CHAPTER III

RESEARCH TECHNIQUE, PROCEDURE AND
STATISTICAL METHODS FOLLOWED:
In this Chapter, the investigator would like to give the technique and procedure followed in the course of this investigation and statistical methods used.

III.1. The first step in any investigation would be to fix-up the procedure for conducting the inquiry. The accuracy of results and validity of conclusions would depend upon the procedure of collecting data. So, in any investigation, the technique and procedure of collecting data are very important steps.

As already pointed out the study can be divided into two parts viz. (1) to survey the ANP with special reference to the situation in Maharashtra and (2) to suggest ways and means to improve the same through schools by conducting a school experiment. Accordingly two research methods—Survey method and Experimental method were adopted in this investigation.
III.2. "A survey is taken for the purpose of ascertaining the prevailing conditions. It seeks to answer the question—what are the real facts with regard to the existing condition? The survey method of research finds expression through a variety of techniques. In this study six aspects of the survey method were adopted, viz., (1) Questionnaire (2) Question schedule (3) Interview study (4) Observation study (5) Discussions—individual and group (6) Documentary study.

III.3. "In general the word questionnaire refers to a device for securing answers to questions by using a form which the respondent fills in himself. Accordingly, questionnaires were carefully prepared for different categories of persons, separately. Then they were handed over to the respective persons by the investigator during his visits to blocks, villages and training centres. For Gramsevaks, Gramsevikas and school teachers at village level and extension officers of block level and the staff and the trainees of Gramsevak Training Centre at their respective places, questionnaire forms were used. Questionnaire forms were given to respective functionaries after explaining the purpose of the survey and they were requested to fill them as freely as possible and hand over them to the investigator. Thus questionnaires were administered and data was collected.

III.4. The schedule is the name usually applied to a set of questions which are asked and filled in by an interviewer in the face to face situation with another person. A schedule is different from a questionnaire as a schedule is administered personally to a respondent or a group of respondents while the questionnaire is usually mailed and the respondents requested to fill it themselves. The advantages this tool has over the questionnaire is that it provides an opportunity to establish rapport which helps to explain the purpose and to make the meaning of items clear. Therefore, this tool was used at the village level for the members of village panchayat, youth and Mahila Mandal members and for common households, because they were either illiterate or less interested to give reply in writing.

The schedules were prepared adequately, for different categories in consultation with the instructional staff of the training centre, Gargotli, and during the village visits, either in the meeting or in the home, questions were asked to respondents by keeping sequence of questions. Thus, the information from the village level respondents was collected.

III.5. Interview as a research tool; in a sense, it is an oral type of questionnaire wherein the subject supplies the needed information in a face to face relationship. It is specially appropriate when dealing with children or illiterate households.

The responses from the mailed questionnaire are generally poor and hence in this inquiry the same were handed over personally by the investigator instead of posting them.
During the survey in the village, house-wives and common villagers were interviewed. In the school, in case of children this type of tool was applied to the survey. To get the desired information through interview, questions to be asked were planned in mind and sequence of questions was kept. Immediately after interview, information was recorded.

(4) OBSERVATIONS:

III.6. Sometimes it is not possible to ask questions and also to get replies to them, but we have to observe and make judgement accordingly. This is called an observation tool of research method.

During the survey, the investigator observed the situation, specially in respect of feeding programmes, school and school gardening conditions, general health and sanitary condition of the village. The attitude of villagers, village level workers and school teachers towards ANP was observed. The attitude of block and other functionaries was also observed during the discussions and points were noted down simultaneously.

(5) DISCUSSIONS:

III.7. After administration of questionnaire, schedule, interview, the investigator held discussions with the village leaders, school teachers, Gramsevaks and Gramsevikas, individually as well as in the group. At the block level Block Development Officer and the Panchayat Samiti Chairman, along with his companions participated. At the training centre, the Principal and staff as well as the trainees were involved in
the discussions. During the discussions, personal opinion and
the purpose of collecting data were explained by the investigator
and the respondents were asked to give their opinions frankly,
regarding the implementation of ANP. They were also requested
to suggest ways and means to overcome the present difficulties
in respect of all components of the scheme. Major part of
discussion was done at the Composite Training Centre, Gargoti
where the officers and non-officials both from district and
block level, were available from all over the Maharashtra.

