Chapter III

Methodology of the Study
CHAPTER – III
METHODOLOGY OF THE STUDY

This chapter presents the description of the design of the study, sample, variables studied, tools, procedure and statistical techniques to analyse data.

3.1 STATEMENT OF THE PROBLEM

“EFFECTIVENESS OF COMPUTER SIMULATED INSTRUCTION AT SECONDARY STAGE IN ACQUISITION OF BIOLOGICAL CONCEPTS AS RELATED TO INTELLIGENCE AND COGNITIVE STYLES”.

3.2 DELIMITATIONS OF THE STUDY

1. Only computer simulations were used in investigation.
2. The study was confined to IX class students only.
3. The study was a sampled study.
4. Computer simulation instructional package was developed on three units of Biology namely; (a) structural organization of cell; (b) cell division; (c) photosynthesis from IX class syllabus prescribed by CBSE.

3.3 OBJECTIVES OF THE STUDY

The study was conducted to achieve the following objectives:

1. To develop computer simulated instruction package for teaching Biology, from the curriculum of IX class.
2. To prepare criterion referenced achievement test on the selected topics of Biology to measure the achievement of students.
3. To investigate if computer simulated instruction result in better acquisition of Biological concepts as compared to traditional methods of teaching.
4. To examine the affect of intelligence on acquisition of Biological concepts irrespective of strategy of teaching of Biology.

5. To study the affect of cognitive style of students on the achievement of Biological concepts.

6. To see whether the variables of intelligence and cognitive styles of students interact with computer simulated instruction and traditional teaching or not.

7. To study the interactional effect of instructional strategies with intelligence, instructional strategies with cognitive style, intelligence with cognitive style on the acquisition of Biological concepts.

3.4 HYPOTHESES OF THE STUDY

Research Hypotheses

1. There will be significant difference in the acquisition of Biological concepts between the groups taught through traditional method of teaching and computer simulated strategy.

2. There will be positive and significant difference in acquisition of Biological concepts at different levels of intelligence irrespective of strategy of teaching.

3. There will be significant difference in the acquisition of biological concepts between groups having field-independent and field dependent style of thinking.

First Order Interaction

4. There will not be significant interaction between instructional strategies and levels of intelligence in terms of students acquisition of Biological concepts.

5. Interaction of teaching strategies and cognitive style will not contribute significantly in the acquisition of Biological concepts.
6. There will not be significant interaction between intelligence and cognitive style in terms of acquisition of Biological concepts.

**Second Order Interaction**

7. There will not be any significant interaction among instructional strategies, intelligence and cognitive style.

**Statistical Hypothesis**

8. Null hypothesis was used to test research hypotheses.

### 3.5 Experimental Design

Pre-test, post-test factorial design was employed in the present study. Schematic lay out of the design is given in table 3.1.

**Table 3.1**

**Schematic lay out of the experimental design**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Group –A&lt;sub&gt;1&lt;/sub&gt; N=80</th>
<th>Group –A&lt;sub&gt;2&lt;/sub&gt; N=80</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Phase I</td>
<td>1. Achievement Test as pre-test</td>
<td>1. Achievement Test as pre-test</td>
</tr>
<tr>
<td></td>
<td>2. Intelligence Test (SPM-1983)</td>
<td>2. Intelligence Test (SPM-1983)</td>
</tr>
<tr>
<td></td>
<td>3. Group Embedded Figure Test (GEFT) to identify cognitive style of subjects</td>
<td>3. GEFT to identify cognitive style of subjects</td>
</tr>
<tr>
<td>II. Experimental Phase</td>
<td>4. Exposure through computer simulated instruction</td>
<td>4. Exposure through Lecture method</td>
</tr>
<tr>
<td>III. Phase – II</td>
<td>5. Achievement Test as post-test</td>
<td>5. Achievement Test as post-test</td>
</tr>
</tbody>
</table>

In phase-I, achievement test based on three selected topics from IX Class biology syllabus, intelligence test (SPM-1983), Group embedded figure test (GEFT) by Phillip. K. Ottman, Evelyn Raskin and Herman. A. Witking were administered to the students of both groups.
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In phase II both the groups were given instruction. Group A₁ was given instruction through, lecture strategy while group A₂ was given computer simulated instruction. The allocation of strategy was random.

In phase III the same achievement test in science which was used as Pre-test was administered to both the groups after the instructions were over.

3.6 SAMPLE OF THE STUDY

It is not possible to study whole of the population for a particular problem under investigation. So every research design has to resort to sampling. For this study keeping in view the design of the experiment, two samples, one for the development of criterion test and other for conducting experiment were raised from the population comprising IX class students admitted in secondary schools of UT Chandigarh. The sample was raised through random cluster sampling technique. One sample consisted of 30 students and the other consist of 160 students. The school-wise break up of the sample is given in Table 3.2

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the School</th>
<th>No. of Students in A₁</th>
<th>No. of Students in A₂</th>
<th>Total No. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shishu Niketan Model Sr. Sec. School, Sector 22-D, Chandigarh</td>
<td>40</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>2.</td>
<td>Govt. Model Sr. Secondary School, Sector 21, Chandigarh</td>
<td>40</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>80</td>
<td>80</td>
<td>160</td>
</tr>
</tbody>
</table>

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3.7 VARIABLES

3.7.1 Independent Variables

In the present study two types of independent variables have been used.

(a) Treatment variable, which involved two instructional strategies:-
   (i) Traditional method of teaching
   (ii) Computer simulated instruction

(b) Classifying variables included
   (i) Intelligence
   (ii) Cognitive style

3.7.2 Dependent Variables

Achievement in the subject of Biology was taken as dependent variable.

