CHAPTER - VIII

SUMMARY CONCLUSIONS AND
SUGGESTIONS FOR FURTHER RESEARCH
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The present study entitled, "Correlates of Achievement in Biology-A Comparative Study of Urban and Rural Senior Secondary Students of Panjab" was undertaken with the following objectives:

1. To develop and standardize an Achievement Test in Biology for senior secondary students of +1 stage.

2(a) To find the relationship of intelligence, SES personality and creativity with achievement in Biology of (i) urban and (ii) rural senior secondary students.

2(b) To compare the relationship of intelligence, SES, personality and creativity with achievement in Biology of (i) urban and (ii) rural senior secondary students.

3(a) To identify the factor structure underlying certain socio-psychological variable i.e. intelligence, SES, personality, creativity and achievement in Biology of (i) urban and (ii) rural senior secondary students.

3(b) To compare the factor structure underlying certain socio-psychological variables i.e. intelligence, SES, personality, creativity and achievement in Biology of (i) urban and (ii) rural senior secondary students.
4(a) To find out the differential predictive efficiency of certain socio-psychological variables i.e. intelligence, SES, personality and creativity for achievement in Biology of (i) urban and (ii) rural senior secondary students.

4(b) To compare the differential predictive efficiency of certain socio-psychological variables i.e. intelligence, SES, personality and creativity for achievement in Biology of (i) urban and (ii) rural senior secondary students.

5. To find out the individual and conjoint effect of predictor variables as also to locate the best combination of predictor variables explaining maximum criterion variance in case of (i) urban and (ii) rural senior secondary students.

6. To find out the effect of different levels of intelligence, SES, personality, creativity and sex on the performance of urban and rural senior secondary students in Biology.

**Hypotheses**

The study was advanced within the framework of the following hypotheses:

1(a) Intelligence of urban senior secondary students correlates significantly with the achievement of the students in Biology.
1(b) Intelligence of rural senior secondary students correlates significantly with the achievement of students in Biology.

1(c) Intelligence of urban and rural senior secondary students correlates differentially with the achievement in Biology.

2(a) SES of urban senior secondary students correlates significantly with the achievement of the students in Biology.

2(b) SES of rural senior secondary students correlates significantly with the achievement of students in Biology.

2(c) SES of urban and rural senior secondary students correlates differentially with the achievement in Biology.

3(a) Creativity of urban senior secondary students correlates significantly with the achievement in Biology.

3(b) Creativity of rural senior secondary students correlates significantly with the achievement of students in Biology.

3(c) Creativity of urban and rural senior secondary students correlates differentially with the achievement in Biology.

4(a) Personality characteristics of urban senior secondary students correlate significantly with the achievement of the students in Biology.
4(b) Personality characteristics of rural senior secondary students correlate significantly with the achievement of the students in Biology.

4(c) Personality characteristics of urban and rural senior secondary students correlate differentially with the achievement in Biology.

5(a) Intelligence, SES, creativity and personality factors cluster together in group factor/s with the achievement in Biology in case of urban senior secondary students.

5(b) Intelligence, SES, creativity and personality factors cluster together in group factor/s with the achievement in Biology in case of rural senior secondary students.

5(c) The factor structure underlying the measure of intelligence, SES, creativity, personality and achievement in Biology of urban senior secondary students differ from that of rural senior secondary students.

6(a) Intelligence, SES, creativity and personality factors are differential predictors of achievement in Biology in case of urban senior secondary students.

6(b) Intelligence, SES, creativity and personality factors are differential predictors of achievement in Biology in case of rural senior secondary students.

6(c) Conjoint effect of the variables of intelligence, SES, creativity and personality factors is higher as compared to their separate prediction in predicting
achievement of urban senior secondary students in Biology.

6(d) Conjoint effect of the variables of intelligence, SES, creativity and personality factors is higher as compared to their separate prediction in predicting the achievement of the rural senior secondary students in Biology.

7(a) There are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of intelligence.

7(b) There are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of SES.

7(c) Extra-version ($E^+$) and introversion ($E^-$) accounts for significant difference in the achievement (in Biology) of urban senior secondary students.