Besides the said respondents, the investigator contacted
the knowledgeable and political personnel like, Medical doctors,
Professors of agricultural extension, President of Zilla
Parishad, and retired persons from such a scheme.

III.8. The State and National level authorities and the
representative of FAO and UNICEF those who were directly or
indirectly connected with this scheme were also contacted and
their views were collected. For this purpose the investigator
had prepared a note, stating his personal observations about
the present condition of ANP in India in general and the
problem under study in particular. Such a note was handed
over to the said authorities and discussions were held. During
the discussions points were noted down simultaneously, or
immediately after the discussions.

(6) DOCUMENTARY STUDIES:

III.9. Besides, above survey types, the investigator approached
the authorities who were involved in this programme and got
the information collected or evaluated by them as the documentary references. ④

Sample Selected For The Survey:

For the survey purpose the area and the personnel have been fixed up in the beginning for getting the valid requisite information in time as given below:

(a) SELECTION OF THE BLOCKS AND VILLAGES:

III.10. ANP is being conducted in the selected blocks in each state and for deep study ten blocks were selected from three districts namely, Kolhapur, Ratnagiri and Sangli of Maharashtra, and the villages under ANP from each block. (Please see the map on left-hand side). The selection of these ten blocks and villages under them can be said to be purposeful sampling based on the following justifications:

(1) The ten blocks from three districts of Maharashtra can be an adequate sample for the present survey because assistance and guidance, pattern of administration and implementation are the same throughout Maharashtra and to some extent in India.

(2) The blocks were under the supervision of Gramsevak Training Centre Gargoti and Kolhapur so that the investigator was able to approach these blocks and villages easily, and

④(ⅰ) "Applied Nutritional Programmes, the past as a guide for future" written by Dr. Mcnaughton, published by FAO, in Food and Nutrition, a quarterly journal, Vol.I. 1975.

(ⅱ) An evaluation report on ANP published by the centre of Agricultural Management, Indian Institute of Agricultural Management, Ahmedabad (India) - 1971.


(iv) The visit reports of the Principal, Gramsevak Training Centres, Gargoti, Kolhapur and Manjari.
The data collected from the sample was supported by other data, gathered from the training centres and from the concerned officials.

### TABLE -III.1
Block-wise villages, visited during the survey:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Block</th>
<th>Starting Year</th>
<th>Completion period at the time of survey</th>
<th>No. of villages visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kudal</td>
<td>1965-66</td>
<td>9 years.</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Shahuwadi</td>
<td>1965-66</td>
<td>9 -&quot;-</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Miraj</td>
<td>1966-67</td>
<td>8 -&quot;-</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>Panhala</td>
<td>1967-68</td>
<td>7 -&quot;-</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Ghuhagar</td>
<td>1967-68</td>
<td>7 -&quot;-</td>
<td>8</td>
</tr>
<tr>
<td>6.</td>
<td>Radhanagari</td>
<td>1968-69</td>
<td>6 -&quot;-</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Tasgaon</td>
<td>1968-69</td>
<td>6 -&quot;-</td>
<td>8</td>
</tr>
<tr>
<td>8.</td>
<td>Swantwadi</td>
<td>1968-69</td>
<td>6 -&quot;-</td>
<td>8</td>
</tr>
<tr>
<td>9.</td>
<td>Ajara</td>
<td>1972-73</td>
<td>2 -&quot;-</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>Devgad</td>
<td>1972-73</td>
<td>2 -&quot;-</td>
<td>7</td>
</tr>
</tbody>
</table>

Total No.of villages:- 88

Note: (In Maharashtra each block consists of 10 villages under ANP, the figures against each block show the number of villages actually visited by the investigator.)

