CHAPTER - III

METHODOLOGY

This chapter deals with the methodological details adopted in this study. The design, the sample chosen, the tools developed and used, and procedures of data collection are discussed in detail.

3.1 DESIGN OF THE STUDY

This study explored the influence of student teacher related factors, teacher educator related factors and institutional related factor on effectiveness of Computer Education course of B.Ed. programme. Here an attempt was made to explore the relationship of selected presage and context variables with the product variables related to computer education course. Since the study attempts to relate presage and product variables, measurement of the variables were done at two phases, once at the beginning of the course and again at the end of the course.

As the organised observations were made at two stages, this method resembles a pre-test post-test single group design, a type of pre-experimental design. But an experimental design needs to have an experimental intervention manipulated by the researcher. In the present research context, the computer education course on which study was centred, existed even before the study was taken up and the researcher had no control over it for any manipulation. Hence it is not an experimental study.

One of the purposes with which a survey study is taken up is to understand the relationship among the variables apart from describing the status. The present study was taken up to understand the relation of selected student teacher variables with institutional variable and teacher educator variables apart from understanding the status of institutions and teacher educators in selected variables. Hence it is a survey study.

3.2 SAMPLE

B. Ed. Colleges affiliated to the University of Mysore was the population of the study at institutional level. Teacher educators teaching ‘Computer Education’ course in the affiliated B.Ed. Colleges were the teacher educator
population of the study. Student teachers studying in the affiliated B. Ed. Colleges were the student teacher population of the study.

Multistage sampling was adopted to select the sample for the study. University of Mysore had 32 B.Ed. colleges under its jurisdiction (year 2007-08). E-maturity of all these institutions was assessed. 16 B.Ed. colleges were selected randomly for the further study.

Stratified random technique was employed to select the student teachers from these 16 teacher education institutions. From each of these selected colleges, 50 student teachers, 25 from Science background and 25 from Social science background, were randomly selected. Though the intended student teacher sample size was 800, since the number of student teachers with science background was less than 25 in some of the colleges, the sample size was 694. But due to absentees during post-test stage, the sample size of the student teachers remained 578.

The teacher educators who were teaching the Computer Education course in these 16 colleges constituted the teacher educator sample. List of the colleges selected for the study is given in annexure 1.

A schematic representation of the sampling procedure adopted in the study is given in the following figure.
3.3 **TOOLS**

The study involved assessment of student teachers’ computer knowledge, computer skill; attitude towards computer use, and computer self-efficacy; teacher educators’ computer knowledge, and computer skill, attitude towards computer use and institutional e-maturity, tools were developed to assess these variables. Following paragraphs give an account of the tools developed for the study.

3.3.1 **Development of student teachers’ computer knowledge test:**

Computer knowledge, in this study, refers to knowledge in basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web and E-mail. The survey of related literature revealed that tool to assess student teachers’ computer knowledge with accepted psychometric properties was not available. Hence the need for developing a tool to assess student teachers’ computer knowledge was felt.

**Steps followed in the development of a computer knowledge test:**

For the construction of computer knowledge test steps suggested by Transler and North (1957 as given in Kishan, 2008) were followed. The steps followed in the development of student teachers’ computer knowledge test is given in the following sections:

3.3.1.1 **Survey of the sub-areas in the subject field.**

In order to have a comprehensive test of computer knowledge, survey of relevant literature was carried out. The curriculum for the Computer Education course taught in Universities, the curriculum developed by NCTE for ICT in teacher Education, namely, ‘Information Communication Technology Literacy Curriculum for Teacher Education’ (NCTE, 2006), curriculum for ICT in teacher education developed by NCERT and UNESCO (2002a) and Computer skills listed in the other research studies (Evaluation and Accountability, Department of Education and Training Western Australia, 2007, Beichner, 1993) formed the basis for arriving at a list of Computer Knowledge areas. The listed areas were broadly presented in seven subheadings: Basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web and E-mail. Objectives were
formulated on these seven areas so that framework for constructing questions was drawn.

3.3.1.2 **Preparation of test items.**

Question items were prepared on all the seven areas of computer knowledge. Thus altogether there were 42 test items in the tool at this stage.

3.3.1.3 **Critical evaluation of the test items by the experts.**

Content validity is defined as the extent to which a set of items is relevant and representative of the concerned domain content (Anastasi, 1968; Cronbach, 1984). One widely used method of finding the content validity is developed by Lawshe (1975). It is essentially a method for gauging agreement among raters or judges regarding how essential a particular item is. Lawshe (1975) proposed that each of the subject matter expert raters (SMEs) on the judging panel respond to the following question for each item: "Is the skill or knowledge measured by this item 'essential,' 'useful, but not essential,' or 'not necessary' to the performance of the construct?" According to Lawshe (1975), if more than half the panellists indicate that an item is essential, that item has at least some content validity. Greater level of content validity exists as larger numbers of panellists agree that a particular item is essential. Using these assumptions, Lawshe developed a formula termed the content validity ratio (CVR).

