CHAPTER-IV
METHODOLOGY

4.1. INTRODUCTION

Research Methodology is of utmost importance in the research process. It describes a systematic study of solving the research problem, such as the manner in which a research problem is formulated, definitions of the terms, choice of subjects for investigation, the validation of data-gathering tools, collection of data, analysis and interpretation of the data, and the process of inferences and generalizations (Koul, 1997). Research methodology involves ways of organizing the fund of available knowledge as well as exploring, creating new knowledge, adoption of appropriate techniques and adoption of suitable statistical procedures (Best and Kahn, 2004). Methodology of investigation is the core component of any research work. Success of all the research studies depends on the methodology adopted and the tools and techniques employed.

The details of the method adopted, variables selected, tools used, sample selected, and procedure adopted and the statistical techniques used for the analysis of data are described under appropriate heads and are presented below:

4.2. RESEARCH DESIGN

Major responsibility of the researcher is to set up a research design capable of providing the solution of the problem while unity of research makes it possible to say that one aspect is more crucial than another design is overall scheme of research and research design is a strategy of investigation. In any research project, design provides the investigator a blue print of research dictates the boundaries of the project and helps in controlling the experimental extraneous and error variance of the problem under investigation.
To carry out an activity smoothly and successfully, proper planning is a prerequisite condition. A problem either educational or social can be resolved only if it is investigated in a scientific and planned way. In this chapter, the plan and procedure adopted for the study under reference is discussed and explained in a systematic way. Plan and procedure of an activity clearly give a picture about the means and ways required to complete the study i.e. type of data needed, how the sources of data were selected, and what data gathering devices were employed. Thus, the phrase “while discoveries cannot be planned, work must be planned as it leads to discoveries” was followed. The plan and procedure adopted to complete this study is given below under different headings such as:

Method of the Study

Variables

Research tools employed in the study

Locale of the study

Sample of the study

Data collection

Statistical Techniques used

4.3. METHOD OF THE STUDY

The method of research concerns itself with the present phenomena in terms of conditions, practices, beliefs, processes, relationship (or) trends. Every study is distinguished on the basis of its different purposes and approaches. Therefore, so many methods have been developed. As the present study aims to study the relationship
between learning style, thinking style and teaching competency of prospective teacher, the Normative Survey Method is adopted in the present study. It is considered as one of the best method in education, it describes the current status of the research work. It involves interpretation, comparison, measurement, classification, evaluation and generalization all directed towards a proper understanding and solution of significant educational problems.

4.3.1. VARIABLES OF THE STUDY

Something that can change in value and can be measured is known as a variable. It can be an aspect of experimental situation or a characteristic that changes in different individuals. Variables are the conditions or the characteristics that the experimenter manipulates or controls or observes (Best and Kahn, 2004).

In the present study, the investigator takes into consideration, mainly, two types of variables, viz., the independent and the dependent variables.

4.3.1.1. INDEPENDENT VARIABLES

The independent variables are the conditions or characteristics, that the investigator manipulates, controls in his attempt to ascertain their relationship to the observed phenomena. The variable, which is manipulated by the investigator, or the variable, which is suspected of being the cause in the investigation is called the independent variable. “It is under the direct control of the investigator who may vary it into any direction, desired” (Sax, 1979).

In the present study, the “Learning Styles and Thinking Styles of prospective teacher” are the independent variable.

4.3.1.2. DEPENDENT VARIABLE

Dependent variables are the conditions or characteristics that appear, disappear, or change as the investigator introduces, removes or changes the independent variables.
The variable that is dependent on something is called the dependent variable. Dependent variable is measured before and after manipulation of the independent variable. In the present study, the dependent variable is the Teaching Competencies of the prospective teachers.

