CHAPTER 4  RESEARCH PLANNING AND PROCEDURE

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Chapter 4

Research Planning and Procedure

4.0.0 Introduction

Planning is the most essential step for any work to be done systematically. Without detailed planning for research work, no specific findings would be generated. The planning helps researcher to make his work in right direction. Robert Travers explain importance of planning this way.

'The research plan helps the investigator to organise his ideas in a form, whereby it will be possible for him to look for inadequacies.'

For better and scientific planning of the work, the main objectives of the research must be kept in view. The main objective of the present investigation is to study achievement in the context of personality, creativity, intelligence, self-concept and school-climate of the students of Ashramshala's of Gujarat.

4.1.0 Method of the study

The objective of the study is to make a base line survey amongst the students of Ashramshalas, their achievement and factors affecting their achievement. Considering the nature and objectives of the present study as well as the resources of the investigator, normative survey method of research was used.
A survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables.

Survey method helps investigator to determine the present trends and status of a given situation. Survey also provides the basis for decisions regarding improvements. In present investigation, all the steps and characteristics have been followed, which are essential for the survey method of research.

4.2.0 Population and sample

"The data obtained in any investigation represents a sample drawn from the total group that in statistical term is called the population or the universe." For any investigator the study of the whole population is very difficult task. The study of population would require big financial fund and thousands of hours and for individual investigator, it is not possible.

The process of sampling makes it possible to draw valid inferences or generalisations on the basis of careful observations of variables within a relatively small proportion of the population. By studying the samples of a defined population, educational research aims at making generalisations, which can be applied to the population.

Sampling is the process of selecting a number of individuals for a study in such a way that the individual represent the large group, from which they were selected.
In social science, it is not possible to collect data from every respondent relevant to the study but only from some fractional part of the respondents. The process of selecting the fractional part is called sampling. The major types of sampling are as under:

1. Random sampling
2. Systematic sampling
3. Stratified sampling
4. Purposive sampling
5. Quota sampling
6. Cluster sampling
7. Double sampling
8. Judgement sampling
9. Sequential sampling
10. Incidental sampling
11. Convenience sampling
12. Self-selected sampling

For the selection of the sample, the investigator has first tried to collect the list of Uttar Buniyadi Ashramshalas. (See Appendix I). After lots of trials, the investigator could collect the list from Social Welfare Board and got guidelines about the situation of the areas of the Ashramshalas. All the students, who were studying in seventy Uttar Buniyadi Ashramshalas of Gujarat during 1995 constitute the population of the study. In Ashramshala, there are 40 students per standard, thus total students of standard VIII and standard IX are 80, and this way, total population of the study is 5600 students. (80 x 70) according to enrolment rule of Ashramshalas. From this, the investigator selected 899 students (16.05%) as sample.
for this investigation. Though the investigator tried very much, the real number of the students studying in Uttar Buniyadi Ashramshalas was not collected from the Government. The real number of total students of Uttar Buniyadi Ashramshalas was not available. The seventy Uttar Buniyadi Ashramshalas were situated in nine districts of Gujarat. From these, two districts namely Dangs and Banaskantha were not included in the study though they are in very interior areas and also very backward. Except the schools of these two districts, twenty Uttar Buniyadi Ashram Schools were selected randomly as a sample. After the selection of the schools, the investigator wrote letters to the principals of the schools to get permission for data collection through reply post cards. Out of these, twenty schools, the principals of the most of the schools gave positive reply along with the date and time for administration of the tools. From some principals, the investigator did not get any response. On the other side, the investigator visited some of the schools without taking the advance permission of the principals, yet healthy co-operation was achieved by the investigator as the principals and the teachers helped her totally in data collection procedure. The investigator also visited two schools twice but it was found from the community that since long, the schools were closed. Thus eighteen schools were included in the study. The investigator has collected data from all the students of standard VIII and IX, who were present at that time in the school. The students of standard X were not included in this study because they were not available in sufficient number in the schools. To collect the data about the school climate from all the teachers, who were present in the school on the day of the visit were included in the study. By applying this process, the investigator has collected data from 950 students, out of which 51 sets of answer sheets being incomplete have been excluded. The exact number of the students of which the data is processed is 899 as shown below.
### Table 4.1
The Sample of the Study