7(d) The levels of anxiety namely high and low contribute to significant differences in the achievement (in Biology) of urban senior secondary students.

7(e) There are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of creativity.

7(f) There are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of sex.

8(a) There are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of intelligence.
8(b) There are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of SES.

8(c) Extraversion ($E^+$) and introversion ($E^-$) account for significant difference in achievement (in Biology) of rural senior secondary students.

8(d) The level of anxiety namely high and low contribute to significant differences in the achievement (in Biology) of rural senior secondary students.

8(e) There are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of creativity.

8(f) There are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of sex.

9. Significant difference exists in the achievement (in Biology) of urban and rural senior secondary students at different levels of intelligence, SES, Creativity, personality characteristics and sex.

10. Significant difference exist in the achievement (in Biology) in case of urban and rural senior secondary students.

**Delimitations of the Study:**

1. The present study was delimited to the senior secondary students of +1 stage.
2. The study was restricted to government, private, rural, urban, recognised schools & colleges of Panjab.

3. The study was restricted to 500 students (urban =340, rural=160) selected on the basis of stratified randomization technique.

**Design of the Study**

The present study was completed in two phases. In the first phase construction and standardization of Achievement Test in Biology was completed.

In the second phase, various research tools were administered and requisite informations were collected. The study of continuous and normally distributed variables in relation to achievement in Biology was done by correlation analysis, factor analysis and step up regression equations. Study of different levels of intelligence, SES, sex, personality and creativity was done with the help of t-ratios.

**Sample**

The proposed study favours for the selection of a sample on the basis of multistaged randomisation of clusters. The sample for the present study was drawn from senior secondary students of +1 stage of Panjab who were studying the same syllabus. The sample was drawn
in two stages. In the first stage 250 students were selected for developing and standardizing of Achievement Test in Biology. In the second stage, the size of the sample was restricted to 500 students (urban=340, rural=160). Proportionate representation was given to rural/urban, boys/girls, school/college students.

Tools

Following tools were used for data collection in the present study:

1. The Group Test of General Mental Ability (Tandon, 1971).
2. 16 PF Questionnaire (Cattell and Eber, 1967).
3. Torrence Test of Creative Thinking Verbal Form A (Torrence, 1966).
5. Achievement Test in Biology. (Constructed and standardized by the investigator herself).

Statistical Techniques used

For developing Achievement Test in Biology, following statistical techniques were used:

(i) The approach of upper-lower index for item analysis.
(ii) Product-moment correlation for establishing reliability of the test.
For analysing the data, following statistical techniques were employed:

i) Descriptive statistics like mean, median, SD, skewness and kurtosis for ascertaining the nature of distribution.

ii) Correlation analysis was done to study the degree of association among different variables.

iii) Factorial analysis was done in order to have a factor structure underlying different variables.

iv) Regression equations were set up, by stepping up one variable at a time to know the percentage contribution to the criterion variance by each variable and prediction of maximum possible 'R' by the combination of the variables.

v) To find out the effect of different levels of Intelligence, SES, personality and creativity the technique of t-ratio was employed.

Significance and need of the Study

The information that is proposed to be gathered with the help of present study is likely to have considerable significance both theoretically and practically. It would enable us to answer what are the basic factors which are responsible for the achievement of the urban and rural senior secondary students in Biology. For studying the total effect of the variables of the intelligence,
SES, personality and creativity as related to the achievement of urban and rural senior secondary students in Biology, multivariate approach will give the true picture regarding the interplay of various forces responsible for differential academic achievement among students.

The other reason for taking such a study was that not much work of this nature has been done leading to achievement of urban and rural senior secondary students in the subject of Biology in this country.

Further an insight into the possible factors underlying differential achievement in the area of Biology would suggest the guidelines for planning instructional groups within a school year. The study will shed light on the possible organisation of classes on the basis of characteristics of urban and rural senior secondary students.

The study will also provide a standardized tool to measure the achievement of the students in Biology. It will equip the teachers, planners and administrators with the valuable statistics to know the pupil better—his abilities, his deficiencies well enough to direct the learning of the students in Biology according to the intellectual level, SES level, sex, creativity of the learners and according to his/her personality.