4.4 SELECTION OF TOOLS

A successful research essential ingredient is a tool. Relevant data to find a solution is collected only with the suitable tool. So the selection of tool is an important process that has to be carried out. Both in India and foreign context, there are various tools available to collect the necessary data for a research study. A researcher can select suitable tool for his study. In case if there is no tool available it is advisable to prepare necessary tools which are appropriate for the study. In researches to study learning styles, thinking styles and teaching competencies researchers had used various tools. In formal education investigators like Agarwal (1983), Davis (1985), Delargy (1991), Furnham et al (2002), Golden (2001), Sudhesh Kumar (1997) used learning style inventory and questionnaire to study the learning styles of a teachers. On the other investigators like Grigorenko and Sternberg (1993), Fer (2007), Gurel & Nergis Ayse (2009), Lam (2000), Richmond et al. (2006), Sternberg, (1997) used thinking style inventory to study the thinking style of a teachers. The investigators like Anisha (2008), Bal Krishna pal (2000), Komur, Sevki(2010), Mutambo (2008), Pushpam, & Soundararajan, (2004) used more than one tools like teaching competency scale, teaching competency inventory, observation Schedule for teaching competency and interviews to study the teaching competency. Major tools used in the above studies are rating scale, questionnaire, interviews, etc. All these devices cannot be claimed to have worked well in the present study. So depending upon the nature and purpose of the study, the researcher has decided to prepare his own tool for his study. But referring to above tools gives deeper insight to
the researcher about the preparation of the required tools for the present investigation. Considering the various tools used by the researchers to assess learning style, thinking style and teaching competency the investigator developed his own tools to assess the learning style, thinking style and teaching competency of the prospective teachers.

4.4.1. DEVELOPMENT OF THE RESEARCH TOOLS

Research tool is one of the most important devices in the acquisition data. Each research tool is appropriate in a given situation to accomplish a particular purpose (Best and Kahn, 2000). The nature of the tools plays an important role in any research. The research tools employ distinctive ways of describing and quantifying the data and yield information which can be most effectively used. The main objective of the study is to assess the learning style and thinking style of prospective teachers and its relation to teaching competency. For the above objective the following research tools are developed.

- Learning Style Inventory (LSI)
- Thinking Style Inventory (TSI)
- Observation Proforma for Teaching Competency

4.4.2. LEARNING STYLE INVENTORY

Preferred styles guide the way persons learn. We learn using our preferred learning styles. Learning styles group common ways in which people learn. Merrill (2000) argued that most students are unaware of their learning styles. Knowledge of one’s learning styles can be used to increase self-awareness about their strengths and weaknesses as learners. All the advantages claimed for metacognition (being aware of one’s own thought and learning processes) can be gained by encouraging learners to become knowledgeable about their own learning and that of others (Coffield, 2004). There is little evidence for the efficacy of most learning style models (Wilson, 1986).
Keefe (1979) defines learning styles as the “composite of characteristic cognitive, affective and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment”. Stewart and Felicetti (1992) define learning styles as those “educational conditions under which a student is most likely to learn”. Learning style refers to the way one internally represents experiences and recalls or processes information. Based on the review of related literature with the deeper insight and theoretical framework on the concept of learning style a rough draft items were developed which is grouped under six main learning styles namely Enactive reproducing, Enactive constructive, Figural reproducing, Figural constructive, Verbal reproducing, Verbal constructive as stated by Felicetti (1992) and Karuna Shankar Misra (2005). The draft items were stated with the help of above learning style classification. The items were stated without any ambiguity. The items were given in a more clear and concise manner. The drafted items were given to the group of experts and the some items were reworded, edited, and some items were deleted. Thus 42 items were finalized in the Learning Style Inventory. The final version of the Learning Style Inventory is given in Appendix I.

