### CHAPTER - III

**DESIGN OF THE STUDY**

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CHAPTER - III

DESIGN OF THE STUDY

The present investigation is concerned with the effects of two methods, i.e., the Natural Approach and the Bilingual Method from the standpoint of communication skills. For this an experimental method involves the formulation and testing of hypotheses and problem solving approach.

In the experimental situation we manipulate one variable and observe the effect of this manipulation on another variable. The manipulated variable is called the independent variable. The variable being observed is called the dependent variable. The experimenter simply measures the subjects’ responses, which thus constitute the dependent variable.

In the present study, the independent variables are the natural approach and the bilingual method, the dependent variable being communication skills.

Before discussing the experimental Design, it is essential to know the characteristics of a good experimental design.

3.1 The Essential Characteristics of a Good Experimental Design:

The essential characteristics of a good experimental design are given below:

1. It will insure that the observed treatment effects are unbiased estimates of the true effects.

2. It will permit a quantitative description of the precision of the observed treatment effects regarded as estimates of the true effects.

3. It will insure that the observed treatment effects will have whatever degree of precision is required by the broader purposes of the experiment.
4. It will make possible an objective test of a specific hypothesis concerning the true effects; that is, it will permit the computation of the relative frequency with which the observed discrepancy between observation and hypothesis would be exceeded if the hypothesis were true.

5. It will be efficient; that is, it will satisfy these requirements at the minimum "cost", broadly conceived.

There are not the only essential characteristics of a good experiment. The usefulness or worthwhileness of an experiment is primarily dependent upon a great many other factors. In the earliest stages of planning any experiment, the problem to be investigated is usually stated in relatively indefinite and general terms. As the planning proceeds, the problem is modified and restated repeatedly, always more definitely and specifically, or always in a form more amenable to experimental attack especially in view of the subjects, equipement, materials and other resources available to the experimenter. Indeed, the final step in the planning is often to restate the problem once more so as to make it fit the particular experimental design that seems feasible, rather than to make a final modification of the design to fit a final statement of the problem.

The important decisions to be made in planning the experiment are concerned with:

1. The definition of the "treatments";
2. The selection or exact definition of the population to be investigated;
3. the selection of a criterion;
4. the identification of the factors to be controlled;
5. the final restatement of the problem, and
6. the selection of a specific experimental design.
These decisions are inter-dependent. A decision made at a particular stage in the planning may require modifications in previous tentative decisions, which may in turn effect other previous decisions, etc.

By giving the characteristics of a good experimental design, we have been familiarised about the types of considerations to have been taken into mind by the experimenter while planning the experimental design.

By keeping into view the characteristics of a good experimental design, which are essential components of it, now let us discuss the design of the experiment specifically.

3.2 Design of the Experiment:

The experimental method was used to know the effects of the natural approach and the bilingual method on communication skills of teaching of English as a foreign language.

The treatments classification in a simple randomized design may be of either of two general types on the one hand, the "treatments" may represent different degrees, or amounts, or intensities, etc., of a single experimental variable or factor. For example, the treatments may represent different intensities or illumination under which the subject reads, or various durations of a certain stimulus, etc. We will call such a classification a "single-factor classification".

On the other hand, the treatments may represent complex combinations of a variety of factors or variables, many of which may not even be identified. For example, the treatments in an educational experiment may represent two methods of teaching fourth-grade arithmetic, one of which may be described as a "Workbook" method, the other as the "traditional" method.
The present study is designed as a single-factor experiment. Ferguson (1971; p.200) discusses three types of single-factor experiments in which the single factor is a treatment variable with K levels or categories, in this case with 2 categories: the natural approach and the bilingual method. The three main types of single-factor experiments are:

First, a group of experimental subjects are divided into K independent groups, using a random method. A different treatment is then applied to each group. One group may be a control group, that is, a group to which no treatment is applied. A meaningful interpretation of the experiment requires a comparison of the results obtained in absence of treatment. Comparisons may be made between treatments and a control, between treatments or both.

