CHAPTER 4
RESEARCH METHODOLOGY

4.0 Chapter Overview
This chapter describes and discusses the methods employed to achieve the purposes of the study. It discusses the methodology used in this research and also gives the reasons for selecting specific methods. Research by its nature is a complex process; hence it is very imperative for the researcher to stick to certain procedures in collecting, analyzing, and interpreting data in order to maximize the validity of the findings (Bryman, 2004). Both the sampling technique used in selecting respondents for the research and the sample itself are discussed. The tools used in the data collection are also discussed and justifications are provided for using these data collection instruments.

4.1 Meaning of the Research
Research has an important role to play in this era as it helps in the generation of knowledge. According to Powell (1997) there is no single widely accepted definition of research in part because there is more than one kind of research. His overview of the literature indicates that research is the systematic nature of the inquiry with respect to a particular problem, thoroughness, application of particular methods to elicit data and the end result being the advancement of knowledge, or for an application (Powell, 1997).

The Oxford Encyclopaedic English Dictionary defines research as a “systematic investigation into the study of materials, sources etc. in order to establish facts and reach new conclusions” (Oxford, 2003).

Busha and Harter (1980) describe research as a ‘systematic quest for knowledge’ (Busha & Harter, 1980).

Thus “Research is an inquiry process that has clearly defined parameters and has its aim as
Discovery or creation of knowledge or theory building
Testing, confirmation, revision, refutation of knowledge and theory and/or
Investigation of a problem for local decision making”.

This inquiry process encompasses five activities

- Reflective inquiry (identification of a problem for conducting a literature search to place the problem in the proper perspective and the formulation of a logical or theoretical framework, objectives and hypothesis/research questions)
- Adoption of appropriate procedures (research design and methodologies).
- The collection of data
- Data analysis and
- Presentation of findings and recommendation for future study (Hernon, 1991).

A more explicit definition is
‘Research is one which uses the scientific method of inquiry and uses it in order to establish or disestablish the truth or a given relationship, in short, to test a hypothesis’ (Goldhor, 1972).

According to Neuman (2006) different definition of research reflect two broad types of research, namely basic and applied research. The primary purpose of basic research is to advance knowledge, whereas applied research attempts to find a solution to problems. For each type of research a particular technique is employed. The two types are not however separate and one may inform the other (Neuman, 2006). The present study is one of the applied researches as it has as its aim, the development of a module for enhancing the information literacy skills of the student teachers.

Thus there are two major paradigms of educational research:

1) The quantitative paradigm
2) The qualitative paradigm

The qualitative paradigm deals with soft data and is aimed at developing an ideographic body of knowledge. It gives less importance to developing universal generalizations. On the other hand, quantitative paradigm requires quantification of data, testing of hypothesis using statistical techniques and making generalizations, which makes the research process replicable.
In the current study the quantitative methods used were questionnaires for the student teachers, development of the module, pre-test and post-test for the student teachers. The qualitative methods used were focus groups.

4.2 Research methodology
All research involves careful observation, description and the analysis of what happens under certain circumstances. Major types of research methods are

4.2.1 Historical Research
It is defined as the systematic and objective location, evaluation and synthesis of evidence in order to establish facts and draw conclusions about the past event.

4.2.2 Comparative Research
Comparative research is often used together with historical research. Researchers compare people’s experience of different societies, either between times in the past or in a parallel situation in the present.

4.2.3 Descriptive Research
Descriptive research relies on observation as a means of collecting data. It attempts to examine situations in order to establish what is the norm i.e. what can be predicted to happen again under the same circumstances. Descriptive studies investigates phenomena in their natural settings; descriptive studies are designed to interpret pertinent and precise information concerning the current status of phenomena and wherever possible, draw valid conclusions from the facts discovered (Kaul, 1997). Descriptive studies can be classified into three broad categories:

I. Survey studies
II. Developmental studies
III. Interrelationship studies

Interrelationship studies attempt to trace the relationship between various variables of the study. These inter relation studies include:

I. Case studies
II Causal Comparative studies
III Co-relational studies
IV Cross Cultural Comparative studies
In the present research the descriptive method of causal comparative type has been adopted for studying and comparing the relationship between information literacy skills, faculty of study and degree.

4.2.4 Correlation Research
The information sought in correlation research is expressed not in the form of artifacts, words or observations, but in numbers. Correlation is another word to describe the measure of association or the relationship between two phenomena. In order to find meaning in the numerical data, the technique of statistics is used.

4.2.5 Experimental Research
Experimental research differs from the other research approaches noted above through its great control over the objects of study. Campbell & Stanley (1966) make their categorization into four classes as shown which can be regarded as a useful starting point for discussing their different characteristics.

Different classes of experimental research are

- Pre Experimental
- True Experimental
- Quasi experimental
- Correlational and Ex post facto

Pre experimental design is an unreliable and primitive experimental method in which assumptions are made despite the lack of essential control of variables. An example of this is the supposition that faced with the same stimulus, all samples will behave identically to the one tested, despite possible differences between the samples.

True experimental designs are those that rigorously check the identical nature of the groups before testing the influence of a variable on a sample of them in controlled circumstances. Parallel tests are made on identical samples (control samples) which are not subjected to the variable.

In quasi experimental designs not all of the conditions of true experimental design can be fulfilled. The nature of the shortcomings is however recognized and the steps are taken to minimize them or predict the reliability of the results (Campbell & Stanley, 1966).
The experimental method of research has also been used in this study. This method has been used in order to ascertain the effectiveness of the program developed by the researcher to enhance the information literacy skills among student teachers.