Although some work has been done in the field of
science education in India while exploring its relationship with some psycho-social variables at different levels of education, yet no work has been conducted in the field of Biology at the Senior Secondary stage and hence the investigator felt the need for such a study.

Lastly the results of the present study can be used for prediction i.e., the success of the students in Biology. Needless to say that subject teachers, counsellor, parents, students and society at large would all be benefitted by actively implementing the research findings of the present study into practice.

CONCLUSIONS:
Nature of Distributions:

Examination into the nature of distributions of scores revealed that most of the variables are normal or near normal as tested through skewness and kurtosis. Test of linearity of relationship revealed that predictor variables i.e. intelligence, SES, personality factors and creativity confirm the assumption of linearity of relationship with only a few exceptions.

I. CORRELATION
A. Conclusions on the basis of Intelligence:

Variable of intelligence was found to be significantly correlated with the achievement of the
urban students in Biology. Also intelligence emerged significantly positively correlated with the achievement of the students in Biology in case of rural sample.

In the light of the above results hypothesis 1(a) that intelligence of urban senior secondary students correlates significantly with the achievement of the students in Biology, hypothesis 1(b) that intelligence of rural senior secondary students correlates significantly with the achievement of the students in Biology and hypothesis 1(c) that intelligence of urban and rural senior secondary students correlates differentially with the achievement in Biology were accepted.

B. Conclusions on the basis of Socio-economic Status

The variable of SES depicted significant positive correlation with the achievement of the students in Biology in case of urban sample. The variable of SES in case of rural sample also showed a significant positive correlation with the achievement of the students in Biology at .01 level.

In the light of the above findings therefore, hypothesis 2(a) that socio-economic status of urban senior secondary students correlates significantly with the achievement of the students in Biology; hypothesis 2(b) that socio-economic status of rural senior secondary students correlates significantly with the achievement
of the students in Biology and hypothesis 2(c) that Socio-
economic status of urban and rural senior secondary students 
correlates differentially with the achievement in Biology 
were retained here.

C. Conclusions on the basis of Personality

1. In both the samples none of the personality factor 
showed a consistent picture of relationship with the 
criterion variable of achievement in Biology.

2. Achievement in Biology was not correlated 
significantly and positively with any of the personality 
factors either in urban sample or in rural sample.

3. Achievement in Biology correlated significantly 
and negatively with the personality factor F (Sobber 
vs happy go lucky) and factor L (Trusting vs Suspicious) 
in case of urban sample whereas, in rural sample achievement 
in Biology correlated significantly and negatively with 
personality factor A (Reserved vs outgoing), factor 
B (less intelligent vs more intelligent), factor G 
(expedient vs conscientious), factor I (tough minded 
vs tender minded).

4. Analytical picture of correlations of personality 
factors with the criterion variable of achievement in 
Biology obtained for urban senior secondary students 
was different to the one obtained for the rural senior
secondary students.

5. Personality factors e.g. factor C (affected by feeling vs emotionally stable), factor E (Humble vs assertive), factor H (shy vs venturesome), factor M (practical vs imaginative), factor N (forthright vs shrewd), factor O (placidness vs apprehensiveness), factor Q₁ (conservative vs experimenting nature), factor Q₂ (dependent vs self sufficient), factor Q₃ (undisciplined vs controlled) and factor Q₄ (relaxed vs tense) were not significantly correlated with the measure of achievement in Biology.

6(a) The overall profile of personality of the urban senior secondary students with the high achievement in Biology that emerged from the negative nature of correlation between personality and achievement in Biology characterized the students as sober, free from jealous tendencies, adaptable, cheerful, good team worker and trusting.

6(b) The rural senior secondary students with high achievement in Biology were characterised by personality traits like reserved, stiff, cool, aloof, slow in grasping power, expedient, toughminded.

On the basis of above results hypothesis 4(a) that personality characteristics of urban senior secondary students correlate significantly with the achievement
of the students in Biology; hypothesis 4(b) that personality characteristics of rural senior secondary students correlate significantly with the achievement of students in Biology and hypothesis 4(c) that personality characteristics of urban and rural senior secondary students correlate differentially with the achievement in Biology were partially accepted.

