CHAPTER 3

RESEARCH METHODOLOGY
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3.1 INTRODUCTION

The research methodology is the general pattern of organizing the procedure for collecting valid and reliable data for an investigation. It gives a detailed description of the research procedures that are followed during the investigation. The research methodology followed for the present investigation is discussed in detail in this chapter.

3.2 PILOT STUDY

The purpose of the pilot study was to ensure that the methods used are sound and to work out the kinks in a study protocols before launching a main experiment. Pilot study was the mock drill, which was conducted from August 2010 to January 2011.

Administrative permission was procured formally from the Principal of Maharshi Karve Stree Shikshan Samstha’s, Bakul Tambat Institute of Nursing Education (MKSSS’s BTINE) and the Principal of Tehmi Grant Institute of Nursing Education (TGINE), from where the sample was chosen. Sample was 75 students studying in second year basic B. Sc. Nursing course in MKSSS’s BTINE and TGINE. The sample was drawn by non-probability incidental sampling technique from the population. 36 students from MKSSS’s BTINE were in the experimental group and 39 students from
TGINE were in the control group. After removing the absentees in prerequisite test or summative tests (cognitive based and psychomotor based), the sample size reduced to 67 (experimental group consisted 36 students and control group consisted 31 students).

Prerequisite knowledge test was administered to test the previous learning that is essential for learning the new content. The result of this test was used to equate the experimental group and the control group. After equating both the groups, the control group was taught by conventional method and the experimental group was taught by Mastery Learning Approach. Mastery learning group received frequent formative tests and feedback until they achieved mastery in specified entry behavior. At the end, the students of both the groups were given summative test with the gap of one day after the last lecture. This test consisted of a paper pencil test and a practical (skill) test on drug administration.

The findings of this pilot study showed promising indicators that Mastery Learning Strategy would be effective in enhancing cognitive and psychomotor domain of the students. During pilot study, because of time constraint effect of Mastery Learning on retention was not investigated. Limitation of time constraint was taken care of at the time of final study. The experience gained in the pilot study was used to fine-tune the research approach, the research design, teaching learning material, and the research methodology for the present investigation.
3.3 RESEARCH APPROACH & RESEARCH DESIGN

Experimental research approach is a systematic, objective method of discovery with empirical evidence under rigorous control. The control is achieved by holding constant all the conditions except for the phenomenon under study for both the experimental group and the control group. Research approach and research design is the blueprint of the procedures that enable the researcher to test hypotheses.

The research design helps the researcher in the selection of subjects for observation, and in determination of the type of analysis to be used for interpretation of the data. The selection of the research design depends upon the purpose of the study and the conditions under which the study is conducted.

For the present study, the researcher adopted quasi-experimental, pretest, posttest, control group design. Quasi-experimental design is same as classic controlled experimental design except the style of assigning subjects to two groups. In classic controlled experimental design, there is random assignment. On the other hand, Quasi-experimental designs are commonly employed in the evaluation of educational programs when random assignment of subjects to the two groups is either not possible or not practical. Thus in a quasi-experimental design, the research substitutes statistical controls for the absence of physical control of the experimental situation. In all cases, when human subjects are involved, there is never a 100% guarantee that the results of an intervention can be completely attributed to the intervention itself, with no regard for the opinions and practice of the individuals involved. Simply stated, true or classical experiments work well in laboratory settings while quasi-experiments work well in natural settings. (Schoenfeld, 2006).
Schematic of research design followed for carrying out the present research work is presented in figure 3.1 given below.

**Target population:** Second year students of basic B.Sc. nursing course.

**Sample:** Second year students of basic B.Sc. nursing course studying in academic year 2011-12 in MKSSS’s BTINE and TGINE recognized by INC and MUHS. Sample size = 76.

**Experimental Group**
MKSSS’s BTINE
Sample size = 38

**Control group**
TGINE
Sample size = 38.

Assessment of prerequisite knowledge

Experimental group → Treatment / Intervention → Control group

Teaching by Mastery learning approach → Formative tests on units → Yes → Post-test → Data analysis and interpretation

Mastery → No → Remedial teaching

FIGURE 3.1: SCHEMATIC PRESENTATION OF RESEARCH DESIGN
3.4 VARIABLES OF THE RESEARCH

Variables are anything that can change or affect the results of a study. In an experimental method, the experiment is conducted by changing the value of one variable and measuring the changes in another variable while holding or assuming surroundings constant. The variable that is varied by the experimentalist is called an independent variable and variable that is measured is called as dependent variable. Variables that are held constant are called controlled variables and those, which are not controlled but can affect the outcome are called extraneous variables. In general, many variables need to be considered in any experimental study. Obviously, if the number of variables involved is more, more complex is the study.

