CHAPTER – VI

SUMMARY, CONCLUSIONS AND SUGGESTIONS

FOR FURTHER RESEARCH

INTRODUCTION

Foremost responsibility of teachers has always been to measure the results of their teaching efforts in so far as they are reflected by the progress and mastery of the subject matter by their students. This accomplishment in the school work is called achievement.

The argument of measuring achievement of the students especially in recent times has much importance particularly when the world is becoming too much competitive. Quality of performance has become the important and major factor not only for students, teachers and parents but for the personal progress of every individual. This desire for attaining high level of achievement puts a lot of pressure on teachers, students, parents and school, including the educational system as a whole.

Giving too much importance to academic achievement of students has raised many questions before the educationists, psychologists, curriculum framers and researchers. They want to know the factors which are responsible for the enhancement of student’s academic achievement in different subjects. An effort to understand the factors underlying the success or failure of students in different subjects does not simply amount to an academic exercise but has practical bearing in the sense that it makes possible the proper utilization of our human and material resources. Such factors when identified, will have practical and theoretical implications for developing curriculum and designing educational programmes to suit the needs of students with varied backgrounds.
No doubt many efforts have been made in the past to ascertain significant predictors of academic achievement in various subjects yet the voluminous data available in the form of inferences and results drawn from various studies have not boiled down to any conclusive generalization about the correlates of academic achievement especially academic achievement in Biology. Present study has led to identification of significant factors for predicting the academic achievement of senior secondary students in the subject of Biology for efficient training and better academic achievement in the subject of Biology.

REVIEW OF RELATED LITERATURE

INTELLIGENCE AND ACADEMIC ACHIEVEMENT

Intelligence as a correlate of academic achievement has been established as is evidenced by the studies reported by Rao (1965), Mohan et.al (1975) and Gupta et. al (1976).

Patel (1992) in his study, “An inquiry into the scholastic achievement in the context of intellectual ability, creativity, personality traits, family background and other personal variables of talent search scholars of Gujrat”, found positive and significant relationship between intelligence and academic achievement.

Meena (1999) and Kumar (1994) found positive and significant correlation between intelligence and achievement in Biology.

Likewise, positive and significant correlations between intelligence and achievement in English have also been established by Kaur (1983) and Kalie (1981).
However **Gupta (1976)** found negative (-.007) and insignificant correlation between achievement in Hindi and intelligence.

**Joshi and Bajwa (1975)** found no significant correlation between intelligence and academic achievement in Physics, Chemistry and Mathematics.

**Sibia (1989)** found no relationship between intelligence and achievement in Mathematics.

**Kumar (1994)** also found positive and significant correlation between intelligence and achievement in Biology.

**Bajwa (1998)** found that intelligence and achievement in Physics were positively correlated.

**EMOTIONAL INTELLIGENCE AND ACADEMIC ACHIEVEMENT**

**Ohm (1998)** confirmed a link between healthy emotional skills and personal and academic achievement.

**Tapia (1998)** explored the relationship of emotional intelligence and academic achievement and found that there existed a low relationship between emotional intelligence and academic achievement.

**Khera and Kaur (1999) and Gandhi (2001)** found no significant difference in emotional intelligence of boys and girls.

**Miglani (2001)** found a significant relationship between emotional intelligence and academic achievement.
Kaur (2001) conducted study on “Emotional maturity of adolescents in relation to intelligence, academic achievement and environmental catalysts”, on a sample of 356 adolescents. The findings revealed: (a) emotional maturity and intelligence were found to be closely related; (b) no significant relationship was found between emotional maturity and academic achievement; (c) No significant differences were found in emotional maturity due to area, sex and type of school; (d) students of government schools were found to be more emotionally mature than those of private schools.

Manhas (2004) in her study on a sample of 400 Xth class students of Jammu region found a positive and significant correlation between emotional intelligence and academic achievement.

