CHAPTER VIII

SUMMARY AND CONCLUSIONS
With the increasing scientific advancement and its impact on education, the need for development of new methods of instruction has been growingly realised. A constant search is going on for the relevant technology of instruction to make it more suitable to the individuals according to their personality types on one hand and to the fast changing spectrum of the classroom on the other.

Growing knowledge of learning theory and learners helps to understand that a systematic knowledge about learning process can be put to use in instruction by considering what we know about learner, and what he learns. The characteristics of the learners are of the fundamental importance for learning. The characteristics, therefore need to be assured in order for instruction to accomplish its purpose. Personality as one of the learners' characteristics, types of learning, and levels of educational objectives were considered as important in relation to instructional designs. The present investigation entitled "Performance of High School students in Biology as a function of Personality types and Instructional design for Concept and Rule Learning" was undertaken with a view to study
the effect of instructional designs with respect to personality and content variables.

The study was designed in order to realise the following objectives:

1. To study the effects of the three instructional designs namely - (i) Programmed Instruction, (ii) Structural Communication and (iii) Teacher directed Structured Instruction on Students' performance in Biology.

2. To study the effect of the three instructional designs on performance of the four personality groups.

3. To study the effect of the three instructional designs on performance at Concept and Rule learning.

4. To study the effect of the three instructional designs on performance at the three levels of educational objectives namely - Knowledge, Understanding (comprehension and application) and Higher Order Understanding (analysis, synthesis and evaluation).

5. To study the effect of the three instructional designs on performance of the four personality groups for Concept and Rule learning.

6. To study the effect of the three instructional designs on performance of the four personality groups at Knowledge, Understanding and Higher Order Under-
The study was advanced within the framework of the following hypotheses:

(i) The three instructional designs vary in their effectiveness with respect to mean gains in a segment of Biology at High school level.

(ii) The three instructional designs do not benefit the four personality groups uniformly in mean gains in Biology performance at High school level.

(a) The design based on Conditioning theories i.e. Programmed Instruction benefits introverts more than the others in mean gains.

(b) The Structural Communication benefits extraverts more than other personality groups in their mean gains.

(c) The Teacher directed Structured Instruction is equally effective for all types of personality group in their mean gains.

(d) The three instructional designs benefit the low and high neuroticism groups uniformly in their mean gains.

(iii) The three instructional designs uniformly affect the mean gains in performance on Concept learning more than Rule learning in a segment of Biology at High school level.
(iv) The three instructional designs do not equally affect the mean gains in Biology performance at the three levels of educational objectives at High school level.

(a) The Programmed Instruction yields higher results for Knowledge level than for Understanding and Higher Order Understanding levels in mean gains.

(b) The Structural Communication yields higher results for Understanding and Higher Order Understanding levels than for Knowledge level in mean gains.

(c) Teacher directed Structured Instruction is equally effective at all the three levels of educational objectives in mean gains.

(v) The three instructional designs do not help the four personality groups uniformly for Concept learning and Rule learning in mean gains in Biology performance at High school level.

(a) The Programmed Instruction for all the four personality groups yields comparable mean gains on Concept learning and Rule learning.

(b) With Structural Communication, the extraverts group shows higher mean gains than all other personality groups uniformly on Concept learning and Rule learning.

(c) With Teacher directed Structured Instruction, the four personality groups perform uniformly in mean gains on Rule learning and Concept learning.
(vi) The three instructional designs do not affect the mean gains in Biology performance of the four personality groups uniformly at the three levels of educational objectives at High school level.

(a) The Programmed Instruction, for all the four personality groups, yields comparable mean gains at Knowledge, Understanding and Higher Order Understanding levels.

(b) With Structural Communication, the extraverts group shows higher mean gains than all other personality groups at Understanding and Higher Order Understanding levels more than at Knowledge level.

(c) With Teacher directed Structured Instruction, the introvert and extravert groups perform uniformly at all the three levels of educational objectives.

The tools used for collecting the data were as follows:

(i) Scientific Knowledge and Aptitude Test (SKA) Form-1064 (Chatterji and Mukerjee).

(ii) Junior Personality Inventory (JPI) (Mohan, et al., 1968).

(iii) Instructional Material (developed by the investigator), viz.
- Mixed Programmed Text (MP).
- Structural Communication Units (SC).
- Structured Lessons (SL).

(iv) Test of Entering behaviour (developed by the investigator).
(v) Criterion test (developed by the investigator) and
(vi) Achievement test (developed by the investigator).

Procedure:

The experiment was conducted in five English medium Secondary schools of Chandigarh and its suburban Mohali. The procedure of the experiment in all these five schools was the same. The study was conducted in two phases. In the first phase, the Scientific Knowledge and Aptitude Test Form-1064 and the Junior Personality Inventory (JPI) were administered. In the second phase, the three treatment of instructional designs were administered to the respective treatment groups.