Besides, these ten blocks and 88 villages, other blocks and villages were also studied through training centres and thus they supported the data collected as above.
(b) **SELECTION OF TRAINING CENTRES**:

III.11. The training of ANP for the block and village level workers is being given at the Gramsevak Training Centres. The Principal and his staff are expected to guide and supervise the ANP activities of the concerned blocks. Therefore, training centres are good sources to get the real information for the survey purpose. Gramsevak Training Centre Gargoti, Manjri and Kolhapur were selected for the survey, out of 9 centres in Maharashtra on the basis of suitability to get the expected information (Please see the map on the lefthand side). Besides the Gramsevak Training Centres, there is only one training centre in Maharashtra known as the Composite Training Centre, located at Gargoti District Kolhapur where the trainees usually come from all over Maharashtra. These trainees are both officials and non-officials of the block as well as the district levels. The investigator got an opportunity to make good discussions with the said trainees and thus through such group discussions he came to know, the different views regarding the ANP activities.

(c) **SELECTION OF THE RESPONDENTS**:

III.12. Different functionaries and beneficiaries are involved in ANP at various levels. The details are given in the survey Chapter No.IV, however the list of definite categories of respondents selected for the survey purpose is given below in a tabular form.
List of different respondents contacted for the survey at various levels:

<table>
<thead>
<tr>
<th>School</th>
<th>Village</th>
<th>Block</th>
<th>Training</th>
<th>Higher Knowledgeable Centre</th>
<th>Authority Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Teacher</td>
<td>1) Common man</td>
<td>1) B.D.O.</td>
<td>1) Principal</td>
<td>1) District</td>
<td>1) Medical Doctors</td>
</tr>
<tr>
<td>2) Pupils</td>
<td>2) Mahila Mandal</td>
<td>2) Extension</td>
<td>2) Instructor</td>
<td>2) Divisional</td>
<td>2) Social Worker</td>
</tr>
<tr>
<td>3) Youth club</td>
<td>3) Local Leaders</td>
<td>3) Trainees</td>
<td>3) State</td>
<td>3) Retired persons</td>
<td></td>
</tr>
<tr>
<td>4) Gramsevak</td>
<td>4) Professors of Extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Gramsevika</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Village Panchayat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Housewives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(B) EXPERIMENTAL METHOD:

III.13. Experimentation is the name given to the type of educational research in which the investigator controls the educative factors to which a child or group of children is subjected during the period of inquiry and observes the resulting achievement. Experimental type of research is the description and analysis of what will be or what will occur under careful controlled conditions.

Generally, the experimental method is used to ascertain the effect of any change in the normal educational programme or practices. Major steps in the experimental method are three:

i) Planning the experiment.

ii) Conducting the experiment.

iii) Reporting the results.

Planning the experiment includes determining the place, time, duration and material of the experiment and selecting the subjects and groups. Then conducting the experiment includes supplying the experimental factors, controlling the variable, measuring the result, interpreting it after classifying and analysing. Lastly, drawing conclusions from the findings and reporting the results.

III.14. In the present experiment comparative approach was made and comparison between the groups was resorted. To one group, where experimental factors were applied was known as the experimental group and the other was the control group where experimental activities were never introduced and regular school teaching was done.

(a) SELECTION OF THE EXPERIMENTAL AREA:

III.15. For the experimental activities seven villages and eight schools from two blocks - Radhanagari and Bhudargad of Kolhapur district were selected. The socio-economic conditions of these two blocks and their positions in the district were studied to get the background of socio-economic conditions of the experimental area, as such conditions affect any programme of nutrition education of the community. Radhanagari is an ANP block where ten villages were covered under this scheme since 1967-68 under the Rural Development Department of

Sukhia S.P.; Mehrotra P.V.; Mehrotra R.N.; Ibid, P.201.
Maharashtra. Out of these ten villages only two villages and their schools were selected as an experimental sample by the random selection method; namely Nartavade and Sarvade (The procedure of random sample selection of the villages is given separately at the end of this chapter). Then, another two villages or schools from the remaining 8 villages were taken as a control group, on the basis of similarity of these villages, specially in school conditions. Kavalav and Rashivade villages were included in the control group. Thus, for experiment purpose, 4 ANP villages and schools from Radhanagari block were considered, two for experiment and two for control, out of ten ANP villages. (Please see the map attached on the left-hand side).