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the District</th>
<th>Name of the village</th>
<th>No. of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Std. VIII</td>
<td>Std. IX</td>
</tr>
<tr>
<td>1</td>
<td>Valsad</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ambheta</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Sarpur</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Adda</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Bharuch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sajod</td>
<td>23</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td>Kondhh</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>Surat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Haldharu</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Bhuvasan</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Ahmedabad</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Otaria</td>
<td>46</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>Baroda</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jetpur Pavi</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Ghelwat</td>
<td>04</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Puniyawat</td>
<td>10</td>
<td>06</td>
</tr>
<tr>
<td>6</td>
<td>Panchmahals</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chandla</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Meerakhedi</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Nagrala</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Zalod</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Garbada</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>Sabarkantha</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dholvani</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Khedbrahma</td>
<td>42</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Above mentioned districts and villages are shown by Map No.1.
4.3.0 Variables of the Study

The present study has involved 11 variables, out of which, achievement has been treated as dependent variable and personality factors (E, N, L), creativity (N, C, U and total creativity), intelligence, self-concept and school climate have been treated as independent variables.

4.4.0 Data Gathering Tools

In order to collect the data regarding the variables of the study, the investigator needs to select or construct a tool. J.C. Aggarwal explains the importance of tools as under:

"The progress of mankind depends upon well conducted research programmes. Well conducted research programmes postulate sufficient, reliable and valid facts. Such facts are obtained through a systematic procedure, which involves various devices."

The investigator used five tools to measure the variables involved in this study. The investigator is so lucky to get the readymade standardised tools for the study for the students of Gujarat. The tools used in the present study are:

1. Personality inventory developed by Dr. K.G. Desai
2. Creative ability test developed by Dr. J.Z. Patel
3. General Ability Test (GAT) developed by Dr. M.T. Patel
4. Self-concept inventory developed by Dr. J.H. Shah
5. Organisational climate description questionnaire developed by Dr. K.A. Gandhi."
For measuring the personality traits of the students under the study, the investigator could get personality inventory developed by Dr. K.G. Desai. There were other tests available in Gujarati prepared by Dr. A.S. Patel in M.S. University and Dr. R.N. Thakur in Gujarat University. But the abovementioned test is easy to administer to the students of Ashramshalas. Moreover, from this test, three types of scores can be found, which are:

i) Extroversion

ii) Neuroticism

iii) Lie

After the discussion with the experts, the investigator decided to use abovementioned test.

This inventory is useful for the students studying in standard VIII to any age of maturity. The inventory consists of sixty statements. Content analysis done by Smt. Sybil Eysenck shows that from sixty statements, twenty four statements are for E scores, twenty four statements are for N scores and twelve statements are for L scores. Classification of the statements are as follows:

- **Statements for E scores**
  1, 3, 6, 9, 11, 14, 17, 19, 22, 25, 27, 30, 33, 35, 38, 41, 43, 46, 49, 51, 53, 55, 57, 59

- **Statements for N scores**
  2, 5, 7, 10, 13, 15, 18, 21, 23, 26, 29, 31, 34, 37, 39, 42, 45, 47, 50, 52, 54, 56, 58, 60

- **Statements for L scores**
  4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48
If the scores of L are more than ten, it is concluded that the responses given by the respondents are not reliable. The scores can be calculated for each factor according to manual.

The reliability of the inventory was found by test-re-test method. The reliability of E score is 0.63, of N score is 0.84 and of L scores is 0.61. The inventory is given in Appendix 2.

II Creativity

For gauging creativity of the students under the study, the investigator tried to get the available tools. Creative ability test for secondary school students developed by Dr. J.Z. Patel is the only tool, which was easily available for the use in this study. The other creative ability test developed by Lilaben Devda was available but it is not for the students of standard VIII and standard IX.

The Creative Ability Test (CAT), is classified in three sections, as shown below:

Section 1 Verbal creativity test
Section 2 Figural creativity test
Section 3 Numerical creativity test

The question of each section is followed by the proper instructions and well illustrated by an example.
Section 1

In verbal creativity test, there are two sub-parts.

