CHAPTER - III

Research Design

In the preceding chapters the historical background of education in India, the start of vocational education in India and the growth of engineering and technology education in India before and after independence were discussed, objectives were specified, hypotheses were formulated and the review of related literature was done. The present chapter is devoted to the research design followed in the study. The development and description of tools in order to fulfill the objectives set before the research investigation has also been presented in the present chapter.

The Methodology and Procedures used for conducting the present study had the following major aspects -

- The Method
- The Population and The Sample
- The Tools
- Collection of Data
- Statistical Techniques
3.1-The Method

The main objective of the present study was to trace the decade wise growth/historical development of Technical Education in Uttar Pradesh after 1900. The study also aimed to identify and compare the motivational factors that stimulate, motivate or influence the students decision to join technical education in terms of gender (male and female), different religions (Hindu and non-Hindu), social background (rural and urban) and medium of instruction (English and Hindi) and in terms of students from different boards (ICSE, CBSE, U.P and other state boards). It also aimed to study linkage between success in selection in technical education vis-à-vis academic background (different boards) and social categories (general, schedule caste, schedule tribe and backward classes).

To attain these objectives the researcher reviewed available related literature to identify the most appropriate research method that was suitable for the present study. After reviewing the related literature and the studies conducted so far the researcher finally concluded that the Descriptive Survey Research method would be most suitable method for this type of research work. Descriptive research\(^1\) includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs, as it exists at present. The main characteristic of this method is that the researcher has no control
over the variables. The researcher can only report what has happened or what is happening. The researcher seeks to measure such items as for example, frequency, preferences or similar data. The methods of research utilised in descriptive research are survey methods of all kinds, including comparative and co-relational methods. In analytical research, on the other hand, the researcher has to use facts or information already available to analyse these to make a critical evaluation of the material. Hence, the descriptive survey method was used for examining the various hypotheses as have been formulated in the beginning of research work in Chapter 1.

3.2-The Population for the Study

The primary purpose of research was to discover facts or principles that have universal application, but to study whole population to arrive at generalisation would be impractical, if not impossible. Some populations are so large that their characteristics cannot be measured; in some cases the characteristics of the population may change before the measurement could be completed, and in some cases the population would have changed during the process of measurement. "Imagine the difficulty of conducting a reading experiment with all American fifth-grade children as subjects. The study of population of this size would require the services of thousands of researchers, the expenditure of millions of dollars, and hundreds of thousands of class hours"2.
Fortunately the process of sampling makes it possible to draw valid inferences or generalisation on the basis of careful observation of variable within a relatively small proportion of the population. A population is any group of individuals who have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type or more restricted part of that group. All public school teachers, all male secondary school teachers, all elementary school teachers of a particular geographical area may be populations.

The population for the purpose of this study has been defined as the total number of students studying in B.Tech. or B.E. programme in institutions recognised by All Indian Council of Technical Education in Uttar Pradesh. For getting the authenticated list of all the B.Tech Colleges/Institutes recognised by the AICTE, the researcher consulted the Information Brochure for State Entrance Examination 2006, Uttar Pradesh Technical University, Lucknow, Directory of approved Institutions for Degree Programmes in Engineering 2003-2004 issued by AICTE, New Delhi and AICTE internet web-site of approved institutions for engineering. As per the above source of information there are 12 Government/Government aided B.Tech./B.E. Institutions, 111 Self-financed (Private) Engineering Institutions, 03 Deemed Universities and 11 University departments offering B.Tech./B.E. degree courses in Uttar Pradesh. List of these institutions is attached as Appendix A. The students
studying in the above mentioned institutions are part of population for this research study. However, IIT Kanpur, and IIT, BHU, Varanasi have not been included in the population being a special kind of institution of technical education, which may need separate study.

### 3.3-Sample for the Study

A sample is a small proportion of a population selected for observation and analysis. By observing the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it is drawn. Contrary to some popular opinion sample are not selected haphazardly; they are chosen in a systematically random way so that chance or the operation of probability can be utilised.

Sampling is an important aspect of life in general and enquiry in particular. The population refers to all cases under investigation and a sample is an actual subset of observations drawn from a population (Calfee, 1975)\(^3\).

The size of the population places an upper limit on the size of the sample that can be drawn from it (Ebel and Frisbic, 1991)\(^4\). The sample cannot be larger than the population (Garrett, 1966)\(^5\). The larger the population, the more likely it is to be heterogeneous. A large sample will always yield a
sample statistics closer to the population parameter than a more limited sample (Garrett, 1966)\(^6\).

