Chapter III

PLAN AND THE PROCEDURE OF THE RESEARCH
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0</td>
<td>Introduction</td>
<td>104</td>
</tr>
<tr>
<td>3 1</td>
<td>Design of the Study</td>
<td>105</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Method of the Study</td>
<td>105</td>
</tr>
<tr>
<td>3 2</td>
<td>Variables</td>
<td>107</td>
</tr>
<tr>
<td>i</td>
<td>Selection of the Independent Variable</td>
<td>108</td>
</tr>
<tr>
<td>ii</td>
<td>Selection of the Dependent Variable</td>
<td>108</td>
</tr>
<tr>
<td>iii</td>
<td>Control of Extraneous Variables to ensure the Internal and External Validity</td>
<td>109</td>
</tr>
<tr>
<td>iv</td>
<td>Control of Validity during the experiment</td>
<td>110</td>
</tr>
<tr>
<td>v</td>
<td>Control by Randomisation</td>
<td>112</td>
</tr>
<tr>
<td>vi</td>
<td>Statistical Control of Variables</td>
<td>112</td>
</tr>
<tr>
<td>3 3.1</td>
<td>Reasons for selecting IX Std students</td>
<td>113</td>
</tr>
<tr>
<td>3 3.2</td>
<td>Sample of the Pilot Study</td>
<td>115</td>
</tr>
<tr>
<td>3 4</td>
<td>Hypothesis</td>
<td>116</td>
</tr>
<tr>
<td>3 4.1</td>
<td>Research Hypothesis</td>
<td>116</td>
</tr>
<tr>
<td>3 4.2</td>
<td>Main. Null Hypotheses</td>
<td>116</td>
</tr>
<tr>
<td>3 4.3</td>
<td>Subsidiary Null Hypotheses</td>
<td>116</td>
</tr>
<tr>
<td>3 5</td>
<td>Experimental Design</td>
<td>117</td>
</tr>
<tr>
<td>3 5.1</td>
<td>Solomans Four Group Design</td>
<td>117</td>
</tr>
<tr>
<td>3 6</td>
<td>Tools</td>
<td>119</td>
</tr>
<tr>
<td>3 7</td>
<td>Theoretical Background regarding measurement of Creativity</td>
<td>120</td>
</tr>
<tr>
<td>3 8</td>
<td>Specific features of a Creativity Test</td>
<td>121</td>
</tr>
<tr>
<td>i.</td>
<td>Reliblity</td>
<td>122</td>
</tr>
<tr>
<td>ii</td>
<td>Validity</td>
<td>122</td>
</tr>
<tr>
<td>iii.</td>
<td>Time Factor</td>
<td>122</td>
</tr>
</tbody>
</table>
CHAPTER III

PLAN AND THE PROCEDURE OF THE RESEARCH

3.0 Introduction

Theoretical background of the problem and the review of related researches have been presented in the previous chapters in an elaborate manner. This presentation brings out the necessity and the significance of undertaking the preparation of verbal package in Marathi language to enhance verbal creativity of the IX Std Marathi medium students.

It also sets out the procedure of conducting the entire training programme.

The major points which are elaborated are given below-

1) Design of the study
2) Method of the study
3) Variables
4) Sample
5) Hypotheses
6) Experimental design
7) Soloman design
8) Tools
9) Theoretical background regarding measurement of creativity.
10) Specific features of a creativity test.
11) A test of literary creativity in Marathi by M.B.Kundale
12) The scoring scheme for measurement of items.
3.1 **Design of the Study**

The design of research refers to the comprehensive plan of work that is prepared largely before the research is actually started and according to which it is carried out. Every research has a plan which tells the researcher to move into certain specific directions at certain specific stages. It constitutes a detailed guideline for carrying out the research work.

The research designs of all types are not alike though basic elements, by and large, remain the same. The experimental design was selected to carry out the present study.

3.1.1 **Method of the Study**

Selection of the method of study is an important part of the whole research. The objectives and hypotheses formulated, act as a guide to what the researcher is proposing to test.