Second, some single-factor experiments involve a single group of subjects. Each subject receives all K treatments. Repeated observations or measurements are made under K conditions, one of which may be a control condition, on the same subjects. In such an experiment as this the measurements made under the K treatments will not be independent. Positive correlations will usually exist between the paired measurements obtained under any two treatments. These correlations will reduce the magnitude of error used in the comparisons of the separate treatment means.

Third, a single-factor experiment may consist of groups that are matched on one or more variables which are known to be correlated with the dependent variable. The error term is reduced thereby.

For this study, first type of single-factor design was chosen because it involves maximum randomization and hence chances of error are greatly minimised. Moreover, instead of an experimental and a control group technique, two treatment groups were formed to further reduce the probability of error.
For the purpose of following single-factor design, the experimenter has followed the technique of randomization.

The importance of randomization in experiments is underlined by many educators and psychologists because randomisation ensures that extraneous variables which are concomitant with the dependent variable, and may be correlated with it, will not introduce systematic bias in the experimental results. Cochran and Cox (1960) write:

"Randomization is somewhat analogous to insurance, in that it is a precaution against disturbances which may or may not occur and that may or may not be serious if they do occur. It is generally advisable to take the trouble to randomize even when it is not expected that there will be any serious bias from failure to randomize. The experimenter is thus protected against unusual events that upset his expectations."

Single-factor experiment was preferred over analysis of covariance design. Authorities on experimental designs point out that if practical considerations prevent the assignments of subjects to groups at random (e.g., the investigator may be required to use existing classes or sections of pupils), in such cases analysis of covariance is used to remove the influence of covariate or the concomitant, i.e., the controled variable (Ferguson, 1971; p.288).

Since, it was possible to reorganize the existing classes on the basis of randomization, single-factor design was used in this study.

It was also a randomized block experiment with two sub-groups divided on the basis of sex-boys and girls.
After describing about the single factor design which was chosen for the present investigation, now let us discuss the views, given by Edwards on the classification of research problems.

According to Edwards (1971) research problems can be classified into 7 cases in terms of organismic stimulus, response variables etc.

Edwards states, 'the classification of research problems in terms of the 7 cases described is useful and convenient way of viewing the kinds of problems with which the psychologist is concerned.'

These seven cases on which the research problems can be classified are mentioned below:

Behavioural Variables, Stimulus Variables, Response Variables, Organismic Variables, Discrete Variables, Continuous Variables, Quantitative and Qualitative Variables.

1. **Behavioural Variables**: By a behavioural variable we shall mean any variable that refers to some action or response of an organism. One commonly used behavioural variable in psychological research is the time required for some action or response to occur. A stimulus is presented to a subject and the time required for him to make a certain response is measured.

In other cases, we may hold the time constant and count the number of responses of a given kind that occurs within a fixed period.

2. **Stimulus Variables**: Although psychology has, on occasion, been defined as the science of behaviour, it is obvious that behaviour does
not occur in a vacuum but always in a particular setting or environment. The general class of things we observe that relate to the environment, situation, or conditions of stimulation, we shall refer to as stimulus variables.

3. **Response Variables**: By a response variable is meant a classification based upon prior observation of response. A person's IQ, for example, is determined by observing his response to a standardized testing situation.

4. **Organismic Variables**: Organismic variables arise from ways in which organisms may be classified and from the observations and measurements of physical, physiological and psychological characteristics of organisms. For example, we may measure the heights or weights of a group of individuals. These observations do not correspond to response variables or stimulus variables, but they may be conveniently described as organismic variables.

5. **Discrete Variables**: In a discrimination experiment, a variable of interest may be the number of correct discriminations made by a subject in a set of ten trials. The only possible values of this variable are 0,1,2,.........10, and this variable would be described as discrete. Values of a discrete variable are always exact. If we observe and record that a subject makes eight correct responses, there is no uncertainty with respect to this value.