The items number with respect to six types are mentioned in the Table 4.1

Table 4.1 Items number with respect to six learning style types

<table>
<thead>
<tr>
<th>S.No</th>
<th>Type of learning style</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enactive Reproducing (ER)</td>
<td>1,4,7,10,13,16,19</td>
</tr>
<tr>
<td>2</td>
<td>Enactive Constructive(EC)</td>
<td>22,25,28,31,34,37,40</td>
</tr>
<tr>
<td>3</td>
<td>Figural Reproducing (FR)</td>
<td>2,5,8,11,14,17,20</td>
</tr>
<tr>
<td>4</td>
<td>Figural Constructive(FC)</td>
<td>23,26,29,32,35,38,41</td>
</tr>
<tr>
<td>5</td>
<td>Verbal Reproducing(VR)</td>
<td>3,6,9,12,15,18,21</td>
</tr>
<tr>
<td>6</td>
<td>Verbal Constructive(VC)</td>
<td>24,27,30,33,36,39,42</td>
</tr>
</tbody>
</table>
The enactive reproducing and enactive constructive was clubbed to as Enactive learning style, similarly figural reproducing and figural constructive was combined to represent Figural learning style and likewise verbal reproducing and verbal constructive is combined to term it as verbal learning style. On the other hand enactive reproducing, figural reproducing and verbal reproducing is representing the reproducing learning style whereas the enactive constructive, figural constructive and verbal constructive represent constructive learning style

4.4.2.1. ADMINISTRATION OF THE LEARNING STYLE INVENTORY

The questionnaire has no time limit. An average subject requires approximately 15-20 minutes for completing this. The subject has to score in a 5 point rating scale.

4.4.2.2 SCORING OF THE LEARNING STYLE INVENTORY

There are five response alternatives for each learning behavior. They are very much, much, normal, less and very less. These responses are to be scored by awarding a score of 5, 4, 3, 2 and 1 respectively. Scores on the seven items belonging to each learning style are to be added together to find scores for each the six types of learning styles i.e. ER, EC, FR, FC, VR and VC. Scores on ER and EC are to be added to get the score for Enactive Learning style (ELS). Scores on FR and FC are to be added to get the score for Figural Learning style (FLS). Scores on VR and VC are to be added to get the score for Verbal Learning Style (VLS). Scores on ER, FR and VR can be added to get the score for Constructive Learning Style (CLS).

The minimum and maximum score on this inventory could be 42 to 210.

4.4.2.3 PRELIMINARY TRY OUT OF THE LEARNING STYLE INVENTORY

After planning the test items and scoring keys, the preliminary draft was administered on a sample of 100 prospective teachers to find out the ambiguity and adequacy of language. It also helped to detect the omissions and mistakes if any, to
examine whether the stated items were actually measure what it suppose to measure. It is also made clear whether the prospective teachers are able to follow the test items and to examine whether the time allotted was sufficient or not. The problems faced by the prospective teachers were asked in the form of suggestions and as a result of preliminary try out 10 test items were modified.

4.4.2.4 FINAL TRY OUT

The purpose of the final try out was to provide data for determining the reliability and validity of the questionnaire. This also helped to determine the number of test items to be included in the final form of the questionnaire. The number of the subjects in the final tryout was raised to 125. In the preliminary tryout, the number of the subjects was kept low because the clarity of instructions and the language was to be judged. In the final try out the number has to be increased because the investigator has to use data for estimating the reliability of the questionnaire.

4.4.3. THINKING STYLE INVENTORY

Thinking style is our preferred way of thinking and managing our activities. Sternberg (1997) defines thinking style as a personality attribute for utilization of abilities. He has proposed a theory of thinking styles intended to illuminate the differences in the way people think. Sternberg has described 13 separate characteristics and five categories that comprise his theory of thinking styles. According to the theory, people can be understood in terms of the functions, forms, levels, scopes and leanings of government. Function refers to how the mind copes with the world. He explained three distinctive thinking styles in the functioning of mind- legislative, executive and judicial. Form refers to the preferred ways of approaching and dealing with problems. They are oligarchic, monarchic, hierarchic, and anarchic. Levels refer to the medium or amount of engagement individuals prefer in a given activity. Levels of thinking styles are global and
local. Scope divides the individual into two personalities that is internal and external. Leanings explain the method and rules by which people solve problem such as progressive and constructive.

The scores for thinking styles of the prospective teacher were collected by using the TSI developed the researcher himself. TSI is based on the R.J. Sternberg (1997) Theory of Mental Self Government. This questionnaire consisted of 78 items selected on the basis of characteristics of thinking styles given by Sternberg. These items belonged to five different categories: (1) Functions (2) Form (3) Levels (4) Scope (5) Leaning. These categories further divided into sub categories. Characteristics of all sub categories are mentioned in the Table 4.2.