Similarly 4 schools, two for experiment and two for control group were selected from Bhudargad block. While selecting the experimental schools of Bhudargad, the similarity, in respect of natural conditions, location of the village and school as well as co-operation from villagers and teachers were considered. Two schools, namely Gargoti and Kolhapur of Bhudargad those somewhat similar to experimental schools of Radhanagari were selected for experiment. Then from a convenient point of view, to enable the investigator, to get valid and reliable data, other two schools for control group were taken, namely Akurde and Gargoti. Thus from Gargoti village, two schools one for experiment and another for control were taken to avoid the differences in village situation. Thus, there
were 4 schools from Bhudargad, from three villages, namely Gargot, Khanapur and Akurde.7

III.17. The intention of selecting the said groups from Radhanagari and Bhudargad was to compare the ANP experimental schools with ANP control schools and then experimental ANP schools with the experimental group of Non-ANP as well as the control group of Non-ANP. Thus, the plan of comparison between the schools is shown as below:

<table>
<thead>
<tr>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radhanagari (ANP)</td>
<td>Radhanagari (ANP)</td>
</tr>
<tr>
<td>i) Nartavade i) Gargot (JBB)</td>
<td>i) Kavalav i) Gargot (PS)</td>
</tr>
<tr>
<td>ii) Saravade ii) Khanapur</td>
<td>ii) Rashivade ii) Akurde</td>
</tr>
</tbody>
</table>

7 At Gargot there are two primary schools one managed by a private society Shri Mouni Vidyaapeeth, and known as Jawahar Bal Bhavan and another known as Pega School, managed by Zilla Parishad, Kolhapur. Hereafter they are referred as Gargot (JBB) and Gargot (PS) in this study.
(b) STUDY OF THE EXPERIMENTAL AREA:

III.18. Seven villages and their respective 8 Schools were selected, four each, for experimental and control group. Before conducting the experimental activities in schools, the general study of the villages and schools was done in respect of factors which can influence the experimental results.

The planning of any nutrition education programme like ANP depends upon the existing food situation of the community and the natural resources available (within the hands of) the people. The general condition of sanitation of the villages and public health in general, play an important role in this respect. The food consumption pattern and dietary habits of people also play an equal role. The present experiment conducted through schools and hence the investigator has tried to gain the said type of knowledge to enable him to organise the teaching activities accordingly.

(I) STUDY OF GENERAL HEALTH AND SANITATION IN THE VILLAGES:

III.19. The general health and sanitary conditions in seven villages were studied by adopting a questionnaire inquiry form, personal observations and discussions with the villagers and the village level workers. For this study the questionnaire was administered through schools. The questionnaire forms were given to the households through the respective children, with an intention that interest should be created among the children, to develop their knowledge in the present study. An adequate questionnaire was framed and copies distributed
among school children of upper grades (5th, 6th and 7th classes) of each school. It was explained to children how to fill the form with the help of their parents. The school teachers were requested to get it done, and hand over the filled questionnaires to the investigator.

III.20. Besides, the questionnaire inquiry the investigator made a deep study and in selected families by visiting homes observed personally many things and after discussions with the house-holds collected the requisite information like drinking water facilities, use of latrine, disposal of refuse and waste water, housing conditions, personal cleanliness of the people, etc. The general health and concept of health from the villagers' point of view was also recorded.

(II) STUDY OF FACTORS INFLUENCING ON DIET AND FOOD HABITS:

III.21. The factors influencing dietary pattern and food habits of the people are many. The cropping pattern of the locality, availability of foods, food-cooking methods, storage of foods, eating habits, awareness of nutrients and cultural and religious influences, etc. were studied with the help of above techniques at the same time. Such type of study greatly influenced the teaching activities in the schools. The knowledge gained from this study, definitely guided the experimenter to plan his school activities accordingly.

(III) STUDY OF SCHOOLS:

III.22. The whole experiment was based on school activities where children were the carriers or medium of the experiment. Therefore,
children from both the groups were studied in respect of factors which influence directly or indirectly on the learning process of the children as far as present study is concerned. In this respect school surroundings, teacher's qualification and experience, cooperation from the villagers, age of children, physical and nutritional status of the children were studied. The school surroundings include teaching materials, building, school garden, locality, etc.