6. **Continuous Variables**: On the other hand, if we should measure the time required for a subject to make a discrimination, this variable would be described as continuous. Values of continuous variables are never exact, because no matter how accurately we measure the variable there is always uncertainty with respect to the observed or recorded value of the variable.

7. **Quantitative and Qualitative Variables**: Variables for which the
possible values represent differences in degree along a single dimension are often referred to as quantitative variables. All continuous variables are quantitative variables because the differences between the possible values of such variables are matters of degree. All discrete variables for which the possible values are counts of the number of responses of a given kind are also quantitative because the differences between the possible values are also matters of degree.

Quantitative variables are also described as ordered variables in that the possible different observed values of such variables, discrete or continuous, can be ordered on a continuum where relationships of equal to, less than, or greater than, will hold true.

Unordered variables are variables in which differences in the possible values are matters of kind rather than degree. Such variables are often described as qualitative variables.

The present problem was of the type SX and RY where SX stands for the stimulus variables and RY for the response variable. In this problem, the relationship between a stimulus variable (methods) and a response variable (communication skills) was to be studied.

After giving the detailed description of design of the experiment, now it becomes necessary to discuss the sample which was chosen for the purpose of present investigation.

3.3 Sample:

It would be impracticable, if not impossible, to test, to interview or observe each unit of the population under controlled conditions in order to arrive at principles having universal validity. Sampling is the process by which a relatively
small number of individuals or measures of individuals, objects, or events is selected and analysed in order to find out something the entire population from which it was selected. The representative proportion of the population is called a sample.

Since the school population is scattered over a wide geographical area and the study is an experimental one, one school in Haryana (where English as a foreign language is still being taught through the old method like grammar-translation method) was selected for the purpose of the study. This school, Govt. Girls High School of Karnal city caters to the needs of the children with average socio-economic status, i.e., children belonging to middle class families is not too advanced or backward city of Haryana. Hence, it was considered to be representative of the general population of this part of India. The sample of the present study was drawn from classes VI and VIII grade, affiliated to the Haryana School Education Board.

Further 68 pupils of grade VI and 68 students of grade VIII of this institution were randomly divided into 2 treatment groups at each of the two grade levels. The pupils of grade VI were given two initial communication skills, i.e., listening and speaking skills as in Govt. School, the teaching of English starts from the grade VI only. To know the effects of other two communication skills, i.e., reading and writing skills were assigned to the students of advanced level, i.e., grade VIII. The responses of the students were recorded. A mixed sample of boys and girls was taken up.

The study continued for 35 minute sessions over a period of 16 weeks. Same teacher at each grade level taught English by two methods. Which group received a particular treatment was decided by flipping a coin. Elaborate experimental controls and control of variables were exercised.

After giving the description of sample, now let us give the lay-out of the experiment.
3.4 Lay Out of the Experiment:

The lay-out of the single-factor design for conducting the experiment is given below:

Single-factor Design Sampe

(136)

Grade VI Grade VIII
(68) (68)

N.A. B.M. N.A. B.M.
(34) (34) (34) (34)

Sex Boys Girls Boys Girls Boys Girls Boys Girls
(17) (17) (17) (17) (17) (17)

From the lay-out given above it is clear that 34 boys of grade VI were divided into two treatment groups and 34 girls of grade VI were similarly divided whereas for the grade VIII, 34 boys and 34 girls were divided at random into 2 treatment groups.

Hence the following diagram also represents the design of the experiment.

<table>
<thead>
<tr>
<th>Communication Skills</th>
<th>Natural Approach</th>
<th>Bilingual Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening &amp; Speaking Skills (Grade VI)</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Communication Skills Reading &amp; Writing Skills (Grade VIII)</td>
<td>Natural Approach</td>
<td>Bilingual Method</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>34</td>
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By giving the lay-out of the experiment, it is clear about the subjects chosen for the experimental purpose.

