Chapter — IV

Methodology
<table>
<thead>
<tr>
<th>Chapter IV METHODOLOGY</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>85</td>
</tr>
<tr>
<td>Design of the Study</td>
<td>85</td>
</tr>
<tr>
<td>Development of Activity Based Learning (ABL) Package</td>
<td>87</td>
</tr>
<tr>
<td>Selection of Content Area from IX Std Science</td>
<td>87</td>
</tr>
<tr>
<td>Selection of the Components of Skills</td>
<td>88</td>
</tr>
<tr>
<td>Structure of the ABL Package</td>
<td>89</td>
</tr>
<tr>
<td>Designing of ABL Package</td>
<td>90</td>
</tr>
<tr>
<td>Evaluation of ABL Package</td>
<td>90</td>
</tr>
<tr>
<td>Validation of ABL Package</td>
<td>90</td>
</tr>
<tr>
<td>Construction of the Pre-test</td>
<td>91</td>
</tr>
<tr>
<td>Development of Criterion Referenced Tests (CRT)</td>
<td>92</td>
</tr>
<tr>
<td>Validity of CRT</td>
<td>93</td>
</tr>
<tr>
<td>Reliability of CRT</td>
<td>93</td>
</tr>
<tr>
<td>Uses of CRT</td>
<td>94</td>
</tr>
<tr>
<td>Pilot Stage</td>
<td>94</td>
</tr>
<tr>
<td>Individual Tryout</td>
<td>94</td>
</tr>
<tr>
<td>Demonstration Stage</td>
<td>95</td>
</tr>
<tr>
<td>Experimentation</td>
<td>96</td>
</tr>
<tr>
<td>Pre-test</td>
<td>96</td>
</tr>
<tr>
<td>Treatment</td>
<td>96</td>
</tr>
<tr>
<td>Post – test</td>
<td>96</td>
</tr>
<tr>
<td>Extension Stage</td>
<td>98</td>
</tr>
<tr>
<td>Sampling Procedure</td>
<td>98</td>
</tr>
<tr>
<td>Tools</td>
<td>98</td>
</tr>
<tr>
<td>Experimentation</td>
<td>98</td>
</tr>
<tr>
<td>Analysis of the Data Collected</td>
<td>100</td>
</tr>
<tr>
<td>Conclusion</td>
<td>100</td>
</tr>
</tbody>
</table>
CHAPTER IV
METHODOLOGY

INTRODUCTION

Research is oriented towards the discovery of relationship that exists among different phenomena of the world. According to George J. Mouly, "Educational research is the systematic and scholarly application of the scientific method interpreted in its broader sense, to the solution of educational problems; conversely, any systematic study designed to promote the development of education as a science can be considered educational research". Since any research is a systematised effort to gain new knowledge, the methodology adopted should be systematic.

In this chapter, the investigator outlines the systematic procedure adopted to carry out his research. He attempts to describe the development and validation of the Activity Based Learning package based on the state board syllabus of 9th standard Science the source of the data, procedure for the data collection and the statistical techniques used. The above methodological considerations are carefully adopted and presented in this chapter.

DESIGN OF THE STUDY

The study was carried out through the following important stages. The process design of the study is given in figure 2.
Stage I → Development of ABL Package
   ↓
Validation against content and methodology

Stage II → Development of Criterion Reference Test
   ↓
Establishing Reliability and Validity

Stage III → Pilot Stage
   ↓
Individual Try out
   ↓
Final draft of ABL learning packages and CRT tests

Stage IV → Demonstration stage
   ↓
Test the effectiveness of ABL learning packages against conventional method

Stage V → Extension stage
   ↓
Test the effectiveness of ABL learning packages against conventional method

FIGURE 2. THE PROCESS DESIGN OF THE STUDY
1. Development of Activity Based Learning (ABL) package

2. Development of Criterion Referenced Tests

3. Pilot stage

4. Demonstration stage

5. Extension stage

DEVELOPMENT OF ACTIVITY BASED LEARNING (ABL) PACKAGE

ABL Package was developed with the following features

The unit selected for ABL package should be precise and brief enough to be completed within the allotted time. The objectives should be defined and the content portion should be accurate. The activities should be relevant and appropriate to the content and they should be sequenced accordingly. The language should be simple and clear and suitable and appealing to the level of learners.