(c) CONDUCTING EXPERIMENTAL ACTIVITIES:

III.23. The teaching activities related to ANP and not much different from the school curriculum, were conducted. These activities were introduced in the experimental group of schools in addition to regular teaching without disturbing the teaching programme of the schools, whereas in the control group schools only regular teaching was done.

It has been already mentioned that the pupils of 5th, 6th and 7th standards participated and activities were limited to them. Besides, the experimental group of students, the teachers and parents of the respective children were involved in this study as school could not be isolated from any one of them.

III.24. In the schools, teachers were approached first and meetings of the teachers were called by requesting the Head Masters. In the first meeting, the purpose of the study and the manner of conducting it, were explained. How these activities would help in their regular teaching was also made clear. The teachers were asked to raise any difficulties or doubts in carrying out such activities.
III.25. The teachers were provided, the printed booklet, prepared by the investigator already, in 'Marathi' and were requested to follow it by making necessary changes without disturbing the purpose of the booklet. The booklet was the guideline for the teachers, just to know how to carry out different activities to achieve the expected aims of ANP. The booklet was the original contribution of the investigator and after including a few modifications made from time to time, is given in volume II of this thesis as Appendix -A.

III.26. Then, next comes the contribution or role played by the school children. The whole result of the experiment depends upon them. Accordingly, pupils, have performed their role as per the instructions, given either by the teachers or the investigator. They took most of the experimental matters to their parents through notes, provided by school teachers and the investigator. Children are pliable and tender nature and it is not difficult to lead them as we desired.

III.27. It is well known that any school curriculum can not succeed without the active participation of parents. Accordingly parents were also involved through their children and side by side the investigator made a rapport with the parents through children and visited each household at least once in a month. At the time of first visit the parents were supplied the pamphlet stating 8 principles of ANP, prepared by the investigator in local language Marathi. (Appendix -B). During his visits, he encouraged parents to be active in this school programme as it is a life-long beneficial programme for the welfare of the family, village and Nation.
(d) **EVALUATION PROCEDURE FOLLOWED:**

III.28. After conducting the experiment the next step is to evaluate the impact of the new approach of factors which have been added, by comparing the effectiveness with controlled conditions of similar group.

The evaluation was made in respect of school children, school teachers, and respective parents. Attention was paid more to the evaluation of school children as the whole experiment was based on them. The school children have been evaluated by conducting the achievement tests. There were four tests. The first test was the pretest, that was the test applied before introducing the new activities in the experimental schools. The pretest was given at the beginning of the academic year, e.g. in first week of July 1974. The pretest was based on general knowledge of the pupils in respect of food production, food consumption, importance of foods in body building and personal hygiene etc. just to know how far the two school groups of pupils were equal in this respect.

After conducting the pretest, the new activities were introduced in the experimental schools and then three tests were given, in September 1974, January 1975 and March, 1975. The questions in these tests were based on the course of the experimental study. (The sets of questions are enclosed in the second volume of this thesis in Appendix -E). All tests were administered by the investigator himself, with the help of school teachers and assessed personally.
Before applying the tests, their reliability and validity were established by statistical methods and given to both the groups. The pretest was essential and equally important and hence that was also made reliable and valid as other three tests and applied to both the groups.

III.29. Besides, the said tests, an oral examination was also arranged by the investigator himself, after completion of the tests, to understand how far the pupils have followed the instructions given to them in the schools. Thus, the investigator observed the practices of the new knowledge, imparted through schools.

III.30. During the course of present study the respective school teachers and parents were involved, therefore for studying their views, regarding the experimental approach was important and essential. In the case of parents—father, mother and elders of the families were taken into consideration. For this purpose question schedule was prepared in the beginning of the approach for the parents as well as for the school teachers and the same was applied at both the times, in the beginning and at the end, as soon as the new course was completed.