4.3 Methodology of the present study
The selection of the methodology of the study depends upon the aims of the study. The present research has a threefold aim:

a) To assess the information literacy skills of student teachers with respect to understanding of the research process and research skills related to information handling.

b) To develop, implement and ascertain the effectiveness of the module enhancing information literacy skills of student teachers based on the first phase of the study.

c) To analyze the Individual research projects of student teachers after the implementation of the module.

In keeping with the three fold aims of the study; the research was carried out in three phases: Phase I, Phase II and Phase III

4.3.1 The Descriptive Research Design In First Phase (Phase I) of the present study
The study has used the quantitative paradigm to test the hypotheses statistically in order to study the difference in the information literacy skills among student teachers based on their faculty of study and degree. The descriptive research method included under the quantitative paradigm has been used in the present research. The descriptive method of the causal comparative type has been adopted in the present study.

4.3.1.1 The Causal Comparative Method
According to Borg and Gall (1983) “The causal comparative approach is a research technique for exploring causal relationships among variables that cannot be manipulated experimentally”. It therefore aims at the discovery of possible causes of a behavior pattern by comparing subjects in whom it is absent or present to a lesser degree” (Borg & Gall, 1983)
This method seeks to find answers to questions like: What factors seem to be associated with certain occurrences, outcomes, conditions or types of behavior? These answers are sought through the analysis of variable relationships. As it is unethical to arrange occurrences, an analysis of past events or of already existing conditions may be the only feasible way to study causation. This type of research is referred to as ex post facto method. This method compares the similarity and differences among phenomena to ascertain factors or circumstances that accompany or contribute to the occurrence of certain events, conditions or practices. The present study attempts to compare the information literacy skills among student teachers based on their faculty of study and degree.

4.3.1.2 Variables of the descriptive study
The variables of the Phase I are as follows:

- Information Literacy Skills
- Faculty of Study (Art, Science and Commerce)
- Degree of study (graduate and post graduate degree)

4.3.1.3 Techniques of sampling in phase I
Sampling is a process of selecting units (example people, organizations) from a population of interest so that by studying the sample the researcher can fairly generalize the results to the population from which it was chosen. In any research, ideally it is essential to cover individuals, institutions or inanimate units in the study to draw generalizations concerning educational phenomena under consideration. However, it is impractical and extremely difficult to involve each and every individual or institution in the study. Under these circumstances the results are generalized back to the population from which it was chosen. Ideally, in any research, it is essential to cover individuals, institutions or inanimate units, in order to draw generalizations concerning finite subset of individuals in a population that has to be studied. This finite subset is called a sample. The size of the sample is referred to as the number of individuals in a sample.

“A sample is a subset of a population to which the researcher intends to generalize the results” (Wiersma, 1998).
The inferences drawn from a sample about a population are based on the theory of probability. To ensure the validity of these inferences an element of randomness has to be introduced in the selection of the sample.

The nature of the population and the type of information required for the study determine the type of sampling. The different types of sampling techniques are as follows:

1. Simple random sampling
2. Stratified random sampling
3. Systematic sampling
4. Cluster Sampling
5. Incidental sampling

The present study requires data to be collected from different colleges of education of Mumbai.

4.3.1.4 Techniques of Sampling for Phase I

A two-stage stratified random sampling technique was used for selecting the sample. At the first stage, sampling involved selection of colleges on the basis geographical areas of Greater Mumbai. Here stratified random sampling technique was used and the stratifying factor was the geographical location of the college. Colleges were selected randomly from three strata of Greater Mumbai, viz, South Mumbai, North Mumbai and West Mumbai.

The second stage of sampling involves selection of students from the colleges of education selected in the first stage. The selection of the sample of students at this stage was incidental or available due to reasons beyond the control of the researcher. The sample included both males and females.

4.3.1.5 The sample – its nature and size

According to Best and Kahn (1959) “The ideal sample is large enough to serve as an adequate representation of the population about which the researcher wishes to generalize and small enough to be selected economically – in terms of subject availability, expense in both time and money and complexity of data analysis” (Best & Kahn, 1959).
The data were collected from students enrolled in colleges of education, from nine colleges situated in Greater Mumbai for phase I.

4.3.1.6 Description of the population of phase I

For the purpose of phase I of the present study, the population includes student teachers from education colleges of Greater Mumbai. The following are the colleges of education from which data were collected:

PHASE I

Name of the colleges

1. Bombay Teachers Training College, Colaba
2. Chembur Comprehensive College of Education, Chembur
3. Gokhale College of Education, Parel
4. Hansraj Jeevdas College of Education, Khar
5. Kranti Jyoti Savitribai Phule College of Education, Vikhroli
6. Lord’s Universal college of Education, Malad
7. Pillai’s College of Education and Research, Chembur
8. R. K. College of Education, Bhandup
9. Rizvi College of Education, Bandra

The following table 4.1 shows the number of colleges selected from various strata identified on the basis of the location of the colleges in phase I.