Lekhi (2005) found significant correlation between academic achievement and emotional maturity.

CREATIVITY AND ACADEMIC ACHIEVEMENT

The relationship between creativity and achievement was first of all systematically examined by Getzels and Jackson (1959, 1962), who selected a creative group consisting of children high on creativity but not commensurately high on I.Q., and an intelligent group consisting of children high in I.Q., but not commensurately high in creativity. They reported that the achievement scores of both the groups were equally superior to the achievement scores of population as a whole. The findings of Getzels and Jackson were supported by a series of studies conducted by Torrance (1960), Cooper and Richmond (1975). They expressed the fact that those superior in creative ability have greater potentiality for success in academic pursuits as compared to their counterparts having lower ability in divergent production.
Passi (1971) and Asha (1983) also found positive and significant correlation between creativity and achievement.

Gakhar (1985) found significant and positive correlation between mathematics achievement and measures of creativity.

Kaur (1992) in her study, “Relationship among creativity intelligence and academic achievement in different subject of X-graders”, found positive and significant correlation between measures of creativity and academic achievement.

However Kapoor (1996) in his study, “A study of creative thinking ability of high school pupils of Arunachal Pradesh in relation to their sex and academic achievement”, found that the mean scores of high and low achievers do not differ significantly on the variable of creativity.

Sood (1999) in her study on 460 students of X+1 stage (260 from residential schools and 200 from non residential schools) found that out of all measures of creativity only fluency has significant positive correlation with the mathematical achievement of the students in case of residential school students.

Prasad (2002) also found significant positive correlation between mathematical creativity and achievement.

PROBLEM SOLVING ABILITY AND ACADEMIC ACHIEVEMENT

Rajnish (1998) in his study on a sample of 600 students of X+1 class taken from senior secondary school of Punjab state revealed that variable of problem solving ability was found to be significantly positively correlated with the scientific creativity as obtained t-value was significant at .01 level of significance.
**Summary, Conclusions and Suggestions for further Research…**

*Sood (1999)* also obtained correlation between problem solving ability and mathematical achievement to be significant.

*Prakash (2000)* found that there is significant relationship between the problem solving ability and mathematical creativity and mathematical achievement.

**STUDY HABITS AND ACADEMIC ACHIEVEMENT**

Often the parents and the teachers are at a loss to understand the reason for the discrepancy between the ability of their children and their actual accomplishment. At least, part of the contribution to the condition is likely to come from poor study habits or lack of training in study. Occasionally, a slight change in the way of studying makes ordinary performance into superior one. So, there is a reason to believe that many students who fail could succeed if they form effective study habits.

*Jamaur (1958)* conducted an investigation into some of the psychological factors underlying the study habits of the college students with the help of study habits inventory. The findings have suggested that the study habits are positively related to academic achievement. *Srivastava (1965)* pointed out that for good academic success, good study habits and positive attendance is importance. *Bala (1990)* in her investigation found that there is a positive relationship between study habits and academic achievement.

*Dinesh (2003)* found no significant differences in the study habits of high, average and low achievers.
HOME ENVIRONMENT AND ACADEMIC ACHIEVEMENT

Ploweden Report (1967) on a study of government schools in England found family and home environment as a most significant factor in affecting academic achievement of students.

The environment provided to the children by their home has drawn the attention of Jagannathan (1986). Significant has been observed difference between high achievers and low achievers on the home variable namely educational environment, income spatial environment, social background provision of facilities and parent child relationship.

In the study of Dwivedi and Sharma (1987) on 40 IXth Class boys studying in two government high schools of Bikaner in Rajasthan, it was concluded that home environment in the form of orthodox nature of family, its economic background, family dispute, lack of opportunities are some of the important factor which affect the creativity and achievement of the students.

Rani (2003) in her study concluded positively significant correlation between home environment and achievement in political science.

Gaur (2005) in her study found significant positive correlation between home environment and academic achievement of students.