Content Validity Ratio is calculated using the following formula (Lawshe, 1975):

\[
\frac{\left( Ne - \frac{N}{2} \right)}{\frac{N}{2}}
\]

where

- \( Ne \) = *the number of experts saying the item is essential.*
- \( N \) = *the number of experts to whom the items were given.*

We can infer from the CVR equation that it takes on values between -1.00 and +1.00, where a \( CVR = 0.00 \) means that 50% of the SMEs in the panel of size \( N \) believe that a measurement item is "essential." A \( CVR > 0.00 \) would, therefore, indicate that more than half of the SMEs believe that a particular
measurement item is “essential,” and, thereby, face valid. Lawshe (1975, p.568) has further established minimum CVR’s for different panel sizes based on a one-tailed test at the $\alpha=0.05$ significance level. For example, if 25 SMEs constitute the panel, then measurement items for a specific construct, whose CVR values are less than 0.37, would be deemed as not “essential” and would be deleted from subsequent consideration.

The tool with 42 items were presented to a group of seventeen experts from the area of ICT, which included teacher educators(11), experts from NIIT(2), research scholars working on ICT(3), and a school teacher (Annexure-11). The experts were requested to rate the items in a three point scale (1=not necessary, 2=useful, but not essential, and 3 = essential) with an additional request for their suggestions and comments on every item. The CVR calculated using the formula given. 35 items having CVR greater than 0.49 (Lawshe, 1975) were included in the test for preliminary administration.

The feedback was also collected on the structure of the test items and the grammatical correctness of the stem. The items were revised based on the observations and feedback given by the content experts.

3.3.1.4 **Try-out of the trial form.**

The test with 35 items was administered to a sample of 192 student teachers who were about to complete their B.Ed. course, since for tool development a large sample would eliminate subject variance (DeVellis, 1991). Tinsley and Tinsley (1987) suggest a ratio of 5 to 10 subjects per item. Thus, administration of the questionnaire containing 35 items to a sample size of 192 was considered satisfactory. The student teachers were also requested to give their feedback regarding structure of the item stems and the alternatives. The researcher interacted with the student teachers regarding the structure of the question, difficulty in understanding and the meaning of each item conveyed to them. The feedback was utilised in modifying the items.

3.3.1.5 **Statistical analysis of the responses to know the difficulty level and discriminative index.**

The tools so administered were scored. Total score of each of the student teacher in the test was calculated. The student teacher data were arranged in descending order of their total scores in the test. Top 27% of the student
teachers were identified as the Upper group and bottom 27% were identified as Lower group. The data obtained from this exercise was used to analyse the difficulty value and discrimination index of the items. Difficulty value (D.V.) refers to proportion of the total group who got the item right. Thus a high value indicates an easy item and a low value indicates a difficult item. The difficulty value of an item is calculated using the formula $D.V. = \frac{U+L}{2N} \times 100$

where

$U$= Number of right responses in the upper group
$L$= Number of right responses in the lower group
$N$= Number of students in either upper or lower group

Ebel (1965) has suggested that a test item which has difficulty index value ranging from 20 to 80 was acceptable for a test.

The data was also used to find the discriminative index of the items. Discrimination index was determined by two methods. In the first method, discrimination index of an item was calculated using the formula $D.I. = \frac{U - L}{N}$.

Ebel (1965) has suggested a reasonable criterion to use this index of discrimination.

<table>
<thead>
<tr>
<th>Index of discrimination</th>
<th>Item evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40 and above</td>
<td>Very good items</td>
</tr>
<tr>
<td>0.30 to 0.39</td>
<td>Reasonably good but possibly subject to improvement</td>
</tr>
<tr>
<td>0.20 to 0.29</td>
<td>Marginal items usually needing and being subjected to improvement</td>
</tr>
<tr>
<td>Below 0.19</td>
<td>Poor item to be rejected or improved by revision</td>
</tr>
</tbody>
</table>

The data was also used to find the discriminative index of the items by another method. For each of the items, an independent sample t-test was conducted between upper and lower groups by considering the scores of the student teachers in the respective items. The items for which t-value was
significant at 0.05 level were considered to be discriminating between student teachers from upper group and lower group.

Details of the difficulty value and discrimination index of the items are given in Annexure 3.

Among the 35 items of the trial form of the test, 29 items were found to be having acceptable values of difficulty value and discrimination index.

**Distractor analysis**

The data obtained from 128 student teachers was used for the distracter analysis from which 27% students of upper group and 27% students of lower group were selected. The frequency of the student teachers selecting various distracters and key were determined. The result of this exercise is given in the Annexure 4.

Based on the results of the distracter analysis options of some of the items (item no. 1, 2, 12, 20, 24 and 26) were either modified or changed.