<table>
<thead>
<tr>
<th>Locations</th>
<th>No. of colleges</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Mumbai</td>
<td>02</td>
<td>22(22.22)</td>
</tr>
<tr>
<td>North Mumbai</td>
<td>04</td>
<td>45(44.44)</td>
</tr>
<tr>
<td>West Mumbai</td>
<td>03</td>
<td>33(33.33)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>9</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The following table 4.2 shows the total number of sample by the gender of the students.
Table 4.2 Sample Size by Gender for Phase 1

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Males</td>
<td>56</td>
<td>14.50%</td>
</tr>
<tr>
<td>2.</td>
<td>Females</td>
<td>330</td>
<td>85.49%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>386</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 4.1 and 4.2 shows the percentage wise distribution of the sample by the location and gender of the students.

Figure 4.1 Percentage Wise Distribution of Number of Colleges by Location in Phase I
4.3.1.7 Tools of the research

To conduct any investigation, data are gathered with which the hypotheses may be tested. The means of collecting this new unknown data are called the instruments or the tools of a research. These tools are of many kinds and employ unique ways of describing and quantifying the data. The selection of appropriate tools is a key to successful research. Each tool is suitable for specific sources of data and helps in yielding the kind of information desired by the researcher. In other words, the choice of the tool depends upon the nature and purpose of the research.

The data for the present study needed to be collected from students. Whenever the research study requires the assessment of certain attributes for which a ready-made tool is not available, it becomes imperative to construct it. For the present study the researcher has constructed the following tool.
4.3.1.8 Construction of Information Literacy Skills Questionnaire

After an intense search for literature on Information Literacy skills the researcher studied the various aspects of information literacy skills. Bay Area Community Colleges Information Competency Assessment Project and Baile Test on Education was considered when constructing a questionnaire. The researcher then pooled all the relevant items in the questionnaire. While constructing the questionnaire the researcher ensured that items tested the students’ understanding and skills of information literacy. The items were objective type. The components of the questionnaire along with the sub variables are represented in the table 4.3.

4.3.1.9 Scoring pattern of constructed questionnaire

The questionnaire on Information literacy skills had five options. The total numbers of items were 48. For each correct option the score was “1” and for incorrect option the score was “0”. Thus the maximum score that a student teacher can obtain is 48 and the minimum score obtainable is “0”. The tool and the scoring is given in Appendix 2
Table 4.3 Components of the Questionnaire along with Sub variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Subvariables</th>
<th>Sub Sub Variables</th>
<th>No. of Question</th>
<th>Question no</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Research Process</strong></td>
<td>Information Research Readiness</td>
<td>Catalogue</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Call Number</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Information Research Needs</td>
<td>Project detail</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information Source</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Information Research Strategy</td>
<td>Research Question</td>
<td>6</td>
<td>9,11, 16, 20, 25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Library Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information Research Reporting</td>
<td>Citation style</td>
<td>4</td>
<td>42, 44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Citation</td>
<td></td>
<td>43, 34</td>
</tr>
<tr>
<td><strong>Information Research Skills</strong></td>
<td>Research Needs</td>
<td>Information Source</td>
<td>7</td>
<td>19, 12, 13, 15, 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research Question</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Encyclopaedia</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Keywords</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>ILL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accessing and Locating skills</td>
<td>Synonyms</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Truncation</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boolean Operators</td>
<td></td>
<td>29, 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controlled</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocabulary</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Catalogue- Search option</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Databases</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Citation elements</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluating Skills</strong></td>
<td>Significant word</td>
<td></td>
<td>6</td>
<td>21, 37, 38, 50</td>
</tr>
<tr>
<td></td>
<td>Information Source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Webpage</td>
<td></td>
<td></td>
<td>40, 39</td>
</tr>
<tr>
<td><strong>Ethical Use of Information</strong></td>
<td>Plagiarism</td>
<td></td>
<td>6</td>
<td>47, 41</td>
</tr>
<tr>
<td></td>
<td>Copyright</td>
<td></td>
<td></td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Copyright</td>
<td></td>
<td></td>
<td>35</td>
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<td></td>
<td>Passwords</td>
<td></td>
<td></td>
<td>49</td>
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<td></td>
<td>Acknowledgement</td>
<td></td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>
Table 4.4 Mapping of Questions according to ACRL Standards

Standard 1: The information literate student determines the nature and extent of the information needed.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Question no</th>
<th>Performance Indicators</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Need</td>
<td>12</td>
<td>1</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>1</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>1</td>
<td>d</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>1</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>1</td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>2</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>2</td>
<td>e</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>3</td>
<td>a</td>
</tr>
</tbody>
</table>

Standard 2: The information literate student accesses needed information effectively and efficiently.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Question no</th>
<th>Performance Indicators</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing and locating skills</td>
<td>10, 22</td>
<td>1</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>2</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>2</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>29, 30, 31</td>
<td>2</td>
<td>d</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>3</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>5</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>3</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>5</td>
<td>c</td>
</tr>
</tbody>
</table>

Standard 3: The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Question no</th>
<th>Performance Indicator</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating Skills</td>
<td>21</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>4</td>
<td>A</td>
</tr>
</tbody>
</table>
### TABLE 4.4 MAPPING OF QUESTIONS ACCORDING TO ACRL STANDARDS

<table>
<thead>
<tr>
<th>Standard 5: The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethical Use of Information</td>
</tr>
<tr>
<td>34</td>
</tr>
<tr>
<td>41, 47</td>
</tr>
<tr>
<td>49</td>
</tr>
<tr>
<td>44, 45</td>
</tr>
<tr>
<td>48</td>
</tr>
</tbody>
</table>

### 4.3.1.10 Validity of Tools

According to Best & Kahn (1986) “Validity of a tool refers to the extent to which a tool measures what it claims to measure.”

