Chapter - IV

Methods of Investigation
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METHODS OF INVESTIGATION

This chapter deals with the research design, various methods employed in the measurement of variables, the methods adopted in the selection of sample and collection of data, mode of scoring of the responses and the different statistical techniques employed in the analysis of data.

4.1 THE DESIGN OF THE STUDY:

The present study aims at finding out the relationship between certain socio-psychological variables of VIII grade students on one hand and their academic achievement in science on the other. So the research method adopted by the investigator in the present investigation is a descriptive survey method, because it usually covers a large number of traits or characteristics of the group. The survey method, undoubtedly, has been the most popular and most widely used research method in education.

Moulay (1964), Tuckman (1978) are of the opinion that no category of educational research is more widely used than the survey type. Educational surveys are particularly versatile and practical as they identify present conditions and point out the present needs. Descriptive surveys are
oriented towards the description of the present status of a

given phenomenon.

The present study is a survey type and to be more
precisely, a descriptive survey type and aims at finding out
the relationship between a bunch of independent variables
and a dependent variable.

4.2 MEASUREMENT OF THE VARIABLES:

The variables included in the present study are
seventeen - both independent and dependent variables. Out of
these 14 are independent (personal and demographic)
variables for which the information was gathered through a
personal data sheet developed by the investigator. The
remaining 3 variables are measured with suitable
instruments.

4.2.1. TOOLS USED:

1. Academic achievement test in Science for Class VIII.
2. Scientific Aptitude Test Battery (SATB)
3. Role expectation scale
4. Personal data sheet.

4.2.2. ACADEMIC ACHIEVEMENT TEST IN SCIENCE FOR CLASS VIII:

An achievement test in science was developed by
the investigator to test the achievement level of the students in Science.

A clearly formulated objective type of test has two dimensions viz., objectives and content aspects. The blueprint is the frame of reference for constructing a test with the objectives, the content, and the number of test items. The test items are distributed according to the importance given to each division in the syllabus. A copy of the test blueprint is shown in appendix 2C

4.2.2.1. Preparation of the Test Items:

Preparation of items of a test involves content outline, objective outline, difficulty level of questions and preparation of blueprint.

To make the content outline, the investigator consulted his supervising teacher and subject experts to prepare a list of content areas for the test. The prescribed science textbook for VIII standard was followed. The topics in the content areas were listed out and they were selected in consultation with experts.

An important consideration in designing a tool is to determine the objectives to be measured by it, in terms of pupil’s behaviour or abilities. It is necessary to determine the relative importance in the form of weightage.
given through the number of items under each of the objectives. Objectives have been termed as broad goals and they can be stated in terms of students' behaviour. Therefore, to measure the pupil's behavioural change, an analysis of objectives has been done. The objectives are usually used as a basis for generating test items which are used to measure the student's achievement.

4.2.2.2. BLOOM'S TAXONOMY OF EDUCATIONAL OBJECTIVES:

The academic achievement test was constructed from the content of science of Class VIII of high school syllabus. The items set in this test were based on objectives - 1. Knowledge, 2. Understanding, 3. Application and skills. Knowledge includes recall and recognition, scientific facts, concepts and principles. Understanding includes, illustrating the given phenomena, giving experimental proof, identifying the cause and effect relationship, discriminating closely related facts, comparing and contrasting the given data, explaining the given phenomena, detecting errors in the given statement. Application includes formulation of definitions, substratiate in the arrangements, analysing the situation, suggesting a hypothesis developing an experimental procedure to test again situation, improve the scientific appliance, drawing inferences from the given data, establishing cause
and effect relationship, to arrive at generalisation and applying generalisations to new situations. Skills include drawing sketches, reading the instruments, locating the biological information and problem solving skills.

4.3.4. PILOT STUDY:

A pilot study is conducted to improve the quality of test items on a representative sample of 100 students selected at random from different managements of schools of Chittoor district in Andhra Pradesh.

Booklets of academic achievement in science test were conveniently printed and were thoroughly tested before use for their clarity of the items. At the time of administration, the students were properly motivated to take the test and clear instructions were given to the students. Then, the test was administered and they were given sufficient time to answer all the items of the test. All the scripts were scored by using the scoring key prepared for the test and the total score of the student was marked at the top of the answer sheet.

4.3.5. ITEM ANALYSIS PROCEDURE:

The purpose of item analysis is to obtain objective information concerning the items selected for the test. It facilitates opportunity to determine the
discrimination of each item between the low group and high group students. By following this procedure, the difficulty level of each item can be estimated and finally it helps to select good items for the test.