**Table 4.2 Thinking Style Dimension and Characterization**

<table>
<thead>
<tr>
<th>Thinking Style Dimension</th>
<th>Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislative</td>
<td>Likes to create, invent, design, do things his or her own way, have little assigned structure</td>
</tr>
<tr>
<td>Executive</td>
<td>Likes to follow directions, do what he or she is told, be given structure.</td>
</tr>
<tr>
<td>Judicial</td>
<td>Likes to judge and evaluate people and things</td>
</tr>
<tr>
<td>Monarchic</td>
<td>Likes to do one thing at a time, devoting to it almost all energy and resources.</td>
</tr>
<tr>
<td>Hierarchic</td>
<td>Likes to do many things at once, setting priorities for which to do when and how much time and energy to devote to each.</td>
</tr>
<tr>
<td>Oligarchic</td>
<td>Likes to do many things at once, but has trouble setting priorities.</td>
</tr>
</tbody>
</table>
Anarchic | Likes to take a random approach to problems; dislike systems, guidelines, and practically all constraints.
---|---
Global | Likes to deal with big picture, generalities, and abstractions.
---|---
Local | Likes to deal with details, specifics, concrete examples.
---|---
Internal | Likes to work alone, focus inward, be self-sufficient.
---|---
External | Likes to work with others, focus outward, be inter-dependent.
---|---
Progressive | Likes to do things in new ways, defy conventions
---|---
Conservative | Likes to do things in tried and true ways, follow conventions.

Each item represents one sub category. The items number with respect to their categories and sub categories are mentioned in the table 4.3.

**Table 4.3 Thinking style type and category wise item numbers**

<table>
<thead>
<tr>
<th>Category</th>
<th>Thinking style</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Legislative</td>
<td>1,14,27,40,53,66</td>
</tr>
<tr>
<td></td>
<td>Executive</td>
<td>2,15,28,41,54,67</td>
</tr>
<tr>
<td></td>
<td>Judicial</td>
<td>3,16,29,42,55,68</td>
</tr>
<tr>
<td>Form</td>
<td>Hierarchic</td>
<td>8,21,34,47,60,73</td>
</tr>
<tr>
<td></td>
<td>Monarchic</td>
<td>9,22,35,48,61,74</td>
</tr>
<tr>
<td></td>
<td>Oligarchic</td>
<td>10,23,36,49,62,75</td>
</tr>
</tbody>
</table>
4.4.3.1. SCORING OF THE QUESTIONNAIRE

Five point rating is given in the Thinking Style Inventory. Items will be scored as ‘5’, ‘4’, ‘3’, ‘2’ and ‘1’ for extremely well, very well, well, slightly well and not at all well respectively. The total score of the respondent will be obtained by adding the scores given for each items in the questionnaire. Appropriate directions to test items were prepared. The directions were clear and concise so that the prospective teachers understand them easily. Instructions were given at the beginning of the test items. The prospective teachers were instructed to put tick mark under their selected options.

4.4.3.2. PILOT STUDY

A pilot study has been conducted to find out the suitability of the test items for investigation. 100 prospective teachers from the study area were taken for the pilot study. The thinking style inventory (TSI) has been administered to them requesting them to point out the suitability of the items in the tool for the investigation. Based on their responses, a few items were modified and restructured. The developed tool is also given to a team of experts for their opinion. Based on the prospective teachers’ data and suggestions and experts opinion the tool is restructured. The final form of the tool is given in the Appendix II.
4.4.4. OBSERVATION PROFORMA TEACHING COMPETENCY

A proforma for assessing teaching competency was developed by the researcher with the help of the supervising teacher and consulting with many experts in test construction and senior teachers who are working in this field. According to their suggestions and reviewing the literature in this field, the concept teaching competency was taken as the collective output of different competencies that a teacher demonstrates while teaching. The researcher identified the components of teaching competency referring the forms of teaching competency by Borrich and Fenton(1997) and identified eight components of teaching competency namely knowledge competency, classroom performance competency, communication competency, professional competency, social competency, innovativeness competency, classroom management competency and evaluation competency. Six statements were constructed for each and every component. Each of these statements gives the observable behavior that a prospective teacher demonstrate while teaching. A five point scale was used for rating the performance of prospective teachers as excellent, good, average, moderate and poor.