D. Conclusions on the basis of Creativity

1. Measures of creativity namely fluency (F), flexibility (X) and originality (O) had significant positive correlation with the criterion measure of achievement in Biology in case of urban sample as also in case of rural sample.

2. Urban as well as rural senior secondary students with high scores on creativity had higher achievement in Biology.

3. The results of the study suggested that urban as well as rural senior secondary students who prefer greater number of relevant ideas whether of the same (fluency) or of different type (flexibility) and original responses (originality) had high achievement level in the subject of Biology as compared to those students who lack fluency, flexibility and originality. In other words, both urban as well as rural senior secondary students, when forced to comply overtly with greater
number of relevant idea of the same or of different type and possess original thinking, then modification occurs to justify the new overt behaviour which automatically results in the higher achievement in the subject of Biology. It may thus, be concluded that fluency, flexibility and originality abilities had their influence in increasing the achievement of the students in the subject of Biology.

4. Total verbal creativity was not related with the achievement of the urban as well as rural senior secondary students in Biology.

The above results led to the acceptance of hypothesis 3(a) that creativity of urban senior secondary students correlates significantly with the achievement of the students in Biology; hypothesis 3(b) that creativity of rural senior secondary students correlates significantly, with the achievement of the students in Biology and hypothesis 3(c) that creativity of urban and rural senior secondary students correlates differentially with the achievement in Biology.

II. FACTOR ANALYSIS

A. Urban Sample

1. Results of factor analysis showed that 79.07% of total factor variance was explained by criterion variable
of achievement in Biology of which 8.35\%, 8.61\%, 7.95\% and 54.16\% was explained by Original Factor I, II, III and IV respectively.

2. Contribution of intelligence in Original Factor III and Original Factor IV was 59.49\% of which 16.48\% was explained in factor III and 43.01\% in factor IV, whereas the percentage of total factor variance in Original factor I and II was zero.

3. The total factor variance explained by personality factors was 51.50\% of which 48.72\% and 2.78\% variance was explained by Original Factor I and II respectively.

4. Total factor variance as explained by SES variable was 82.97\% wherein 38.08\% and 44.89\% variance was explained by Original Factor I and II respectively.

5. Percentage of total factor variance as explained by measures of creativity was equal to 46.48\% in which 11.08\% and 35.40\% factor variance was explained by factor II and III respectively.

6. Highest percentage of variance in Original Factor I was shared by personality factor (48.72\%) followed by SES variable (38.08\%) and achievement in Biology (8.35\%).

7. Intelligence did not share any percentage of variance in Original Factor I.
8. Original Factor I, Criterion variable of achievement in Biology, personality factors and variable of SES shared common element and there was more nearness between the criterion variable of achievement in Biology and personality factors.

9. In case of Original Factor II highest percentage of variance was shared by SES variable (44.89%), followed by creativity (11.08%), achievement in Biology (8.61%) and personality factors (2.78%). Again intelligence did not share any variance in this factor. In this factor there was greater nearness between the criterion variable of achievement in Biology and variable of SES.

10. It was noticed that highest percentage of variance in factor III was shared by measures of creativity (35.40%) followed by intelligence (16.48%) and criterion variable of achievement in Biology (7.95%). In Original Factor III, therefore, there was greater closeness between the achievement in Biology and measures of creativity.

11. In case of Original Factor IV, the maximum variance was shared by criterion variable of achievement in Biology (54.16%) followed by variable of intelligence (43.01%). No other variable except the variable of intelligence shared total factor variance with the criterion variable of achievement in Biology in Original Factor IV and hence it established the closeness between the criterion variable of achievement in Biology and variable of intelligence.
12. From the results of Varimax Factor, it was noticed that the total percentage of variance as explained in all the three factors i.e. Factor I, III and IV by the variable of achievement in Biology, personality factors and measures of creativity was 99.52%, 72.01% and 19.53% respectively.