**3.3.1.6 Selection of the best items for the final test.**

29 items fulfilled the criteria for the selection of the item. 28 items, four items each from seven areas from the initial tryout form of the computer knowledge test were retained in the final form of the test.

The distribution of the questions included in the final form of the test is given in the Annexure 5.

**3.3.1.7 Formulating precise instructions for administration and scoring.**

Instructions for the tool were given in simple language in which the respondents were asked to select one of the four options given for each of the question. A scoring key was also prepared.

The tool was translated into regional language (Kannada) and the equivalence of the two versions was validated by a language expert from Central Institute of Indian Languages (CIIL), Mysore.
3.3.1.8 Establishing the validity and reliability of the tool

The content validity of the tool was established by determining the content validity ratio for every item of the tool and including items having content validity ratio greater than 0.49.

The reliability of the tool was found out by determining Cronbach’s internal consistency coefficient which was found to be 0.58 and test retest reliability found on administering the tool to 74 student teachers with a gap of two weeks, was 0.57, which is moderately high.

3.3.2 Development of student teachers’ computer skill test:

Computer skill in this study refers to student teachers’ skills in performing operations in the areas of Basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web and E-mail.

The steps followed in the development of student teachers’ computer skill test is given in the following sections:

3.3.2.1 Identification of computer skills to be attained by the student teachers:

In order to get a comprehensive list of computer skills that are to be attained by the student teachers, a review of relevant literature was carried out. The curriculum for the Computer Education course taught in Universities, the curriculum developed by NCTE for ICT in teacher Education, namely, ‘Information Communication Technology Literacy Curriculum for Teacher Education’, curriculum for ICT in teacher education developed by NCERT and UNESCO (2002a) and Computer skills listed in the other research studies (Evaluation and Accountability, Department of Education and Training Western Australia, 2007, Beichner, 1993) formed the basis for arriving at a list of Computer Skills. The listed skills were broadly presented in seven subheadings: Basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web and E-mail.

3.3.2.2 Determining the method of measurement:

There are different methods of measuring skills. Performance test and self-assessment are frequently used methods. In the direct observation
method, the examinee would be given certain tasks to perform and the performance would be assessed against the standards. When an individual makes judgements and evaluations based on self-knowledge, a self-assessment is made (Shrauger & Osberg, 1981). Self-assessment refers to the involvement of learners in making judgements about their own learning, particularly about their achievements and the outcomes of their learning (Boud & Falchikov, 1989).

Self-assessment has several advantages. For example, individuals possess extensive information, which can be used to draw inferences about themselves, much more information than an external evaluator is likely to collect. The people being evaluated may also be aware of changes in their motives and attitudes that affect their behaviour and these changes may not always be elicited by external observers (Shrauger & Osberg, 1981). Another advantage of self-assessment is that it may decrease the time-investment teachers otherwise need to make in their assessment. In addition, using self-assessment assists the development of self-assessment skills and self-criticism (Dochy & McDowell, 1997). Other advantages of self-assessments through questionnaires are their apparent simplicity, versatility and low cost as a method of data gathering (Schaughnessy & Zechmeister, 1997).

Recently, there has been an upsurge of interest in self-assessment, as the role of self-assessment both in learning generally, and in the development of professional competence, has been recognised. Some studies have compared the prediction accuracy of self-assessment with the prediction accuracy for external measures, and reviews of the empirical literature have offered favourable evaluations of self-assessments (Sundstrom, 2005). It has been shown that self-assessments are affected by the scale used to measure them. When people assess their competence in broadly defined areas and when a relative scale is used, people rate themselves as above average. When the questions are specific rather than general and when an absolute scale is used, the self-assessment are more realistic (Ackerman et al., 2002). Though self-assessment methods are criticised by saying that when people judge themselves, they have a tendency to present themselves to others in a socially desirable way, and therefore the self-assessment might not be valid (Shrauger & Osberg, 1981), they could be very useful tools if the concurrent validity of
such tools are established by comparing the scores obtained through self-assessment with performance test.

For the present study self-assessment of student teachers’ computer skill was opted.

3.3.2.3 Determining the format of scaling:

Review of the literature revealed that in the self-assessment of skills, scaling format used varied from three point scale of ‘Yes’, ‘No’ and ‘Unable to say’ to four point scale of ‘unable to do’, ‘some skill’, ‘considerable skill’ and ‘able to use in lesson’ (McCoy, 2000). But with the specific nature of the skills identified, it was decided to have a dichotomous options ‘Yes’ and ‘No’.

3.3.2.4 Content validity and review by experts

In order to validate the list of skills for their comprehensiveness and to review the items, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed. The list of 77 items spread over seven areas was presented to a group of fourteen experts from the area of ICT, which included teacher educators(9), expert from NIIT(1), research scholars working on ICT(3), and a school teacher(Annexure 11). The experts were requested to rate the items in a three point scale (1 = not necessary, 2 = useful, but not essential, and 3 = essential) with an additional request for their suggestions and comments on every item.

Their responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.