Present study is based on teaching-learning process. Teaching and learning is a process that includes many variables such as teacher characteristics, subject contents taught, students’ characteristics etc. In addition, these variables interact as learners work towards their goals and incorporate new knowledge, behaviors, and skills that add to their range of learning experiences.

In the present study, the researcher identified many variables involved in the experiment. These variables are listed in table 3.1. This table also gives the classification of the variables into independent variables, dependent variables, controlled variables, and extraneous variables.
TABLE 3.1: CLASSIFICATION OF THE VARIABLES INCLUDED

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variables</th>
<th>Controlled variables</th>
<th>Extraneous variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Mastery Learning Model of teaching</td>
<td>1) Summative test (cognitive based) scores</td>
<td>1) Prerequisite knowledge</td>
<td>1) Mother tongue</td>
</tr>
<tr>
<td></td>
<td>2) Summative tests (psychomotor based) scores</td>
<td>2) Topic taught - parenteral drug administration</td>
<td>2) Scores in H.S.C. Exam</td>
</tr>
<tr>
<td></td>
<td>3) Retention tests (cognitive based and psychomotor based) scores</td>
<td>3) Class of students – second year basic B.Sc. nursing students</td>
<td>3) Scores in first year basic B.Sc. nursing university exam</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Teacher</td>
<td></td>
</tr>
</tbody>
</table>

As stated in the above table, there are four controlled variables, which the researcher has controlled, so that they do not have any influence on the results caused by the intervention carried during experiment. The first variable of prerequisite knowledge was controlled by giving a same prerequisite knowledge test to both the groups, the experimental group and control group, and comparing the scores obtained by them on this test for their equality in terms of their prerequisite knowledge level. To control the second variable, namely, topic taught, the same topic and the same textbooks prescribed in the university syllabus were used for teaching both the groups. The students in the experimental group as well as those in the control group were all studying in the second year basic B.Sc. nursing course of MUHS in the academic year 2011-2012. Thus the third variable, namely, class of students, could be controlled. Teacher variable is one of the important variables that may have effect on students’ achievements. The researcher has tried to control this variable by carrying out detailed discussion of topic to be taught with the teacher of Tehmi Grant Institute of Nursing.
Education. During discussion, it was decided to use same content of teaching from same books. Hence, both the teachers, one who taught to the experimental group and one who taught to the control group used same knowledge content and same textbooks. In this fashion, teacher variable could be controlled in the study. However, due to constraints, it was not possible to control the variables namely mother tongue, scores in HSCE exam, and scores in first year basic B.Sc. nursing university exam.

3.5 SETTING OF THE STUDY

Study was conducted at Maharshi Karve Stree Shikshan Samstha’s Bakul Tambat Institute of Nursing Education (MKSSS’s BTINE) and Tehmi Grant Institute of Nursing Education (TGINE). Both the colleges are under dual control of Indian Nursing Council (INC) and Maharashtra University of Health Sciences (MUHS). Both the colleges admit only female students for Basic B.Sc. nursing course and follow the same rules, regulations and syllabus led down by INC and MUHS.

Eligibility for admission to Basic B.Sc. nursing course is passing of Higher Secondary Certificate Examination (HSCE), with science or equivalent subjects and collective minimum score of 45% in four subjects namely Physics, Chemistry, Biology and English.

3.6 POPULATION AND SAMPLE

A population is a group whose members possess specific attributes that the researcher is interested in studying. The requirement of defining the population for a research
project arises from the need to specify the group to which the result of the study can be generalized. The population of the present study comprises of second year students of basic B.Sc. nursing course of Maharashtra University of Health Sciences.

3.6.1 Sampling Technique: A sample is a portion of the population that has been selected to represent the population of interest. A sample is used in research when it is not feasible to study the whole population from which it is drawn. Sampling technique is defined as the method used in drawing samples from a population usually in such a manner that the sample will facilitate determination of some hypothesis concerning the population. The process of sampling makes it possible to accept a generalization to the intended population based on careful observation of variables, within a relatively small proportion of population.

In the present investigation, the sample is drawn from the population of second year students of basic B.Sc. nursing course. The sample was drawn by non-probability incidental sampling technique. In this technique, the sample comprises of the students who are easily accessible to the researcher and who meet the sampling criteria of the study.