13. Further, the results showed that in Varimax Factor III only the measures of creativity had the sharing of 19.53% and the achievement in Biology contributed 8.82% variance.

14. In Varimax Factor IV, the highest contribution was only by the criterion variable of achievement in Biology which explained 90.70% variance.

15. Variable of intelligence, factors of personality, variable of SES and measures of creativity shared common variance with the criterion variable of achievement in Biology but were independent of each other in case of Factor I, II, III and IV in terms of Original and Varimax Factor structure.

In the light of the above findings the hypothesis 5(a) that variable of intelligence, SES, creativity and personality factors cluster together in group factor/s with the achievement in Biology in case of urban senior secondary students was accepted.
B. Rural Sample

1. 70.38%, 55.86%, 35.48%, 36.21% and 17.96% of total factor variance had been explained by the criterion variable of achievement in Biology, variable of intelligence, personality factors, variable of SES and creativity respectively in rural sample.

2. It was found that like urban sample in case of rural sample too, the highest percentage of variance in factor I was shared by personality factors (24.14%) and variable of SES (20.37%). These results showed that in Original Factor I the personality factors in comparison to other variables had greater association with the criterion variable of achievement in Biology.

3. In Original Factor II, however, there was close relationship between criterion variable of achievement in Biology and the variable of intelligence.

4. In Original Factor III, there was more nearness between the variable of SES and achievement in Biology than any other variable.

5. In Factor IV, maximum variance was contributed by achievement in Biology (12.89%) followed by measures of creativity (9.61%), personality factors (9.24%) and variable of intelligence (8.00%). The results also led
to the findings that although variable of intelligence, personality factors, variable of SES and creativity constellated with the criterion variable of achievement in Biology, yet they were independent of each other.

6. Also, 78.05% 66.91% and 8.60% of total factor variance was explained by achievement in Biology, independent variable of intelligence and measures of creativity in case of Varimax Factor.

7. In Varimax Factor II measures of creativity shared 8.60% of variance with the criterion variable of achievement in Biology, whereas in Varimax Factor III, the variable of intelligence shared 66.91% variance with the criterion variable of achievement in Biology. In other words in Varimax Factor II, there was closer proximity between achievement in Biology and measures of creativity and in Varimax Factor III there was closeness between variable of intelligence and achievement in Biology.

Therefore, in case of rural sample also, the results of factor structure confirmed the hypothesis 5(b) that variable of intelligence, SES, creativity and personality factors cluster together in group factor/s with the achievement in Biology in case of rural senior secondary students.
It may be inferred from above mentioned findings through factor analysis and rotation of factors in respect of both urban and rural samples that:

1. In urban sample four Original Factors (Factor number I, II, III, IV) and two Varimax Factor (Factor number III and IV) were identified. Similarly in rural sample four Original Factors (Factor number I, II, III, IV) and two Varimax Factors (Factor number II and III) were identified wherein measure of achievement in Biology shared common variance with the variable of intelligence, personality factors, variable of SES and creativity.

2. The variable of intelligence shared significant loading with the criterion variable of achievement in Biology in Original Factor III and IV in urban sample as well as in Original Factor II, III, IV and Varimax Factor III in case of rural sample.

3. Personality factors revealed factorial constellation with the criterion measure of achievement in Biology in Original and Varimax Factor structure in urban sample and in Original Factor structure in case of rural sample.

4. Variable of intelligence and creativity showed a structural unification with the criterion variable
of achievement in Biology and thus may be conceived as belonging to the same domain in both the samples in Original as well as Varimax Factor structure. It implied although variable of intelligence and creativity belong to the same domain, yet they were factorially distinguishable from each other.

5. Although a number of relevant factor identified for urban and rural samples are nearly comparable yet pattern of constellation of various variables namely, variable of intelligence, personality factors, variable of SES and creativity with the criterion measures of achievement in Biology was different in case of urban and rural samples.

6. Criterion measure of achievement in Biology shared the maximum variance on relevant factors in factor analysis with the variable of SES, intelligence, personality and creativity in descending order of magnitude in Original Factor structure and it shared maximum variance with personality and creativity in descending order of magnitude in Varimax Factor structure in case of urban sample.