The items with a CVR greater than 0.51(Lawshe, 1975) were retained in the test for administration. The content experts also suggested addition of few skills to the list. All skills which were suggested at least by two experts were added to the list.

3.3.2.5 Administration of the items to a development sample:

The scale with 82 items was administered to a sample of 192 student teachers who were about to complete their B.Ed. course, since for scale development a large sample would eliminate subject variance (DeVellis, 1991).
3.3.2.6 Analysis of the psychometric properties:

As the tool included the items based on the acceptable values of CVR, the test was said to have content validity.

The data was scored and used to find the discriminative index of the items. For this data collected from student teachers were arranged in descending order of their total scores in the test. Top 27% of the student teachers were identified as the Upper group and bottom 27% were identified as Lower group. For each of the items, an independent sample t-test was carried out between these groups by considering the scores of the student teachers in each of the items. The items for which t-value was significant at 0.05 level were considered to be discriminating between student teachers of upper group and lower group. Table given in annexure 6 gives the details of the discrimination index of different sections of computer skill test.

Further, to test the concurrent validity of the tool, the tool was administered to 20 student teachers selected randomly from a B.Ed. collage, to which a performance test was also done.

Results of the two forms of the test are presented in the following table:

The table values show that there is a very high and significantly positive correlation between self-assessment scores and performance test scores except for the database component. The mean scores obtained from self-assessment though marginally higher than the performance test scores, they are not significantly different. Hence the tool is said to have a very high concurrent validity.

The reliability alpha coefficient for the test was 0.88, which indicated that the items in the scale were highly inter correlated, and test retest reliability coefficient was found to be 0.82 on administering on a sample of 74 student teachers, which showed that the tool was highly reliable.

3.3.3 Development of Student teachers’ attitude towards computer use scale:

Attitude is a tendency to react favourably or unfavourably towards a designated class of stimuli, a custom or an institution (Anastasi, 1968).
Allport (1935) defined attitude as “a mental or neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual’s response to all objects with which it is related”.

The affective quality of attitude was also emphasised by Krech and Crutchfield (1948). They defined attitude as an enduring organisation of motivational, emotional, perceptual and cognitive processes with respect to some aspect of the individual’s world.

Attitude is considered as a hypothetical construct, being unobservable; it must be inferred from measurable responses that reflect positive or negative evaluation of the attitude object.

As discussed in section 2.9.3, there is no tool to measure the attitude of student teachers towards computer use and so such a tool is to be developed. For the scale development, the guidelines and steps suggested by DeVellis (1991) as given in Mishra and Panda (2007) was followed. The steps followed in the development of student teachers’ attitude towards computer use is given in the following sections:

3.3.3.1 **Generating an item pool**

The investigator thoroughly examined the available tools concerning attitudes towards computers in order to collect the statements. A large number of statements each expressing one opinion were collected after careful study of existing tools. For screening of statements thus obtained, the criteria given in annexure 8 were used.

Each statement was carefully examined in the light of these criteria. As a result of rigorous culling 42 statements about attitude of student teachers towards computers were identified.

3.3.3.2 **Determining the format of the scale**

At this stage, different scaling option was investigated. For attitude measurement Thurstone’s equal appearing interval scale and Likert’s scale are frequently used. From this, the Likert scale was chosen for its simplicity, wide use in attitude measurement, higher reliability coefficients with fewer statements, and method of summated ratings (Edwards & Kenney, 1946). Thus, for each statement the following five-point agreement /disagreement
scale given with the numerical values assigned to each point (which was reversed for negative statements) was used:

5 = strongly agree,
4 = agree,
3 = neither agree nor disagree,
2 = disagree, and
1 = strongly disagree.

3.3.3.3 Content Validity and Review by Experts:

In order to review the statements, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed. The list of 35 statements was given to twelve experts from ICT area, which included teacher educators (8), expert from NIIT(1), research scholars working on ICT(2), and a school teacher (Annexure 11), to rate how relevant the statements were to measure student teachers’ attitude towards computer use. A three-point scale (1 = not necessary, 2 = useful, but not essential, and 3 = essential) was used by them to rate the statements. These responses were analyzed to calculate the Content Validity Ratio (CVR) for each statement using the formula as given earlier.

31 statements were of CVR greater than required value of 0.54. But a lesser number of statement were desired, only statement with a CVR greater than 0.8 were included in the scale for administration. There were 25 statements in the scale at this stage of which 12 were negatively keyed.

3.3.3.4 Administration of the items to a development sample

The scale with 25 statements was administered to a sample of 192 student teachers who were about to complete their B Ed course, since for scale development a large sample would eliminate subject variance (DeVellis, 1991). Tinsley and Tinsley (1987) suggest a ratio of 5 to 10 subjects per statement. Thus, distribution of the questionnaire containing 25 statements to a sample size of 192 was considered satisfactory.