The major intention of the present investigation is to develop a verbal package and to test its effectiveness for enhancement of verbal creativity of IX Std. Marathi medium students.
Keeping these two objectives in mind, the experimental method of research was selected for the present study.

In experimental method researcher strives to ascertain 'how' and 'why' a particular condition or event occurs through manipulating an experimental variable under highly controlled conditions. The main steps of experimental research given by Van Dalen¹ (1966) are shown here in the form of a flow chart.

**Flow chart showing steps of experimental research**

Fig. 3.1

- Identify and define the problem.
- Formulate hypotheses and deduce their consequences.
- Construct an exp. design.
- Conduct an experiment.
- Reduce data to produce the unbiased appraisal of the effect which is presumed to exist.
- Apply statistics to determine the credence

The discussion in this chapter is primarily concerned with the third important step - designing the experiment and establishing the necessary controls.
3.2 Variables

In experimentation the researcher manipulates the independent variable and controls all extraneous variables to a minimum and then to determine if such manipulation which generates a change (or variance) in the dependent variables is effective. The total variance in the dependent variable is caused by various factors as shown in the figure below.

Fig. 3.2
Various Factors Affecting Total Variance

Experimental variance is a variance due to manipulation of the independent variable. Extraneous variance is contributed by all the variables other than the independent variable whose effect is being studied in the experiment. These variables affect the effect of independent variables and hence the dependent variable indirectly. Error variance results from random fluctuations in the experiment due to known and unknown variable and masks the effect of the experimental variable.
Main functions of the experimental design are to maximise the effect of experimental variance, control the external source of variance and minimize error variance. This is to ensure internal validity of the design.

Another criterion to satisfy is extraneous validity. It means representativeness or generalizibility of the results. A good design satisfies both these criteria.

The various aspects of the experimental design are elaborated here.

i) **Selection of the Independent Variable**

The present study intends to investigate the effect of special training programme on the development of training package to enhance verbal creativity of the students. The independent variable is the verbal package, prepared by the researcher to enhance verbal creativity. The various programmes developed by the researches and educationists are discussed in chapter II. The similarities and differences of the package and the training programme have been also mentioned and discussed there.

ii) **Selection of the Dependent Variables**

The present study intends to measure the effect of special training programme on the development of creativity among IX Std students. The development of creativity in students was the dependent variable.
It was assumed that enhancement of creativity on the part of students should reflect in their achievement on the test of creativity. Therefore dependent variable in this study was achievement of students in the form of raw scores on the test of creativity which was administered after the training was over.

For the purpose of training the researcher constructed a verbal package, based on S. I. model by Guilford. No such package was available in Marathi language. The package which was prepared by the researcher consisted of items related to fluency, flexibility and originality. Also the areas of convergent production and divergent production were covered.

iii) **Control of Extraneous Variables to ensure Internal and External validity**

An experiment has internal validity if it is ensured that the results observed may be attributed within limits of error to the treatment only. If the difference brought about in the dependent variable results from some extraneous variable, they may mark the original effect of the experimental (treatment) variable is masked.

Campbell & Stanley\(^2\) have discussed various threats to the internal validity, such as maturation, history, testing, selection, bias etc.
To ensure the maximum internal validity influence of extraneous variable to the purposes of the study were minimised, nullified or isolated through various ways such as

i) Control of variables during the experiment by eliminating the variable or by incorporating the variables in the experiment.

ii) Randomization of subjects

iii) Statistical control of the validity

External validity is the extent to which the validity relationships can be generalized to other setting involving other treatment validity, other measurement validity and other populations.

Randomization, used for sampling, is one way of increasing generalizibility or external validity of the results.

Control of validity, achieved through various above mentioned ways in the present study, is discussed below.

iv) Control of validity during the experiment

1) Age of the students - It was observed that all the students in the IX Std had completed 13 years or more.

2) Sex - The training was conducted in the girls' school. So only the female students were available for the training. If the training would have been
given to both sexes different type of results might have been obtained in the process. By involving both the sexes generalizibility would have been increased. The researcher is aware of this fact. But the programme had to be conducted in the schools which were available at that time.