3.6.2 Sampling criteria: Following inclusion and exclusion, criteria were used for selecting the sample.

Inclusion criteria:
- Students who are studying in second year basic B.Sc. nursing course in academic year 2011-12.
• Students who have cleared the course of Fundamental of nursing in first year basic B.Sc. nursing university examination.

**Exclusion criteria:**

• Students who were absent for prerequisite knowledge test or any of the formative tests and summative tests

### 3.6.3 Sample size:

There were 47 students studying at MKSSS’s BTINE and 39 students studying at TGINE. The data such as age, the scores in HSCE and first year basic B.Sc. nursing university examination were collected from all these students. The students who did not meet inclusion criteria were not considered as a part of study sample. Also, those students, who met exclusion criteria were not considered. Finally, there were 76 students in the sample, with 38 in the experimental group and 38 in the control group.

**3.6.4 Equivalence of samples:** For testing the equivalence of the experimental group sample and the control group sample i.e. to confirm that they are from the same population, the students from both the groups were given prerequisite knowledge test. The tests namely, test of normality, critical ratio (CR) test, Fisher’s $F$ test ($F$), and independent sample $t$ test were applied to the scores of the students in the two groups. It was found that both the experimental group and the control group are normally distributed. It was also found that the experimental group and the control group are equivalent as far as prerequisite knowledge is considered and hence can be considered to be from the same population. Thus, in order to equate the two groups, the
researcher did not have to exclude any student from any group. More details about the results of these statistical tests are given in chapter IV.

3.7 TOOLS AND TECHNIQUES USED FOR COLLECTION OF DATA

The most important and crucial aspect of any research is data collection, which provides answers to the questions under the study. Data collection relies on instruments. The present study is aimed at assessing the effect of Mastery Learning Strategy on the performance of the nursing students with respect to learning of different modes of drug administration namely intramuscular, subcutaneous and intradermal. For this purpose, the researcher developed and used various tests to assess both the cognitive competencies and psychomotor abilities of the students. The tests used were as below:

- Prerequisite knowledge test (cognitive based).
- Formative tests (cognitive based and psychomotor based).
- Summative tests (cognitive based and psychomotor based).

3.7.1 Prerequisite knowledge test (cognitive based): For any new learning, students need to have some prerequisite knowledge. In addition, when two groups are to be treated by two different teaching techniques and effectiveness of techniques is to be compared then two groups should be statistically equal as far as prerequisite knowledge base is concerned.

For the learning of new topic, namely, parenteral drug administration, the students are supposed to have the prerequisite knowledge of the following topics:
a) Terms related to medication administration, b) Abbreviations used in drug administration, c) Principles applied in drug administration, d) Tablet & liquid drug dosage calculations and e) Classification of drugs according to action.

The researcher developed a prerequisite knowledge test consisting of 50 multiple-choice questions on the above topics. This test was administered to both the experimental group and the control group. The scores of this prerequisite knowledge test were then used to check whether the two groups are statistically equal as far as prerequisite knowledge is considered. This test is attached in Annexure 1.

3.7.2 Formative tests (cognitive based and psychomotor based): As mentioned earlier, the topic taught namely parenteral drug administration was divided into various units. These units were classified into two classes: cognitive-based units and psychomotor-based units. In case of experimental group, formative tests were administered after completion of teaching of each unit. Depending upon the type of unit, the formative tests were also of two types. A) cognitive based formative test and B) psychomotor based formative test. These test are attached in Annexure 2.

A) Cognitive based formative test: Each formative test for cognitive-based unit consisted of 15 multiple-choice questions on contents of respective unit. A student is said to have mastery on cognitive-based unit if and only if student attains score of 80% and above in the formative test of that unit.

B) Psychomotor based formative test: Each formative test for psychomotor-based unit consisted of certain practical tasks that student has to perform and assessment is
made with the help of observation checklist prepared for that task. A student is said to have mastery on psychomotor-based unit if and only if student attains 100% score in the formative test of that unit. Since the psychomotor-based skills of parenteral drug administration is most critical, the level of achievement was set to 100% and not at 80%.

The students who could not achieve mastery level were given re-teaching and individual guidance. After re-teaching, re-evaluation was carried out. This process was continued until every student reached mastery level.