At the first stage of the study, the three sets of the instructional material, namely Mixed Programmed Text, Structural Communication Units and Teacher directed Structured Lessons, were developed on a segment of Biology namely - "Heredity and Variation" for High school students. A criterion test and an achievement test with items pertaining to Knowledge, Understanding and Higher Order Understanding levels of Bloom's taxonomy were developed.
The sample for the validation of the instructional materials and tests consisted of High school students of both the sexes. These were taken from different Government Model Schools of Chandigarh. Details of the validation samples have been given with the development of different instructional materials and tests in the respective chapters.

For conducting the experiment, a group of 510 students was selected out of a sample of 644 High school students (IXth and Xth classes) on the basis of their scores on the Scientific Knowledge and Aptitude Test-Form 1064 (Chatterji and Makerjee). The ten percent top and the same number of bottom scoring students were dropped. The Junior Personality Inventory (JPI) (Mohan et al., 1968) was administered to 510 students. The test was scored for $E_a$ and $E_b$ of extraversion/introversion dimension and $N_a$ and $N_b$ of neuroticism dimension with the help of the respective keys. The subjects showing discrepancy of 5 or more scores between $E_a$ and $E_b$ and also between $N_a$ and $N_b$ were dropped and others were retained in the sample. The means and SDs of the whole sample were calculated separately for $E$ and $N$ scores. Out of the middle $M \pm 10$-scoring students on neuroticism dimension, the cases with $E^+ = 20$ and above were identified as extraverts and the cases with $E^- = 10$ and below as introverts. Similarly, out of the middle $M \pm 10$-scoring students on extraversion dimension the cases with $N^+ = 19$ and above were included in high on
neuroticism group and with $N^- = 7$ and below in low on neuroticism group. Thus the number of students falling in the four personality type groups were 95 (extraverts); 48 (introverts); 76 (High on neuroticism) and 45 (Low on neuroticism). Each of these groups on personality type was further allocated randomly into the three instructional treatment groups with 82, 84 and 82 students.

Though the initial experiment was started with all 266 students of the four personality group but the experiment was completed by 250 students only.

For the purpose of the analysis of data, the study employed two separate analyses, one involving $3 \times 4 \times 2$ factorial design and another $3 \times 4 \times 3$ factorial design with repeated measures on one variable in each design. The $3 \times 4 \times 2$ factorial design involves three variables namely Instructional design (I), Personality types (P) and the Types of learning (L) each one with fixed classification. The first variable i.e. instructional design was studied at three levels namely - Mixed Programme (MP), Structural Communication (SC) and Teacher directed Structured Lessons (SL). The second variable i.e. Personality types was studied at four levels namely extraverts, introverts, high on neuroticism and low on neuroticism. The third variable i.e. types of learning was studied at two levels namely Concept learning and Rule learning. Out of these
three variables, instructional design was the treatment variable. Personality types was an organismic variable. On the third variable i.e. types of learning, the measures were repeated.

The $3 \times 4 \times 3$ factorial design involves the three fixed variables namely Instructional design, Personality types, and Levels of educational objectives formulated after Bloom's classification of cognitive domain. The first two variables were similar to that of $3 \times 4 \times 3$ factorial design but on the third variable i.e. 'Levels of educational objectives, the measures were repeated at the three levels. Performance was the dependent variable which was measured by specially developed achievement test for the purpose. The analyses were done on modified gain percentage (an index developed after Peterline, 1966). For analysis of variance, the technique given by Winer (1971) was followed.

In the second phase of the experiment, the selected students were given an entering behaviour test. Before starting with the instructional treatment, an achievement test developed on the selected content, was also administered. It was scored and the test scores were used as pretest scores.

The students belonging to the four personality groups were randomly allocated to three instructional designs. The
similar time schedule was followed for the three treatment groups. The same achievement test was administered. It was scored and these scores were termed as post-test scores. The scores of the achievement test were split in two ways. Firstly, the total scores of each subject were split into two types of Gagne's classification namely Concept and Rule learning. Secondly, the total scores obtained by each subject were split into three components for Knowledge, Understanding and Higher Order Understanding formulated after Bloom's categories. The achievement test scores were used for further analysis.

The raw scores obtained from the tools were processed and converted into percentage gain scores. The means for these processed scores were computed. The entire analysis was done on these processed scores.

The results of the study have been given in the following paragraphs and all the findings pertain to a segment of Biology at High school level:

- The three instructional designs viz. Mixed Programme, Structural Communication and Teacher directed Structured Lessons differ in their effectiveness with respect to mean gains. It may be further specified that the Mixed Programme was found less effective than the Teacher directed Structured Lessons. The Structural Communication did neither differ from Mixed Programme nor from Teacher directed Structured Lessons.
Regarding the pooled effect, the extraverts, introverts, high on neuroticism, and low on neuroticism groups at high school age do not differ in their mean gain performance.

As the pooled effect of the three instructional designs, the subjects differ in their gain in performance at Concept and Rule learning tasks. The mean gain scores on Concept exceeds the mean gain scores on Rules.

The Mixed Programme and Teacher directed Structured Lessons were found equally effective for extraverts, introverts as well as high on neuroticism and low on neuroticism groups.