While conducting the experiment, the experimenter has to take into consideration the experimental controls to make the study unbiased. Now, let us discuss the experimental controls.

3.5 **Experimental Controls**:

The observed differences among the treatment means in any experiment are due to only partly to actual differences in the effectiveness of the treatments. They are also partly due to errors of various kinds, that is, to the effects of extraneous variables or factors. Some errors may vary from experiment to experiment; others may be constant over all experiments concerning the same treatments. The variable errors may be classed into three categories according to the experimental units with which they are associated: subjects, treatment groups and replications. Errors which are constant for all replications or throughout the experiment cannot be taken into consideration in any error analysis, their effects being inextricably intermingled with or inseparable from the treatment effect.

It may be worth while to illustrate these three types of variable errors by referring to a concrete experiment. Suppose an experiment to determine the relative effectiveness of two methods (A₁ and A₂) of teaching fourth-grade arithmetic is performed in a certain school. For the purposes of the experiment, the pupils are divided into two groups; one is to receive treatment or method A₁, the other treatment A₂. One teacher is assigned to teach one group by one method, another to teach the other group by the other method. The "treatments effect" is measured by the difference in the mean scores for the two groups on a criterion achievement test administered at the close of the experiment.
Suppose that essentially the same experiment is performed independently in several different schools, the same treatments being administered under as nearly as possible the same conditions in each school. Suppose, also, that, these schools are drawn from a certain population of schools. Suppose, finally, that the object of these experiments individually and collectively is to estimate the difference in treatment means for the entire population of schools. Suppose, finally, that the object of these experiments individually and collectively is to estimate the difference in treatment means for the entire population of schools from which these particular schools are drawn, and to test the hypothesis that this difference is zero. To highlight this situation, Lindquist (1953; pp 8-11) discusses basic types of errors in conducting the experiments. These errors are commonly known as type S, type G and type R errors. These were controlled by taking the following steps:

1. **Type S Errors**: In any single replication of such an experiment, it is usually left to chance to determine which treatment each subject is to receive. If the subjects are assigned at random to the treatment groups, the group assigned to $A_1$ may be chance contain a larger proportion of the more intelligent pupils, or of those who like arithmetic, or of the more industrious pupils, or of the pupils who received superior instruction during the year preceding, etc., etc. Accordingly, the mean criterion score may be higher for $A_1$ than for $A_2$, even, though the treatments are on the average equally effective for all pupils in general in the particular school involved. That part of an observed treatment effect which is thus due solely to the assignment of subjects to treatment groups will, be referred to as a "Type S" error.

Type S errors were controlled through statistical means. These errors are those which characterise simple random sampling (An initial check by testing IQ's and comparing means of ages was also made to test whether the groups were properly formed—description follows).
2. **Type G Errors**: In any single replication of an experiment, substantial differences would be found in the criterion means for the various treatments, even though no type S errors were present, and even though the methods or treatments were on the average equally effective for the population sampled.

Type G errors were minimised by 'fixing' same classroom, similar timings and same teacher etc. for each of the two treatment groups at each of the two levels. Type G errors arise due to the operation of extraneous factors which tend to have the same effect on all the members of any given treatment group, but different effects on different treatment groups in any single replication. For example, the group receiving treatment A₁ may have been assigned a better teacher, or a better classroom, or a more favourable hour of the day for instruction, than the A₂ group. Again, the pupils receiving treatment A₁ may inadvertently have been given more time on the criterion test than those receiving treatment A₂, or some other accidental failure to administer the experiment properly may favour one treatment at the expense of the other in the comparison of means. The effect of most such factors can and should be randomized with reference to treatments in each replication independently; those that arise during the experiment and cannot be randomized will in most cases be accidental and without bias. If this is the case, such errors will tend to cancel out in the long run (for a very large number of replications), but in any single replication they may have a pronounced effect on the observed differences in treatment means.