Test - The same test of creativity was administered before the training and after the training. The same test was administered to all four groups.

Test administration - The uniform procedure of test administration was followed everytime. The same person administered the test to the students. Thus error variance was well taken care of.

Evaluation of answer sheets - For the evaluation a detailed scoring key was prepared by the researcher. The answer sheets were examined and raw scores were obtained.

Physical environment - The same classrooms were used for administering the tests. The subjects were familiar with the surroundings and they were comfortable too.

Because of the experimental design contamination diffusion of experiment was minimum.
**Hawthorne effect** - Hawthorne effect relates to motivational aspect of the students. Every effort was made to keep the motivational level of the students high. Still this factor was difficult to control.

**History and maturity** - The training programme was of short duration. So these factors did not play any significant role in the design.

v) **Control by randomization**

Error variance is variability of measures due to random fluctuation of the known and unknown variance. Error variance may be due to the students involved in the study, and error of measurement. Though the sample was incidental, sample randomization was used while selecting the classes and assigning them to the different treatments.

Thus every possible attempt was made to reduce error variance.

vi) **Statistical control of variables**

In order to estimate precisely the variance due to the treatment other concomitant variable must be controlled or minimized.

One of the methods is the direct control of experimental error by incorporating the variables in the experiment.
In the present study the randomized Soloman four group design was used. It provides the best control of the threats to internal validity.

**Sample** - A sample in a research study refers to any group on which information is obtained.

In the present study IX\(\text{Std}\) students, studying in Marathi medium schools in Pune City (Maharastra) constituted the population for the study. The average age of the students was 13 years eight months. The age group ranged from 13 years to 15 years.

### 3.3.1 Reasons for selecting IX\(\text{Std}\) students

i) The students are able to understand the basic concepts in the language. They have already acquired a fair amount of knowledge of the language i.e. Marathi and the students are exposed to the intricacies of the language too.

ii) Students of this age group are able to use hypothetical reasoning, based on the logic of all possible combinations and they can apply it in the exercises and in their own way of thinking. These characteristics develop between the ages of 12 and 15 years i.e. during the fourth stage of cognitive development which is preparatory to adult thinking. (Piaget and Inheldor 1958).
iii) In the students of this age group the literary interests and attitudes are developing rapidly but are still unstable. Torrance (1962) describes this behaviour of young children as follows:

"The youth is able to see that there are no absolute solutions to some problems but he has not yet learnt how to apply creativity, the principles he has learnt about right and wrong. He worries about peer acceptance and his fears cause him to avoid situations which involve exploration, testing of his abilities and other pursuits."

iv) This is the time for learning and practising the skills of creative problem solving. At this stage vigourous efforts are needed to motivate students to learn the basic concept about the languages and develop their ability to apply their knowledge, logic adapt flexible ways to solve various problems.

v) The students, during this period face the problems of adolescence. They get disturbed by rapid physiological changes. Their minds are between preserving their identity and confirming to the norms. The burden of adjusting to these dimensions of adolescence may produce overwhelming anxiety and make productive thinking a difficult enterprise for many adolescents. Training in verbal creativity will be useful for these students to nurture productive thinking.
vi) Besides above psychological reasons, there were some practical reasons too, behind the rationale of selecting 9th Std students. The students below 9th std student are more child-like and may not pay serious attention to the skills. The 10th Std students are pre-occupied with their studies, as they have to appear for their board examinations. Secondly the parents and teachers do not want to disturb their routine. They do not like to participate in training programmes of such novel nature. So the only alternative remained was to select the 9th Std students. The researcher has been a teacher at Secondary high school level and a lecturer at College of Education for many years. The above observations are noticed due to her vast experience.

3.3 Sample of the Pilot Study

i) It was decided to conduct the Pilot study in Modern High School, Pashan, Pune. It is a Marathi medium school. The principal, teachers and students were ready to give full cooperation. It was decided the sample of the pilot study will consist of two divisions of 9th Std. Both divisions had more than 50 students (both boys and girls). It is a large sample.

ii) Reasons for the large sample - Since it was decided to follow the randomized Solomon, four group design in the present research it was found necessary to opt for a large
sample. Thus a threat to internal validity will be controlled and it is a major step in any educational research.