3.3.3.5 Analysis of the psychometric properties

The statements were scored as indicated in Step 2, with the twelve negative statements in the scale being reverse scored. The obtained scores
were used to find the discriminative index of the statements. For this, the student teacher data were arranged in descending order of their total scores. Top 27% of the student teachers were identified as the Upper group and bottom 27% were identified as Lower group. For each of the statement, an independent sample t-test was carried out between these groups by considering the scores of the student teachers in the respective statements. The statements for which t-value was significant at 0.05 level were considered to be discriminating between student teachers from upper group and lower group. The result of the t-test conducted is given in Annexure 10.

For 24 statements, t-values were found to be significant. These 24 statements were retained in the final form of the test.

The reliability alpha coefficient for the scale with 24 statements was 0.66, which indicated that the statements in the scale were highly intercorrelated and were all measuring the same attribute, i.e. attitude towards computer use. The test retest reliability coefficient was found, on administering the tool on 74 student teachers with a gap of two weeks, to be 0.62 which indicates that the tool was reliable.

3.3.4 Development of student teachers' computer self-efficacy scale:

Computer self-efficacy refers to a judgment of one’s capability to use a computer (Compeau & Higgins, 1995). To develop the computer self-efficacy scale the scale development guidelines and steps suggested by DeVellis (1991) were followed. The steps followed are as follows:

3.3.4.1 Generating an item pool

The investigator thoroughly examined available tools concerning computer self-efficacy. A large number of statements were collected after careful study of available tools. Computer self-efficacy represents an individual’s perceptions of his or her ability to use computers in the accomplishment of a task (i.e., using a software package for data analysis, writing a mail merge letter using a word processor), rather than reflecting simple component skills (i.e., formatting diskettes, booting up a computer, using a specific software feature such as “bolding text” or “changing margins”) (Compeau & Higgins, 1995), only those items which would reflect an
individuals’ perceptions of his or her ability to use computers in the accomplishment of a specified task were retained.

### 3.3.4.2 Determining the format of the scale

At this stage, different scaling option was investigated. For measurement of computer self-efficacy Likert’s scale is frequently used. It was also found that there is no uniform scaling being used with usage of five-point agreement/disagreement scale in some research (Eachus & Cassidy, 1997) and ten point numerical scaling with a scale value ranging from 1 to 10. As large number of scale values makes the distinction between neighbouring values difficult, it was decided to have five point numerical scaling with the values ranging from 0 to 4. The understanding of each number was considered to be as follows.

- 4 = Very high confidence
- 3 = High confidence
- 2 = Low confidence
- 1 = Very low confidence
- 0 = No confidence

The scale contained 29 items at this stage.

### 3.3.4.3 Content Validity and Review by Experts :

In order to review the items, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed. The list of 29 items was given to twelve experts from ICT area, which included teacher educators(8), expert from NIIT(1), research scholars working on ICT(2), and a school teacher (Annexure 11), to rate how relevant the items were to measure computer self-efficacy of student teachers. A three-point scale (1=not necessary, 2=useful, but not essential, and 3=essential) was used by them to rate the items. These responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.

The 23 items, with CVR greater than 0.54, were retained in the scale for administration.

### 3.3.4.4 Administration of the items to a development sample

The scale with 23 items was administered to a sample of 192 student teachers who were about to complete their B Ed course, since for scale
development a large sample would eliminate subject variance (DeVellis, 1991). Tinsley and Tinsley (1987) suggest a ratio of 5 to 10 subjects per item. Thus, distribution of the questionnaire containing 23 items to a sample size of 192 was considered satisfactory.

3.3.4.5 Analysis of the psychometric properties

The items were scored as indicated in Step 2. The data was used to find the discriminative index of the items. For this the student teacher data were arranged in descending order of their total scores in the test. Top 27% of the student teachers were identified as the Upper Group and bottom 27% were identified as Lower group. For each of the items, an independent sample t-test was carried out between these groups by considering the scores of the student teachers in the respective items. The items for which t-value was significant at 0.05 level were considered to be discriminating between student teachers from upper group and lower group. The result of the t-test conducted is given in annexure 13.

All the 23 items were found to be discriminating the student teachers of two groups. All the 23 items were retained in the final form of the tool.

The reliability alpha coefficient for the scale with 23 items was 0.93, which indicated that the items in the scale were highly inter correlated and were all measuring the same attribute, i.e. computer self-efficacy. The test retest reliability was found, on administering the tool on 74 student teachers with a gap of two weeks, to be 0.90 which shows that the tool is reliable.

The student teachers’ tools developed are given in annexure 11.