SELECTION OF CONTENT AREA FROM IX-STD SCIENCE

Selection of content area is very important because some of the areas would not involve practical activities for the development of the skill. The area should be such that it should utilize their cognitive level. Keeping this in mind, the investigator has analysed and finally selected the following lessons for the preparation of Activity Based Learning package. The content analysis is given in the Appendix (1).
LESSONS

1. Measurements
2. Force and motion
3. Newton’s Law of Motion
4. Work, Power, Energy
5. Heat and Temperature
6. Wave motion and Sound
7. Light
8. Nature of Matter
9. Chemical Reactions
10. Coal and Petroleum
11. Reproductive Biology
12. Our Environment

SELECTION OF THE COMPONENTS OF SKILLS

In spite of the fact that the practical skills to be developed among the students are plenty, the investigator has selected a few skills for his study after reviewing the practical skills given in Science A Process Approach (SAPA) format considering the age, nature and level of the students observation, Identification, Classification, Measuring and Inferring are considered as primary process skills whereas Formulation of hypothesis, Experimental setup, Testing hypothesis, Revision of hypothesis and Generalization are considered as integrated process skills
and scientific communication skills included Inquiry, Tabulation, Drawing, Graphical, Representation and Interpretation.

**STRUCTURE OF THE ABL PACKAGE**

With the ultimate aim of promoting individualized instruction, this ABL package is developed, considering the level of students, materials and facilities available in the schools and attitude of the teachers. Fifteen scientific skills are identified to be developed in IX std students. The format which is presented in figure.3 specifies the title, defines the objectives, describes the activities and outlines the feedback followed by the post test.

![Figure 3 Structure of the ABL package](image)
DESIGNING OF ACTIVITY BASED LEARNING (ABL) PACKAGE

Design of learning package needs a systematic development. This process begins with identifying the needs of the target population. After formulating instructional objectives of ABL package, suitable learning activities in order to attain the objectives were planned and they were arranged in sequence. A rough draft deciding the format and components of the ABL packages was written and then revised making necessary modifications. The learning ABL package was validated by consulting with content and methodology experts. The ABL package was tried out with individuals selection from the target population and it was revised on the basis of the feedback received. The effectiveness of ABL package in a classroom situation was studied in demonstration stage for any revision and the ABL package was printed for extension stage. A copy of ABL package is given in Appendix (2).

EVALUATION OF ABL PACKAGE

The ABL package was evaluated on the following basis; Features of the ABL package, linguistic content, content of theme, low cost improvised learning material. Activity Based learning experiences, feedback from learners and flash card design. The evaluation proforma is given in the Appendix (3).

VALIDATION OF ABL PACKAGE

The Activity Based Learning Package was evaluated by 25 High School science teachers. The evaluation Performa developed by Mr. Rangarajan and Dr. N. Balasubramanian (1995) has been modified and used to evaluate the Activity Based Learning package.
The investigator met the experts and demonstrated the developed ABL programme. Then, the evaluation proforma was supplied to the experts with a request to register their opinion in a three point scale. The percentage scores of their responses were calculated (see Appendix-3).

From the evaluation, it was found that 96% of the respondents were of the opinion that the features of the ABL package were relevant to students' needs.

The linguistic aspects of the content of the programme was clear, relevant to the objectives, suited to students' linguistic competence.

It was found that 95% of the respondents were of the opinion that the content of themes was matched to the student's age and interest, the content of themes was thought-provoking, matched to the goal of instruction and the content represented the importance of the subject.

It was also found that 94% of the respondents' opinion was that the design of the low cost improvised learning material was apt to the aim of the programme, and suitable to the students' task.

It was also found that 98% of the respondents' opinion that ABL experience given in the programme was suited to the objectives and apt to students' competence. The ABL package was expected to kindle the interest in the learner and the learning experiences planned were suited to the programme with suitable length and time duration.

