CHAPTER V
EXPERIMENTAL DESIGN

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CHAPTER V

EXPERIMENTAL DESIGN

5.1 Introduction

The previous chapter of planning and procedure deals with (a) the details of the syllabus prescribed by the Gujarat Government of L.L. English for Std. VIII (1976-78) with its some apparent shortcomings (b) a study of some other textbooks of L.L. English for Std. VIII or such beginners being taught in Gujarat and outside Gujarat in the late sixties (c) an outline of some approaches in teaching English for the beginners (d) objectives and delimitations of the present study (e) a detailed procedure of the preparation of tool and conduction of the experiment and lastly (f) a study of some of the psycho-socio correlates used in matching the groups initially.

5.2 Pre-requisites to the Formation of Hypotheses

The following questions have been raised to serve as pre-requisites to the formulation of hypotheses:

1. What happens to the scores of criterion tests in English when pupils of Std. VIII who have studied the specially prepared programme?

2. What happens to the scores of criterion tests when pupils of Std. VIII do not study the special programme and study their regular prescribed programme?
3. What happens to the criterion scores when pupils study the programme in the context of controlled and independent variables?

The answers to the above questions are the pre-requisites to the formulation of hypotheses for the present investigation.

5.3 Formulation of Hypotheses

A sound research must make the use of carefully formulated hypotheses.

Hypothesis or a hunch can give an idea or suggestion put forward as a starting point for reasoning or explanation. Like objectives, hypotheses have also a definite place in any research work.

"It is an explanation of a complex set of data, admittedly tentative and not yet proved."

So it was decided to formulate the following operational forms of hypotheses for the present investigation which could be tested statistically:

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1. The eight grade girl students of experimental group would score on criterion test significantly higher than the girl-students of control group, controlling Pre-Achievement in languages, IQ, SES, Anxiety, n.Ach and emotional stability.

2. The eighth grade boy-students of experimental group would score on criterion test significantly higher than the boy-students of control group controlling Pre-Achievement in languages, IQ, SES, Anxiety, n.Ach and emotional stability.

3. The eighth grade urban students of experimental group would score on criterion test significantly higher than the urban students of control group controlling Pre-Achievement in languages, IQ, SES, Anxiety, n.Ach and emotional stability.

4. The eighth grade rural students of experimental group would score on criterion test significantly higher than rural students of control group and controlling Pre-Achievement in languages, IQ, SES, Anxiety, n.Ach and emotional stability.

The hypotheses thus formulated have guided the investigator in selection of appropriate method of experiment. For this the researcher had to go through different methods of experimentation. In the field of education the following three methods are most widely used by the researchers:
1. One-group method.
2. Parallel or equivalent group method.
3. Rational group method.

Out of these three methods, the second method i.e. parallel or equivalent group method is widely used because it is convenient in it to control other intervening variables.

Before describing the actual steps of the method it would be in the fitness of the things to consider the basic requirements of the experiment.

5.4 Basic Requirements of the Experiment

In order to test hypotheses formulated earlier the following requirements are essential:

1. Representative sample of the population.
2. An appropriate experimental design.
3. Comparative presentation of the programme.
4. Reliable and criterion test to measure learning in English.
5. Scores of criterion tests of the sample.

The requirement no. 3 is described in the previous chapter. The remaining requirements are described in the following paragraphs:
5.5 Sample Schools

It was decided to select the schools in such a way that representative sample of pupils studying in Std. VIII of secondary schools would be procured for the purpose. The representative sample proves to be immensely helpful in drawing out reliable and valid conclusion. The main purpose of the investigator is to study the effectiveness of the programme of teaching English on the students of Std. VIII of Sabarkantha District of Gujarat State. Therefore four schools of the district were selected keeping in view the following criteria:

(1) Strength of the school
(2) Area of the school
(3) Type of the school - whether single or mixed
(4) Its results

Four schools were selected from Sabarkantha District in such a way that pairs could be matched keeping in view the above criteria.