The validity of a tool can be ascertained by the following methods:

1. Face Validity
2. Content Validity
3. Criterion Validity
4. Construct Validity

**Face Validity:** A test has face validity when the items look like they measure what the test is supposed to measure. It refers, not to what the tool necessarily measures, but to what it appears to measure. Does the tool ‘look’ valid? Does it seem to be relevant to its objectives when viewed by the subjects who take it, the researches using it, or anyone else who might judge it? Face validity is determined by a somewhat superficial examination of the tool by the subjects/ respondents/ experts and only the obvious relevance is considered.

**Content Validity:** It refers to the extent to which a test measures a representative sample of the subject matter or behavioral change under consideration. Content validity of a tool is ascertained with a view to ensure the representativeness of the content matter in the tool (Best & Kahn, 1986).
According to Cronbach (1970), “adequacy of the content is attained by defining the universe approximately and representing the universe fairly in the test” (Cronbach, 1970).

4.3.1.11 Reliability of Tools

According to Best & Kahn (1986) “Reliability of a tool refers to the consistency with which a tool measures what it proposes to measure.”

The reliability of a tool can be determined through the following methods:

1. Internal-consistency Reliability
2. Test-retest Reliability and
3. Alternate/ Parallel Forms Reliability

1) Internal Consistency Reliability: This is used to ascertain the internal consistency of the test. There are many methods of establishing internal consistency such as the split-half method, Cronbach’s alpha, Spearman Brown’s formula, Kuder Richardson Coefficient and Hoyt’s ANOVA.

2) Test-Retest Reliability: This reliability is expressed in terms of coefficient of stability over time. Hence scores on the first administration of a test are correlated with the scores on the second administration after a gap of about four weeks.

3) Alternate or Parallel Forms Reliability: This determines the reliability of the test with other similar test of known reliabilities. Since all types of reliability are concerned with the degree of consistency or agreement between two independently derived sets of scores, they all can be expressed in terms of coefficients of correlation (Anastasi, 1970).

A monograph on test and item analysis for universities recommends the value of 0.65 for the reliability of group tests as acceptable. For the purpose of the present study, the internal consistency reliability and the test-retest reliability of each tool was determined (Best & Kahn, 1986).

4.3.1.12 Description of the Information Literacy Skills Questionnaire

The study is concerned with studying Information literacy skills among student teachers. As no readymade tool was found suitable for measuring the variable of information literacy skills, this tool was prepared by the researcher.
Pre-Pilot Study

The pre-pilot study was done in order to carry out an item analysis and establish the validity of the questionnaire.

Face Validity and Content Validity: To ascertain the face validity and content validity, the draft version of the scale was given to eight experts in the field of education and library and information science. The list of experts is given in Appendix 3. The operational definition of the variable was included as an aid to the experts in judging the face and the content validity. Those items, which were agreed upon, by ninety percent of the experts were retained and a few items were modified in accordance with the experts’ suggestions. The remaining items were deleted from the tool. The face validity and content validity of the tools were thus established.

Item Validity: To determine the item validity of the individual items, an item analysis of tool was carried out. For the pre-pilot study, an information literacy skills questionnaire was administered to the student teachers of Pillai’s College of Education. The size of the sample was 45 students including 3 males and 42 females.

After administering the tool, the responses were quantified and the scores on each item were arranged in a descending order. This was followed by counting off twenty seven percent of the scores high and twenty seven percent of the scores low on information literacy skills questionnaire.

The validity index or Discrimination Index (DI) of each item was determined using the following formula.

\[ DI = \frac{N_H - N_L}{0.27 \times N} \]

where the NH = number of students getting a high score in the upper 27% of the group.

\[ N_L = \text{number of students getting a higher score in the lowest 27% of the group} \]

\[ N = \text{sample size} \]

The discrimination index shows how sharply the item differentiates between persons higher on the scale of criterion from those lower on the scale. According to Brown’s
recommendation, the items having a discrimination index of 0.20 or more were retained and others were deleted (Brown, 1976).

Pilot Study of the Tool

The next step was to conduct a pilot study of the information literacy skills questionnaire in order to determine the reliability of the tool.

The pilot study was conducted in the K. J. Somaiya Comprehensive College of Education, Training and Research. The tool was administered to students including males and females of college.

A tool should have the ability to consistently yield the same results every time it is administered to the same respondents’. In order to ascertain the reliability of the information literacy skills questionnaire, internal consistency and test re-test reliability coefficients were computed.

Internal Consistency Reliability

The internal consistency reliability coefficient of the tool was computed by using Cronbach’s Alpha method. The formula for which is as follows:

$$\alpha = \frac{n}{n-1} \left(1 - \frac{\sum \sigma_i^2}{\sigma^2 t}\right)$$

The alpha coefficient value was 0.80 which is higher than the acceptable value of 0.5. Hence the scale is said to be internally consistent.

Test-Re test Reliability

In this method, the same test is administered to the same group after some time gap, usually, four to five weeks and the correlation between the scores obtained is computed.

This research tool was re-administered to the same sample after a gap of 30 days. The Test –Re-test reliability coefficient of the tool was found to be 0.80. Thus the tool is valid and reliable.