3.4 **Hypotheses** -

The objectives of the study have already been mentioned in the first chapter. To test these objectives statistically, it was thought desirable to form statistical hypotheses in Null form. This step was essential to maintain unbiased attitude in interpretation of results.

3.4.1 The training is effective in terms of significant increase in the scores on the creativity test.

3.4.2 **Main Null Hypotheses**

1) There will be no significant difference between the mean scores of the students from control and experimental group.

2) There will be no significant difference between the gains of the students from control and experimental groups on the test of creativity.

3.4.3 **Subsidiary Null Hypothesis**

1) There will be no significant difference between the achievements of the experimental groups on creativity pretest and post test with respect to common abilities, such as flexibility fluency and originality.
2) There will be no significant difference between the achievements of the experimental group on creativity pre test and post test with respect to convergent and divergent thinking.

3.5 Experimental Design

Selection of experimental design depends upon the information which the investigator wants to explore with respect to a particular problem. To test the effectiveness of the verbal package a true experimental design was selected.

According to Frankel and Wallen* "the essential ingredient of a true experimental design is that subjects are randomly assigned to treatment groups. It is a powerful technique for controlling the subject characteristics threat to internal validity a major consideration in an educational research."

In the present study the randomized Soloman four group design was used.

1) The Soloman four group design

The Soloman four group design is an attempt to eliminate the possible effects of a pre test. Cambell (1957) strongly recommended its use. According to him "this design has become the new ideal for social scientists. This is a combination of 'after only research design and before after research design.'
The experimental and control group taken together constitutes before - after type of design and the second and the third control groups taken together represent the after only type of design.

Graphic representation of the Soloman design

<table>
<thead>
<tr>
<th>Yb</th>
<th>X treatment</th>
<th>Ya (experimental)</th>
</tr>
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<tbody>
<tr>
<td>No treatment</td>
<td>Ya (control 1)</td>
<td></td>
</tr>
<tr>
<td>X treatment</td>
<td>Ya (control 2)</td>
<td></td>
</tr>
<tr>
<td>No treatment</td>
<td>(control 3)</td>
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Where, 

Yb = Scores before the treatment  
Ya = Scores after the treatment  
X = treatment

As stated by Kerlinger the design becomes a strong design for following reasons -

- Demand for the first two lines in the figure.
- Statistical equivalence of the groups being ensured through randomization.
- History and maturation being controlled by the two times of the design.
- Interaction effects due to pre test subject sensitization being controlled by the first three lines.
- Temporary conterminous effects between Yb and Ya being controlled by the addition of the fourth line.
Kerlinger says that if $Y_a$ of the experimental group is significantly greater than control 1, and control 2 is significantly greater than control 3 together with a consistency of results between the two experiments, this is strong evidence of the validity of the research hypotheses.

Soloman and Lessac (1949) point out that this design can more appropriately be employed in studies of developmental process because it allows one to assess the influence of pretesting and the type of effect produced by the experimental treatment.

This design however has some pre-conditions. The first is that it requires many subjects to have four groups and a lot of time to conduct the experiment.

Another feature is that there is no statistical test which can be applied to the analysis of six sets of observations simultaneously.

In the present study it was decided to have four groups of the 9th Std students. Each group had 50 students. The total no. of subjects was 200. It was a large sample.

In the present study it was decided to follow all the principles of Soloman design.

3.6 Tools -

For the collection of new and unknown data, it is necessary to use some device. For each type of research technique, a different
device is needed to gather facts. This instrument or device is called a tool. These tools employ distinctive ways of describing and qualifying data. Using an appropriate tool is an important part of the research.

It was decided to use following tools in the present research.
1) A test in verbal creativity designed by Dr. M. B. Kundale.
2) A verbal package made by the researcher based on Guilford's S. I. Model.