The students of the schools studying in Std. VIII could be treated as representative and randomized since it was found from the discussion with the heads of the schools that the pupils are generally admitted in the institutions on the 'first came first served' basis. There are no selection criteria for the pupils except that they have been declared successful in their previous standard. This has been the
common practice found in the whole district. There are no specific criteria even in formation of different classes. Therefore any pupils who are admitted to the eighth grade are likely to be placed in any division.

Besides this, the sample is also treated as 'representative' of the population. Since the primary and secondary education in Gujarat State is free, practically the children from all the strata of the society attend the school. The eighth grade is the initial stage of secondary education in Gujarat where pupils belonging to various castes and subcastes, various religions, various income groups are found heterogeneously combined.

From the above discussion it becomes evident that the sample is quite representative and members of the groups called 'subjects' are randomly assigned to the various divisions of Std. VIII.

Looking to this, it was presumed that the sample taken, represented in all respects, the population of the eighth grade pupils of schools in Sabarkantha District.

5.6 Formation of Equivalent Groups

In order to test the four hypotheses of the research an experimental method of equivalent group was contemplated.
For the formation of equivalent group generally two methods are popular, namely matched-pairs and matched-groups. Of the two matched-pairs method is possible when the number of the subjects is restricted to 50 and the number of the control variables is restricted to two. For this the investigator has to administer tests of control variables to a fairly large number of the students studying in different schools and then has to form pairs for experimental and control groups, making them equal in all the variables.

As in the present study there are six control-variables this would be impossible. For matching groups the tests of control-variables are administered to the subjects of two groups and their means and S. Ds are compared. The 't' ratios are also worked out for each control variables. If the 't' ratios are well within the random variation and not differing significantly the groups are considered to be matched. Even in this technique matching of the groups on six variables incorporated, would be a stupendous task. For this a fairly large sample is needed to be administered upon, while matching the groups. In social sciences where data from human beings are collected it is really very tough to have completely matched pairs without any error. Even if the pairs are evolved out with a lot of extra labour it is equally inconvenient to the school teachers and the heads of schools to redistribute the students according to the need of the researcher. So the researcher has to resort to
such statistical technique as would help him to take care of all the possible errors and to form groups of two types easily.

Forming groups as desired would require a sort of manipulation of students for experimental purposes. It is indeed often impracticable to move students from one teacher to another or from one syllabus to another in order to help the investigator in working out a 'tight' research design. Therefore the researcher must resort himself to the necessity of dealing with 'intact' student-groups on many occasions. It is already discussed previously that the matching operation inevitably reduces the size of the sample. Since many students cannot be properly matched and must be discarded for the analysis.

The use of 'intact groups', of course poses certain research design problems. In such circumstances, it is advisable, to use such a statistical tool as would allow the researcher to exploit the easiest situation and yet would control the errors creeping in. In the present research to match the groups on the measures of mean, matching of control variables is the tough task, since the researcher has to administer tests on a wider scale and has to drop a large number of students for matching purpose.

Fortunately, a statistical tool of considerable value known as 'Analysis of Covariance' can be employed in just
such instances where a researcher cannot afford to administer tests of predictor variables to a sufficiently large sample and then drop out the subjects who do not match. This technique is an extension of the 'analysis of variance model' combined with certain features of 'Regression analysis'. It provides a useful statistical device for educational investigators.

Advising when to use Popham says:

"Analysis of covariance may be used when relationship is being studied between a dependent variable and two or more groups representing an independent variable. This powerful technique allows the researcher to statistically equate the independent variable groups with respect to one or more variables which are relevant to the dependent variable". To put in another way, analysis of co-variance allows the researcher to study the performance of several groups which are unequal with regard to an important variable as though they were equal in this respect."

This powerful technique has important implications for educational researchers since it permits the use of 'intact student groups' where still the controlling variables might otherwise confound the results of investigation.

In the light of above discussion the researcher decided to use 'analysis of co-variance statistical technique to overcome the possible hazard in equating the groups.

After deciding this the experimentor took up the school classes as experimental groups and control groups shown in table no. 5.1.