The following table gives the internal consistency reliability and test – retest reliability of the information literacy skills questionnaire
Table 4.5  Reliability of the Information literacy skills Questionnaire

<table>
<thead>
<tr>
<th>Type of Reliability</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal consistency reliability</td>
<td>0.80</td>
</tr>
<tr>
<td>(Cronbach’s Alpha)</td>
<td></td>
</tr>
<tr>
<td>Test-retest</td>
<td>0.80</td>
</tr>
</tbody>
</table>

4.3.2. Research Design in the Phase II of the Present Research

The second phase of the research was to develop, implement and ascertain the effectiveness of the module enhancing information literacy skills of student teachers based on the first phase of the study. A second phase was initiated with the following objectives:

1) To develop and implement the information literacy instruction modules
2) To ascertain the effectiveness of the program to enhance information literacy skills among the student teachers by comparing the post-test scores of information literacy when the differences in the pre-test scores of the two groups have been controlled.
3) To seek the feedback of the B. Ed student teachers with respect to their
   a) opinions about Information literacy Instruction Modules
   b) suggestions about Information Literacy Instruction Modules

Development and implementation of the module is discussed in detail in the next chapter.

4.3.2.1. Experimental Design in the Phase II of the Present Research

For achieving the second objective the experimental method was used for implementing and testing the effectiveness of the program developed.

There are various experimental designs. Selection of a design is based upon the purpose of the experiment, the type of variables to be manipulated and the conditions under which the experiment is conducted, how subjects are to be assigned to the experimental and control groups, the way variables are to be manipulated and controlled, how observations are to be made and the type of statistical techniques to be employed in analyzing variable relationships.
The three types of experimental designs are as follows:

1. **Pre – Experimental Design**: This design is the least effective. It provides no control group or no way of equating the groups that are used.

2. **True Experimental Design**: In a true experiment, the experimental and control groups are equated by random assignment of subjects.

3. **Quasi Experimental Design**: In quasi experimental design the experimental and control groups are not equated by random assignment of subjects.

In the present investigation, the following quasi-experimental design is used.

**The pre-test – post-test non-equivalent groups design**, which is described as follows:

\[ O_1 \times X \times O_2 \]
\[ O_3 \times C \times O_4 \]

Where, X: Experimental group      C: Control group

\( O_1 \) and \( O_3 \) Pre-test scores

\( O_2 \) and \( O_4 \) Post-test scores

The design is often used in classroom experiments where experimental and control groups are naturally assembled groups such as intact classrooms, which may be similar. The difference of the means of \( O_1 \) and \( O_3 \) scores and the difference between the mean of \( O_2 \) and \( O_4 \) scores are tested for statistical significance. If this design is the only feasible one, the comparison is justifiable, but caution should be taken in interpreting the results.

Based on the findings of phase I, it was found that in general student teachers were lacking information literacy skills. As the main objective of the second phase of the study was to develop, implement and ascertain the effectiveness of the information literacy skills module to enhance the information literacy skills among the student teachers. For this purpose, two groups of student teachers pursuing their Bachelor in Education were considered. One group formed the control group and one group formed the experimental group.
For the present study, randomization in sample selection was not possible because random assigning of student teacher to the experimental group and the control group would disturb the normal functioning of the colleges. Therefore for the present study, the researcher conducted the experiments in two colleges with similar characteristics. To conduct experiments intact classes formed the groups. For selecting the colleges, the researcher has made use of multistage purposive sampling. In the first stage the two colleges offering the B Ed course who gave permission to conduct the experiment were chosen. In the second stage, the researcher randomly assigned one college as the experimental group and others as a control group. B Ed student teachers from All India Khilafat College of Education, Byculla were assigned as the experimental group and student teachers from the Akbar Peerbhy College of Education; Vashi was assigned as a control group.

4.3.2.2 Nature and size of the sample

For the phase 2, the total sample is 111 student teachers, 65 student teachers were in the experimental group and 46 student teachers in the control group. The following table shows the nature and composition of the sample.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name of the college</th>
<th>Group</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All India Khilafat College of Education</td>
<td>Experimental</td>
<td>5</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>Akbar Peerbhy College of Education</td>
<td>Control</td>
<td>4</td>
<td>42</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>9</td>
<td>102</td>
<td>111</td>
</tr>
</tbody>
</table>

The researcher first administered the pre-test to both experimental and control groups. After the pre-test, the experimental group was exposed to the series of lessons aimed at enhancing the information literacy skills among the student teachers. For teaching the experimental group, six periods from the college timetable were taken up which were spread over three days. Each period was of fifty minutes duration. The control group was not exposed to any such lessons for enhancing the information literacy skills. At the end of the series of lessons conducted with the experimental group, a
post-test was administered to the students of both the experimental and control groups. The scores were analyzed using statistical techniques.

The researcher has used this design as it was the most feasible one and the interpretation of the results has been carefully done.

4.3.2.3. Variables of the Experimental Study
According to Best and Kahn (1986) “variables are the conditions or characteristics that the experimenter manipulates, controls or observes”. The independent variables are the conditions or characteristics that the experimenter manipulates or controls in his or her attempt to ascertain their relationship to observed phenomena. The dependent variables are the conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes independent variables” (Best & Kahn, 1986)

There are two types of independent variables: treatment and organismic or attribute variables. Treatment variables are those factors that the experimenter manipulates.

Attribute variables are those characteristics that cannot be altered by the experimenter.

Independent Variables
In the present research, the treatment variable is the program developed to enhance the information literacy skills among the student teachers. These lessons that were given to the experimental group form the independent variable.