The answer scripts were arranged in an ascending order on the basis of total score. Top 27 per cent and bottom 27 per cent of the scripts were collected and formed as high group and low group respectively. Each item was tested for its discrimination between the high and the low group. The item analysis chart developed by Davis was used to determine the discrimination power and difficult value of the items. Items with good discrimination power (above .20) were retained and the remaining were discarded. The details are shown in appendix 2

4.3.6. SELECTION OF ITEMS FOR THE FINAL STUDY:

Items having discriminant validity 0.20 and above and also items with appropriate difficulty levels were considered for the final study. The items so selected ensured good coverage of all the areas of the subject. After selection of the items on the above criteria, the final form of the test was made ready for administration. The test blue print tables for final test items are shown in the appendix 2C.
After a preliminary trial of the tests on a sample of 100 students, the duration for the test was fixed for answering the achievement test. Instructions to the examinees were printed on the top of the booklet.

4.3.7 VALIDITY:

4.3.7.1. CONTENT VALIDITY:

This form of validity is established by evaluating the relevance of the test items individually and as a whole. Each item should be a sampling of that aspect which the test purports to measure and taken collectively, the items should constitute a representative sample of the variable that is measured. In the construction of the present instrument items were collected from the prescribed science text book. The concerned science teachers were asked to include all possible items that come under the objectives and specifications. Thus, it can be reasonably assumed that the inventory has content validity.

4.3.8. RELIABILITY OF THE ACHIEVEMENT TEST:

The split-half reliability of the test was computed using the Spearman-Brown Prophecy formula (Garrett, 1979). The obtained reliability co-efficient was found to be 0.879. The value demonstrated that the achievement test was a fairly reliable measure.
4.4 ADOPTION OF SCIENTIFIC APTITUDE TEST BATTERY (SATB):

The present battery of psychological test was developed by K.K. Agarwal of Agra, and used to predict the success in science at the high school level. It has been observed that the result of high school examination ranges between 40 per cent and 50 per cent every year. One very important reason of this mass failure is that some students do not evince interest in science subjects, thus resulting in a large number of failures in science at high school level. To check this wastage and to save the students from failure and frustration, they must be given proper guidance in science subjects especially in Scientific Aptitude. Keeping the above aim in view, the investigator has made use of the battery of psychological tests.

In the present investigation, this tool was adopted because of its simplicity, validity and reliability. The instrument was translated into Telugu from Hindi. Copies of both Hindi and Telugu versions were given to language experts, and two members of subject teachers for their comments on translation. Their suggestions were carried out and the final form in Telugu version was prepared. The questionnaires are shown in appendix 7. The battery of the tests consists of the following sub-tests.
A. Reasoning test
B. Numerical ability test
C. Science information test
D. Science vocabulary test.

The third and fourth combined are measuring scientific interest. Elsewhere Peels has pointed out "the information method of measuring interest proved a useful predictor of further progress in school science". Super describing scientific aptitude as "scientific aptitude being presumably largely an intellectual matter, it seems that battery of tests for the selection of promising scientists will stress such factors as reasoning spatial, visualization, number ability, scientific vocabulary and mechanical comprehension are two aptitudes which should also be significant".

A. REASONING TEST:

Its purpose is to gauge the capacity of the students to discover the analytic, synthetic and reasoning powers. It is a verbal group test and a point scale in ominous form. It consists of 52 items divided into two sections. Section-A comprises items on general reasoning and Section-B has items on science reasoning. The items may be classified as analogies, number series, word grouping,
multiple choice classification etc. The questions are in simple Telugu to enable the students of Telugu speaking areas to answer them without being influenced by proficiency in language. Time allotted for the test was 25 minutes.

B. NUMERICAL ABILITY TEST:

The test is named as Arithmetic test. It is also divided into two sections - Section-A consists of problems on arithmetical computation and Section-B on arithmetic reasoning. The items in section A are of multiple choice type and section B consists of simple problems. Total number of items are 52 and the time allowed for the test is 30 minutes.

C. SCIENCE INFORMATION TEST:

The test consists of 50 items on Physics and Chemistry. It attempts to know whether the students keep them ready with the recent discoveries in scientific field, and whether they have the ability to apply principles in making simple predictions. Some of the items are based on recall of basic science concept while others on the application of these concepts, principles etc., time allotted for the test is 20 minutes.
D. SCIENCE VOCABULARY TEST:

As the name of the test suggests, the test attempts to gauge the extent to which the students understand the language of science. It consists of items based on the definition of important terms, acquaintance with important concepts and understanding of theories and principles. The number of items comprising the test are 56 and the time fixed is 15 minutes. All the items in the various test constituting the battery are of objective type. They are in simple Telugu to enable the students of Telugu speaking areas to answer them.

4.5. VALIDITY AND RELIABILITY:

The validity and reliability of the test was established by the author. The test - retest reliability of the entire battery was 0.94 and split half reliability was found to be 0.93 by its author. However, the Telugu version has the test - retest reliability of 0.896, which is fairly good.

4.6 ROLE EXPECTATION SCALE:

To measure the pupils' role expectations (as perceived by themselves) 'A role expectation scale' developed by Dr. K.Jagannadhan (1983), Department of
Education, S.V.University, Tirupati was used. The scale consists of 35 items.