EMERGENCE OF THE PROBLEM

In view of the contradictory findings and inconsistent results of previous studies, here is need to probe the relationship of some of the cognitive and non-cognitive variables with the academic achievement of students specially in the subject of Biology because Biology is an
important subject at the school level and in the field of science and in
the life of individuals for their survival and welfare.

As reported in the fourth and fifth survey of research in
education the relationship of cognitive and non-cognitive variables
taken with the academic achievement of students in Biology have not
been studied by researchers. In other words practically no work has
been done in this area. Hence the need is felt to re-search the present
problem adequately in order to know how to maximize academic
achievement of students in Biology by looking into the interplay of
variables under references.

STATEMENT OF THE PROBLEM

"Cognitive and Non-Cognitive Variables as Predictors of
Achievement in Biology at the Senior Secondary Stage".

OBJECTIVES

The present study is undertaken by keeping in view the
following objectives:

1. To study the relationship of achievement in Biology with the
cognitive variables i.e. intelligence, emotional intelligence,
creativity and problem solving ability.
2. To study the relationship of achievement in Biology with the
Non- cognitive variables i.e. study habits and home
environment.
3. To investigate whether cognitive variables ( i.e. intelligence,
emotional intelligence, creativity and problem solving ability)
and non-cognitive variables ( i.e. study habits and home
environment) are significant predictors in predicting the achievement in Biology or not.

4. (a) To study the difference in the achievement in Biology due to high and low level of intelligence.

(b) To study the difference in the achievement in Biology due to high and low levels of emotional intelligence.

(c) To study the difference in the achievement in Biology due to high and low levels of creativity.

(d) To study the difference in the achievement in Biology due to high and low levels of problem solving ability.

(e) To study the difference in the achievement in Biology due to high and low scores on study habits inventory.

(f) To study the difference in the achievement in Biology due to rich and poor family environment.

**HYPOTHESES:**

The present study is conducted to test the following hypotheses:

1. (a) There exists positive and significant relationship between academic achievement in Biology and intelligence.

(b) There exists positive and significant relationship between academic achievement in Biology and emotional intelligence.

(c) There exists positive and significant relationship between academic achievement in Biology and creativity.
Summary, Conclusions and Suggestions for further Research...

(d) There exists positive and significant relationship between academic achievement in Biology and problem solving ability.

2. (a) There exists positive and significant relationship between academic achievement in Biology and study habits.
(b) There exists positive and significant relationship between academic achievement in Biology and family environment.

3. The increase in the prediction value after step up addition of each variable of intelligence, emotional intelligence, and creativity, problem solving ability, study habits and home environment is significant towards the prediction of academic achievement in Biology.

4. (a) There would be significant difference between academic achievement in Biology due to high and low level of intelligence.
(b) There would be significant difference between academic achievements in Biology due to high and low level of emotional intelligence.
(c) There would be significant difference between academic achievements in Biology due to high and low level of creativity.
(d) There would be significant difference between academic achievements in Biology due to high and low level of problem solving ability.
(e) There would be significant difference between academic achievements in Biology due to high and low scores on study habits inventory.
Summary, Conclusions and Suggestions for Further Research....

(f) There would be significant difference between academic achievement in Biology due to rich and poor family environment.

DESIGN

Research design is the sequence of those steps which are taken ahead of time to ensure that the relevant data will be collected in such a way that allows objective analysis of the different hypotheses formulated in the study.

Technique of product moment correlation has been employed to find the relationship of achievement in Biology with the cognitive and non-cognitive variables. In order to know the combination of predictor variables which best explain the achievement in Biology, the technique of multiple correlation and step-up regression equations has been employed.

To find the effect due to different levels of independent variables on the dependent variable of achievement in Biology, the statistical technique of t-ratio has been employed in the present study.

SAMPLE

The present study was conducted on a random sample of 515 students of XI class (males = 277 and females = 238) studying Biology in Govt. and private Sr. Sec. Schools situated in the state of Punjab.