Dependent Variables
Information literacy skills

Confounding Variables
Confounding variables are those variables which may influence the dependent variables and whose effect may be confused with the effects of the independent variable. They are of two types: intervening and extraneous variables.

In educational research, there are certain variables, which cannot be controlled or measured directly but may, have an important effect upon the outcome. These modifying variables intervene between the cause and the effect. These are intervening variables.
4.3.2.4 Controlling Intervening Variables

In the present study, the researcher has tried to control such intervening variables as

**Anxiety:** The students’ level of anxiety was controlled to some extent by the researcher. The researcher herself taught in the class in the absence of the teacher, so that the students did not feel anxious or detrimental in sharing their views in regard to information literacy skills or even disagree on points where they felt not convinced. Besides, the researcher also made sure that there was no test in between or immediately after the treatment got over. Thus test anxiety was also controlled.

**Fatigue:** The researcher made sure that the students were mentally and physically ready for the lessons. The method of teaching involves a lot of activity and unstructured questions where each one of them was part of the activity. This made sure that the students were not tired and bored of the lessons.

**Motivation:** The researcher herself administered the tool in the experimental and control groups thereby motivating the students to give an honest representation of their views and opinions in the pre-test as well as the post-test, in both the experimental and the control group.

4.3.2.5 Controlling Extraneous Variables:

The following extraneous variables were controlled in the present research:

**Gender:** The researcher controlled this by making sure that there were males and females in the control and the experimental group.

**Teacher Personality and characteristics:** since researcher herself taught the experimental group, teacher personality, her presage characteristics, teaching style, classroom behavior with student teacher was same throughout. This ensured that teacher personality and characteristics did not interfere with the experiment.

4.3.2.6 Experimental Validity

If a significant contribution has to be made to the development of knowledge, an experiment must be valid. Campbell and Stanley (1966) have described two types of experimental validity: internal and external.

According to Campbell & Stanley (1966) an internal validity is the basic minimum without which any experiment is uninterpretable: Did in fact the experimental treatment make a difference in this specific experimental instance? External validity
asks the question of generalizability: to what population, settings, treatment variables and measurement variables can this effect be generalized?”

Accordingly, an experiment is said to have internal validity to the extent that the factors manipulated have a genuine effect on the observed consequences in the experimental setting. An external validity is the extent to which the variable relationships can be generalized to other settings, other treatment variables, other measurable variables, and other populations (Campbell & Stanley, 1966).

### 4.3.2.7 Threats to Internal Experimental Validity

In educational experiments, a number of extraneous variables influence the results, which are difficult to evaluate, and cannot be completely eliminated. Sound experimental design minimizes the influence of these variables.

An experiment has internal validity to the extent that the factors that have been manipulated (independent variables) actually have a genuine effect on the observed consequences (dependent variable) in the experimental setting. In educational experiments, a number of extraneous variables are present in the situation or are generated by the experimental design and procedures. These variables influence the results of the experiment in ways that are difficult to evaluate. Although these extraneous variables usually cannot be completely eliminated, many of them can be identified and their effect on the experiment can be nullified by taking all possible precautions. The independent variable of the present study was the module developed on information literacy skills. The dependent variable of the study was the information literacy skills. In order to study the genuine effect of information literacy instruction module on information literacy skills of student teachers, the researcher has controlled the effects of the following factors. The researcher has overcome these factors as follows:

*Maturation:* student teachers change over a period of time and they are exposed to various experiences, which may lead to normal maturation. In the present case, the lessons given to the experimental group lasted over a period of three days. The pre-test and post-test were given to both the groups immediately before and after the program. Moreover, the duration between the pre-test and post-test was the same for both the groups, the average maturation, if any, is likely to be the same for both the groups.
History: some specific external event may have occurred between the first and the second test i.e. between the pre-test and post-test. Information literacy instruction modules are not the only means of enhancing the information literacy skills of student teachers, many other factors like reading, searching in the library can also contribute to enhancement of information literacy skills. This is controlled by having a control group. The same events may have occurred for the student teachers of the control group also; thus nullifying the effect.

Testing: pre-test may produce a practice effect that can make students more proficient in the post-test. In the present study pre-test was given to both the groups, so the practical effect on both, the experimental group and the control group is expected to be the same.

Unstable Instrumentation: The threat is nullified by using reliable and valid instruments for both the groups. Reliability of information literacy questionnaire was established by test retest and Cronbach alpha methods. Experts from the field of education and library science established the content validity of the questionnaire. This helped stabilising the instruments i.e. research tools of the study.

Statistical Regression: it occurs when student teachers are selected on the basis of extremely high or extremely low pre-test scores. For the present study, the student teachers were not taken on the basis of low or high scores. The class as a whole was selected for the study.

Selection Bias: selection bias is represented by the non-equivalence of experimental and control group. For the present study, selection of the college was done on the basis of the availability of colleges. Since two colleges who gave permission to conduct the experiment were chosen, later one college was randomly assigned to control group and other to the experimental group.

Experimental Mortality: In none of the groups, experimental mortality was found for the duration of the experiment was limited.

Experimenter Bias: The experimenter did not have any previous knowledge about the subjects involved as the colleges were chosen randomly.

Walter R. Borg and Meredith D. Gall later extended Campbell and Stanley’s list by adding two more extraneous variables that can threaten the internal validity of an experiment.