CONSTRUCTION OF THE PRE-TEST

A pre-test was developed to assess the students' existing practical skills in science at the 9th standard level before going to experimentation.
The pre-test consists of questions to test the practical skills of IX std students. It was administered to control and experimental groups both at demonstration stage and extension stage. The mean and standard deviation of the scores of the pre-test in demonstration and extension stages for the control and experimental groups were computed for analysis.

A copy of the pre-test question is given in Appendix (4) and scoring key and marking scheme is given in Appendix (5). The pre-test scores obtained from the control group at the demonstration stage is given in the Appendix 10(A) and extension stage is given in the Appendix 10(E). The pre-test scores in experimental group at the demonstration is given in Appendix 10(C) and at the extension stage is given in Appendix 10(G).

DEVELOPMENT OF CRITERION REFERENCED TEST (CRT)

Criterion-Referenced Tests (CRT) is developed to study the student’s level of proficiency or mastery in some skills or set of skills. This is accomplished by comparing a student’s performance to a standard of mastery namely criterion.

James Popham, (1978) says “a CRT is used ascertain an individual’s status with respect to a well defined behavior domain”. The term well defined behavior domain’ implies that it will specify the stimulus situation in which the learner’s responses are made. This system of evaluation is to cope up the drawbacks and inability of traditional system with the changing needs of education.
VALIDITY OF CRT

The investigator has tested the validity of the criterion referenced test in which a test purposes to establish that subjects have achieved certain levels of proficiency or skill development. Thus, validity refers to the soundness of the interpretation of a test; the most important consideration is measurement (Best J.W. and Khan, J.Y. 1995).

RELIABILITY OF CRT

Reliability is the term used to describe one of the most significant properties of a set of test scores as consistent or error free. The measurements of the scores that are highly reliable are accurate, reproducible and generalisable to the other testing occasions and other similar test instruments (Frisbie, 1991).

Reliability is calculated using a statistic that compares the performances by the same individuals at different times or at different parts of the instrument. Two of the most common approaches to determine the reliability involve the use of repeated measures and calculation of internal consistency.

The two types of repeated measures reliability are,

1. Test-retest method and
2. Parallel forms method

In order to establish the reliability of the tool, the investigator has selected test-retest method because it is found to be relevant for the nature of the present criterion test. In this technique, a group of individuals were administered with the instrument, and the same individuals received a
second administration of the same instrument after a short period. Scores from both administrations were compared to determine the consistency of the responses. The co-efficient of test-retest reliability for the criterion references test was 0.89. Hence, it was concluded that the criterion reference test was reliable.

USES OF CRITERION REFERENCED TEST

The criterion referenced measuring is useful to identify the student’s mastery in learning the subjects concerned and to find out the level of attainment of various objectives of instruction. It also finds out the level at which a particular concept has been learnt and helps the parents to find the reports of their children more easily than any conventional progress card. While it is useful in better placement of concept of different graded levels, it helps in dividing the relative class order of the students in terms of their success in realizing the objectives of the course.

PILOT STAGE

INDIVIDUAL TRYOUT

In order to determine the effectiveness and feasibility of the ABL package, the programme was tried with a single student at a time and he was observed for his reaction and the part of the package that needed revision was found out. Six students of different levels namely two-bright, two average and two below average were selected through an interview from C.S.I. Boys higher Secondary School, Coimbatore. A pretest was administered to confirm that they do not process previous knowledge on the skills. Each activity of the ABL package was written on a sheet of paper. Correct responses for the practical activity, which
will not be visible to the pupils were given separately. Materials to be used while experimenting or learning were supplied to them. Bright students were selected first and they were given all the instructions which were in the written form. Average students were involved next and finally below average students were involved. The students were then asked to go through each activity. At the end of the programme, posttest was administered and the effectiveness of the learning packages was analysed.