3.8 TOOLS USED

Following tools were used in the study to collect data.

1. Computer simulated instructional package was developed by the investigator. The topics from the IX class CBSE syllabus included were (a) structural organisation of cell, (b) cell division, and (c) photosynthesis.

2. A criterion referenced achievement test on the same topics of Biology was developed and standardized by the Investigator to measure the achievement in Biology on the selected topics.

3. Raven Progressive Matrices Test (SPM - 1983) for measuring intelligence was used.

4. The Group Embedded Figure Test (GEFT) by Philip K. Ottman, Evelyn Raskin and Herman A. Witkin was used to identify the cognitive style of students.
3.9 DESCRIPTION OF TOOLS

a) Standardized Tools

b) Locally developed tools specifically for the use in the present study

3.9.1 Standardized Tools

a) Standard Progressive Matrices Test (SPM-1983)

This test was used to measure the intelligence of the sample of 160 students. Standard Progressive Matrices, is a test of a person’s capacity at the time of the test to apprehend meaningless figures presented for his observation, see the relations between them, conceive the nature of the figure completing each system of relations presented and, by so doing develop a systematic method of reasoning. The scale consists of sixty problems divided into five sets of 12. In each set the first problem is as nearly as possibly self-evident. The problems which follow become progressively more difficult. The order of the items provides the standard training in the method of working. The five sets provide five opportunities for grasping the method and are progressive assessments of a person’s capacity for intellectual activity.

The scale is intended to cover the whole range of intellectual development from the time a child is able to grasp the idea of finding a missing piece to complete a pattern, and to be sufficiently long to assess a person’s maximum capacity to form comparisons and reasons by analogy without being unduly exhausting unwieldy. As the order of the problem provides, the standard training in the method of working, the scale can be given either as an individual, a self-administered or as a group test. A person’s total score provides an index of his intellectual capacity. The contribution which each of the five sets makes to the total provides a means of assessing the consistency of the estimate and the psychological significance of discrepancies in the test results. The scale has a retest reliability varying with age from 0.83 to 0.93. It correlates...
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0.86 with the Terman Merill scale and has been found to have a ‘g’ saturation of 0.82.

The test was administered and evaluated strictly on the basis of instructions given in the manual. The raw scores were used to classify the students of each group into three levels i.e. above average, average and below average.

b) **The Group Embedded Figure Test (GEFT)**

The Group Embedded Figure Test, an adaptation of the original individually administered embedded figure test (EFT) was preferred as a suitable instrument to measure the cognitive style dimension of field-independence/dependence of the sample primarily because it makes group testing possible and scores for a large number of individuals can be conveniently obtained in a single test session of 20 minutes.

GEFT required the subjects to locate a simple visual figure embedded within a more complex one. Besides the seven simple forms (A,B,C,D,E,F,G) that have to be located, the test has three sections; first section comprising of a seven- item practice set which served the purpose of providing practice to the subjects and is not to be scored, second and third sections are comprised of nine difficult figures which are arranged in ascending order of difficulty within each section. Thus, the test has a scored set of 18 items administered in two equal parts and for which subjects are allowed a time-limit of 5 mts each, where as for the practice set only 2 minutes are to be allowed (Manual of GEFT, 1971). The total number of simple form correctly traced in second and third sections combined is the individual’s score, since the items in practice set are not scored but, merely scanned to ensure that the instructions have been understood properly by the subjects.

Since GEFT is a speed test, an appropriate method of estimating reliability is the correlation coefficient between parallel forms with identical time-limit. Correlation between the second and third sections...
were computed and calculated by Speraman Brown Prophecy formula, producing a reliability of 0.82 for both males (N=80) and females (N=97) from an eastern liberal arts college (as reported in GEFT Manual, 1971). The test along with its scoring key is appended in the Appendix No. IV.

3.9.2 Locally Developed Tools

Achievement Test in Biology

As the investigator could not get an appropriate standardized achievement test in Biology, so as to evaluate learning outcomes in the concerned topics, the need was felt to develop one. Various steps involved to develop the test have been given in Chapter IV. Final draft of the Achievement Test is attached in the Appendix I.

3.10 DATA COLLECTION

The sampled data had been collected comprising following sets of scores for the investigation which was carried out providing due consideration to the target group, general and specific objectives of the course, teaching and evaluation methods and amenability of computers as a medium.

1. Achievement scores as Pre-test and Post-test scores. Gain score as the difference between these scores.
2. Intelligence score
3. Cognitive style score

3.11 STATISTICAL ANALYSIS OF DATA

The data was analyzed by computing mean, Median and standard deviation. To test Hypotheses, three way analysis of variance (2x3x2) and t-test were employed to see the effect of three variables viz. two modes of instruction, three levels of intelligence and two levels of cognitive style.

Analysis of variance was used to get the difference in total achievement of different modes of instructions for significance. Also the
significant F-ratios, the t-test was employed so as to find out the significance of difference between means related to different groups and different variables.

Schematic lay out of analysis is given in Fig. 3.

**Fig. 3.1**

*Schematic Layout of the Analysis*

2 x 3 x 2

A _____ A2

A1 A2

B1 B2

B1 B2

where:

A stands for Teaching strategies
A1 stands for conventional lecture method
A2 stands for computer simulated instruction
B stands for Intelligence
B1 stands for Above average intelligence group
B2 stands for average intelligence group
B3 stands for below average intelligence group
C1 stands for field dependent cognitive style
C2 stands for field independent cognitive style