Chapter – III

METHODOLOGY

The methodology used for the present study is described in this chapter. This chapter mainly deals with the nature of study, type and size of sample selected, tools used, design of the study and statistical analysis by which the effectiveness of different models of teaching is computed, interpreted and explained.

3.1 Procedure

Present investigation is an experimental type of study which was undertaken to study the effect of Advance Organizer Model and Concept Attainment Model for teaching Biological sciences to IX grade student. The achievement in and attitude towards biological sciences are the main criteria for finding out the effectiveness of different teaching techniques. To carry out the study three groups of class IX grade students were taken into consideration. Two were experimental groups and one was control group. Each Group was matched on the basis of the intelligence of students and their socio-economic status index. Advance Organizer Model was chosen for one experimental group and Concept Attainment Model for the other. Conventional teaching was followed for the control group. The treatments under various strategies done on the basis of randomization 30 periods of 35
minutes duration were given to each treatment and control-groups. Teacher variable has also been controlled as the same teacher taught through all the strategies. Before teaching through different models and strategy each group was pre-tested for student achievement in the subject and also for their attitude towards biological sciences.

3.2 Sample

Purposive sampling was done for the present study. For this the school, Maharaja Kumar Anant Narayan Singh Vidya Sansthan, Gyanpur, was selected. Initially there were 74 students but only those students were included in the study who were present throughout the experiment. Thus, finally, the sample consisted of 69 male students dispersed in three groups.

3.3 Tools Used

Following tools were used for the collection of data in the present study-

(a) Samanya Mansik Yogyata Parikshan,

(b) Socio-economic Status Index Scale,

(c) Uplabdhi Parikshan,

(d) Jeev Vigyan Ke Prati Chatra abhivriti Mapan Suchi

3.3.1 Samanya Mansik Yogyata Parikshan —

Sananya Mansik Yogyata Parikshan is used to match the groups on the basis of Intelligence. This test is constructed by M.C.
Joshi (1956). Hindi version of the test was used. Intelligence is the major factor in the academic achievement of students. Kohli (1976), Shukla (1968) and Kumaraiah (1976). So it has become necessary to equate the groups on the basis of their Intelligence.

Joshi’s test of general mental ability has been proved to be useful for the age range of 12-19 years. It can be used for both rural and urban students. Test consists of items related to synonyms, antonyms, number of series, classification, best answers reasoning and analogies. It contains 100 item, to be answered in a fixed time limit of 20 minuets only. Administration procedure, scoring system, interpretation of raw scores, are given in the manual. The test is standardized on a quite large sample selected from class VIII to XII by the author. It has been found to be fairly valid when compared to the other tents of intelligence. The reliability co-efficient to the total scores and the score of all different categories was obtained as 0.88 by applying K-R (20) formula (Appendix – ).

3.3.2 Socio Economic Status Index Scale

Like intelligence socio-economic status of the parents also affects on the academic achievement of children (Menon, 1973, Anand, 1973; and Abraham, 1974). For finding out the economic conditions of the children a test of socio-economic status index, developed by
Verma and Saxena (1976) was used. This index is mainly used to equate the groups.

The Socio-economic Status index measures the socio-economic status of the subject in terms of family status, parents' education, occupation income, caste, dwelling areas, possession of few prestigious commodities, memberships of famous clubs, political affiliation and taxability of income. A high score on the scale indicates a high socio-economic status and the low score indicates the low status. The test-retest reliability computed on the sample of 50 students was found to be 0.74. Validity of the test lies in its capacity to classify people in the society in correct classes formed on the basis of their socio-economic status. It was administered on a known group of 50 people and 95 percent classifications were found to be true (Appendix- ).

3.3.3 Upalabdhi Parikshan

Uplabdh Parikshan in Biological Sciences was developed by the researcher himself. It was developed on the basis of the selected content from the prescribed U.P. Board text book ‘Vigyan’ for class IX. To fulfill the first and third objectives of the study, "To study the effect of Advance Organizer Model on pupils’ achievement in Biological Sciences and "To study the effect of Concept Attainment Model on pupils’ achievement in Biological Sciences". This test was constructed
as it measures the achievement of students in the Biological Sciences which is one of the major criteria for judging the effectiveness of different models of teaching. The following steps were followed while developing the test.

**Step I** - First step of the test construction was the preparation of blue print of the test. While making blue print all the cognitive aspects of the educational objectives (Bloom, 1956) and also objective of Biological Sciences teaching were taken into consideration.

For this purpose Unit - 5 & 6 Comprises 10 chapters out of each only seven chapter were selected for the present study. 30 lesson plan were prepared by researcher to test the null hypothesis. Draft of blue print included 120 items related to knowledge, understanding and application level.

**Step II** – After consulting books it was found that multiple choice type questions are more suitable for the present study than other types of objective questions, *i.e.* true and false type, matching type, and classification type. Ebel (1966) in his book, also has selected that multiple choice type of objective questions have less chance of error due to guessing as is there in the true and false type of questions. According to the blue print 120 items of multiple choice type were formed. These items were taken from the content of selected topics of
the text-book 'Vigyan' for IX Grade. Only Hindi version of items were made.