**DEMONSTRATION STAGE**

The investigator had done the field work under classroom conditions at Sri. Baldevadas Kikani Vidyamandir Higher Secondary School, Coimbatore. 62 students from class IX were selected for the experimental treatment. The method used for the present stage was quasi-experimental design known as pretest-posttest, parallel equated group method. Group ‘A’ was considered as the control group which was treated with conventional method used by the regular school teachers. Group ‘B’ was considered as the experimental group which received the experimental treatment by the investigator using ABL package. The following tools were used in this stage.

1) ABL package

2) Criterion Reference Tests (Pre, post-tests)

3) Students Reaction Scale for ABL package
EXPERIMENTATION

Pretest

On the first day, control and experimental groups were diagnosed for their primary process skills through the pre test. While Integrated process skills were tested on the second day, scientific communication skills were tested on the third day.

The three divisions of skills consist of five skill components and each component carries a maximum of 4 marks and the time allotted was 45 minutes. A copy of pre-test question paper and scoring key are given in Appendix (4) and (5).

Treatment

The investigator had given the treatment to the experimental group using ABL package. The control group was taught by the concerned science teacher with regular lesson plan for the same content. Copy of ABL package is given in appendix (2).

Post Test

At the end of the treatments, the control and experimental groups were administered the post test by the same criteria as in the protest. A copy of post test and scoring key are given in appendix (6) and (7).

The scores obtained in the pre and post-tests by the 62 students were collected, tabulated (See Appendix -10A, 10B, 10C, 10D) and analyzed by the investigator.
THE PROCESS DESIGN OF DEMONSTRATION STAGE

Selection of the School

Pretest for Control and Experimental Groups

Science Teaching By Two Different Methods

Science Teaching to the experimental group by ABL method

Science Teaching to the Control group by conventional method

Post test for control and Experimental groups

Analysis the results

FIGURE 4. THE PROCESS DESIGN OF DEMONSTRATION STAGE
EXTENSION STAGE

The process design of the extension stage is given in Figure 5.

SAMPLING PROCEDURE

Ten high schools which follow State Board Syllabus were identified for the present study. Among the schools, were class each was selected from eight schools, two classes from the ninth school and four classes from the tenth school with a total number of 14 classes from 10 schools were selected for the experiment. Applying parallel equated group, technique, 822 number of students were taken from standard IX as the sample for the present study.

TOOLS

The following tools were used at this stage

1. ABL package
2. CRT (Pretest and posttest)
3. Student Reaction scale for ABL package.
4. Attitude scale for IX standard science teacher.

EXPERIMENTATION

The investigator had arranged for an orientation program for science teacher from 10 experimental schools to train about ABL package, CRT and their procedures. The timeslot was given as in the demonstration stage. These teachers were requested to adopt the procedure to give the ABL as well as conventional treatment to the needed students. Frequent visits were made by the investigator during the pretest, treatment and the posttest activities to observe the experimentation and positive suggestions
PROCESS DESIGN OF EXTENSION STAGE

Selection of 10 High schools

Orientation programme for teachers

Pretest for 822 students of the 10 schools

Science teaching to the experimental group of 411 students in 10 schools by ABL package

Science teaching to the Control group of 411 students in 10 schools by conventional method

Posttest for 822 students

Analysis the results

FIGURE 5. THE PROCESS DESIGN OF EXTENSION STAGE
were made wherever needed. The scores obtained in the pre and posttests by the 822 students from the 10 schools were collected, and tabulated (See Appendix -10 E, 10F, 10G, 10H).

ANALYSIS OF THE DATA COLLECTED

The scores obtained by the control and experimental groups of the students in pre-test, post-test, and students reaction scale were tabulated and analyzed using appropriate statistical techniques. The formulated hypotheses were also tested by using appropriate statistical techniques such as t-test and F-test etc.

CONCLUSION

While outlining the design of the study, this chapter has discussed the development of ABL package and the criterion reference test. It also explains the methods used for establishing the reliability and validity of the tools. An account of the pilot stage, during which an individual try out was carried out, and the demonstration and extension stages, during which the effectiveness of ABL package against conventional method is tested, is given in this chapter. The analyses and interpretation of the data along with the description of testing of the hypotheses are given in the following chapter.