Section 1.1 Instances
Section 1.2 Uses

Each sub-part consists of two questions.

Section 2

In figural creativity test, there are two sub-parts.

Section 2.1 Line meaning
Section 2.2 Pattern meaning

Each of the two sub-parts consists of two figures in each.

Section 3

In numerical creativity test, there are two sub-parts.

Section 3.1 Numerical
Section 3.2 Operations

Each of these two sub-parts consists of one question. Thus the whole test consists of ten questions.
The CAT is classified as above. Five minutes time limit is given for each question and thus sixty minutes time limit is required for the complete administration of the test.

The reliability of the test was found by test-re-test and split-half method. Reliability of this test was found by two other ways also.

1. Reliability of the sub-test scores and
2. Reliability of the factor scores

Test-re-test reliability co-efficients and split-half reliability co-efficients of CAT are as shown below.

<table>
<thead>
<tr>
<th>Name of the sub-test</th>
<th>Test-Re-test reliability</th>
<th>Split-half reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal test</td>
<td>0.91</td>
<td>0.84</td>
</tr>
<tr>
<td>Figural test</td>
<td>0.73</td>
<td>0.77</td>
</tr>
<tr>
<td>Numerical test</td>
<td>0.93</td>
<td>0.90</td>
</tr>
<tr>
<td>Total creativity</td>
<td>0.88</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Test-re-test reliability and split-half reliability of factor scores of CAT are as shown below.
<table>
<thead>
<tr>
<th>Name of the factor</th>
<th>Test-Re-test reliability</th>
<th>Split-half reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>0.94</td>
<td>0.90</td>
</tr>
<tr>
<td>Category</td>
<td>0.91</td>
<td>0.88</td>
</tr>
<tr>
<td>Uniqueness</td>
<td>0.86</td>
<td>0.82</td>
</tr>
<tr>
<td>Total creativity</td>
<td>0.88</td>
<td>0.86</td>
</tr>
</tbody>
</table>

The concurrent validity of creative ability test with different criteria is shown below.

<table>
<thead>
<tr>
<th>Name of the sub-test</th>
<th>Criteria</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal test</td>
<td>PTC</td>
<td>VTCT</td>
</tr>
<tr>
<td>Figural test</td>
<td>0.71</td>
<td>0.64</td>
</tr>
<tr>
<td>Numerical test</td>
<td>0.63</td>
<td>0.65</td>
</tr>
<tr>
<td>Total validity</td>
<td>0.68</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Scoring of Creative Ability Test

As there are no right or wrong responses for the test, much care has to be exercised at the time of scoring. The scorer has to acquaint himself fully with the method of scoring and the use of scoring sheet. Each test item is to be scored for number, category and uniqueness. The total of these component scores become creativity score for each item. And the total of all the item scores become the total creativity score of the subject.
The creative ability test provides for testing three major factors related to creativity viz. 1) number, 2) category, 3) uniqueness.

In scoring for number responses, which are irrelevant and/or have been repeated get a zero score.

Each of the remaining responses gets one mark. Thus the total scores of all the items is called the 'number score (CN). Category score (CC) is represented by a respondent's ability to produce ideas, which differ in approach. All ideas, which fall under one category of approach are treated as one for purposes of category scoring. Thus, if five ideas were produced and all belong to only one category of approach, then the score for category will be done. There could be intermediate scores for category depending on the number of categories of approach to which the responses belong.

Uniqueness is represented by uncommonness of a given response. Responses given by less than 4% of the group are treated as unique. For the scoring of uniqueness (CU), the investigator directly followed the scoring guide.

The sum of the 1) number score, 2) category score and 3) uniqueness score becomes the 'creativity score (CT). The test is given in Appendix 3.