Through Structural Communication, extraverts group was found to benefit more than introverts group. It may also be noted that the Structural Communication and Teacher directed Structured Lessons were found more effective than Mixed Programme specifically for extraverts whereas the three instructional designs were found equally effective for introverts.

High on neuroticism and low on neuroticism groups were found to have been equally benefitted from all the three instructional designs.
The differences among the mean gain scores through the three Instructional designs were different for the three levels of educational objectives.

Subjects taught through Mixed Programme attained highest mean gains in performance at Knowledge level, second highest at Understanding and lowest at Higher Order Understanding levels.

For Knowledge, Mixed Programme and Teacher directed Structured Lessons were superior to the Structural Communication. For Understanding level, Structural communication was found more effective and Teacher directed Structured Lessons were found slightly less effective than Structural Communication but more effective than Mixed Programme.

The Teacher directed Structured Lessons benefit Knowledge and Understanding levels equally and more than it does for Higher Order Understanding. For Higher Order Understanding, Structural Communication and Teacher directed Structured Lessons were found uniformly more effective than Mixed Programme.

The gain in performance at different levels of educational objectives was independent of type of personality.
The nature of interaction between Instructional Design and Personality types (IxP) was not similar for different levels of educational objectives. The results suggest that through Mixed Programme, extraverts score highest at Knowledge level, second highest at Understanding level and lowest at Higher Order Understanding level.

Through Mixed Programme, introverts do not differ in their performance at Knowledge, Understanding and Higher Order Understanding level.

The two types of learning i.e. Concept and Rule learning were uniformly affected by the three instructional designs viz. Mixed Programme, Structural Communication and Teacher directed Structured instruction.

It was also concluded that the four personality types i.e. extraverts, introverts, high on neuroticism and low on neuroticism were uniformly benefitted at Concept and Rule learning.

The interaction between the variables of personality types and types of learning was independent of the types of instructional design.

The mean gain scores attained at different levels of educational objectives were not equal.
The pooled effect of the designs under investigation yields equal performance at Knowledge level and Understanding level. The performance at Knowledge and Understanding levels was found superior to that of Higher Order Understanding level.

Through the Mixed Programme, the high on neuroticism group shows higher performance at Knowledge level than at Higher Order Understanding level.

For low neuroticism group, Mixed Programme was found highly effective at Knowledge level, moderately effective at Understanding level and least effective at Higher Order Understanding level.

Through Structural Communication, the extraverts group attained higher gains in performance at Understanding and Higher Order Understanding levels than Knowledge level.

For extraverts group, the Structural Communication was found more effective for Understanding level than for Knowledge and Higher Order Understanding levels.

For high neuroticism group, the Structural communication was considered more effective at Understanding level than it was at Higher Order Understanding and Knowledge levels.
For low neuroticism group, the Structural Communication was found more effective at Understanding level than at Higher Order Understanding level and Knowledge level.

Through Teacher directed Structured Lessons, extraverts were equally benefitted for all the three levels of educational objectives.

For introverts group, the Teacher directed Structured Lessons were considered equally effective for Knowledge, Understanding and Higher Order Understanding levels.

For high neuroticism group, the Teacher directed Structured Lessons were more effective for Knowledge and Understanding levels than it was for Higher Order Understanding level.

For low neuroticism group, the Teacher directed Structured Lessons showed a gradual increase from Higher Order Understanding level through Understanding level to Knowledge level but the gain was statistically superior at Knowledge level to that at Higher Order Understanding level.

Educational Implication and Suggestions for Further Study:

The present findings have direct implications for designing instruction for subjects with different personality types. The findings indicate a direct relationship between
personality types and gains in their performance in Biology. The results of the study provide a guideline for designing group instruction and adopt instructions to the individual differences with respect to personality types.

The overall performance through Teacher directed Structured Lessons was found superior to the two modes of self-instructions. The finding has a direct application in present educational system for designing group instruction and identifying the suitable mode of the self-instructional programmes.

The findings of the present study also highlight the implications of designing instructions for different levels of educational objectives. They point out that for realizing higher objectives, the Structural Communication must be preferred over Mixed Programmes. Whereas for knowledge level of objectives, the Mixed Programmed Instruction must be preferred to other designs. These findings work as guidelines for designing instructions for different levels of educational objectives.

The findings also indicate suitable instructional designs for Concept learning and Rule learning. More research in this direction is required to confirm the findings of the present investigation. The further research in the area may be undertaken on the following aspects:
(i) For the purpose of cross-validation of the present findings, a project covering different content areas may be undertaken.

(ii) Certain experimental studies may also be undertaken considering the variables of creativity and intelligence to pinpoint the effect of different types of instructions on different creativity and intelligence groups.

(iii) Certain similar experimental projects may be initiated with the variable of age and sex.

(iv) To pinpoint the effect of different instructionals material and instructional modes on the different types of learning, experimental studies can be conducted on varying types of learning.

This evidently is not a comprehensive list of research problems which may probably be taken up in this area. Many more problems in this area may be formulated and worked out.