Chapter VI
Summary and Conclusions
CHAPTER VI

SUMMARY AND CONCLUSIONS

6.1 INTRODUCTION

One of the most important challenges before education is to make learning interesting and exciting. Teaching is an activity which is designed and performed for multiple objectives in terms of changes in pupil behaviour. The main focus of teaching is to bring about a desirable change in the behaviour of learner. It is brought about by the teacher using teaching strategies to achieve his objectives. But traditionally we have been using teaching methods for content presentation. The traditional educational methods in India cannot keep pace to the changes in the people’s individual needs and aspirations and the developmental needs of the people in India. Most of these changes are affected directly or indirectly by contribution of science and technology.

Technology has helped to improve the quality and pace of activity as well as production in most aspects of human endeavour. With the impact of modern technology, rapid changes are coming in the field of education. A teacher is required to engage in several professional roles, which requires different teaching strategies. Recent developments have made it possible for teachers to conceptualize a variety of instructional strategies.

Stones E. and Morris S. (1972) defined “teaching strategy is a generalized plan for a lesson which includes structure, desired learner behaviour in terms of goals of instruction, desired learner behaviour in terms of goals of instruction and an outline of planned tactics necessary to implant the strategy. The lesson strategy is a part of larger development scheme of the curriculum.”
A good strategy involves the points of one or more methods/strategies. Strategy is a part of teaching apart from many more activities involved in this process and the blue print of teaching which takes into consideration all those activities which are needed to generate educative environment within the framework of task in hand and reference to the essential elements of teaching.

Models of teaching try to describe teaching as it ought to be. Psychologists are of the view that the best substitute for the theory of teaching is a model of teaching for it explains the various teaching and learning conditions and their relationship. When we teach well, we help students learn well. A model of teaching helps learning. Powerful learners have repertoires of powerful strategies for acquiring education.

**Computer Based Teaching Model**

The computer is one of the most important and outstanding invention that has made an increasing and powerful impact on the working methods of research. Computer allow a large variety of contents and symbolic modes ranging from printed words to dynamic scheme, from graph to musical notation, while all other instructional technologies are restricted to a particular kind of symbol systems and hence to a limited range of contents, computers differ from other technologies in a variety and kind of activity they afford. Computer applications in education cover many areas. Various instruction modes that the computer assisted instruction can facilitate most effectively are –

- Drill and practice
- Tutorial and Dialogue
- Discovery learning
- Simulation

Within the field of computer assisted instruction the present study dealt with computer simulation, which is more recent and exciting development than the various other instructional modes.
6.2 STATEMENT OF THE PROBLEM

"EFFICACY OF COMPUTER SIMULATED INSTRUCTION AT SECONDARY STAGE IN ACQUISITION OF BIOLOGICAL CONCEPTS AS RELATED TO INTELLIGENCE AND COGNITIVE STYLE"

6.3 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.

6.4 OBJECTIVES OF THE STUDY

The study was conducted to achieve the following objectives:

1. To develop computer simulated instructional package for teaching biological concepts 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 effect of intelligence on acquisition of biological concepts irrespective of strategy of teaching of Biology
5. To study the effect of cognitive style of students on the achievement of Biological concepts.
6. To see whether the variables of intelligence and cognitive style 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.

6.5 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 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 any significant interaction between intelligence and cognitive style in terms of students acquisition of Biological concepts.
Second Order Interaction

7. There will not any significant inter-action among instructional strategies, intelligence and cognitive style.

Statistical Hypothesis

Null hypothesis was used for testing research hypotheses.

6.6 EXPERIMENTAL DESIGN

Pre-test, Post-test factorial design was employed in the present study.

In phase I, achievement test based on selected topics in Biology, intelligence test (SPM –1983,), Group Embedded Figure Test (GEFT) by Philip K. Otman, Evelyn Raskin and Herman A. Witkin were administered to the students of both groups.

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.

6.7 SAMPLE OF THE STUDY

The sample of 160 students was raised through random cluster sampling technique from IX Class students. Two Schools were selected from UT Chandigarh. The average age of sample was +13 years.

6.8 TOOLS USED

A criterion referenced achievement test in Biology (Developed by the Investigator), Raven progressive Matrices Test (SPM – 1983) for measuring intelligence, Group Embedded Figure Test (GEFT) by Philip K. Ottman, Evelyn Raskin and Herman A. Witkin were used as basic tools for the collection of data.
6.9 DEVELOPMENT OF ACHIEVEMENT TEST

A locally developed achievement test was used to measure achievement in Biology. The reliability was checked against the Test- Re-test method and Test was validated against the criterion on content validity. The final draft of achievement test consisted of 55 items. All items were of multiple choice type.

6.10 DEVELOPMENT OF COMPUTER SIMULATION PACKAGE

With the valuable suggestions of experts, school teachers and system analysts a computer programme based on selected topics of Biology was locally developed. The programme was developed to attain the predetermined educational objectives expressed in behavioural terms.

6.11 ANALYSIS OF DATA

The data collected with the help of tools mentioned in Chapter III and IV was analysed by using descriptive statistics such as mean, medium, standard deviation, skewness and Kurtosis. To test the hypothesis ANOVA (2x3x2) was employed. In order to test significance of difference between means, the t-ratios were calculated.

