was limited to IX Standard Kannada medium students of Mysore city.

6.2 Design of the Study

6.2.1 Setting up Multiple Regression Equation for the Identification of Two Groups of Normal and Underachievers in Mathematics

For this purpose, a multiple regression equation in raw score form was set up using intelligence, numerical reasoning and numerical ability of students as predictor variables and achievement in mathematics as the criterion variable using Atkinson's method. The above said regression equation is given below.

\[ X_1^1 = 0.142X_2 + 0.487X_3 + 1.024X_4 + 12.69 \]

Where \( X_1^1 \) = Predicted score in mathematics,

\( X_2 \) = Intelligence test score,
$X_3 =$ Numerical reasoning test score, and  

$X_4 =$ Numerical ability test score.

The multiple 'R' was found to be 0.554 which is significant at 0.05 level.

6.2.2 Tools for Setting up Multiple Regression Equation

(a) Standard Progressive Matrices Test  
(Raven's Progressive Matrices (RPM))

For the assessment of intelligence, the Standard Progressive Matrices test was used. This test was constructed by Raven, J.C., Court, J.H. and Raven, J. The concurrent validity of the test ranges from 0.542 to 0.860 when correlated with Binet and Weschler's scale and 0.58 when correlated with Raymond, B. Cattell's Culture Fair Test. The stability reliability ranges from 0.832 to 0.93.

(b) The Number Series Test

The number series test available in the Psychology laboratory of University of College of Education, Dharwad was used to assess numerical reasoning of the students. It has content validity according to judges. The stability reliability is 0.70 ($n=70$) and the consistency reliability 0.73 ($n=70$). These values were determined by the researcher.
(c) **The Numerical Ability Test**

The numerical ability test is a part of Differential Aptitude Test (D.A.T.) constructed by George, K.B., Harold, G.S. and Alexander, G.W. This test was used to assess the numerical ability of the student.

The concurrent validity against mathematics test ranges from 0.25 to 0.71 for grades VIII & IX and against numerical aptitude test, a part of general aptitude test (G.A.T.) battery, is found to be 0.62 (n=78) and 0.51 (n=90). The consistency reliability of the test ranged from 0.85 (n=166) to 0.93 (n=122).

(d) **Achievement Test in Mathematics (ATM)**

Achievement test in mathematics is constructed by the researcher using scientific procedure. The final test consists of 64 items. The stability coefficient of the test was found to be 0.949 (n=205) and the consistency reliability 0.92 (n=242). The achievement test has content validity. The concurrent validity against the class-room annual mathematics test is 0.639 (n=183). The intrinsic validities ranged from 0.959 to 0.974.
6.2.3 Actual Selection of Normal and Underachievers in Mathematics

For this purpose, three predictor tests and the criterian test were administered to a sample of 501 students studying in IX Standard in fourteen high schools in the month of February 1992. Then using multiple regression equation in raw score form, their achievement scores were predicted. The scores on achievement test in mathematics constituted criterion scores.

The group of 501 students was split up at random into two groups of 300 and 201 each with a view to identify causal factors by cross-validating the results obtained from the first group.

The skewness and kurtosis of estimated scores in mathematics of the two groups revealed that both the distributions are fairly symmetrical/normal. Then candidates who had obtained scores on the criterion test between $+1\sigma$ units of estimated scores were considered as normalachievers and those who had obtained scores less than $-1\sigma$ unit below mean of estimated scores were considered as underachievers in this study. It was found that, in the first group (n=300) 56 to 62 were found to be normalachievers and 108 to 115 underachievers and in the second group (n=201) 39 to 43 were found to be normalachievers and 92 to 99 under-achievers. It may be pointed out here that the same number of students did not take all the tests.
6.2.4 Tools Used for Assessing Hypothetical Causal Factors

(a) Attitude Toward Mathematics Scale

It was developed by Louis, R.A. and consists of 24 statements - 13 negative statements and 11 positive - to be responded on five-point scale. Positive statement is scored 4, 3, 2, 1 or 0 and negative 0, 1, 2, 3 or 4. The sum total of these scores represents the attitude of a student towards mathematics. The consistency reliability of this test is found to be 0.78 and stability reliability 0.77 (n=158). The attitude scale has content validity according to the judges and its intrinsic validity of the scale ranges from 0.877 to 0.883. It may be pointed out here that the reliability and validity coefficients were determined by the researcher.

(b) Confidence Scale (Factor-0)

This is a part of 16 P.P. questionnaire constructed by Raymond, B.C. and others. It consists of 13 statements and each is followed by 3 alternative answers. The subject is required to choose anyone of them. The scoring key as given by the author is used. The stability and consistency coefficients of the scale are 0.70 (n=44) and 0.59 (n=6476) respectively. The direct validity of the scale is 0.71 (n=958).
(c) **Emotion Scale (Factor-C)**

This is a part of 16 PF questionnaire constructed by Raymond, B.C. and others. This scale consists of 13 statements and each is followed by 3 alternative answers. The subject is required to choose anyone of them. The scoring key as given by the author is used.

The consistency and stability coefficients are 0.54 ($n=6476$) and 0.66 ($n=44$) respectively. The direct validity of the scale is 0.70 ($n=958$).