Table 5.1

<table>
<thead>
<tr>
<th>TABLE SHOWING NUMBER AND KIND OF SCHOOLS AND POPULATION OF EXPERIMENTAL AND CONTROL GROUPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Schools</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>2 (Urban)</td>
</tr>
<tr>
<td>2 (Rural)</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The steps followed after the formation of experimental and control groups are given below:

5.7 Steps of Design

To ascertain whether specially constructed programme of teaching learning English would increase achievement in the language, the investigator followed the steps with a little modification suggested by Van Dalen.
1. "Test the groups on dependent variable (scores on achievement in languages) and find the mean of pre-test score for the experimental and control groups ($X_1^E$ for experimental and $X_1^C$ for control)".

2. Keep all the conditions identical for the groups except for exposing the experimental subjects with the prepared special teaching-learning language programme (Language lessons) and the control subjects with the usual textbook (lessons).

3. Test the groups on dependent variable and find the mean post-test scores for each replication ($Y_E$ for criterion test in achievement in English for experimental group and $Y_C$ criterion test in achievement in English for control group).

4. Find the mean difference between $X_1^E$ and $X_2^E$ and $Y_E$ and $Y_C$ for each replication. (Here $f$ ratio of Analysis of Covariance $DE$, $DC$ should be brought forth).

5. Compare $DE$ and $DC$ to determine whether the application of $X$ caused a significant change in experimental groups' scores as compared with the control groups' scores.

6. Apply an appropriate statistical procedure to ascertain whether the difference in the scores is
sufficiently great to be a real different or whether it is only a chance occurrence."

All these steps can be depicted as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>$X_1E$</td>
<td>$Y$</td>
<td>$YE$</td>
</tr>
<tr>
<td>Control</td>
<td>$X_1C$</td>
<td></td>
<td>$YC$</td>
</tr>
</tbody>
</table>

Treatment randomly assigned to groups:

- Experimental group: $YE - X_1E = DE$
- Control group: $YC - X_1C = DC$

The investigator followed the above steps with all possible precautions and exactness required for conducting the experiment. With this fundamental concept of the design in mind, the experiment proceeded to test the hypotheses mentioned earlier in this chapter.

5.8 Naming the Groups

Besides this, in the present experimental design there were two types of treatment using original test lessons and rewritten test lessons which were given to the intact

groups. Basically both the groups received either of the two types of treatments. Theoretically the control group was conspicuous by its absence in the experimental design. However, the original text-lesson material was considered as traditional teaching-learning English material. The group reading that material was treated as control group. With this explanation, the ensuing pages of this report would use henceforth the 'control group' in the above sense. The classes reading specially written material by the investigator was called 'experimental group'.

Six classes of the intact groups had been assigned treatment randomly. This act of randomization was necessary to insure against the chance error that might creep into the experiment.

Requirements to be fulfilled by the members of the groups

Before starting the experiment, the investigator made sure that the subjects (pupils) of both the groups satisfy the following requirements.

1. Each pupil under the study must belong to the eighth grade of secondary school.

2. Each pupil's scores in the languages of their previous final examination must be obtained.
3. Each pupil must take up the final test in English Achievement (i.e. criterion test).

4. Each pupil must take up IQ, S.E.S., n.Ach, Anxiety and emotional stability tests.

5. Each pupil of the experimental group should not be taught the traditional prescribed material.

6. Each pupil of the control group should not be taught the language programme prepared by the investigator.

5.9 Time Allowance

It was decided to work on the experiment for 18 weeks, (i.e. for 108 days and 160 periods) during the first term. During the second term the experiment was conducted for 16 weeks, (i.e. for 96 days and 160 periods). During the first term 12.5 and 5.5 weeks and during the second term 12.5 and 3.5 weeks were allotted approximately to the language teaching programme and in administering other tests (namely IQ, S.E.S., Anxiety, n.Ach, and emotional stability) respectively. It is understood here that the duration of teaching of language material of textbook, given to the control group was similar to that given to the experimental group (i.e. 12.5 weeks per each term). Thus the experimental work was all over during the first year of experimentation.
i.e. 1978-79. The computational work was completed during the subsequent year i.e. 1979-80.