III.31. After evaluation as stated above the data collected, was arranged into four heads in the case of teachers and under five heads in the case of parents and tabulated accordingly. With the help of this data and personal discussions of investigator with the teachers and parents and his personal observations the result was obtained.
III.32. As regards the survey study, the survey was completed with the help of survey tools as stated in the beginning of this chapter and reported in the separate Chapter No.IV, called the survey of ANP.

Then the findings of the survey are discussed in a separate Chapter No.VIII, known as Results and Discussions, where both the survey findings and the experimental results are discussed and on the basis of the said discussions recommendations have been given in the last chapter of this thesis.

(E) STATISTICAL PROCEDURE FOLLOWED:

III.33. In making an experimental study or school survey, a teacher should use the suitable statistical methods in reporting and interpreting his findings to make the results more accurate. In the present study the investigator had followed the different statistical techniques as given below:

(I) Selection of the experimental villages by random method:

Two, out of ten ANP villages, from Radhanagari block, were selected by the random method. For this purpose the names of the ten villages were written on a slip of paper, separately and closed in such a manner that one can not identify a particular slip for a particular village. All these ten slips, were kept in a small tin pot and shaken well. Then, one small boy was asked to pickup, only two slips from the said tin pot. Thus, two villages and their schools were selected from the ten ANP villages of Radhanagari block, namely Nartavade and Sarvade as shown in Map Number3. 
(II) To establish the Reliability and Validity of the tests:

An instrument applied to judge the performance of the pupils in respect of knowledge, gained or practised is called the test. There are different kinds of tests, chief among them for educational purpose is the performance or the achievement test. To measure any subject, the measuring device must be valid and reliable, otherwise the measurement has no value. Therefore, the investigator framed the tests and established their reliability and validity. Other characteristics of good tests, objectivity, ease in administration and interpretability were also taken into consideration while constructing the tests. Any test examination must satisfy certain conditions if it is to be useful. The following are the important characteristics of a good test:

1. Validity
2. Reliability
3. Objectivity
4. Administrability
5. Interpretability

The investigator has tried to fulfil these conditions in all his tests before conducting them in the class.

(1) VALIDITY:

Any measuring device can be valid if it measures what it is supposed to measure. Validity is sometimes referred to as the truthfulness of a measure. It is the most important characteristic of a test. If a test does not truly measure what is supposed to measure, it is of no value, regardless of its other good features. Sometimes a test is referred to as a "Valid test", but in fact a test can not be said to be valid in a general sense because it can only be valid for a
particular purpose or purposes. A test which is a valid measure of achievement in one school subject and in a particular grade in one community may not be a valid test in the same object and in the same grade in an adjoining community.

III.35. There are two main types of validity. The first type is logical or rational validity and the second type is statistical or empirical validity.

The former type of validity is established by inspecting the test itself to determine the extent to which the item in the tests correspond to the objective in the course or unit that is being evaluated. In the first place, the test must be valid from the point of view of the curriculum. For this purpose, the test constructor must consider the course of study, objectives of the instruction of the subject, etc.

This may be defined also as a curriculum validity and depends upon the test contents. Our present tests possess such validity to a high degree as the objectives were stated very clearly and the application of the questions covered the course of study or the unit that was being evaluated.

The second kind of validity depends upon the test scores. In order to determine the statistical validity the scores of group of pupils are correlated with the scores of a certain criterion, for example, the criterion of a mathematics achievement test may be school marks in mathematics.

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In the case of present tests the teacher's marks in the subjects of general science were correlated with the test scores and the correlation co-efficient was found out. The correlation co-efficient for the present tests ranged from 0.65 to 0.70. As the marks given by teachers are affected by factors like attendance, working habits, personal likes and dislikes and other subjective matters, the above correlation coefficient may be said high. This correlation coefficient is called a validity coefficient. (As validity coefficient theoretically can take on the whole range of values from 1.00, perfect positive correlation through zero correlation to 1.00, perfect negative correlation.)

(2) RELIABILITY:

The reliability of a test is the accuracy with which it measures what it proposes to measure. What a test measures may not be what it proposes to measure but if it measures accurately it is reliable test. Thus if a test is valid it must be reliable; on the other hand a reliable test may not be valid.