TOOLS USED

Following tools were used for data collection:

1. Group Test of General Mental Ability (Tandon, 1971);
2. Emotional Intelligence Scale (Hyde, Pathe and Dhar, 2001);
Summary, Conclusions and Suggestions for further Research…

3. Verbal Creativity Thinking Test (Baqer Mehdi, 1985);
4. Problem Solving Ability Test (Rajnish, 1998);
5. Study Habits Inventory (Mukhopadhyaya and Sansanwal, 1995);
6. Home Environment Inventory (Misra, 1989);
7. Achievement Test in Biology (Ghorai, 2002).

**STATISTICAL TECHNIQUES USED:**

1. Mean and Standard Deviation were worked out.
2. Pearson's Product Moment Method of Correlation was used to find Inter-correlation between dependent variable of academic achievement in Biology and independent variables of Intelligence, Emotional Intelligence, Creativity, Problem Solving ability, Study Habits and Home Environment.
3. Step-up regression equations were set up for knowing the conjoint predictability of Intelligence, Emotional Intelligence, Creativity, Problem Solving ability, Study Habits and Home Environment in predicting the achievement of students in Biology.
4. To find the effect of groups high and low on the variable of Intelligence, Emotional Intelligence, Creativity, Problem Solving Ability, Study Habits and Home environment, the technique of t-ratio was employed.

**DELIMITATION OF THE STUDY**

Present study was delimited as given below:

1. The study was delimited to the male and female students studying in X+1 (medical stream) class in the senior secondary
Summary, Conclusions and Suggestions for Further Research....

schools situated in urban areas of Punjab having rural as well as urban students.

2. The study was delimited to five districts of Punjab.

3. Only four cognitive independent variable i.e. Intelligence, Emotional Intelligence, Creativity and Problem Solving Ability were taken in the study.

4. Only two non-cognitive independent variables i.e. Study Habits and Home Environment were taken in the present study.

5. Study was delimited to one dependent variable i.e. academic Achievement in Biology.

SIGNIFICANCE OF THE STUDY

A study of the relationship of the cognitive and Non-cognitive variables under study in the light of inconsistent and contradictory results and also due to the rationale referred in the review of related studies give rise to the need of further probing into the problem. Moreover reference of research studies involving general intelligence, emotional intelligence, creativity, home environment and study habits variable as correlate of academic achievement in isolation and in combination are available but not much of the work has been done subject wise. Therefore, there is a great need of studying the problem subject wise because each subject is unique in it self and it is common experience to find a student achieving high in one subject of study while not doing so in other. Each subject of study requires a specific set of mental and emotional operations, though sharing some thing common with the other subjects. The different variables will not have the same degree of relationship with different sets of mental and emotional operations. The analysis shown earlier indicates that the
bulk of studies deals with achievement in general, though some stray attempts have been made with reference to a particular subject of study.

Present research will be of great help to teachers, school administrators, guidance worker and counsellors.

In the present study, academic achievement is taken only in the subject of Biology. The choice of this subject is because of its relative importance in the school curriculum as well as in the daily life of the students, also, because of the good back of the researcher ground in the subject of Biology.

The study does not confine itself to examining the nature of relationship alone but extends its scope to the identification of variables establishing the predictive efficiency of Intelligence, Emotional Intelligence, Creativity, Problem Solving Ability, Home Environment and Study Habits for Biology individually and conjointly for academic achievement in Biology.

**OPERATIONAL DEFINITIONS**

**Intelligence:** - As per author of the test “Group Test of General Mental Ability” by R. K. Tondon (1971). “Intelligence is the ability to complete the number series, write vocabulary similar, vocabulary opposite, classification, best answer analogies and have reasoning”.