7. Variable of achievement in Biology shared maximum variance with the variable of intelligence, SES, personality factors and creativity in descending order of magnitude in Original Factor structure where as it shared maximum variance on relevant factors with the variable of intelligence and creativity in Varimax structure in case of rural sample.
8. Measures of personality constellated themselves with the criterion measure of achievement in Biology in case of Original Factor I and II and Varimax Factor I in case of urban sample and Original Factor I, III and IV in case of rural sample.

9. Measures of creativity were grouped with the criterion measure of achievement in Biology in Original Factor II and III and Varimax Factor III in the urban sample and Original Factor II and IV and Varimax Factor II in case of rural sample.

10. Variable of intelligence and SES constellated themselves with the achievement in Biology only in Original Factor structure and not in Varimax Factor structure in urban sample.

11. Variable of personality and SFS constellated themselves with the criterion measure of achievement in Biology only in Original Factor structure and not in Varimax Factor structure in case of rural sample.

12. "Group Factor of Personality" and "Factor of SES" sharing common variance with the achievement in Biology appeared in both the samples (Original Factor I and II in urban sample and Original Factor I and III in rural sample.)
13. "General Factor of Cognition" sharing common variance with achievement in Biology also appeared in both the samples (Original Factor III in urban sample and Original Factor II in rural sample).

14. "General Factor of Mental Ability" sharing common variance with the criterion variable of achievement in Biology also appeared in both the samples (Original Factor IV in urban sample and varimax Factor III in rural sample).

15. "General Factor of Biological Achievement" also appeared in the urban as well as in rural samples (Varimax Factor III in urban sample and Original Factor IV in rural sample).

Thus in the light of the above results hypothesis 5(c) that factor structure underlying the measure of intelligence, SES, creativity, personality factors and achievement in Biology of urban senior secondary students differ from that of rural senior secondary students was accepted.

III. STEP-UP REGRESSION EQUATIONS

On the basis of regression equations, following results were concluded:

1. Variable of intelligence was a good predictor of
achievement in Biology of both urban as well as rural senior secondary students.

2. Variable of SES also emerged as a good predictor of achievement in Biology in both the urban as well as rural samples.

3. Out of sixteen measures of personality only two measures i.e. Personality factor F (Sobber vs happy go lucky) and Personality factor L (Trusting vs. suspicious) emerged as a good predictors of achievement in Biology.

4. Four measures of personality i.e. Personality Factor A (Reserved vs. Outgoing), personality factor B (less intelligent vs more intelligent), personality factor G (conscientiousness vs Expedience) and personality factor I (Toughminded vs Tenderminded) out of sixteen measures, emerged as good predictors of achievement in Biology in rural sample.

5. None of the personality factors which was common in both the samples emerged as a predictor of achievement in Biology in both the samples.

6. Remaining fourteen personality factors i.e. personality factors A, B, C, E, G, H, I, M, N, O, Q₁, Q₂, Q₃ and Q₄ were not significantly correlated with achievement in Biology in urban sample. Similarly remaining twelve
personality factors i.e. C, E, F, H, L, M, N, O, Q₁, Q₂, Q₃ and Q₄ were not found to be the good predictors of achievement in Biology in rural sample. Deletion of these personality factors did not reduce the predictive efficiency as based upon the remaining personality factors in urban as well as rural sample.

7. Measures of creativity i.e. fluency (F), flexibility (X) and Originality (O) were influencing the achievement of the urban as well as rural students in Biology and hence measures of creativity also emerged as strong predictor of urban and rural senior secondary students' achievement in Biology.

In the light of the above findings, therefore, hypothesis 6(a) that Intelligence, SES, Creativity and Personality factors are differential predictors of achievement in Biology in case of urban senior, secondary students; hypothesis 6(b) that Intelligence, SES, Creativity and personality factors are differential predictors of achievement in Biology in case of rural senior secondary students; hypothesis 6(c) that conjoint effect of the variables of intelligence, SES, creativity and personality is higher as compared to their separate prediction in predicting the achievement of urban senior secondary students in Biology and hypothesis 6(d) that conjoint effect of the variables of intelligence, SES, creativity and personality is higher as compared to their separate prediction in predicting the achievement of rural senior
secondary students in Biology were accepted.