A Sample procedure is representative if every sub-class eventually occurs with the same proportion in the sample as in the general population (Garrett, 1966)\(^7\). In probability sampling statistical inferences about the population can be made from representative sample where the sample is taken as a representative of the population (Robinson, 1996)\(^8\). Various techniques have been devised for obtaining sample, which may be representative of its population. Most commonly used sampling techniques are:

- Random Sampling
- Stratified Sampling
- Incidental Sampling
- Purposive Sampling

**Random Sampling**\(^9\) means that researcher relies upon a certain technique of selection called random to provide an unbiased cross-section from the larger group or population. The individual observations or individuals are chosen in such a way that each have an equal and identical representation of population. The criteria for randomness are met when:
Every individual in the population or sample has the same chance of being chosen for the sample.

The selection of one individual or thing in no way influences the choice of another.

Stratified Sampling\(^\text{10}\) is used when the population from which a sample is to be drawn does not constitute a homogeneous group. If population is constituted of certain status or subgroups then stratified sampling technique is applied so as to obtain a representative sample. It is applicable when the population is composed of subgroups or strata of different sizes so that a representative sample must contain individuals drawn from each category of strata in accordance with the sizes of the sub groups. With each stratum of sub-group, the sampling is done randomly or as nearly as possible. This involves dividing the population into a number of groups or strata where members of a particular group show a particular characteristic.

Incidental Sampling as the word suggests is sometimes referred to as accidental sampling. It is applied to those groups, which are used chiefly because they are easily or readily available.

In Purposive Sampling a sample is built up which enables the investigator to satisfy the specific needs in the project. The principle of
selection in purposive sampling is the investigators judgment of the
typicality of his interest.

There is usually a trade-off between the desirability of a large
sample and the feasibility of a small one. The ideal sample is large enough
to serve as an adequate representation of the population about which the
researcher wishes to generalise and small enough to be selected
economically in terms of subject's availability and expense in both time and
money. There is no fixed number or percentage of subjects that determine
the size of an adequate sample. It may depend on the nature of the
population of interest or the data to be gathered and analysed.

Before the second decade of the 20th century, statisticians
believed that samples should be relatively large so that the normal
probability table could be used to estimate sampling error. The work of
William H. Haynes11 in 1915, in which he developed data on the
probability distribution of small sample, led to the effective use of small
samples. Gosset's contribution made feasible research studies that
necessarily had to be limited to a small number of subjects. Small-sample
research has made a significant contribution to statistical analysis to
research data, particularly in experimental studies. Now samples of 30 or
more are usually considered large samples and those with fewer than 30,
small samples.
More important than size is the care with which the sample is selected. The ideal method is random selection, letting chance or the laws of probability determine which numbers of the population are to be selected. When random sampling is employed, whether the sample is large or small, the errors of sampling may be estimated, giving researchers an idea or the confidence that they may place in their findings.

Since the number of students in the population of the present investigation was too large, it was not feasible to collect data for all the B.Tech / B.E. students in the population. The researcher, therefore, methodically had to choose a sizeable number of students. Therefore, in the present study Stratified Cluster Random Sampling Technique has been used for selecting sample subjects for the study. The researcher first selected some engineering colleges through lottery system from the total population of engineering institutions. Before doing this, entire population of engineering institutions was divided into four categories namely Deemed Universities, Government Financed Engineering Colleges, Self–Financed (Private) Engineering Colleges and University departments. A lottery was drawn separately out of the list of the institutions in each of these four categories and it was ensured that one institution of each type was selected for inclusion in sample. The composition of the population and the sample for the present investigation is given in table 3.1.
Table 3.1
Composition of Population and Sample

<table>
<thead>
<tr>
<th>S.No</th>
<th>Categories of Institutions</th>
<th>Total Institutions</th>
<th>Sample Institutions</th>
<th>Total Students</th>
<th>Total number of students who provided data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Deemed Universities</td>
<td>03</td>
<td>1</td>
<td>420</td>
<td>405</td>
</tr>
<tr>
<td>2.</td>
<td>Government Aided Engineering Colleges</td>
<td>12</td>
<td>1</td>
<td>160</td>
<td>150</td>
</tr>
<tr>
<td>3.</td>
<td>Self – Financed Engineering Colleges (Private)</td>
<td>111</td>
<td>1</td>
<td>120</td>
<td>113</td>
</tr>
<tr>
<td>4.</td>
<td>University Departments</td>
<td>11</td>
<td>1</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>137</strong></td>
<td><strong>4</strong></td>
<td><strong>770</strong></td>
<td><strong>728</strong></td>
</tr>
</tbody>
</table>

The names of the institutions taken as sample in above mentioned four categories are given below. After selecting the B.Tech. Colleges the students sample was drawn randomly from various streams of B.Tech. Course. The names of the sample institutions in the above mentioned four categories are as mentioned below.