3.3.5 Development of Teacher Educators’ computer knowledge Test:

Following steps were followed in the development of a computer knowledge test:

3.3.5.1 Survey of the sub-areas in the subject field.

In order to have a comprehensive test of computer knowledge for teacher educators, survey of relevant literature was carried out. The curriculum for the Computer Education course taught in Universities, the curriculum developed by NCTE for ICT in teacher Education, namely, 'Information
Communication Technology Literacy Curriculum for Teacher Education’, curriculum for ICT in teacher education developed by NCERT and UNESCO (2002a) and Computer skills listed in the other research studies (Evaluation and Accountability, Department of Education and Training Western Australia, 2007, Beichner, 1993) formed the basis for arriving at a list of Computer Knowledge areas. The listed areas were broadly presented in eight subheadings: Basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web and e-mail. Objectives were formulated on these seven areas, so that framework for constructing questions was drawn.

3.3.5.2 Preparation of test items.

Test items were prepared on all the seven areas of computer knowledge. Thus altogether there were 56 test items in the tool at this stage.

3.3.5.3 Critical evaluation of the test items by the experts.

The tool with 56 items were presented to a group of twelve experts from the area of ICT, which included teacher educators (8), an experts from NIIT, and research scholars working on ICT(3) (Annexure 12). The experts were requested to rate the items in a three point scale (1=not necessary, 2=useful, but not essential, and 3=essential) with an additional request for their suggestions and comments on every item.

These responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.

The items were revised based on the observations and feedback given by the content experts.

The 45 items, with a CVR greater than 0.51, were included in the test for administration.

3.3.5.4 Try-out of the trial form.

The test with 45 items was administered to a sample of 96 teacher educators. They were also requested to give their feedback regarding structure of the question stems and options. The feedback was utilised in modifying the questions.
3.3.5.5 Statistical analysis of the items to know the difficulty level and discriminative index.

The tools, so administered, were scored. The data obtained from the teacher educators were arranged in descending order of their total scores in the test. Top 27% of the teacher educators were identified as the Upper Group and bottom 27% were identified as Lower group. The data obtained from this exercise was used to analyse the difficulty value and discriminate index of the items. The difficulty value of an item is calculated using the formula

\[ D.V. = \frac{U+L}{2N} \times 100 \]

where

- \( U \): Number of right responses in the upper group
- \( L \): Number of right responses in the lower group
- \( N \): Number of students in either upper or lower group

The data was used to find the discriminative index of the items. Discrimination index of an item is calculated using the formula

\[ D.I. = \frac{U - L}{N} \]

The discriminative index of the items was found by another method also. For each of the items, an independent sample t-test was conducted between upper and lower groups by considering the scores of the teacher educators in the respective items. The items for which t-value was significant at 0.05 level were considered to be discriminating between teacher educators in upper group and lower group.

Table in annexure 13 gives the difficulty value and discriminative index of 45 items and the result of the t-test carried out on the 45 items.

36 items found to be having difficulty value and discrimination index of acceptable level. The following table gives details of the difficulty value and discrimination index of the test items administered in the try-out stage and the action taken on them.

36 items were found to be having acceptable levels of difficulty value and discriminative index.
Distractor Analysis

The data of 27% teacher educators from upper group and 27% teacher educators from lower group were used for distractor analysis. The frequencies of the teacher educators selecting various distracters were determined. The result of this exercise is given annexure 14.

Based on the results of the distracter analysis options of some of the items (item no. 9, 16, 22, 24, 26, 38 and 42) were either modified or changed.

3.3.5.6 Selection of the best items for the final test on the basis of item analysis.

36 items from the initial try-out form of the computer knowledge test were retained in the final form of the test. The distribution of the questions of the test is presented in the following matrix given in annexure 15.

3.3.5.7 Formulating precise instructions for administration and scoring.

Instructions for the tool were written in simple language in which the respondents were asked to select one of the four options given for each of the question. A scoring key was also prepared.

3.3.5.8 Establishing the validity and reliability of the tool

The content validity of the tool was established by determining the content validity ratio for every item of the tool and including items having content validity ratio greater than 0.51.

The reliability of the tool was found out by determining Cronbach’s internal consistency coefficient which was found to be 0.86, which shows that the test is reliable.

3.3.6 Development of teacher educators’ attitude towards computer use scale:

Following steps were followed in the development of teacher educators’ attitude towards computer use scale:
3.3.6.1  **Generating an item pool**

The investigator thoroughly examined all the available tools concerning attitudes towards computer use in order to collect the statements. A large number of statements each expressing one opinion were collected after careful study of available tools. For screening of statements thus obtained, the criteria mentioned earlier given in annexure 8, were used.

Each statement was carefully examined in the light of those criteria. As a result of rigorous culling 42 statements about the attitude of teacher educators towards computers were retained.

3.3.6.2  **Determining the format of the scale**

At this stage, different scaling option was investigated. For attitude measurement Thurstone’s equal appearing interval scale and Likert’s scale are frequently used. From this, the Likert scale was chosen for its simplicity, wide use in attitude measurement, higher reliability coefficients with fewer items, and method of summated ratings (Edwards & Kenney, 1946). Thus, for each statement the following five-point agreement/disagreement scale given with the numerical values assigned to each point (which was reversed for negative items) was used:

- 5 = strongly agree,
- 4 = agree,
- 3 = neither agree nor disagree,
- 2 = disagree, and
- 1 = strongly disagree.