The 'role' of the student involves two broad fields of research. On the one hand 'role' refers to behaviour, thus studies of pupils role performance are those in which the actual behaviour of the students is observed. On the other hand 'role' refers to expectations of behaviour, thus studies of student role expectations are those in which expectations maintained for students by themselves are investigated.

It is given in the Encyclopaedia of Education that 'role' concerns the behaviour of others in a social system. The expectations held by members of social system for a particular position are called role expectations. The behaviour of the persons occupying the particular positions for which others hold expectations is defined as role performance or role behaviour.

Expectations are learned through experience and once they are formed expectations will affect the behaviours of those who hold them up in predictable ways (performance). Any expectations we should posses means, it indicates the activity performance.
An expectation will be defined as an incumbent of a position. Some social psychologists regard a position in the social structure as a set of expectations or acquired anticipatory reactions. That is to say, the person learns to the extent or anticipates certain actions from persons and the others expectations of him.

4.6.1 VALIDITY AND RELIABILITY:

The validity and reliability of the role expectation scale was established by the concerned author. The reliability of the scale was found to be 0.74 which is a reliable one.

4.7 DEVELOPMENT OF PERSONAL DATA SHEET:

A personal data sheet was developed to obtain information from the students with regard to their personal characteristics like sex, caste, age, birth order, hobby, and home conditions like type of residence, size of the family, locality, type of management of the school, and socio-economic factors of their family like parents' education, occupation and income. Care was taken to include suitable items to obtain adequate information regarding to all the variables included in the study. Both Telugu and English versions of the sheet are given in the appendix 12.
4.8 SAMPLING PROCEDURE:

The population of the study comprised children studying in VIII class in Government High schools, Zillparishad schools, Municipal High schools and Private High schools located in S.V.University area in Chittoor District of Andhra Pradesh. Schools were selected at random from the schools located in S.V.University area in Chittoor District. Weightage has been given to schools run by the Government, Zilla Parishad, Municipalities and Private organisation. 460 students were selected from these schools consisting of 214 boys and 246 girls.

4.9 COLLECTION OF DATA:

It was decided to administer the testing in two sittings. In the first phase the sample children were given the personal data sheet, and academic achievement test in Science were administered in the morning hours and in the second phase 'Role expectation scale' and 'Scientific Aptitude Test Battery' (SATB) were administered in the afternoon. This procedure is adopted to reduce the boredom and fatigue in the students taking the tests.

In the first phase (during the first two periods in the morning) the students randomly selected in a class were assembled in a room. The subjects were given detailed
instructions to fill up the questionnaire, and they were asked to sit in equal distance and adequate time was given to answer all the questions. Short introduction was given and the students were asked to answer the questions. All necessary precautions of the test administration were scrupulosuly followed. The personal data sheets were distributed and they were asked to fill in the particulars in the sheet. They were requested to fill in all the columns with out any omission. The importance of the personal data was explained and the researcher requested them to give correct information and that the information would be kept very confidential. After collecting the data sheets, the science achievement test questionnaire was distributed and the students were asked to answer. The answer booklets were distributed and the students were directed how to answer the test. Doubts if any from the students were clarified. To make students familiar with the test, the instructions were read aloud to the group. As soon as they finished answering the questions all the response sheets were collected.

In the afternoon, role expectation scale and scientific aptitude test battery (SATB) were administered. The same procedure was adopted as explained above.
4.10 SCORING:

On completion of the test administration, all the response sheets were scored with the help of the key provided in the manual by the respective authors. For academic achievement test the right responses were assigned score 'One' and 'zero' score for wrong responses. There are 100 maximum marks on the full science achievement test.

The SATB responses are scored conveniently with the help of scoring key prepared by K.K. Agarwal. The wrong and left out questions are crossed out and then the number of correct answers are counted, which is a raw score. Here one score is allotted for one correct response. There are 210 maximum marks on the full battery.

For the role expectation scale an item answered 'yes' by the student was assigned a score 'one' and 'zero' score was awarded for giving 'no' answer. There are 35 maximum marks on the full scale. The total scores for all the subjects, were computed and entered on the right hand side top of the questionnaire.

The information provided by the respondents in the personal data sheet was also numerically coded to suit the computer analysis.
4.11 STATISTICAL METHODS EMPLOYED IN THE ANALYSIS OF DATA:

The total scores obtained by each 460 students on all the variables were computed. The obtained data were carefully analysed by employing appropriate statistical techniques.

To establish whether the sample is followed normality, all the descriptive statistics such as mean, median, mode, range, quartile deviation (QD), standard deviation (SD), skewness and kurtosis were calculated. To study the influence of independent variables on pupil’s role expectations, science achievement test, and scientific aptitude test battery, inferential statistics such as 't' test and 'F' test were employed appropriately. Finally step wise regression analysis was carried out to identify the contribution made by each one of the independent variables on academic achievement in science.

The detailed analysis of the data and the discussions made on the results are presented in the succeeding chapter.