- Motilal Nehru Institute of Technology, Tiliargunj, Allahabad, Deemed University.
- Kamla Nehru Institute of Technology, Sultanpur, Government College.
3.4-Tools Used

To carry out the descriptive type of research investigation the researcher must gather data with which she has to test the hypotheses or answer the questions. Many different methods and procedures have been developed to aid in the acquisition of data. These tools employ distinctive ways of describing and qualifying the data. Each tool is particularly appropriate for certain source of data, yielding information of the kind and in the form that can be most effectively used.

Many writers have argued the superiority of interview over questionnaire. The late Arvil S. Barr\(^1\) resolved discussion of this sort by asking, "which is better, a hammer or a hand saw? Like the tools in the carpenters' chest each is appropriate in a given situation".

The general category of inquiry form includes data-gathering instrument through which respondents answer questions or respond to statements in writing. The interview is in a sense an oral questionnaire.
Instead of writing the response, the subject or interviewee gives the needed information orally and face-to-face.

For the purpose of present research, the researcher has used questionnaire to get the best results. The questionnaire used in the print study had two parts. The first part i.e. part A included the triographical description such as name, fathers name, age, sex, institution, course, branch, year, name of the institution, from where passed intermediate (+2), name of the board, percentage of marks in intermediate, whether belong to rural or urban area, caste, category, fathers profession, mothers income (if working), father’s income, mother’s education and attempts made to clear the engineering entrance test.

The second part of the questionnaire included the motivational factors for joining technical education programme. About eleven motivational factors have been formed in part B. A student was permitted to choose one or more reasons for joining the technical courses. In four colleges/institutions offering B.Tech/B.E. programmes, all the students studying in 1st year B.Tech/BE. programmes were included in the sample. The researcher initially contacted the academic directors of the aforesaid institutions and obtained the list of students studying in first year in different streams of B.Tech./B.E. courses. For developing the questionnaire five teachers/administrators were consulted to elucidate points/questions to be included in the proposed questionnaire. On the basis of the discussion and
hints given by these experts, a tentative form of questionnaire was developed which was again discussed with these experts. On the basis of the suggestions given by the experts the questionnaire was finalized. For language clarity and ease in the communication the questionnaire items were given to ten students and they were requested to ask any question for clarification. On the basis of their queries minor changes i.e. language/terminology of the item of the questionnaire were made. The sample of the questionnaire is given at Appendix B.

3.5-Collection of Data:

The questionnaire was administered personally to groups of students doing B.Tech /B.E. course. This gave an opportunity to the researcher to personally establish a rapport, explain the purpose of study, and explain the meaning of the items that may not be clear. The availability of a number of respondents in one place made possible an economy of time and expense and provided a high proportion of usable responses.

3.6-Scoring and Tabulation

After collection of the data, scoring was done and data was recorded in the form of table. First of all the filled questionnaire were seen for completeness. In some cases data was missing. The researcher made an attempt to collect missing information and completed the questionnaire. However in few cases, some vital information couldn’t be collected and
researcher was bound to delete these cases from the sample. As such only 728 students provided complete and usable data and were included in the structural sample. The same is attached at Appendix C.

3.7-Statistical Techniques

The following statistical techniques have been used for the purpose of data analysis-

1. Percentage

2. Graphical Representation

3. Chi-Square test

The investigator used Chi-square test to test all the hypotheses. The work of data analysis was done by computer hence the formulas used for data analysis i.e. for Chi-square test is standard formula being used by the general computer software. However the general formula\(^{13}\) for Chi-square test analysis is given below: -

\[
\chi^2 = \sum \frac{(F_o - F_e)^2}{F_e}
\]

In the above formulas the various symbols, notations and letters connote the standard meaning and as such there is not need to describe them here.
References


6. Ibid.

7. Ibid.