6.12 DISCUSSION OF RESULTS

The results of analysis of variance and significance of difference between mean scores are shown in Table 6.1-6.5.
Table 6.1
Summary of ANOVA

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>SS</th>
<th>MV</th>
<th>F-ratio</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSA</td>
<td>1</td>
<td>4182</td>
<td>4182</td>
<td>269</td>
<td>.01</td>
</tr>
<tr>
<td>SSB</td>
<td>2</td>
<td>732.24</td>
<td>366.12</td>
<td>23.6</td>
<td>.01</td>
</tr>
<tr>
<td>SSC</td>
<td>1</td>
<td>163.83</td>
<td>163.83</td>
<td>10.5</td>
<td>.05</td>
</tr>
<tr>
<td>SSAB</td>
<td>2</td>
<td>45.77</td>
<td>22.88</td>
<td>1.47</td>
<td>Insignificant</td>
</tr>
<tr>
<td>SSAC</td>
<td>1</td>
<td>29.62</td>
<td>29.62</td>
<td>1.91</td>
<td>Insignificant</td>
</tr>
<tr>
<td>SSBC</td>
<td>2</td>
<td>32.43</td>
<td>16.21</td>
<td>1.04</td>
<td>Insignificant</td>
</tr>
<tr>
<td>SSABC</td>
<td>2</td>
<td>471.42</td>
<td>235.71</td>
<td>15</td>
<td>.01</td>
</tr>
<tr>
<td>SSW</td>
<td>148</td>
<td>2292.65</td>
<td>15.5</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.2
Table showing t-ratio among two groups taught through different modes of instruction

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>S.D.</th>
<th>N</th>
<th>S.E.D.</th>
<th>C.R.</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Control Group</td>
<td>15.87</td>
<td>3.89</td>
<td>80</td>
<td>0.76</td>
<td>13.46</td>
<td>Significant at .01 level</td>
</tr>
<tr>
<td>A2 Experimental Group</td>
<td>26.1</td>
<td>5.71</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6.3
Table showing t-ratio between levels of intelligence

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>S.D.</th>
<th>N</th>
<th>S.ED.</th>
<th>C.R.</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>B₁</td>
<td>24</td>
<td>6.31</td>
<td>53</td>
<td>1.24</td>
<td>3.4</td>
<td>Significant at .01 level</td>
</tr>
<tr>
<td>B₂</td>
<td>19.78</td>
<td>7.15</td>
<td>64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B₁</td>
<td>24</td>
<td>6.31</td>
<td>53</td>
<td>1.33</td>
<td>3.71</td>
<td>Significant at .01 level</td>
</tr>
<tr>
<td>B₃</td>
<td>19.06</td>
<td>6.75</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B₂</td>
<td>19.78</td>
<td>7.15</td>
<td>64</td>
<td>1.35</td>
<td>0.53</td>
<td>Insignificant</td>
</tr>
<tr>
<td>B₃</td>
<td>19.06</td>
<td>6.75</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.4
Table showing t-ratio between different cognitive styles

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>S.D.</th>
<th>N</th>
<th>S.ED.</th>
<th>C.R.</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁</td>
<td>19.2</td>
<td>6.5</td>
<td>39</td>
<td>1.22</td>
<td>2.06</td>
<td>Significant at .05 level</td>
</tr>
<tr>
<td>C₂</td>
<td>21.56</td>
<td>7.1</td>
<td>121</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 6.5

Table showing t-ratio between strategy of teaching x intelligence x cognitive style

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>N</th>
<th>S.D.</th>
<th>S.ED.</th>
<th>C.R.</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 B1 C1</td>
<td>14.4</td>
<td>5</td>
<td>1.51</td>
<td>1.48</td>
<td>3.89</td>
<td>Significant at .01 level</td>
</tr>
<tr>
<td>A1 B1 C2</td>
<td>20.16</td>
<td>12</td>
<td>4.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1 B2 C1</td>
<td>16.25</td>
<td>8</td>
<td>4.77</td>
<td>1.77</td>
<td>0.74</td>
<td>Insignificant</td>
</tr>
<tr>
<td>A1 B2 C2</td>
<td>14.93</td>
<td>29</td>
<td>3.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1 B3 C1</td>
<td>15</td>
<td>9</td>
<td>3.24</td>
<td>1.35</td>
<td>0.12</td>
<td>Insignificant</td>
</tr>
<tr>
<td>A1 B3 C2</td>
<td>15.17</td>
<td>17</td>
<td>3.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 B1 C1</td>
<td>28.2</td>
<td>5</td>
<td>6.79</td>
<td>3.16</td>
<td>0.65</td>
<td>Insignificant</td>
</tr>
<tr>
<td>A2 B1 C2</td>
<td>26.13</td>
<td>31</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 B2 C1</td>
<td>23.8</td>
<td>5</td>
<td>7.52</td>
<td>3.58</td>
<td>0.76</td>
<td>Insignificant</td>
</tr>
<tr>
<td>A2 B2 C2</td>
<td>26.54</td>
<td>22</td>
<td>5.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 B3 C1</td>
<td>21.71</td>
<td>7</td>
<td>7.06</td>
<td>3.03</td>
<td>1.91</td>
<td>Insignificant</td>
</tr>
<tr>
<td>A2 B3 C2</td>
<td>27.5</td>
<td>10</td>
<td>4.57</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• **Main Effect of Teaching Strategy**