3.7 Theoretical background regarding measurement of creativity

Torrance defines ‘creative thinking’ as the process of sensing gaps of disturbing missing elements, forming ideas or hypotheses concerning them, testing these hypotheses and communicating the results possibly modifying and retesting the hypotheses”.

Acceptance of an educational objective of creativity eventually leads in the area of measurement of creativity. It necessitates the identification of creative talents and the test to measure them.

From the history of the intelligence tests, it is observed that these tests and the criteria of I.Q. had earned a prestigious status as a reliable and authentic tool of measuring intellectual capacity of a pupil and as an indicator of his educational achievement. But intelligence tests could measure only certain abilities of the mind and it was believed that much was the only exposed mental ability or the intellectual functions.
J.P. Guilford, J. C. Taylor, E. B. Meneil, and E. S. Morgan and others have exposed the limitations of intelligence tests and put forward the idea of creativity and its measurement.

Intelligence tests are incapable of measuring the creative ability because these tests demand merely the ability of convergent thinking on the part of the testees while creativity is characterised by the process of divergent thinking. Creativity tests are fundamentally different from intelligence or achievement tests. The former ask for the definite answer from the testee which may either be right or wrong. But in creative process one can expect not only response but other manifestation also.

Creativity tests are of various types. Following are some of the salient features of the creativity tests.

3.8 **Specific features of a Creativity Test**

Before the construction of a test following aspects have to be considered.

i) Specification of the field - The field of creativity consists of many sections. The two main sections are 1) general and 2) specific. In the second category there are sub-sections like figural, semantic, behavioural and symbolic.

ii) Once the area has been decided the items are constructed to measure creativity.
Construction of Creativity tests

Before constructing the test one must specify the field i.e. general, figural, semantic, behavioural, symbolic.

i) **Reliability**- It refers to the degree of consistency of results obtained. If one particular part of a test gets more responses consistently, it is better to retain that item. The degree of reliability can be determined by such techniques as test-retest or split-half correlations.

ii) **Validity**- Tests used to measure creativity must possess the characteristics of validity. A particular test may be valid for one objective and invalid for another. The specific nature of validity leads to an obvious conclusion i.e. one must determine degree of validity for oneself. Creativity is multidimensional and not unidimensional. The test also should have a factorial validity. So it has to have a battery of tests and can have sub test form.

iii) **Time factor** - Creativity tests are not time bound. A testee can score well and can give original responses if ample time is given. But it is necessary to set some kind of time limit for practical purpose.

iv) **Scoring** - The assessment of responses in the creativity test is a very time consuming process. There are no right or wrong answers. There is no limit on the responses a testee can give. So it is a very difficult task for computerised assessment. The examiner should also be knowledgable
and expert in the field of creativity. Scoring key is not much helpful. It can be lengthy and cannot remain static. In the school test the total marks for a particular test can be decided but in the test of creativity there are so many correct and endless responses that it is difficult to decide the total marks. Here every item is an open-ended one, while in the school tests like multiple choice, fill in the blanks, give opposites, there is only one right answer. But in the test of creativity there can be a number of right answers.

v) Nature of creativity tests - The creativity tests are of various types. One possible classification is as follows:

<table>
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<th>Tests in creativity</th>
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<tr>
<td>Verbal</td>
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<tr>
<td>Nonverbal</td>
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<tr>
<td>Literary</td>
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This is a tentative classification. Most of the information has words attached to it.

Literary creativity is a potentiality or an aptitude for creation of new works of beauty of any size and form through the medium of language and literary creativity should not be confused with literary ability. The latter is a wider concept which includes both appreciation on the basis of a creative ability and actual creative writing ability. The basis of the literary test is verbal.
vi) Reasons for using a test of literary Creativity

1) Communication is a very vital process. It can best be achieved through medium of a language.

2) Attainment of mastery over a language helps communication.

3) If students have a good knowledge of language, it will be beneficial for them in the present situation and also in their future.