(d) **Study Habits Inventory**

The study habits inventory is constructed by Gopal Rao, D. This inventory consists of 40 statements - 25 positive and 15 negative - to be responded on five-point scale. The positive statements are scored 5, 4, 3, 2 or 1 and negative 1, 2, 3, 4 or 5. The sum total of the scores quantifies an individual's 'study habits'. The consistency coefficient of the inventory is 0.84. It has content validity. It discriminates students with poor study habits and good study habits. That is, it has concurrent validity.

(e) **Achievement Motivation Scale**

The achievement motivation scale was constructed by Deo, Pratibha and Mohan Asha. This scale consists of 50
items - 37 positive and 13 negative - to be responded on five-point scale. The positive items are scored, 4, 3, 2, 1 or 0 and negative 0, 1, 2, 3 or 4. The sum total of the scores represents an individual's level of achievement motivation. The stability coefficient of the scale ranges from 0.67 (n=33) to 0.78 (n=50). The concurrent validity against 'Aberdeen Academic Motivation Inventory (AAMI)' is 0.54.

(f) Educational Adjustment Test

The educational adjustment test is a part of Adjustment Inventory for School Students (AISS), constructed by Sinha, A.K.P. and Singh, R.P. It consists of 20 items - 10 positive and 10 negative - to be responded on two-point scale. For the positive items, if the subject ticks off 'Yes', he is given one score, otherwise zero and if the subject ticks off 'No' for negative items, he is given one score, otherwise zero. The sum-total of the scores represents the level of educational adjustment. The consistency and stability reliabilities are 0.96 and 0.93 respectively (n=1950). The concurrent validity against superintendent's ratings was found to be 0.51 (n=60).

(g) General Anxiety Scale (Manifest Anxiety)

The general anxiety scale, constructed by Sinha, D., consists of 100 statements to be checked as 'Yes' or 'No'.
The score of one is awarded when the response is 'Yes', otherwise zero. The sum-total represents the level of general anxiety of the subject. According to this scale, higher the score lower is the level of general anxiety. The stability and consistency reliabilities are 0.85 (n=88) and 0.92 (n=239). The concurrent validity against Taylor's manifest Anxiety Scale is 0.69 and against Dutt's Anxiety Questionnaire 0.72.

(h) **Examination Anxiety Scale**

The examination anxiety scale constructed by A. Sukumaran Nair, consists of 30 items - 6 positive and 24 negative to be rated on three-point scale. The positive item is scored 0, 1 or 2 and negative 2, 1 or 0. The sum-total of the scores represents level of examination anxiety of the subject.

6.2.5 **Administration of Tests/Scales/Inventory for Assessing Hypothesised Causal Factors to Normal and Underachievers of both the Groups**

The tests/scales/inventory for assessing hypothesised causal factors were administered to normal and underachievers of both the groups \((n_1=300; n_2=201)\) identified.
6.2.6 Testing of Hypotheses

The research hypotheses set up were examined using appropriate 't' test separately for both the groups (300 and 201).

6.3 Findings

The findings of the present study are:

i. Poor attitude towards mathematics is the cause of underachievement in mathematics.

ii. Higher general anxiety is the cause of underachievement in mathematics.

iii. Higher examination anxiety is the cause of underachievement in mathematics.

iv. Lack of educational adjustment is the cause of underachievement in mathematics.

v. Poor study habits is the cause of underachievement in mathematics.

vi. Low achievement motivation is the cause of underachievement in mathematics.

6.4 Suggestions for Improving Mathematics Achievement of Underachievers

Based on review of related literature and personal experience, the following suggestions are made.
6.4.1 **Helping Underachievers to Understand both the Mechanics and Methods of Effective Study**

According to Kulwant Kaur (1974), this was useful in helping the underachievers develop positive attitude towards study (4:348).

6.4.2 **Counselling Treatment**

Counselling treatment may consist of profiles of eminent men from different fields, case conferences, quiz programmes and group discussions. Dandapani, S. (1976) and Fernandes, L. (1984) found that such counselling sessions stimulate interest among underachievers, arouse desire for emulation and raise their level of aspiration (1:452 and 2:531).

6.4.3 **Achievement Motivation Training**

Markle, A., Rinn, R.C. and Goodwin (1980) have found that application of achievement motivation training programme helped underachievers to improve their academic performance (6:567-574).

6.4.4 **Use of Clearly Articulated Behaviour Change Models**

Tobias, S. and Weissbroad, C. (1980) have found that such models reduce mathematics anxiety (8:63-70).
6.4.5 Development of Clear Understanding of Objectives of Mathematics Education

John, P. and Abraham, M. have found that, this improved the level of achievement of underachievers of College students (3:454).

6.4.6 Use of Variety in Teaching Mathematics

Use of cut-outs, projected materials, non-projected materials and activity aids, etc., may be used in teaching a mathematics with a view to help them to develop favourable attitude towards mathematics.

6.4.7 Correlation With Life

Mathematics particularly arithmetic be taught correlating it with day to day life activities like banking, population dynamics, agriculture, industries, etc., with a view to develop liking for mathematics.

The above stated suggestion may also lead to improvement of school adjustment of underachievers.

6.5 Suggestions for Further Research

The researcher while conducting the present study identified a few allied problems. They are given below:
i. A similar study be conducted for identifying the causes of underachievement in different school subjects.

ii. The study may be conducted at the different levels of education - primary and college, etc.

iii. Preparation of programmes for improving the achievement of underachievers and their experimental evaluation may be taken up.

iv. A study on personality correlates of underachievement may be taken up.
REFERENCES