3.3.6.3  **Content Validity and Review by Experts**

In order to review the items, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed. The list of 42 items was given to twelve experts from ICT area, which included teacher educators (8), an experts from NIIT, and research scholars working on ICT(3) (Annexure 12). A three-point scale (1 = not necessary, 2 = useful, but not necessary, and 3 = essential) was used by them to rate the items. These responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.
3.3.6.4 **Administration of the items to a development sample**

The scale with 31 items was administered to a sample of 96 teacher educators, since for scale development a large sample would eliminate subject variance (DeVellis, 1991).

3.3.6.5 **Analysis of the psychometric properties**

The items were scored as indicated in Step 2, with the fifteen negative items in the scale being reverse scored.

The data was also used to find the discriminative index of the items. For this the student teacher data were arranged in descending order of their total scores in the test. Top 27% of the teacher educators were identified as the Upper Group and bottom 27% were identified as Lower group. For each of the items, an independent sample t-test was conducted between these groups by considering the scores of the teacher educators in the respective items. The items for which t-value was significant at 0.05 level were considered to be discriminating between teacher educators from upper group and lower group. The discrimination index of 31 items as a result of the t-test conducted on the 31 items is given in the annexure 16.

One item failed to discriminate between the upper group and lower group. That item (No. 4) was removed and hence final form of the scale had 30 items in which fifteen were negatively keyed.

The reliability alpha coefficient for the scale with 30 items was 0.94, which indicated that the items in the scale were highly inter correlated and were all measuring the same attribute, i.e. attitude towards computer use.

3.3.7 **Development of teacher educators’ computer skill test:**

Following were the steps followed in the development of the computer skill test:

3.3.7.1 **Identification of computer skills to be attained by the Teacher Educators:**

In order to get a comprehensive list of computers skills that are to be possessed by teacher educators, a review of relevant literature was carried out. The curriculum for the Computer Education course taught in Universities, the curriculum developed by NCTE for ICT in teacher Education,
namely, ‘Information Communication Technology Literacy Curriculum for Teacher Education’, curriculum for ICT in teacher education developed by NCERT and UNESCO (2002a) and Computer skills listed in the other research studies (Evaluation and Accountability, Department of Education and Training Western Australia, 2007, Beichner, 1993) formed the basis for arriving at a list of Computer Skills. The listed skills were broadly presented in eight subheadings: Basic Computer Operations, Word Processing, Spreadsheet, Presentation, Database, World Wide Web, e-mail and Using Computer in Teaching and Learning.

3.3.7.2 **Determining the method of measurement:**

There are different methods of measuring skills. Performance test and self-assessment are frequently used methods.

Self-assessment format of skill assessment was opted, as the target group is that of adults and for the convenience involved in the data collection.

3.3.7.3 **Determining the format of scaling:**

Review of existing tools revealed that in the self-assessment of skills scaling format used varied from three point scale of ‘Yes’, ‘No’ and ‘Unable to say’ to four point scale of ‘unable to do’, ‘some skill’, ‘considerable skill’ and ‘able to use in lesson’ (MeCoy, 2000). But with the specific nature of the skills identified, it was decided to have dichotomous options ‘Yes’ and ‘No’ which indicates possession of a skill and not having it respectively. But for the last component ‘Using Computer in Teaching and Learning’, it was decided that, instead of alternative response, a five point scale was to be used.

3.3.7.4 **Content validity and review by experts**

In order to validate the list of skills for their comprehensiveness and to review the items, the method followed by Biner (1993) as adapted from Lawshe (1975) was followed. The list of 110 items pertaining to eight areas were presented to a group of twelve experts from the area of ICT, which included teacher educators (8), expert from NIIT (1), and research scholars working on ICT (3). The experts were requested to rate the items in a three point scale (1 = not necessary, 2 = useful, but not essential, and 3 = essential) with an additional request for their suggestions and comments on every item.
Their responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.

The items with a CVR greater than 0.51 (Lawshe, 1975) were retained in the test for administration. The content experts also suggested addition of few skills to the list. All skills which were suggested at least by two experts were added to the list.

3.3.7.5 Administration of the items to a development sample

The scale with 125 items was administered to a sample of 96 teacher educators, since for scale development a large sample would eliminate subject variance (DeVellis, 1991).

3.3.7.6 Analysis of the psychometric properties

The data were scored as given in step 2 and used to find the discriminative index of the items. For this the student teacher data were arranged in descending order of their total scores in the test. Top 27% of the teacher educators were identified as the Upper Group and bottom 27% were identified as Lower group. For each of the items, an independent sample t-test was conducted between these groups by considering the scores of the teacher educators in the respective items. The items for which t-value was significant at 0.05 level were considered to be discriminating between teacher educators from upper group and lower group. Table given in annexure 17 shows the difficulty values and discrimination indices and the result of the t-test conducted.