4) Students have a fairly good knowledge about the language due to their school curriculum

3.9 A test of literary Creativity in Marathi by Dr. M. B. Kundale

A) The test is constructed in the area of creative, imaginative, or artistic writing in which all resources of language and powers of words, logical as well as psychological, intellectual as well as emotional, literal figural or suggestive, are freely drawn upon for exploration and expression of life as the writer sees it, experiences it, and weighs its worthwhileness and values.

Creative writing has been equated with imaginative writing by most of the experts. Gerald defines it in the Encyclopedia of Education as "that which stirs the emotion delineates a new idea or gives fresh insight into the life. Blond's Encyclopedia of Education' describes creative writing as "autonomous" or "free writing" and says that pupils undertake it for "self expression" and "self satisfaction."
In Marathi language the term creative writing is equivalent to creative literature that is beautiful, which is based on aesthetic principles.

Creative linguistic expression was considered to have the following constituents.

1) Poetic diction
2) Plot building
3) Imagination
4) Descriptive style
5) Emotional expression
6) Dialogue writing
7) Rich language equipment

Test variables were as follows -

1) Poetry writing
2) Short story writing
3) Imagery formation
4) Poetry completion
5) Story completion
6) Descriptive style
7) Emotional writing
8) Dialogue writing
9) Semantic fluency
10) Verbal fluency

B) Language Area - Since the test language was Marathi, the test and their items had to be in tune with the nature of Marathi language usage and literature.
C) The Sample - Sample of the students belonged to 9th Std class only. The age group of these students was about 15 years. But the grade had been fixed as criterion and not the exact age.

Relationship of the tests with the factors of creativity
It was observed that fluency, flexibility, originality and elaboration were the factors or the abilities that the tests were related with. Most of the tests involved mixed abilities. Originality here is defined on the basis of the quality and not merely the statistical infrequency.

3.5.3.1 Scoring of the tests - As indicated earlier each test was different from the other, it needed different type of scoring. In some tests scoring had to be done on the basis of quality and originality and in some fluency and flexibility.

The quality scale also had been prepared for correcting and evaluating answers. The reason was, the answers were not only different in nature but also differed in quality.

D) "Reliabilities of tests of creative criteria will be generally low," said Guilford. This is because the function of creativity is very fluctuating. Some writers have said that there are rhythms in creativity which result in considerable error variance in the measurement of creativity. However some tests have shown high reliability, even more than 0.90.
E) **Validity**

The validity of the creativity tests have posed the same problem as reliability. Validity of all the previous tests have been challenged, including that of Guilford’s.

The problem arises due to the absence of dependable external criteria. In the present test also the same difficulty occurs. But attempts have been made to overcome these difficulties.

The tests have been kept free from the subject matter, background or courses prescribed for examinations in Marathi. So it can be said that tests have adequate content validity, which is desired and they do measure to creative writing potential of the students.

An effort also has been made to validate the test against external criterion. The criterion used was the rating of the students by teachers who taught Marathi.

### 3.10 **Finalisation Of A Package**

After carefully studying the test and after discussions with some experts in the field of creativity some categories were selected. Similarly some categories were omitted. Poetry writing dictation was omitted because the researcher had constraints. First, the time which was provided to conduct training session was not very long. The school authorities had allotted only three weeks and about 25
periods of 30 minutes in the school time table. So it was not possible to touch all the aspects measured by the test. Thus a separate test in the form of a question paper was prepared. The scoring key was prepared too. On both the occasions experts in Marathi language were consulted.

3.10.1 The Scoring Scheme for measurement of items

It was decided to base The Scoring Scheme on the basis propounded by Torrance (1974) for Torrance test of creative thinking. It was decided to evaluate the responses and to give scores in the following way.

Following categories were decided for the evaluation

i) **Fluency** - It was decided to give the score of fluency by counting number of appropriate or relevant responses which would be given by the subjects. This score would show the number of total responses which would be given by the students in a given period of time. In other words it would indicate ideational fluency. It was decided not to score the responses which were irrelevant to the question.

ii) **Flexibility** - This is determined by counting the number of different categories into which responses could be classified or variety in the responses. If two or more responses came under one category only the flexibility score will be given.
iii) **Originality** - The responses will be scored for originality on the basis of statistical frequency of the question. The rare responses will get Score 2.

iv) **Elaboration** - The style to describe, use of words, literary style was also given weightage.