IV. t-RATIOS
A. Urban Sample

1. From the results it was found that there exist significant differences between the three groups of urban senior secondary students divided on the basis of their intelligence scores as the value of t-ratios between groups I (low) and II (average), between I (low) & III (high) and between II (average) & III (high) were found significant at .05 level or above (t-between group I & II =1.982, between I & III =6.306, between II & III = 6.720). In other words students of low, average and high intellectual ability differed with each other in their achievement in Biology and that too significantly from each other.

Therefore, the hypothesis 7(a) that there are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of intelligence was accepted.

2. From the results of mean difference on achievement in Biology among three groups of students on the variable of SES it was found that group III (high SES group) scored higher on Achievement test (mean =41.123), while the group I (low SES group) scored lower (mean = 33.409),
whereas the group II (average SES group) scored the average marks (mean = 38.722). Mean difference between group I & II (t = 2.972), I & III (t = 4.378) and II & III (t = 2.370) were found to be statistically significant at .01 level or above. Results showed that student with high socio-economic status did better on achievement test as compared to their counterparts whose SES was lower or average.

Therefore, the hypothesis 7(b) that there are significant differences in the achievement (in Biology) of urban senior secondary students at different levels of SES was also accepted.

3. It was observed that t-ratio of 11.73 related to extraversion was significant at .01 level. Urban extrovert scored 10.53 scores higher than the urban introverts on the achievement test in Biology. Therefore, the hypothesis 7(c) that extraversion (E⁺) and introversion (E⁻) account for significant differences in the achievement (in Biology) of urban senior secondary students stood accepted.

4. The variable of anxiety was also found to be significantly influencing the achievement of urban senior secondary students in Biology, as the t-ratio was found to be significant at .01 level (t = 10.824). It was also
noticed that the mean achievement score of high anxiety group was lower than the low anxiety group (mean of high anxiety group on achievement test = 34.44 and mean of low anxiety group on achievement test = 44.72). In this way the hypothesis 7(d) that the levels of anxiety namely high and low contribute to significant differences in the achievement (in Biology) of urban senior secondary students was accepted.

5. From the results it was clearly observed that t-ratio between high and average creative, average and low and high creative were insignificant. That is, high creatives, average creatives and low creatives did not differ from each other on the achievement in Biology, however, the high creatives did better on the achievement test than did the average and low creatives (Mean of low creative group I = 38.272, average creative group II = 40.064 and high creative group III = 40.698). Therefore, the above results led to the rejection of hypothesis 7(e) that there are significant differences in the achievement (in Biology) of urban Senior Secondary students at different levels of creativity.

6. On the variable of sex although the value of mean score (in Biology) of female was slightly higher as compared to male yet no significant difference existed between their means. Therefore, the hypothesis 7(f) that there
are significant differences in the achievement in Biology of urban senior secondary students at different levels of sex has been rejected.

B. Rural:

1. The results showed that significant differences occurred between low, average and high intelligence groups of rural students. The results also showed that significant differences were obtained between mean scores of low intelligence, average intelligence and high intelligence groups. Thus the hypothesis 8(a) that there are significant differences in the achievement (in Biology of rural senior secondary students at different levels of intelligence has been confirmed.

2. t-ratio for the variable of SES were found to be significant between group I & II (low and average SES group) at .01 level; between group I & III (low SES and high SES groups) at .01 level; between group II & III (average and high SES groups) at .05 level (t between group I & II = 2.942; between I & III = 4.025; between II & III = 2.234). This indicated that socio-economic status of the students significantly effect their achievement in Biology. These findings, thus, accept the hypothesis 8(b) that there are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of SES.
3. It was noticed that mean scores of extroverts were higher as compared to introverts (mean of $E^+ = 36.720$ and mean of $E^- = 26.751$). In other words, achievement of the extroverts was better than the achievement of the introverts on the achievement test in Biology. Thus, the hypothesis 8(c) that extraversion ($E^+$) and introversion ($E^-$) account for significant differences in the achievement (in Biology) of rural senior secondary students was accepted.