The John Henry effect: it refers to a situation in which subjects of the control group perform beyond their usual level because they perceive that they are in competition
with the experimental group. In the present study the researcher has selected student teachers from two different colleges hence the experimental group and the control group was not in close proximity. Each group did not know that there was another group involved. Thus the effect is nullified.

*Experimental Treatment Diffusion:* if the treatment condition is perceived very desirable to the control group, then the members of the control group may seek access to the treatment condition. Experimental treatment diffusion is especially likely if the experimental and control group is in close proximity to each other. In the present study effect of this was nullified, since the student teachers are selected from two different colleges hence the experimental group and the control group were not in close proximity (Borg & Gall, 1983).

4.3.2.8 *Threats to External Experimental Validity:*

*Interference of prior treatment:* In the present research, the experimental and the control group were two different groups. Thus this threat was controlled by the experimental design. The researcher ensured that the class division involved in the first phase of the study was not the same class for the experiment. This was done in order to minimize the threat of prior treatment on the subjects as well.

*The artificiality of the experimental setting:* There were no controls exhibited in the class. Since the intact classes formed the groups the teaching and testing took place within the classrooms for both the experimental and the control group. The researcher went alone in both the classrooms and there were no observers from outside. There were no video cameras or screens in the classroom that would make the students aware of the artificiality of the setting. Hence efforts were made to minimize or eliminate the artificiality of the setting.

*The interaction effect of testing:* The pre-test taken at the beginning of the study was the same for both the groups. The subjects did not know the purpose of the test nor whether they belonged to the experimental group or the control group. So the subjects could not have been sensitized to the purpose of the research.

*The extent of treatment verification:* The experimenter has tried to the best of her ability not to let her bias affect the outcome of the experiment. If ever there has been any such interference it has been unintended.
4.3.2.9. Tools Used in the Experimental Design in Phase II

- Information Literacy Questionnaire (Pre-test and Post-Test)
- Information Literacy Feedback Form (Appendix 4)
- Focus Group Interviews (Appendix 5)

Information Literacy Questionnaire: The Information Literacy Questionnaire developed in the first Phase of the study was used as pre-test and post-test in the second phase.

Information Literacy Feedback Form: The feedback form was developed by the researcher which included closed ended as well as open ended questions. This was used to elicit opinions and suggestions of the student teachers with respect to the module.

Focus Group Interviews:
According to Kuhn (2008) the focus group method is used in qualitative research. It is used for gaining information and listening to the views of the participants. A focus group is described as a small structure group of selected individuals who meet for a particular period of time to discuss (to focus on) a topic or set of issues. Focus group data can be used in conjunction with other methods and for a purpose of triangulation.

The researcher considered that the use of focus groups would be appropriate in terms of discussing with some participants their reactions to the opinions and suggestions to the module. It was considered the most suitable method of obtaining detailed insights into this (Kuhn, 2008). The groups were pre-existing as the participants had been attending the module so had been subjected to the same experience and at least knew each other by sight and thus shared many similar characteristics. The teacher as facilitator was known to the participants and the researcher. The author used the note taking method with tape recordings to support the notes and provide verbatim quotes. The reporting of data was in the form of a narrative with a representative selection of quotations to support analysis. The focus groups took place at the end of the module during lecture periods so as to be convenient for the participants. The focus groups took place in the All India Khilafat College of Education.

4.3.3 Phase three of the Present Research

The main aim of the phase three was to assess the extent of usage of Information Literacy skills in preparation of the research project by the B. Ed student teacher. For this phase researcher used ready-made tool which is a NJIT assessment tool for
portfolio. The students of experimental group who had attended information literacy instruction modules were assessed by the researcher based on NJIT assessment tool for portfolio.

4.3.3.1 Tool Used
A tool developed by NJIT for portfolio assessment was used for assessing the research report (Appendix 6). This tool uses four independent variables to capture the construct of information literacy as it appeared in the portfolios of senior students. The four variables are citation, evidence of research, integration and appropriateness. The reliability and validity of the tool were established.

4.4 Data Collection
Data collection is the actual process of collecting information that the researcher sets out to study, analyze and interpret. The researcher enjoyed the process of data collection and the opportunity to meet new people, thus getting an insight into the environment of different types of B Ed colleges. The support, the response and the interest shown by all the principals was encouraging. The investigator established a rapport with the subjects and explained the purpose and procedure for giving their response in the given form. The instructions were also given for every tool.

The locale for the study: the researcher obtained permission by explaining the need for the study to the principals of B Ed colleges. The first phase involved around 9 B Ed colleges and 386 students. The second phase of the study had an experimental group consisting of 65 students from All India Khilafat colleges of Education, Byculla. The control group had 46 students from the Akbar Peerbhoy College of Education, Vashi. The third phase of the study involved research projects of 65 students from the experimental group.

Data collection for the 1st Phase of the study: the main aim of the first phase was to identify the extent of information literacy skills among the B Ed students so that modules can be developed. The first phase also aimed to study the information literacy skills among student teacher from different faculty and degree. Data was collected for the first stage by administering the Information literacy questionnaire tool for different education colleges from greater Mumbai.
Data collection for the 2nd phase of the study: during the first phase it was identified that students’ teachers from different colleges lack information literacy skills. Thus information literacy instruction module was developed. The information literacy instruction module components were obtained from the available literature and researches conducted in the past. With the in depth study of the different topics in information literacy skills, the researcher conceptualized the following topics which were considered necessary for enhancing the information literacy skills of the student teachers.