III Intelligence

For measuring intellectual ability, the investigator studied the available standardised tests meant for Gujarati knowing students. They were as follows:
Desai-Bhatt Group intelligence test had been developed by the author before few years and it is a verbal test. The investigator had no information about the revision of the test, if there be any. Hence it was not used for the study. The investigator then inquired about the construction and standardisation of a spiral omnibus type group non-verbal test of intelligence for grade VIII to XII prepared by Tarulata M. Shah. It is a non-verbal test developed for grade VIII to XII. But for Adivasi students, the general ability test developed by Dr. M.T. Patel was more proper according to experts, so for measuring intelligence of the students under the study, the investigator used this test. It is useful for the students of standard VIII to X. It has been standardised for Gujarati speaking children. The test does not require reading, arithmatic or any other form of school achievement. The test has been divided into two parts. Part I tests the student's familiarity with the world around him through his experiences in the home, in the school and in the community. Part II presents geometric drawings designed to test the student's power of abstract reasoning. This part of the test presents an equal challenge to all students regardless of their cultural backgrounds. The number of right answers for both the parts of the test are added together to get raw score to obtain the student's I.Q. The reliability co-efficients of the test ranges from 0.82 to 0.94 established through various methods. The test validity against Bhavsar's test is established as 0.77. This test for students of standards VIII, IX and X is designed
to be given to many pupils at a time. The time for the test is 45 minutes. The test is given in Appendix 4.

IV Self-concept

For measuring self-concept of the students under the study, the investigator tried to get the available tool. But self-concept inventory developed by Dr. J.H. Shah is the only available tool for the use in this study, so abovementioned tool was used in this study, to measure the self-concept of the students studying in standard VIII and IX of Ashramshalas. This inventory is useful for the students of standard VIII to X. The inventory has 40 traits, that are positive and the other 40 traits, which are negative. Against each trait, five points 'most like that', 'like that', 'undecided', 'not like that' and 'least like that' are given. For the positive traits, weights of 5, 4, 3, 2, 1 are given to the five responses in that order and the scoring is reversed for the negative traits. Thus the scores in this inventory range from 80 to 400 in the direction of increasing level of self-concept. An individual's score in this inventory is the sum of the scores for all the 80 traits. If a student scores more than 330, that shows high self-concept. If it is less than 286, it shows low self-concept and if a student scores between 286 to 330, it shows average self-concept. This tool was standardised on 718 students chosen with the method of stratified random sampling technique from six schools of Bhavnagar city. There is no time limit for this inventory. Reliability of this inventory found by test-retest method was 0.86 and the validity of the tool with 'ME' test (semantic differential test) of Dr. H.G. Desai by concurrent method was 0.47. The inventory is given in Appendix 5.
School climate

In this study, the investigator used the organisational climate description questionnaire developed by Dr. K.A. Gandhi to measure school climate of the Ashramshalas, because it is more recent and widely used tool. Moreover, this questionnaire is in Gujarati. It has 115 statements. These 115 statements are classified in 12 sections. They are as follows:

- Statements 16, 33, 55, 64, 75, 76, 78 For disengagements
  80, 86, 94, 105
- Statements 10, 28, 38, 49, 68, 79, 88, 114 For hinderance
- Statements 2, 17, 22, 35, 39, 63, 81, For esperity
  91, 98, 104
- Statements 7, 21, 36, 43, 52, 93, 106, 111 For intimacy
- Statements 8, 51, 59, 61, 67, 89, 97, 103 For aloofness
- Statements 3, 15, 20, 25, 32, 54, 69, 74 For production emphasis
- Statements 6, 14, 24, 34, 41, 48, 56, For thrust
  83, 110, 112
- Statements 1, 13, 30, 46, 53, 57, 65, For consideration
  70, 72, 77, 95, 113
- Statements 4, 9, 19, 29, 42, 50, 82, For non-graded order
  92, 100
- Statements 18, 23, 31, 40, 85, 87, 107, For feedback
  108, 115
- Statements 11, 26, 27, 37, 44, 45, 47, For human relations
  62, 73, 84, 90, 101
- Statements 5, 12, 58, 60, 66, 71, 96, 99 For autonomy
  102, 109
From these 12 sections, disengagements, hinderance, esperity and intimacy show teacher's behaviour. Whereas aloofness, production emphasis, thrust and consideration show principal's behaviour and administrative behaviour are known from sections namely non-graded order, feedback, human relations and autonomy. According to the manual, the stanine scores were found and from these stanine scores, types of schools can be read. Section-wise reliability of this tool is shown below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Section</th>
<th>Range of r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disengagements</td>
<td>0.51 to 0.69</td>
</tr>
<tr>
<td>2</td>
<td>Hinderance</td>
<td>0.47 to 0.55</td>
</tr>
<tr>
<td>3</td>
<td>Esperity</td>
<td>0.46 to 0.62</td>
</tr>
<tr>
<td>4</td>
<td>Intimacy</td>
<td>0.46 to 0.63</td>
</tr>
<tr>
<td>5</td>
<td>Aloofness</td>
<td>0.43 to 0.68</td>
</tr>
<tr>
<td>6</td>
<td>Production emphasis</td>
<td>0.45 to 0.55</td>
</tr>
<tr>
<td>7</td>
<td>Thrust</td>
<td>0.55 to 0.78</td>
</tr>
<tr>
<td>8</td>
<td>Consideration</td>
<td>0.49 to 0.77</td>
</tr>
<tr>
<td>9</td>
<td>Non-graded order</td>
<td>0.44 to 0.55</td>
</tr>
<tr>
<td>10</td>
<td>Feedback</td>
<td>0.53 to 0.62</td>
</tr>
<tr>
<td>11</td>
<td>Human relations</td>
<td>0.51 to 0.70</td>
</tr>
<tr>
<td>12</td>
<td>Autonomy</td>
<td>0.52 to 0.70</td>
</tr>
</tbody>
</table>

