Chapter-4
Research Design

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Chapter-4
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4.1.0 Introduction

After reviewing past related studies, the investigator decided to work on *Action-oriented* and Competency-based Mathematics Test for Grades V, VI and VII students. The present chapter is related to the design of the study which includes selection of the sample, the variables employed, the sources of data, the tool, methods of gathering data and the statistical procedures used in the analysis.

Research Design sets up the frame work for the whole study. It tells us what observations to make, how to collect data and how to proceed with the analysis and interpretation. It also suggests the direction of observation making and analysis.

Research design of a study is a blue-print of the research. Keeping this in view, the investigator decided about the various stage of her study, the methodology adopted for the study, samples of the study, tool construction, data collection its classification and statistical techniques to be used for data analysis.

4.2.0 Origin of the Problem

For the quality of Teachers and Teacher educators,

According to Kothari Commission (1964-66) :

"*Off all the different factors that determine the quality of education and its contribution to national developments, the teacher is undoubtedly the most important it is on his personal qualities, characters, educational qualification and professional competence that the success of all educational endeavours must ultimately depend.*"\(^1\)

\(^1\) Ministry of Education (1964-66) ; *Report of the Education Commission*, New Delhi, Govt. of India, p-46
The investigator is presently working as a lecturer in District Institute of Education and Training, Ahmedabad (Urban). Also she has been working as a subject advisor for the new Activity based and Competency based Textbook of Mathematics for Grade V, VI and VII.

According to the textbook, GCERT has decided to evaluate the achievement of students in three sections. Oral, Written and Action oriented. After the experience of such process, the investigator has found that no study has been undertaken for Action oriented Evaluation. No standardized test has been prepared to evaluate the Action oriented competencies of the Students. So in such situation the investigator decided to conduct a Research titled : “Construction and Standardised an Action oriented and Competency based test for mathematics of Grade V, VI and VII students.

4.3.0 Research Method

According to P.M. Cook (1985) :

“Research is an honest, exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem. It is the process of arriving at dependable solutions to problems through the planned and systematic collection, analysis and interpretation of data”. 2

Therefore, it becomes necessary that there should be a proper methodology for collection, analysis and interpretation of data to get reliable results. Though there are number of methods, but while selecting a method, number of factors like the nature of the study, the sample to be taken, the purpose of the study and the conditions to be met, have to be kept in mind. For the present study, the survey method was used because of the following reasons-

1. The population under study was large.
2. The population was spread all over the Gujarat state.
3. The investigator dealt with the general characteristics, rather than individual characteristics.
4. The investigator was interested in studying the present situation about the achievement level of the students.

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4.4.0 Population

In any research, the investigator has to think of the population to which the results are to be applied. The population is an universal set of subjects to whom the results are to be applied.

According to K.S.Sidhu(1985),

“Population means an aggregate or the totality of the subject regarding which inferences are to be made in a sampling study”3

Here, the investigator has decided to prepare Action-oriented and Competency Based test for the students studying in Grade V, VI, VII who are presently studying in Government Primary schools. So, the students of Grade V, VI, VII from Government Primary schools of Gujarat State becomes the population for the present study.

4.5.0 Selection of Sample

It is not easy to cover entire population for investigation. So that one has to select representative subjects from the population. Actually speaking, a sample is a small proportion selected for observation and analysis. It is a collection consisting of a part of the individuals of selected population. By observing the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it was drawn, in fact the sample has drawn scientifically and systematically.

According to W.G.Corrate (1985),

“In every branch of science we lack the resources to study more than a fragment of the phenomena that might advance our knowledge”4

The main characteristics of a good sample are as follows:

1. The sample can represent almost all characteristics of the whole population.
2. The sample should not be biased in any characteristics.
3. The sample must have all the other factors in equal proportion that of the whole population.

The generalization of the results of any study depends on the type of sample. i.e. how the sample was selected? Therefore the method of sample selection has a great importance.

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3 Loc.cit, page.25
4 Loc.cit, page.195
It is therefore convenient to pick up a sample out of the universe proposed to be covered by the study. There are a number of sampling methods proposed by different research experts. Out of which one can select any one method or more than one method together, to select a sample according to need and objectives of the study.

For the present study, following aspects were taken into consideration while selecting the representative sample from the population.

The tool was administered individually, in such case the size of the sample is smaller one for final run.

### 4.5.1 Sample for Pre-pilot study

After generating the test items for Grades V, VI and VII, TLM design-effectiveness was found out by purposively selecting one Urban (Sabarmati Primary School-7) and one rural (Durgi Primary School, Ta- Viramgam) school. At the time of selection of students, it was decided to select one low achiever, one medium achiever and one high achiever for each Grade were selected on the basis of their last annual results of Mathematics. Hence the sampling technique was purposive. Twelve students (Boys-6, Girls-6) were selected from each Grade representing three levels of learners such as Low Achiever, Medium Achiever and High Achiever by purposive sampling technique. Thus, the sample size for pre-pilot was 36 students. The sample is shown in table 4.5.1.

<table>
<thead>
<tr>
<th>Grade\Gender</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>02</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>VI</td>
<td>02</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>VII</td>
<td>02</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>Total</td>
<td>06</td>
<td>06</td>
<td>06</td>
</tr>
</tbody>
</table>

### 4.5.2 Sample for Pilot Study

For Pilot testing, the researcher selected six schools from Urban area and four schools from rural area from Ahmedabad district only. From each school and each Grade, Twenty-Twenty students were selected randomly from the attendance register. In such situation the total sample for pilot study comprised 60 students (Boys-30, Girls-30)
The sample is shown in table 4.5.2.