The following method was used to find the reliability of the present tests.

The test-retest method:

Before implementing the tests, each test was given to the group of pupils of 6th standard of the primary school of the village Shengaon in Bhudargad Taluka. Then after a week the same tests were given to the same group of pupils.

The correlation co-efficient between the two sets of scores for each test was calculated separately, that is known
as the reliability coefficient. The reliability coefficient of the present tests ranged from 0.88 to 0.92 by this method.

III.38. The third important characteristic of a test is its objectivity. A test is objective when the personal judgement of the scorer does not affect the scores. In these tests each question has one and only one specific answer and the chance of any subjective judgement influencing the score is very small.

In the fourth place a test must be easy to administer. Administrability is that characteristic of a test which is common with clarity and uniformity in its administration. In these tests definite instructions were given by the investigator so that the procedure of testing should not vary.

Lastly the test should be easy to interpret. The utility of a test depends upon the availability of criteria for the interpretation of the scores made by the pupils.

(III) STATISTICAL ANALYSIS OF TESTS SCORES BY ANALYSIS OF VARIANCE METHOD:

III.39. The most valuable measure of variability is the standard deviation, which is computed from the squares of the deviations from the mean and is represented by the symbol \( \sigma \). If we square each of the deviation from the mean, sum, and divide by \( N \), we obtain a measure, which is called the mean square or 'Variance' and that is symbolized by \( \nu \). The standard deviation is simply the square root of the variance. Thus the variance is equal to \( \frac{\Sigma x^2}{N} \), then the standard deviation is equal to \( \sqrt{\frac{\Sigma x^2}{N}} \).
When the experiment involves only two groups and a test of a single mean difference, then the test of significance 't' can be developed very easily. And suppose that we have an experimental design involving three variables, for example, the performance of three groups, A, B, C. under three different sets of conditions, then we can still use 't' to evaluate the differences between the means, by comparing A and B, B and C, and A and C. This is a simple procedure and it is workable as long as there are not too many groups in our experiment. But if we have five groups, the number of comparisons will be ten. And if we have as in our present experiment, eight groups, then the number of comparisons can be 28 as per the formula $n(n-1) = \frac{8(8-1)}{2} = \frac{56}{2} = 28$.

And thus, we would have no assurance before going through all of the calculations involved that any single mean difference would be significant.

The method of analysis which will satisfy the said requirement is known as the 'Analysis of variance'. This method which has been developed in recent years by R.A. Fisher, represents one of the most important contributions that has been made to the techniques of experimental research. Analysis of variance and the corresponding test of significance, F, permit us to do this.

Analysis of variance, as the name indicates, deals with variances rather than with the standard deviations and standard errors. The variance of a sample is the standard deviation squared or $s^2 = \frac{1}{N-1} \sum (x_i - \bar{x})^2$ and the estimate of the population variance is $\frac{1}{N-1} \sum (x_i - \bar{x})^2$.

The rationale of analysis of variance is that the total sum of squares of a set of measurements composed of several groups can be analyzed or broken down into specific parts, each part identifiable with a given source of variation. The total sum of squares is broken down into two parts: a sum of squares based upon variation within the several groups and a sum of squares based upon variation between group means.

The sum of these two sums of squares, independent estimates of the population variance are computed, on the assumption that the groups making up the total series of measurements are random samples from a homogeneous population. The two estimates of the population variance may be expected to differ only within the limits of chance fluctuations. This is the null hypothesis and it is tested by dividing the longer variance by the smaller variance to get the ratio of the variances. This ratio has been designated by the letter 'F'. If the value of F exceeds the value at the level of significance agreed upon, then the null hypothesis is considered untenable. (The null hypothesis is often used to designate the hypothesis that a given population parameter is zero. The term covers any hypothesis which is set up to be tested for possible rejection).
If we reject the null hypothesis, then the populations from which the samples have been drawn may differ in terms of either means or variances or both. If the variances are the same, then it is the means which differ. With the help of said procedure the analysis of each test score on the mean basis has been calculated and result has been given in Chapter VII.