The questionnaire is given in Appendix 6.
Data collection for the study has been based on survey method. The investigator administered a set of four tests. Four tests for students have been administered separately with the help of duly framed instructions. It was an enormous work for the investigator. The investigator, after getting the list and the details of the Uttar Buniyadi Ashramshalas, planned the work of the study. After that the investigator wrote letters to the principals of the selected Uttar Buniyadi Ashram Schools with the purpose of taking permission and inquiring about the available bus routes to those villages. According to their reply, the investigator visited the schools. Some schools were situated at the distance of two to three kilometres from the bus stop. The investigator had to walk down the distance compulsorily. The principals or the heads of the institutions were contacted first and briefed about the purpose of the visit. Most of the school principals co-operated well and gave the permission for the test administration. In some schools of Baroda district, there was an atmosphere of the election and, therefore, in those schools, the students were not present in sufficient number. The investigator had to collect the data from those who were present that day. The investigator commenced the work of administering the tests, with one assistant trained in this type of work. Much care was exercised for the administration of the I.Q. test and creativity tests. The others were not time bound and, therefore, the students filled in the details themselves according to their convenience. To fill in these tests, guidance of the investigator was necessary because of the language problem. From the discussion with the experienced teachers and persons, the investigator could come to know this matter. Then the investigator discussed this problem with the experts and got suggestion that the meaning of the difficult words should be given to the students. Keeping this suggestion in view, the investigator gave the meaning of such words.
according to their need. The organizational climate description questionnaire was administered to the teachers of the Uttar Buniyadi Ashramshalas at the same time and necessary instructions along with the purpose of this questionnaire were clarified to them. This way, data about school climate was collected.

The data collection exercise continued from December 1994 to July 1995. After a careful planning and number of trials, 950 students were taken as a sample. While checking and marking their answersheets, it was found that a few of them were not duly filled in and, therefore, they were cancelled. At last, 899 cases were taken for data analysis. The achievement is one of the important factor, which has been taken into consideration, with a view to observing whether various abilities have any relationship with achievement. For obtaining achievement score, the result of previous year examination of the students was taken into consideration. The percentage of the aggregate marks obtained at the annual examination of previous year is taken as achievement score. The investigator got the scores from the school records. In Ashramshalas, one set of the question papers for whole the district was used and the weightages of udyog, krushi are equal to other theoretical subjects. The construction of achievement test for these students is difficult task hence the percentage of previous year were taken as achievement scores of the students.