**Emotional intelligence:** - According to Hyde Pethe and Dhar (2001) emotional intelligence comprises of self awareness, empathy, self motivation, emotional stability, managing relations, integrity, self development, value orientation, commitment and altruistic behaviour.
Summary, Conclusions and Suggestions for Further Research....

Problem solving ability: - As per author of the test Rajnish (1998) Problem solving ability means “formal reasoning of complex nature”.

Creativity: - According to Mehdi (1985) creativity involves divergent thinking with respect to the traits of fluency, flexibility and originality of thought processes.

Achievement in Biology: - “Achievement means the extent to which a learner is profiting from instruction in a given area of learning”. Therefore achievement in Biology means marks of students in the subject of Biology on the Achievement Test in Biology. (by Ghorai, 2002)

Home environment: - Misra (1993) has identified the following characteristics of home environment: Permissiveness, willingness to devote time to the child, parental guidance, parental aspirations for achievement, provision for the child’s intellectual needs, effective reward, instrumental companionship, prescription, physical punishment, principled discipline, neglect, deprivation of privileges, protectiveness, power, achievement, demands and conformity.

Study habits: - Mukhopadhyaya and Sansawal (1983) defined study habit as, “The sum total of all the habits determined, purposes and enforced practices such as concentration, drilling, task orientation etc. that the individual uses in order to learn”.

CONCLUSIONS

On the basis of the analysis of data following conclusions were drawn.
SECTION I.

1. Variable of intelligence measured through general mental ability was found to be significantly and positively correlated with the achievement in Biology. Therefore hypothesis I (a) that there exists positive and significant relationship between academic achievement in Biology and intelligence was accepted in the present study.

2. Correlation between variable of emotional intelligence and achievement in Biology was found to be positive and significant. Thus hypothesis I (b) that there exists positive and significant relationship between academic achievement in Biology and emotional intelligence was accepted.

3. Measures of fluency, flexibility and originality were found to be positively and significantly correlated with the dependent variable of achievement in Biology. In other words, students found to be high on fluency, flexibility and originality were also found to be high in their achievement in the subject of Biology. Therefore hypothesis 1 (c) that there exists positive and significant relationship between academic achievement in Biology and creativity was also retained in the present study.

4. Significant positive correlation was obtained between the variables of problem solving ability and achievement in Biology. Therefore hypothesis I (d) that there exists positive and significant relationship between academic achievement in Biology and problem solving ability was retained.
Summary, Conclusions and Suggestions for Further Research....

5. Study habits of the students were found to be significantly positively correlated with the achievement in Biology. Thus students with good study habits were also good on the achievement in Biology. Therefore the hypothesis 2 (a) that there exists positive and significant relationship between academic achievement in Biology and study habits was accepted.

6. Significant positive correlation were obtained between the six measures of home environment (Protectiveness, conformity, Social Isolation, Reward, Deprivation of privileges and Rejection) and students achievement in Biology. Thus hypothesis 2 (b) that there exists positive and significant relationship between academic achievement in Biology and family environment was accepted.

SECTION II

On the basis of data two regression equations were set up. The results of which have been given below.

1. **Model I** was designed to know how much variance towards the criterion variable of achievement in Biology was accounted for by the independent variable of general mental ability. On the basis of significant F-value, the variable of general mental ability was found to be a good predictor of achievement in Biology.

2. **Model II** was set up by stepping up the variable of creativity in the previous model. With the addition of this variable, the values of R and $R^2$ were increased. Also F-value was found to be significant. Therefore the variable of creativity was also found to
be a good predictor in predicting the achievement of students in Biology.

3. Out of six variables, that is, intelligence, emotional intelligence, problem solving ability, creativity, study habits and home environment, only two independent variables, that is general mental ability and creativity were found to be good predictors in predicting the achievement of students in Biology.

Thus hypothesis (3) that the increase in the prediction value after step up addition of each variable of intelligence, emotional intelligence, creativity, problem solving ability, study habits and home environment would be significant towards the prediction of academic achievement in Biology was partially accepted in the present study.