In general, these errors are associated with the administration of the experiment or with the experimenter, in the sense that they are subject to the experimenter's control, although many of them (such as teacher differences) are unavoidable and not the "fault" of the experimenter. It is the experimenter's responsibility to reduce these errors to a minimum, and to randomize the effects of any factors that cannot be completely equalized.
3. **Type R Errors**: It is quite possible that Treatment $A_1$ may actually be better than $A_2$ for certain schools in the given population, but that $A_1$ may really be inferior to $A_2$ for certain other schools. This could result from differences in curriculum, or in the administrative organization of the schools, or in school plant and equipment; or it could be due to any other conditions in the school or community making one method really more appropriate or effective than the other for that particular school or community. The observed effect of a treatment in any particular school could then be free from error so far as that school alone is concerned, yet be considerably in error as an estimate of the average treatment effect for all schools in the given population of schools.

Type R errors were controlled through sampling techniques used.

The next discussion followed is on the control of variables.

3.6 **Control of Variables**:

In order to make the study objective and scientific, the control of variables is essential. If these extraneous variables were not controlled by the experimenter, these could influence the results of the study adversely.

In research, the performance of one treatment group is often compared with that of another group. These groups consist of subjects who differ on a variety of traits which could influence the results. It is important that all treatment groups of an experiment be approximately equal as to these various traits, so that whatever results are found are attributable to the independent variable and not to the fact that subjects in one treatment were different on some trait (e.g., IQ) from subjects in another treatment.
The problem can be avoided by having the researcher assign the subjects to the various treatment groups in a manner that insures that the subjects in the groups are approximately equal on all relevant characteristics.

There are three general techniques for controlling the extraneous variables.

The first technique is called a randomised design because subjects are assigned to the separate treatments. The random assignment of subjects allows the experimenter to be fairly certain that the subjects in all treatments are approximately equal as to subject variables.

The second technique is the matched-groups design. Using this design the experimenter first gets the scores for each subject on some task or test and then assigns subjects to the various treatment groups so that all of the treatment groups are equal with respect to these scores.

The third technique is the within subject design. Using this design all subjects participate in all experimental treatments, which insures that the treatment groups are equal as to subject variables.

In the first two techniques, random groups design and matched-groups design different subjects are assigned to the different experimental treatments. These two designs are called independent-groups design. In the third technique, the within subjects design, the same subjects participate in all experimental treatments.

The experimenter has followed the first technique - random group design.

In the random-group design, the subjects were chosen randomly by flipping
coin. For checking that the groups are formed equal Terrell's culture fair intelligence test was administered on whole of the sample as the subjects were found equal on the scores of means and SD's of the scores of natural approach and bilingual method groups of grades VI and VIII. Again the subjects found equal on the scores of ages of both grades.

Other variables were also controlled to make the study objective. These variables were like organismic variables such as IQ, Sex, S.E.S. etc. had been controlled through randomization, whereever possible in this experiment.

Stimulus variables were controlled by assigning same teacher, classroom etc. to each of the two treatment groups at each of the two levels. Since the same teacher taught each of the two treatment groups, same time could not be fixed to keep the variable of time 'fixed' the two groups were alternately taught at the two fixed periods each day.

Response variables were taken care of by post testing each individual student in the same classroom, by same experimenter, by the same tasks presented in a particular order.

Any bias in the treatment effect resulting from uncontrolled error variations was successfully eliminated by randomizing the error variations with reference to the treatments.

3.7 Limitations of the Study:

1. The findings of this study will be limited by the restricted population and will be applicable only to similarly defined populations.
2. The statistical significance of the results is restricted by the limited population size.

3. The study is restricted to the two grade levels, i.e., grade VI and grade VIII.

4. The study is limited only to two methods: Natural Approach and Bilingual method. In natural approach, the instructional model given by Terrell and Krashen (1983) is included.