Totally four different types of tests were to be administered to these students. The task was completed according to the planning of test administration. The schematic view of the plan is given in Table 4.2.
Table 4.2

Schematic View of Testing

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of the tool</th>
<th>Total time taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Personality Inventory</td>
<td>35 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Creative Ability Test (CAT)</td>
<td>70 minutes</td>
</tr>
<tr>
<td>3</td>
<td>General Ability Test (GAT)</td>
<td>45 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Self-concept Inventory</td>
<td>40 minutes</td>
</tr>
</tbody>
</table>

The obtained data sheets were then scored with the help of the scoring keys developed by the test constructors. The mass data collected through the use of various tools, however, reliable, valid and adequate, have been found meaningless to use. Therefore, the data has been organized in a systematic way to achieve the purpose of the study. This data has been checked also to see the accuracy, utility and completeness and then tabulation has been performed.

4.6.0 Statistical Techniques

The objective to be achieved through this study have been to find out the relationship among intelligence, personality factors, creativity, self-concept, school climate and achievement of students and to study the individual as well as the joint contribution of intelligence, personality factors, creativity, self-concept and school climate in predicting the achievement of the students. Hence multiple regression and multiple co-efficient of correlation have been used for describing the relationship between the dependent and the independent variables, whereas ANOVA and 't' test are used for the different studies.
Multiple regression is a procedure that employs multiple regression to study the relationships between several independent variables and on dependent variable.\(^6\)

Multiple regression is a multivariate technique for determining the correlation between a criterion variable and some combination of two or more predictor variables. It permits to compare simultaneously relationships of several independent variables with a dependent variable. By this method, it is possible to compute the equation, which gives the best possible linear combination of a number of independent variables for the purpose of predicting another dependent variables. This equation is known as multiple regression equation.

The regression equation, which expresses the relationship between a single variable \(X_1\) and any number of independent variables \(X_2, X_3, \ldots, X_n\) may be written in deviation form as follows:\(^7\)

\[
X_1 = b_{12.34} \ldots nX_2 + b_{13.24} \ldots nX_3 + \ldots + b_{n.23} \ldots (n-1)^X_n
\]

and in score form, it will be as follows:

\[
X_1 = b_{12.34} \ldots nX_2 + b_{13.24} \ldots nX_3 + \ldots + b_{1n.23} \ldots (n-1)^X_n + k
\]

where b co-efficients are called the partial regression co-efficients and give the weight to be attached to the scores in each of the independent variables, when \(X_1\) is to be estimated from all these in combination.
Furthermore, these regression co-efficients give the weight, which each variable exerts in determining $X_i$, when the influence of other variables is partialled out. Thus, the regression equation tells just what role each of the several variables plays in determining the score in $X_i$, the criterion.

4.6.2 Multiple correlation

The multiple correlation analysis provides an analysis of the relations among a single criterion measure and two or more predictor measures. One result of the analysis is an equation for predicting the unknown criterion score of a new subject from his known set of predictors' scores. The obtained equation for predicting the criterion is called multiple regression equation. The another result of the analysis is a co-efficient of multiple correlation. The multiple correlation co-efficient between observed value of the dependent variable and those values estimated from the multiple regression equation. Multiple R shows how accurately the scores from a given combination of variables represent the actual value of the criterion, when independent variables are combined in the best linear equations. The multiple correlation can be interpreted by squaring it.

The co-efficient $R^2$ provides an estimate of the proportion of the total variance in the criterion that can be predicted from the known variance in the predictors and is a measure of the overall effectiveness of the multiple regression. The quantity of $100R^2$, which gives the percentage of the variation of the dependent variable, which is due to regression, is known as the co-efficient of determination.
4.6.3 ANCOVA

ANCOVA (Analysis of co-variance) technique requires one to assume that there is some sort of relationship between the dependent variable and the uncontrolled variables. This form of the relationship is the same in the various treatment groups. As some are,

1) Various treatment groups are selected at random from the population.
2) The groups are homogeneous in variability.
3) The regression is linear and is same from group to group.

4.7.0 Computations Done

The multiple correlation and regression analysis is so tedious that they cannot be used unless the assistance of the computer is taken. The computer has made these techniques accessible and practical. Therefore, in the present study, all the computations have been made with the help of the computer. After making all the necessary computations, the results were summarized and interpreted. These have been set forth in the tables appearing in the text.
References