**Table 4.5.2**

Sample for pilot

<table>
<thead>
<tr>
<th>Grade\Gender</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>VI</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>VII</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>30</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

4.5.3 Sample for the Final Run

For the final testing, the sample selection was done by using multi-stage sampling technique. The entire process was as follows.

Twenty (20) districts were selected by draw system. From each district one taluka was also selected by draw system. From each Taluka one school was selected by voluntary sampling technique. At the time of selecting school, it was kept in mind that the voluntary school must have all the three grades. i.e. Grade V, VI and VII. The selection of students from each class, a separate list of boys and girls were prepared. From that list, students having their roll numbers 5, 10 and 15 were selected. In such situation the selection of students was systematic randomized technique. The final sample consisted of 180 boys and 180 girls and the grand total of the sample was 360 at the time of data analysis. Since the tool was administered individually, the size of the sample was small one for the final run. The sample is shown in table 4.5.3.

**Table 4.5.3**

Detail Information of the Sample for Final Run

<table>
<thead>
<tr>
<th>Area</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade\Gender</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>V</td>
<td>45</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>VI</td>
<td>45</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td>VII</td>
<td>45</td>
<td>45</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>135</strong></td>
<td><strong>135</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

4.5.4 Sample for Re-testing

After fifteen days, re-testing was carried out to compute test-retest reliability. For that purpose the same sampling technique was used and the sample size was 40 (Boys-20, Girls-20) for each grade. Thus the total sample size for retesting was 120 students. The sample is shown in table 4.5.4.
### Table 4.5.4

**Detail Information of the Sample for Retest**

<table>
<thead>
<tr>
<th>Area</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade\Gender</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>V</td>
<td>15</td>
<td>15</td>
<td>05</td>
</tr>
<tr>
<td>VI</td>
<td>15</td>
<td>15</td>
<td>05</td>
</tr>
<tr>
<td>VII</td>
<td>15</td>
<td>15</td>
<td>05</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>45</td>
<td>15</td>
</tr>
</tbody>
</table>

On the whole the total sample consisted of 180 boys and 180 girls and the grand total of the sample was 360 at the time of data analysis.

### 4.6.0 Tool

A valid and reliable tool is necessary for collecting the data for any research work, so the selection of the tool should be done after a detailed study of the content and the subjects on which it is to be used. Now a days a battery of tools and techniques are available but as has been mentioned earlier that the present study is based on *Action-oriented* and Competency-based approach, which is a new concept in the field of Primary education.

Therefore, it was decided by the investigator to construct a proper tool for the purpose of the present study.

The present study deals with measuring student’s performance on Action-oriented competencies incorporated in Mathematics of Grade V, VI and VII.

The Action-oriented competencies can only be measured by individual performance test. In such situation the investigator has to construct an individual performance test based on competencies included in present curriculum of Mathematics. A detailed description of test-construction, its try-outs, item-analysis, finalization of test and its validation process are discussed in next chapter at length.

### 4.7.0 Data collection

Data collection is the heart and soul of the research plan. For getting reliable and valid data, the steps given below were followed.

1. Investigator contacted personally the school authorities to take permission for testing.
2. A brief introduction of the work was given to the teachers and the students concerned.
3. Data collection was done at the end of second term, when students are mentally ready and fully prepared for final Examination.
4. Students were told that this is not their examination but just a test to assess their achievement and it will not affect their results. They were motivated to give their answers without any stress.

5. Instructions were explained to students properly.

6. The investigator ensured that the students understood the instructions properly, each one of them was given a test paper along with individually Mathematical instrument kit and were asked to complete their task within 45 minutes which time limit was worked out during try-outs.

7. After the completion of the assigned work, Test papers with answers were collected.

8. Student’s responses on performance test were observed and were assessed as per scoring scheme prepared by the investigator.

Same procedure was followed in all the selected schools to collect the data. An individual scores were found out for data analysis.

**4.8.0 Classification and Analysis of the data**

A data file was prepared to compute Difficulty and Discrimination value. The Difficulty and Discrimination values of each item were computed by NRTVB software during all the try-outs. NRTVB is a programme written in Visual Basic language. Dr. Navneet Rathod, Retired Professor, Department of Education, Bhavnagar University is the Compiler of this programme. It is available in CD including its manual free of cost. MSVBVM60.DLL and MSFLXGRD.OCX are essential for the run of NRTVB programme. Following statistical calculations can be made through NRTVB. (1) Item Analysis: Calculations of Difficulty Value and Discrimination Index. (2) Reliability: Split-half and Cronbach Alpha. (3) Validity Cliff’s consistency index (4) Norms: Summary statistics and norms.

IOCI (Item Objective Congruence Index) for each item was computed by using experts scaling. After finalization of test items, Grade wise tests were prepared. The Reliability and Validity of each test were established.

After final run, scores were worked out for each student as per scoring key. Scores were classified in the light of variables under investigation. Grade wise and Competency wise mastery levels in terms of percentages were calculated.

To decide the effect of Area and Gender, t-value were computed. All these details are described in the chapter five, six and seven.
4.9.0 Conclusion

The discussion of Research method, Population, Sample selection, Selection of tool, Data collection, Data analysis with Statistical method of the present test discussed in this chapter. The detailed process of test construction with try-outs are explained in the following chapter. In which content for the construction of items, construction of initial test, Pre-pilot study, Pilot study, Item analysis, preparation of Final form of test, Instruction for test administration and duration have been discussed in the following chapter.