The F-ratio of 269 for 1/148 degree of freedom vide Table 5.11 was found to be significant at .01 level of significance. The results revealed that two groups differed significantly in mean achievement. The difference in means of two groups could not be attributed to mere sampling error or chance difference. It may be due to treatment variable. The null hypothesis could not be retained on the basis of result. Therefore the research hypotheses that there is significant difference in terms of mean achievement scores of two groups taught through two different instructional strategies, stand accepted.

• **Main Effect of Intelligence**

The F-ratio of 23.6 (df= 2/148) was found to be significant at .01 level of significance. This showed that levels of intelligence affect the achievement in Biology differentially. The difference in the means of above average, average and below average intelligence group cannot be due to sampling error, it may be due to their ability levels. The mean of the group of above average student was higher than the mean of below average group students. The null hypotheses that there will not be any significant difference in mean achievement of groups differing in intelligence stand rejected.

• **Main Effect of Cognitive Style**

The F-ratio of 10 (df 1/148) was found to be significant at .05 level of the significance. It indicated that there is difference between the mean gain scores of the field independent and field dependent groups. The null hypotheses that there will not be significant difference in mean achievement of groups having field independent cognitive style and field dependent cognitive style towards Biology stands rejected.
• **Interactional effect between strategies of teaching x levels of intelligence on achievement (AXB)**

   The F-ratio in case of treatment X levels of intelligence was found to be insignificant, which implied that there is no significant interaction among strategies of teaching and levels of intelligence.

• **Interactional effect between strategies of teaching x cognitive style (AXC)**

   The F-ratio in case of treatment X cognitive style was found to be insignificant even at .05 level of significance. The result revealed that there is no significant interaction for strategies of teaching x cognitive style.

• **Interactional effect between levels of intelligence x cognitive style (BXC)**

   The F-ratio in case of levels of intelligence x cognitive style was found to be insignificant even at .05 level of significance. The results revealed that there is no significant interaction between levels of intelligence and cognitive style.

• **Interactional effect between strategies of teaching x intelligence x cognitive style (AXBXC)**

   The F-ratio of 15 (df 2/148) in case of AXBXC was found to be significant at .01 level of significance therefore the hypotheses that there will be significant interaction among strategies of teaching, intelligence and cognitive style is accepted.

**6.13 CONCLUSIONS**

1. Computer simulated instructional strategy was found to be more effective as compared to lecture strategy in terms of acquisition of Biological concepts at secondary stage.
2. High intelligent students achieved more marks than average and below average students in both strategies. Level of intelligence emerged as significant factor in learning biological concepts.

3. Achievement in the subject of Biology was appreciately affected by the cognitive style of the learner. Field independent group irrespective of strategy of teaching scored higher than field dependent group.

4. No significant interaction between different strategies of teaching and level of intelligence was found on achievement of students in Biology.

5. There was no significant interaction for strategy of teaching and cognitive style.

6. No significant interaction between levels of intelligence and cognitive style was found on achievement in Biology.

7. Significant interaction between strategy of teaching, intelligence and cognitive style was found.

6.14 EDUCATIONAL IMPLICATIONS

The finding of the study suggest that instruction through computer simulations may be used to teach important concepts in different subjects at secondary stage. The result of this study is limited by the fact that this was a small scale investigation and sample size was also small. Still this study is very much significant for policy makers, Principals and Teachers. Because in this study an effort has been made to see the effectiveness of teaching strategies to be employed by the Teacher. Teacher should try to identify cognitive style of student and should choose teaching strategies in accordance with the cognitive style. The study also implies that course could be completed in comparatively less time when taught through computer simulation than teacher directed instruction and thus the spare time can be utilized for more
enriched educational activities. Ability to draw accurate diagrams also improve when Biology is taught through computer simulation. The below average and average students may be compensated by teaching through computers but before the use of computers in the field of Biology, the teacher must be trained properly to utilize them. For this purpose, application of modern educational technology should be stressed upon. Teacher should be encouraged to prepare simple soft-ware packages including animation and simulation as children are more attracted towards coloured visuals. Also fundamental concepts in Biology if cleared at secondary stage would 'inculcate in them love and curiosity for the living world around them which is so very important for the progress of science and technology.

6.15 SUGGESTIONS FOR FURTHER STUDY

1. This study can be conducted involving the entire course of Biology at secondary and senior secondary stage.

2. This study can be conducted in other subjects at secondary or senior secondary stage.

3. The study may be conducted by involving more variables like sex, age, personality of student and socio-economic status.

4. Computer simulated package can be developed for other disciplines of science.

5. Similar studies may be conducted to compare effectiveness of computer assisted instruction with other strategies of teaching.

6. The study may be conducted at college or University level to find out effectiveness of computer simulated instruction at higher grade level.