**SECTION III (t – ratios)**

1. From the results of present study, it was observed that significant differences exist in the achievement of students in the subject of Biology due to low and high level of general mental ability. In other words students of low and high mental ability differed significantly from each other in achievement in Biology.

   Therefore hypothesis 4 (a) that there would be significant difference in the achievement in biology due to high and low level of intelligence was accepted here.

2. Results of present study indicated significant difference in the achievement of students in the subject of Biology due to low and high emotional Intelligence as t-ratio was found to be significant at .01 level.
Summary, Conclusions and Suggestions for Further Research....

Thus hypothesis 4 (b) that there would be significant difference in the achievement in Biology due to high and low level of emotional intelligence was accepted here.

3. Result of present study showed significant difference in the achievement of students in the subject of Biology due to low and high verbal creativity as t-value was found to be significant. Also when mean scores were compared it was found that students high on verbal creativity secured higher on achievement test as compared to their counterpart.

Therefore hypothesis 4 (c) that there would be significant difference in the achievement in Biology due to high and low level of creativity was retained here.

4. It was observed that significant difference exists in the low and high problem solving ability group of students on the variable of achievement in Biology as t-value was found to be significant at .01 level.

Therefore hypothesis 4(d) that there would be significant difference in the achievement in Biology due to high and low level of problem solving ability was accepted here.

5. It was noticed that significant difference exists in the achievement of students in Biology due to poor and good study habits as t-value was found to be significant at .01 level.

Therefore the hypothesis 4(e) that there would be significant difference in the achievement in Biology due to high and low scores on study habits inventory was also accepted here.
6. Result showed significant difference in achievement of students in Biology due to poor and rich home environment as t-ratio was significant at .01 level. Also, it was found that those students who lived in rich environment secured higher in the subject of Biology as compared to students who lived in poor environment. Therefore, hypothesis 4 (f) that there would be significant difference in the achievement in Biology due to rich and poor family environment was also accepted in the present study.

EDUCATIONAL IMPLICATION

The knowledge of the factors/variables which promote achievement and which are hindering it is of great importance in developing curriculum and designing educational programmes to suit the need of the students with varied backgrounds. Further, the study of these variables assume special significance in view of their implications in respect of day to day curriculum planning on the part of classroom teachers.

The finding of the study with respect to the correlates of academic achievement in Biology will be beneficial for improving curriculum and teaching. It can thus be of great help to teachers, school administrators and to guidance and counseling workers.

Further to understand the factors/variables that tell the success and failure of students does not simply amount to academic exercise but has practical bearing in the sense that it makes possible the proper and full utilization of our limited resources which otherwise can go waste.

117
From the results of the present study, it can be inferred that general mental ability, emotional intelligence, creativity, problem solving ability, study habits, and rich home environment are essential factors/variables for the progress in academic achievement of the students. Therefore proper stress may be given by the school to develop the general mental ability, emotional intelligence, problem solving ability, creativity and at the same time care must be taken by the parents that students develop good study habits and live in a rich home environment.

**SUGGESTIONS FOR FURTHER RESEARCH**

This study may also be conducted on the students of elementary stage or some other stage of education.

Instead of taking achievement in Biology as dependent variable, achievement in other school subjects may be taken as dependent variables.

The study may be conducted by taking some other independent variables, for example attitude and aptitude of student for the subject of Biology.

The study may be conducted by taking some classificatory variables such as rural and urban differences, low and high achievers, more talented and less talented students in Biology.

In order to find the reliability and validity of the study, study may be conducted on some large and different sample. More cognitive and Non cognitive variables may be incorporated in this study.
Summary, Conclusions and Suggestions for further Research...

Similar study may be conducted on the adolescents of some other state.

Potential researcher can undertake research study by incorporating the characteristics of the teachers, for example teaching experience, qualification and their personal variables such as general mental ability, creativity and personality etc.