**Strep III** – Now this list of items was given to few judges together their views regarding the format of questions and their distracters. These Judges were the senior teachers from the Dept. of Education, specialist of subjects and the experts of tool construction. On the basis of their opinions and suggestions 20 items of the list were removed as they were having some vague ideas.

**Step IV** Further the forms of the questions and the language must be according to the mental level of the students. So for this the questions approved by the Judges were given to the 30 students of IX Grade. They were in all respects similar to the sample to be selected for the present study. 100 Items were given to these students and 10 Items have been dropped out as the language of these Items was not suitable for the students.

**Try-out**

A booklet containing the list of 90 items was made separate with answer-sheets cyclostyled. These were distributed to the IX grade students of Maharaja Kumar Anant Narayan Singh Vidya Sansthan, Gyanpur, and Vibhuti Narayan Govt. Intermediate College, Gyanpur studying in for the try-out session 2009-10. Introductions for answering the questions, the approximate time limit, types of items and the
purpose were also briefly given in the booklet. It was administered on a sample of 100 students. Booklets were distributed in the class and instruction were read and explained. Students were asked to answer the questions which were given as the example. This was done only to acquaint the students with the type of items present in the test booklet and the procedure of answering them. Clear instructions were given to select the best answer out of possible four and write a, b, c or d against the box of the item number on separate answer sheet and not to put any sign on the test booklet. At this level the time taken by the student who completed first and the item taken by the rest of the students was also noted. Students took approximately 90 minutes, to answer all the questions of the test booklet. Correct answer of each question was also noted on a separate paper, for making scoring key. Each correct answer was awarded one mark and all the wrong answers were given zero mark.

**Item analysis**

Item analysis was done by taking upper 27 percent or the 27 percent of the students who scored highest and 27 percent of students who scored lowest. This was done to select the items which discriminates best among the low and high achievers.
Final form of test

Out of the 90 items only 60 items were selected for the final form of the test. These 60 questions were from the selected content. Test booklet for final data collection was prepared. Necessary instructions were also given in the final test booklet. Final form of the test booklet is given in Appendix No. .... Separate handmade scoring key was also prepared for the purpose of scoring. 45 mins. were given to answer all the 60 questions of the test booklet. One mark was fixed for each correct answer.

Reliability

The reliability of the test was calculated by Kunder Rechardson formula (K-R-20) and was found to be 0.86.

\[ R = \frac{k}{k-1} \left( 1 - \frac{\Sigma pq}{\sigma^2} \right) \]

where,

- \( R \) = Reliability.
- \( k \) = Total no. of questions in test
- \( \Sigma \) = Summation
- \( p \) = Ratio of students who solve the question correctly
- \( q \) = Ratio of students who responding wrong
- \( \sigma \) = Standard Deviation (S.D.)
Validity

The test showed high content validity as it employed systematic test construction, objective based item selection and expert judgment during the preparation.

Jeev Vigyan ke prati Chatra abhivritti Mapan Shuchi–

To realize the second and fourth objectives of the study i.e. "To study the effect of the Advance Organizer Model based teaching on pupils' attitude towards Biological Science" and "To study the effect of Concept Attainment Model based teaching on pupils' attitude towards Biological Science "a scale to measure the attitude of students towards Biological Science constructed by Sushma (1987) was used by the investigator. While constructing test, systematic development procedure was followed, which includes objective based items selection and consultation of judges thus, inventory bore high content validity. In inventory scoring was done according to Likert’s (1932) scoring method. For each positive statement Strongly Agree (SA) was given- 4 marks, Agree (A) was given - 3, Uncertain - 2, Disagree - 1, Strongly Disagree – 0. For each negative statement 0 (Zero) mark by given strongly agree, 1- mark to agree, 2 – mark for uncertain, 3- for disagree, 4- awarded to strongly disagree (Scoring pattern enclosed Appendix No. ). Which spilt half reliability of test was found to be 0.71 and test, re-test after a time interval of three months was found to be
0.78. It has been found that the achievement of the student is directly related to the attitude of the pupils towards the subject. Effective teaching of any subject develops the positive attitude among the pupil. So it has become necessary to take the attitude of pupils towards the Biological Science as a dependent variable.

3.4 Content to be Taught

Science text book of class IX, ‘Vigyan’ was followed for the content of topics for the present study. Seven chapters of the book named–

1. Plant Classification
2. Animal Classification,
3. Cell,
4. Tissue,
5. Bacterial Diseases,
6. Viral Diseases,
7. Our environment were selected.

3.5 Lesson Plans

Lesson plans for the Advance Organizer Model and Concept Attainment Model were developed by the researcher himself. Lesson plan follows the syntax of the model (Joyce & Weil, 1992, 2008), For Control group lesson plans according to conventional Herbartian teaching steps– introduction, presentation, association, generalization,
and application were developed. 30 lesson plans were based on seven chapters mentioned earlier. Model lesson plans for each treatment and control groups are given in Appendix no.  .