4.4.4.1. SCORING SCHEME

Altogether 48 observation statements were scored in five point rating scale as excellent, good, average, moderate and poor. Scores were given as 5,4,3,2 and 1 respectively. The overall score of the prospective teachers vary from a maximum of 240 to a minimum of 48.

4.4.4.2. PILOT STUDY

A pilot study has been conducted to find out the suitability of the test items for investigation. 100 prospective teachers from the study area were taken for the pilot study. Teaching competency proforma has been administered to them requesting them to point
out the suitability of the tools for the investigation. Based on their responses, a few items were modified and restructured. The final form of the tool is given in the Appendix III.

4.5. RELIABILITY AND VALIDITY OF THE TOOLS

Reliability asserts the accuracy or precision of a measuring instrument. It is the consistency of the measurement or the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects. In short, it is the responsibility of the measurement. A measure is considered to be reliable if a person’s score on the same test given twice is similar. “It is important that reliability is not measured, but, it is estimated” (Best & Kahn, 2004). A test is reliable to the extent that it measures accurately and consistently from one time to another. A reliable measuring tool is one which gives the same measurements when you repeatedly measure the same unchanged objects or events. 100 prospective teachers were selected and they were administered with the LSI.

Henry, E. Garrett (1966) says, “A test score is called reliable when we have reasons for believing the score to be stable and trustworthy. In fact, a comparison of scores made upon repetition of an unreliable test, or upon two parallel form of the same test, will reveal many discrepancies some large and some small test in the two scores made by each individual in the group. The correlation of the test with itself, computed in several ways is called the reliability co-efficient of the test.

Henry, E. Garett (1966) describes four methods of establishing the reliability of a test. They are: (a) Test-retest method (b) Alternate or parallel forms (c) Split-half method (d) Rational equivalence method. Of these four procedures, the split-half method is regarded by many as the best of the methods for measuring test reliability (Garette, E
Henry and Woodworth, 1981). This method is used by many investigators because the data for calculating reliability are obtained from one occasion so that variations brought about by differences between the two testing situations are eliminated.

In the split-half method, the test is divided into two equivalent ‘halves’ and the correlation is found for these half-tests by using Karl Pearson’s correlation co-efficient formula.

\[
r = \frac{N\Sigma xy - \Sigma x \Sigma y}{\sqrt{(N\Sigma x^2 - (\Sigma x)^2)(N\Sigma y^2 - (\Sigma y)^2)}}
\]

Where

\( r = \) Correlation co-efficient

\( x = \) Score obtained in one half of the test

\( y = \) Score obtained in another half of the test

\( \Sigma x = \) Sum of obtained x values

\( \Sigma y = \) Sum of obtained y values

\( \Sigma x^2 = \) Sum of squared x values

\( \Sigma y^2 = \) Sum of squared y values
\[(\Sigma x)^2 = \text{Squared value of the sum of obtained } x \text{ values}\]

\[(\Sigma y)^2 = \text{Squared value of the sum of obtained } y \text{ values}\]

\[N = \text{Number of cases}\]

From the reliability of the half test, the self-correlation of the whole test is then estimated by using Spearman Brown Prophecy formula.

\[r_{11} = \frac{2r_{12}1/11}{1+r_{12}1/11}\]

\[r_{11} = \text{Reliability co-efficient of the whole test}\]

\[r_{12} = \text{Reliability co-efficient of the half test found experimentally}\]

**4.5.1. RELIABILITY OF THE LEARNING STYLE INVENTORY (LSI)**

In this study, the investigator has used split half method to estimate the reliability of the learning style inventory.

From the obtained data, odd numbered and even numbered scores were pooled out separately and correlation between these two sets of test scores have been computed by using Karl Pearson’s formula (r value 0.61). From the half-test reliability, the reliability of the whole test was estimated by using Spearman Brown’s Prophecy formula.