It was planned to use the above described scheme for the correction of answersheets. It was decided to use means of scores within a group, and their standard deviation and other statistical calculations.

### 3.11 Significance of Difference between Means

Design of experiments is done with a view to ascertain the effect of a treatment given to the population or to check a particular facet with relation to a basis of grouping. Since it is impossible to examine the entire population, groups are selected and they are tested for various parameters. Measurement of a particular parameter is first carried out according to an experiment design. Thereafter a treatment is given to the group. Finally once again the particular parameter is measured after the treatment. Thus two sets of scores are obtained. Alternately when two groups are to be compared on same basis, the two groups are measured for the parameter under comparison. Once again two sets of scores are obtained. In all such cases each member of the group is examined and assigned a test score. The parameter value is then the arithmetic mean of the test scores within the group. An experiment design thus results in comparison of means of group
scores obtained as a result of two separate tests. Such comparison gives the result of the effect of a treatment on the group or effect of a basis of selection of the groups. If the two means have strikingly and substantially differing values it is immediately possible to see the effect of treatment or basis. However in many cases the values may be different by a small number. It is then necessary to ascertain that the difference in means has arisen, not because of a chance or measurement error, but has definitely to an extent arisen because of a true difference between the means. Statistically speaking it becomes necessary to make a valid significance test as to the difference in mean values of compared test scores. In practice a "Null Hypothesis" is set up. The null hypothesis, simply stated, assumes that there is no difference between the two mean values proposed to be compared. An experiment is designed and as per the design sets of scores are obtained. The observed sets of scores give the two means to be compared. Relevant statistics is applied and if it is concluded that the difference in the means is significant then the null hypothesis is rejected. The difference in the means is concluded to be not accidental or not due to any measurement error or not unimportant. On the other hand if the statistics concludes that the difference in means is unimportant and is not significant then the null hypothesis is accepted and it is further concluded that the means to be compared are not different in values. The statistics used for testing the hypothesis that the difference in means does exist or not (or is significant or not) will thus have an important role in the design of experimental methods. This statistics will enable the experimenter to assess whether or not the difference between the means represents a true difference between the means and will
also determine in terms of a probability level for such a difference being significant.

3.12 **Statistical Technique**

1) Use of the ‘t’ test.
2) Qualitative analysis - It was decided to analyse the responses of the two groups on the test of Creativity qualitatively with the help of specific criterion. An attempt was made to relate these results to those of quantitative analysis.

**Statistical Techniques** -

**The Students ‘t’ test**

In designing an experiment manageable groups are set up so that tests can be conveniently administered. Such groups can be given effective training where experiment so requires. On the basis of observations made on such group sizes (or sample sizes) conclusions have to be drawn in respect of a population size. When it is wished to make valid significance tests as to the difference between the mean values it is necessary to have a statistics for adequately dealing with such cases. Mr. W.S. Gosset carried out research under the pseudonym of ‘Student’ and arrived at a ratio which he called the ‘t’ ratio and the test related to this ratio is called the **t Test**. According to the ‘t’ test first, group means are obtained. These are the means to be compared for significance in their difference. The ‘t’ ratio is found out from the two group scores by the formula.
\[
    t = \frac{M_x - M_y}{\sigma D}
\]

Where: \( M_x \) and \( M_y \) are the means of two groups \( x \) and \( y \) and \( \sigma D \) (Sigma \( D \)) is the standard error of the difference between the means.

Statistics tells us that the difference between two sample means \((M_x - M_y)\) is distributed approximately normally and tends to be normal with increasing numbers in samples. ‘\( t \)’ thus has an almost normal distribution. The normality of ‘\( t \)’ distribution increases with increase in sample size. With a sample size which is very very large (or infinity) the ‘\( t \)’ distribution becomes normal.