4. Mean achievement of the high anxious rural students in Biology was lower than the low anxious rural students. In the light of these results, hypothesis 8(d) that the level of anxiety namely high and low contribute to significant differences in the achievement (in Biology) of rural senior secondary students was accepted.

5. The result of present study suggested that achievement of the rural senior secondary students did not differ regardless of their creativity level. Therefore, the hypothesis 8(e) that there are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of creativity was rejected.

6. The results revealed that there were no significant differences between means of boys ($M=31.422$) and girls ($M=31.977$). In other words, sex differences had not influenced the achievement of the boys and girls in Biology. Thus, the hypothesis 8(f) that there are significant differences in the achievement (in Biology) of rural senior secondary students at different levels of sex was rejected.

C. Urban/Rural:

The results of t-ratios related to the independent variables of intelligence, SES, personality, creativity...
and sex with the dependent variables of achievement in Biology led to the following conclusions:

1. Significant differences exist in the achievement (in Biology) of urban as well as rural senior secondary students at different levels of intelligence.

2. Significant differences exist in the achievement (in Biology) of urban as well as rural senior secondary students at different levels of SES.

3. Significant differences exist in the achievement (in Biology) of urban as well as rural senior secondary students at different levels of personality (extraversion and anxiety).

4. No significant differences exist in the achievement (in Biology) of urban as well as rural senior secondary students at different levels of creativity.

5. No significant differences exist in the achievement (in Biology) of urban and rural senior secondary students at different levels of sex.

Therefore, on the basis of the inferences drawn from the above results hypothesis 9 that significant differences exist in the achievement (in Biology) of
urban and rural senior secondary students at different levels of intelligence, SES, creativity, personality characteristics and sex was retained here except in case of creativity and sex.

6. Results showed that for the students of urban setting the mean score of achievement in Biology was higher as compared to their counterparts in rural setting (mean score of urban students on Achievement Test in Biology = 39.873 while mean score of rural students on Achievement Test in Biology = 31.712). Mean difference of these groups was statistically quite significant (t = 11.65) at .01. In other words, according to the results of present study the achievement of the urban senior secondary students was certainly better than the students of rural setting.

In the light of the above findings the hypothesis that significant difference exists in the achievement (in Biology) of urban and rural senior secondary students was also retained.

EDUCATIONAL IMPLICATIONS:

1. The present study, it is hoped, will contribute to the theoretical understanding of achievement in Biology of urban and rural senior secondary
students in relation to socio-psychological variables namely intelligence, creativity, personality, SES and Sex.

2. It has been noticed that rural boys and girls scored lower than their urban counterparts in Biology and thus special coaching may be arranged for them. Similarly, for poor students from villages voluntary agencies may be approached for their help in studies.

3. Teachers can prepare classroom achievement tests in the subject of Biology and help the students to do these tests at least once in a month or so.

4. Parents Teachers Association would also help in providing proper guidance to parents in rural areas so that they may be able to improve learning conditions for their children.

5. Mass media can provide better learning to the students. Programs on Biology recorded on VCR and other such media would be helpful for students of rural areas as well as urban areas.

6. The findings of the present study may form a part
of the refresher courses, seminars, workshops organised for science teachers, specially for those teachers who are teaching Biology to Senior Secondary classes.

Suggestions for Further Research

Based upon the findings and limitations of the present study, the following suggestions are given to conduct further research in this field:

1. Predicted variables other than used in the present study e.g. achievement motivation, study habits, adjustment etc. may be used to predict achievement of the Senior Secondary Students in Biology.

2. The study can be conducted on a larger sample and the variable of class difference (junior secondary and secondary or secondary and senior secondary) may be taken into consideration.

3. The study may be conducted by taking the achievement of the students (in Biology) of different groups such as gifted, backward, physically handicapped, mentally handicapped and problem children.

4. The study may be conducted by studying the correlates of achievement in subject other than Biology.
5. Comparison of prediction of achievement of students studying Botany and Zoology or Chemistry and Biology or Physics and Biology may be made.