The obtained r- value is high (0.76) indicating the reliability of the Learning Style Inventory used in the study.
4.5.1.1. RELIABILITY OF THE THINKING STYLE INVENTORY (TSI)

The reliability for the half test is found to be 0.96. From this half test reliability, the whole test reliability is calculated by using spearman Brown Prophecy formula. The obtained r- value is high (0.98) indicate the reliability of the Thinking Style Inventory used in the study.

4.5.1.2. RELIABILITY OF THE OBSERVATION PROFORMA FOR TEACHING COMPETENCY

The reliability for the half test is found to be 0.92. From this half test reliability, the whole test reliability is calculated by using spearman Brown Prophecy formula. The obtained r- value is high (0.96) indicating the reliability of the Observation Proforma for Teaching Competency used in the study.

4.5.2. VALIDITY OF THE RESEARCH TOOLS

Validity is the quality of research tool or procedure that measures what it proposes to measure. A tool is said to be valid if it possesses content validity, face validity and intrinsic validity. According to John W. Best (2004), “validity is the quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure”. The index reliability is sometimes taken as a measure of validity (Garett Henry & Woodworth, 1981). Several kinds of Validity are ascertained.

4.5.2.1. CONTENT VALIDITY

The Content validity shows the adequacy of the content of a test. The tool used in the current study possessed content validity. The items in the tool were based on the relevant literature and consultation with experts in the field. Their valid suggestions were
taken into account while constructing and restructuring Learning Style Inventory, Thinking Style Inventory (TSI) and Observation Proforma for Teaching Competency used in the study and thus the tools used in this study possessed content validity.

4.5.2.2. FACE VALIDITY

Face validity refers to the way the test appears to those it is meant, to experts and educationists. That is, the test items should be related to the variable being measured based on the expert’s consultation and the opinions, it can be said that the Learning Style Inventory (LSI), Thinking Style Inventory (TSI) and Observation Proforma for Teaching Competency possesses face validity.

4.5.2.3. INTRINSIC VALIDITY

Intrinsic validity is stated as how well the obtained scores measure the test true score components. Square root of the reliability value of the scale is its intrinsic validity. Intrinsic validity of the Learning Style Inventory (LSI), Thinking Style Inventory (TSI) and Observation Proforma for Teaching Competency were found to be 0.87, 0.99 and 0.97 respectively. Thus the research tools used in the study possesses intrinsic validity.

4.6. LOCALE OF THE STUDY

The study was conducted in six College of Education, in various districts of Tamil Nadu.

4.7. SAMPLE OF THE STUDY

Sample of the study is a small portion of the 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 it are drawn (John W, Best and James V. Kahn, 2007). There are around 605 college of education in Tamil Nadu. In the present study, the six B.Ed Colleges from five Districts namely Dindugul, Karur, Erode,
Salem and Thanjavur were selected randomly for the present investigation. 600 prospective teachers from the above six colleges served as a sample for the present study.

4.8. DATA COLLECTION

The investigator visits various college of education and obtains prior permission from the authorities for collecting the required data from prospective teachers. The investigator went to the College of Education with the copies of the Learning Style Inventory (LSI), Thinking Style Inventory (TSI) and Observation Profoma for Teaching Competency (OPTC). He administered the tools one by one with the help of the teacher educator. Enough time was given for the prospective teachers to complete their responses.

4.9. STATISTICAL TECHNIQUES ADOPTED IN THE STUDY

In the present study, the hypotheses were tested by employing the appropriate statistical techniques. The entire statistical procedure was done by the researcher himself with the help of the research guide.

Part-I deals with the background characteristics of the sample. Descriptive statistics like Mean, Median, Mode, Standard Deviation, skewness and kurtosis were calculated to explain the background characteristics of the sample.

In the Part –II, percentage analysis was done, to find out the number, percentage and level of agreement of the prospective teachers on learning style and thinking style.

In the Part –III, correlation analysis was done, to find out the relationship between Learning Styles, Thinking Styles and Teaching Competency of prospective teachers.
In the Part-IV, to find out the significant difference between the dependent and independent variables such as the learning style, thinking style and teaching competency of prospective teachers ‘t’ test and ‘f’ test were calculated.

The results and discussions are presented in the Chapter- V.