3.6 Design

The present study is confined to find out the difference in achievement scores and attitude towards the Biological Sciences, of IX grade students when taught through Advance Organizer Model and Concept Attainment Model of teaching, so the study envisages the measurement of academic achievement and attitude of pupils before and after the treatment. For this purpose three groups, two experimental and one control group were taken into account.

Experimental groups

(a) Advance Organizer Model (AOM)

(b) Concept Attainment Model (CAM)

Control Group -

(a) Taught according to the conventional teaching based on Herbartian steps.

Before teaching through different models the teaching groups have been matched on the basis of the intelligence and socio-economic status index scores. Analysis of variance was applied. F-ratio has been calculated for matching the groups. 'F' ratio 2.13 for I.Q. with its details are given below in table 3.1.
Table – 3.1

Summary table for ANOVA among the means of intelligence scores

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Sum of squares</th>
<th>'F'</th>
</tr>
</thead>
<tbody>
<tr>
<td>among means</td>
<td>2</td>
<td>292.77</td>
<td>146.38</td>
<td></td>
</tr>
<tr>
<td>within groups</td>
<td>66</td>
<td>4532.54</td>
<td>68.67</td>
<td>2.13*</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>4825.31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* not significant 0.05 level

F-ratio 2.40 for socio economic status index with its details given below in table 3.2.

Table – 3.2

Summary table for ANOVA among the means of Socio-economic Status index scores

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Sum of squares</th>
<th>'F'</th>
</tr>
</thead>
<tbody>
<tr>
<td>among means</td>
<td>2</td>
<td>266.27</td>
<td>266.27</td>
<td></td>
</tr>
<tr>
<td>within groups</td>
<td>66</td>
<td>7292.7</td>
<td>110.49</td>
<td>2.40*</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>7825.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* not significant 0.05 level.

Both the tables show that all the three groups (two experimental and one control) were similar so far as there intelligence and socio-economic status are concerned.
All the approaches and overall design of the study is given in table 3.3.

**Table – 3.3.**

Summary table for Showing Design for the Study

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration</th>
<th>Treatment</th>
<th>( T_1 )</th>
<th>( T_2 )</th>
<th>( T_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-testing</td>
<td>Three days</td>
<td>1. Administration of Joshi's Metal Ability Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Administration of SES Index</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Administration of Uplabhdhi Parikshan in Biological Sciences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Administration of Jeev Vigyan ke prati Chhatra Abhivritti Mapan Shuchi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>30 days</td>
<td>AOM CAM CT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Each group was taught separately for 30 periods of 35 minutes duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post - Testing</td>
<td>1 day</td>
<td>1. Administration of Uplabhdhi Parikshan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Administration of Jeev Vigyan ke prati Chhatra abhivritti Mapan Shuchi</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.7 Treatment

All the three groups were given treatment for 30 period of 35 minutes duration. First group was taught through Advance Organizer Model, second group through Concept Attainment Model, and the third group was taught through conventional teaching. Investigator himself acted as a teacher to all the groups.

3.8 Sequences of Activities

Sequences of activities involve in the study were as follows -

a) All the groups were administered Sananya Mansik Yogyata Parikshan and Socio-Economic Status Index for matching the groups in terms of students intelligence and socio-economic status index scores.

b) Each group was pre-tested for measuring their achievement by self made Upalabdhi Parikshan, and attitude by Jeev Vigyan ke Prati Chhatra Abhivritti Mapan Suchi constructed by Shusma (1987).

c) Group I was taught through Advance Organizer Model; Group II was taught through Concept Attainment Model; and Group III through conventional teaching. Researcher himself taught all the groups. Contents selected for teaching were also same. Total
time taken for treatment was 30 periods of 35 minutes duration for each group.

d) After the treatment was over each group was post-tested for their achievement and attitude towards the subject on Uplabdhi Parikshan and Jeev Vigyan Ke Prati Chhatra Abhivritti Mapan Suchi.

3.9 Data Collection

Pre-test and post-test scores on Upladhi Parikshan and Jeev Vigyan Ke Prati Chhatra Abhivritti Mapan Suchi were collected for the testing of hypotheses of the present study.

3.10 Scoring

Scoring was done according to the scoring procedure for the particular tests given in the description of the tests. Gain scores of achievement and attitude test was obtained by subtracting the pre-test scores from the corresponding post-test scores obtained by the students.

3.11 Statistical Analysis Used:

Analysis of variance was applied to see the significance of difference among the mean gain scores of achievement and attitude of students towards Biological Sciences. For significant 'F' ratio, 't'-test was applied for each pair of groups to test the hypotheses of the
present study. The ‘t’-test was also applied to see the efficacy between pre-test and post-test scores obtained by the students under various treatments separately. For comparing the efficacy of these three treatments analysis of variance was employed.