The reliability alpha coefficient for the test was 0.70, which indicated that the items in the scale were highly inter correlated.

The teacher educators’ tools developed are given in annexure 18.

3.3.8 Development of e-maturity scale for teacher education institutions:

Institutional e-maturity is the capacity of a college or learning institution to make strategic and effective use of technology to improve educational outcomes (BECTA, 2006). Review of the literature yielded only one report, in which attempt to measure institutional e-maturity was made. Learning and Skills Network (2007) has made an attempt to measure e-maturity in the FE
sector. The tool used attitudes towards, and use of, technology amongst staff at FE colleges as the components of e-maturity. Further the tool was meant for institutions of further education, an e-maturity scale for teacher education institutions needed to be developed.

**Indicators of e-maturity:**

An indicator is a tool, mechanism to picture the state, qualitative or quantitative characteristic of an observed object by the form perceptible for a human being (Dictionary of International Words p. 311 in Chreptaviciene and Kondratas, 2005).

Five key indicators of e-maturity have been used to track trends over time (BECTA, 2006). These five indicators were used for the development of e-maturity scale. They are:

1. E-learning resources
2. Student access
3. Management and strategy
4. Use across the curriculum
5. Workforce skills

For the development of e-maturity scale for teacher education institutions, following steps were followed as given by Chreptaviciene and Kondratas (2005) in the preparation of a tool to measure ICT implementation stage of secondary schools:

**3.3.8.1 Identification of criteria for measurement of e-maturity:**

A criterion can notionally be defined as “basis for evaluation, measure, parameter” (Dictionary of International Words, p. 412 in Chreptaviciene and Kondratas, 2005). This is a feature according to which something is evaluated, measured, classified. Every criterion should be related to field, domain including evaluation systems and it is defined, identified by certain component elements, indicators and characterisations. Indicators and characterisations have to be defined by specific reasonable terms.

In order to evaluate the e-maturity of teacher education institutions, it was necessary to have such criteria by means of which the level of e-maturity would be easily identified. The e-maturity scale with eleven criteria in ‘E-
Learning Resources’ indicator, five criteria in ‘Student Access’ indicator, eight criteria in ‘Management Strategies’ indicator five criteria in ‘Integration Across Curriculum’ indicator and four criteria in ‘Workforce Skill’ indicator were identified. The criteria were given with response rubrics which were in interval scale.

3.3.8.2 Content Validity and Review by Experts:

In order to check the appropriateness and comprehensiveness of the criteria identified to measure e-maturity of teacher education institutions, the criteria were presented to a group of thirteen experts from the area of ICT, which included teacher educators (8), expert from NIIT(1), research scholars working on ICT(3), and a school teacher. The experts were requested to rate the items in a three point scale (1 = not necessary, 2 = useful, but not essential, and 3 = essential) with an additional request for their suggestions and comments on every item.

These responses were analyzed to calculate the Content Validity Ratio (CVR) for each item using the formula given earlier.

The 32 items, with a CVR greater than 0.51, were included in the scale for administration.

The e-maturity scale developed is given in annexure 19.

3.4 DATA COLLECTION

The data collection was carried out at two stages. In the first stage all the 32 B.Ed. Colleges affiliated to University of Mysore were visited, to have interaction with the Principals and the Teacher Educators teaching the Computer Education course. The e-maturity scale prepared by the researcher was used to collect and record data. Whenever possible the data obtained from these two sources were cross verified by interacting with the teacher educators and student teachers of the institutions.

In the second stage of the data collection, the data related to student teachers and teacher educators were collected. The academic year of the B.Ed. Collages affiliated to University of the Mysore starts in the month of January and will come to an end in the month of November. The B.Ed. colleges were visited twice, once in the month of February, i.e., in the beginning of the
academic year to collect the pre-test scores and teacher educator data and second time in the months of October and November, i.e., in the end of the academic year to collect the post test data from the student teachers.

3.5 SCORING:

The tools administered to student teachers and teacher educators were scored.

For scoring the computer knowledge of the student teachers and the teacher educators, the scoring key given in annexure 20 and 21 respectively were used. The items for which correct answer were identified were given one mark. Otherwise no mark was allotted. Marks obtained in each of the component of computer knowledge and in the total test were calculated.

The responses to the attitude scale was scored by giving weightages 5 to 1 for strongly agree to strongly disagree for positively keyed items and 1 to 5 for negatively keyed items. Total scores of all 24 items were found out.

The computer skill test was scored by giving one mark each for the selection of presence of skill. Total scores of the entire test were found out.

The computer self-efficacy was scored by giving weightages 0 to 4 as given in the scale of the tool. Total scores of all 23 items were found out for individual student teachers.

3.6 CONCLUSION:

The present chapter discussed the details pertaining to methodology followed in the study. The next chapter deals with the analysis of the data collected and its interpretation.

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99