From the equation of \( t \) it is clear that it is a ratio of difference in means and standard error of the difference in means. The numerator is a linear quantity and the denominator is a Sigma score. It is not very different from the ratio of deviation from mean to the standard deviation in case of a classical normal distribution. The area under the normal curve gives the probability of that score. Likewise area under \( t \) distribution curve also gives the respective probability. \( t \) scores are calculated and tabulated for different sample numbers (or degrees of freedom) over a wide range of degrees of freedom. The values of \( t \) in tables are \( t \) distances beyond which - to the right and to the left - certain percents of sampling distribution fall. These percent points are also indicated in the \( t \) tables. Generally these are for percentages of one, two, five and ten. These percent scores act as the confidence levels. In practice firstly \( t \) value is calculated from
the two group scores. The calculated t values are then compared with the values for respective percentages (or probability parents) of the t tables. If the t value is more than that as per the table value then the difference in mean is considered significant at that percent level of confidence. The t value thus enables the determination of acceptance or rejection of a null hypothesis at different confidence levels.

Use of t test is done in this research since randomised sample groups of N=50 are first set up by a random selection of the groups from a universe or population. The difference in the observed means are then calculated (Mx - My). Calculation of standard error of difference between means involves calculation of group standard deviations which takes into account variance and the sample size. Thus t distribution takes into account all aspects of sample size for a statistical comparison with the population with a certain level of confidence. It is this statistics which is used therefore in the analysis of the results in this research.

Concept of degrees of freedom - t tables have t scores tabulated for different probability percents and for varying numbers of degrees of freedom.

When a statistic is used in estimating a parameter the number of degrees of freedom available depends upon the restrictions placed on observations. In sample statistics calculations involving N numbers of observations one degree of freedom is lost for each restriction imposed. When a mean is calculated from scores one degree of freedom is lost. For calculating t values first means
are calculated for both sets of scores. For calculating the standard error of difference between the means to get the t ratio therefore one degree of freedom is lost. Thus for t scores degree of freedom becomes N-1 for each sample size N. For two sample sizes of N1 and N2 the degrees of freedom will be (N1 - 1) + (N2 - 1).

Equations used in the calculation of t values:

1. Arithmatic Mean $M_x = \frac{\Sigma x}{N}$ Where x = scores of sample x and N = Sample size

2. Standard Deviation $\sigma = \sqrt{\frac{\Sigma X^2}{N} - M^2}$

3. Linear Correlation $\gamma = \frac{\Sigma XY - NM_xM_y}{\sqrt{[\Sigma X^2 - NM_x^2][\Sigma Y^2 - NM_y^2]}}$ Coefficient for groups scores X’s and Y’s

4. Standard error of means $\sigma_m = \frac{\sigma}{\sqrt{N}}$

5. Standard error of difference between means of correlated scores $\sigma_D = \sqrt{\sigma_{M_x}^2 + \sigma_{M_y}^2 - 2\gamma\sigma_{M_x}\sigma_{M_y}}$

6. t values $t = \frac{|M_x - M_y|}{\sigma_D}$

3.13 The verbal package

To impart training in verbal creativity the verbal package was prepared on the basis of Guilford’s theory of creativity. The basis of the package and the rationale behind it is discussed in the next chapter.
3.14 **Pilot study** -

It was decided to conduct the pilot study to test the stimulus potential of the items in verbal package. It was decided to conduct the study in two divisions of IXth Std. Each class consisted of about 50 boys and girls, in Marathi medium school.

3.15 **Conduct of field trials** -

The main consideration at this point was to maintain internal and external validity. Attempts were made to follow a uniform working procedure for the administration of various tests and the training programme.

3.16 **Planning**

To implement the training programme a lot of detailed careful planning was done. It covered the following areas.

i) Preparation of the researcher regarding the content which was to be taught.

ii) Activities to be implemented and the discussions to be conducted.

iii) Organization of instrumental material.

iv) Sheets, note-books for students.

v) Observations of the training sessions - Some sessions were observed by the guide and some by the teachers, in the school.

vi) Time schedule of the activities involved in the field trials. Thus an attempt was made towards the integration of the various activities which were needed for giving training.
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