The information literacy instruction module included the following areas.
Components 1 Research Success
Components 2 Re-Searching
Components 3 Research Ethics
These components were taught using different interactive methods of teaching like Lecture with PowerPoint presentation, discussion, worksheets and reflection exercises, quiz and group work.
In order to implement the module, pre-test was given to both control and experimental group. The treatment was then given to the experimental group. After giving treatment post-test was given to control as well as the experimental group. Similarly opinions and suggestions of student teachers regarding the module was collected through information literacy feedback and focus groups.

Data collection for the 3rd Phase of the study: In order to collect the data for 3rd phase, the individual research projects submitted by student teachers from experimental group was analyzed on the basis of the NJIT assessment tool.

Uniformity was maintained during data collection to get valid and reliable data. Every precaution was taken to ensure that the tools were administered in the same manner and under similar condition to all the student teachers.

The co-operation of the teachers, support staff and student teachers during the period of treatment helped the researcher at all stages of data collection. There were only few disappointing instances when permission was not granted and also during the treatment period when technology did not support, but this did not dissuade the researchers’ persistence.
4.4.1 Quantification of Data
After the collection of data, the responses of students were quantified by assigning scale values to the items and the scores were so organized that the process of tabulating becomes easier.

4.4.2 Tabulation of Data
Tabulation refers to the recording of classified scores. The method of tabulation depends upon the aims and objectives of the study.

4.4.3 Analysis of Data
At this stage, the tabulated data are scientifically and systematically studied in order to determine the underlying, inherent facts or relationships. During this process, the existing complex factors are broken down into smaller, simpler parts. These parts are then put together in new arrangements so as to synthesize and interpret them.

4.5 Unit of analysis
The unit of analysis in the present study has been the individual student in both the phases. The choice of the unit of analysis depends on the aims and objectives of the study. It uses the individual student as the unit of analysis for the following reasons.
1. The individual is the fundamental unit of human learning, behavior and interaction
2. Every individual experiences and perceives the interactions with his environment uniquely and selectively. These perceptions of an individual are likely to influence his attitudes and behavior in a unique way.

4.5.1 Statistical Techniques of Data Analysis
The contribution of the statistical techniques is considerably higher in the process of analyzing the data. In the present study, two types of analyses are adopted:
1. Descriptive Analysis
2. Inferential Analysis

Descriptive Analysis: This type of analysis is necessary to establish normality of the distribution of the data so that appropriate techniques can be employed for testing the null hypotheses. Descriptive analysis is useful in studying the characteristics of a particular group of individuals. The generalizations made through the descriptive analysis of one group of individuals cannot be extended beyond that group.
The statistical techniques used by the investigator for the descriptive analysis of data are as follows:

I. **Measures of Central Tendency**: These include the mean, the median and the mode.
II. **Measures of Variability**: These include the standard deviation, skewness and kurtosis.
III. Estimation of the population parameters of mean and SD.
IV. **Graphical Methods**: These include frequency polygon graphs, bar diagrams and pie charts.

**Inferential Analysis**

This is also known as the testing of hypotheses. It involves the use of statistical techniques in order to arrive at generalizations and conclusions about the nature of the data and the relationship between various scores.

### 4.6 Ethical issues in the experimental research

Besides the technical aspects of the process of experimental research, various ethical considerations based need attention prior to commencing upon the experimental research study. Experimental educational research involves working with the people. Since the study is conducted on humans, the researcher has to contend with the complexity and unpredictability of human behavior and the likelihood of its changing under observation. Due to this, the experiment is conducted in strictly controlled conditions and designing such that their purpose is not immediately apparent to the subjects of the experiment. Therefore, on the one hand the exigencies of the experimental situation may necessitate manipulation and deception, there is on the other hand, the need for proper conduct of the experiment in the relation with and behavior towards the subjects according to moral principles governing human behavior and relationships. Due to this, there arises an ethical dilemma or ethical concerns in experimental research.

The conflict between scientific principles and ethical consideration in the process of research is sometimes unavoidable and begs the question whether a violation of ethical principles is justified by the importance and significance of the study and its contribution towards the human welfare. The areas of concern in an experimental study include:
**Informed consent:** the subject’s complete understanding of the procedures is necessary. For the present study, the subjects were adult student teachers. Therefore the consent of the student teachers as well as the consent of the concerned head of the institutions was secured before the commencement of the study.

**Invasion of privacy:** it is an invasion of privacy to observe and record intimate behaviors that the subjects have reason to believe in private. In the present study, the questions about invasion of privacy did not arise because the study was conducted in a normal classroom setting, as normal teaching.

**Confidentiality:** the ethical researcher holds all information that he or she may gather about the subjects in strict confidence disguising the participant’s identity in all records and reports. For the present study, the results of the test conducted by the researcher were kept confidential. Also, the information gathered by the researcher was generally related to day to day life and there was nothing embarrassing or discomforting to the participants.

**Protection from physical and mental stress, harm or danger:** the researcher must take all the precautions to protect his/her subjects from physical or mental harm. Since the present study has taken place in normal classroom settings and surroundings of the college, there was no problem of stress or harm to students. Conduct of the information literacy skills module was done naturally as part of the normal curriculum.

**4.7 Summary**

This chapter has outlined the methodology and the methods that were used in carrying out the study, the sample and sampling used research instruments that were used in gathering data, and data analysis. Chapter 5 will discuss in detail about the information literacy instruction modules.