3.7.3 Summative tests (cognitive based and psychomotor based): Summative tests tested both cognitive competencies and psychomotor competencies achieved by the students during the experiment. Cognitive-based summative test consisted of 50 multiple-choice questions. Psychomotor-based summative test was developed to test the psychomotor skills namely intramuscular drug administration, subcutaneous drug administration and intradermal drug administration. These skills were assessed against observation checklist prepared by carrying out task analysis of each skill. These three skills were assessed through three different checklists each consisting of 19 steps with maximum score of 38. All the tests and the observation check lists with grading criteria for cognitive based and psychomotor based test used in the present research work are attached in Annexure 3

3.8 DEVELOPMENT OF TOOLS

All the tests used in this study were criterion referenced tests (CRT). According to Glaser (1963) criterion-referenced measures depend upon an absolute standard of
quality measures which assess student’s achievement in terms of a criterion standard. It provides information about the degree of competence attained by a particular student independent of reference to the performance of other students. Criterion referenced tests are the measurement tools, developed to evaluate a student’s performance with reference to predefined criteria. These tests also help in the evaluation of student’s performance compared to his/her previous level of performance. This measurement also helps in discriminating between those who have acquired target behaviors and those who have not. The results of this measurement are interpreted in an absolute sense i.e. either met or unmet. (Glaser, 1963).

Typically, any kind of test is constructed by following the steps given below:

- Selection of content
- Content analysis
- Listing down the specifications (expected behavior)
- Preparing a blueprint
- Constructing the tests
- Deciding time limit
- Preparing the marking scheme
- Deciding cut score
- Validating the tests
- Item analysis
- Testing reliability of the tests

3.8.1 Selection of content: The syllabus of first year and second year basic B.Sc. nursing course related to drug administration was reviewed. The syllabus content was divided in to prerequisite knowledge content and content for new learning. For the
present research, the researcher selected the topic ‘parenteral drug administration’ for teaching. The topic was divided in small units for easier understanding of the subject.

These units are:

a. Introduction to parenteral drug administration
b. Preparation of drugs
c. Identification of injection sites
d. Intramuscular drug administration
e. Subcutaneous drug administration
f. Intradermal drug administration

3.8.2 Content analysis: The topic of drug administration was analyzed for its sequence in curriculum for first year and second year basic B.Sc. nursing course. The interrelationship of elements of content was identified. How these elements are required at different levels of learning was also identified. This content was further analyzed to identify the specifications (competencies) needed to be acquired by students to achieve mastery in particular unit. For the table of content analysis please refer Annexure 4.

3.8.3 Listing down the specifications (expected behaviors): On the basis of content analysis, the expected behaviors were listed down. The analyzed content was classified according to Bloom's taxonomy of educational objectives. Standard verbs were used to state the expected learning outcomes. List of these expected learning outcomes stated for prerequisite knowledge test, and summative tests is given in Annexure 5.
3.8.4 Preparing blueprints: The blue print was prepared for each cognitive-based test. These blue prints consist of weightage given to content units, objectives and types of questions. All the blue prints are given in Annexure 6.

3.8.5 Constructing the tests: The cognitive-based tests were prepared as per the blue prints. The questions included in all the tests were objective type multiple-choice questions. Each question has four options with one of them being appropriate. The psychomotor-based tests were prepared on the basis of task analysis.

3.8.6 Deciding time limit: Time limit to answer the test is generally required for testing of speed. In Mastery Learning Technique, what is tested is whether a student has acquired or has not acquired mastery in expected behavior, and not speed of answering the questions. Since, the present study was to evaluate the effect of Mastery Learning Technique, no rigid time limit was prescribed for completing the tests. From the experience of the pilot study and for practical purpose of planning and scheduling, a time limit of 90 minutes was allotted to the students to answer the test consisting of 50 multiple choice questions and 30 minutes were provided to answer a test of 15 multiple choice questions.

3.8.7 Preparing the marking scheme: Answer key was prepared for each test by referring standard textbooks and reference books. These answer keys were checked by experts in the nursing colleges.
3.8.8 Deciding cut score: According to Mastery Learning Theory there are only two categories namely masters and non-masters. After reviewing the literature on Mastery Learning, the researcher found that in most of the studies, level of 80% score is considered as a minimum level of proficiency. Hence, for cognitive achievements, the researcher decided to grade a student as masters if and only if she scores 80% and above in cognitive based tests. Student scoring less than 80% is graded as non-master.

Mastery in psychomotor skills is most important in case of parenteral drug administration since any error in drug administration can lead to serious consequences and can even be fatal in some cases. Keeping this in mind it was decided to grade student as master when she achieves 100% score in psychomotor-based test. If she does not perform up to 100%, she is graded as non-master.

Numerical scores obtained by students were converted in to percentage and then grading of student was done. Percentage score of a student in any test helped in determining the extent to which the predetermined expected behavior has been achieved by that student. This was also useful for reporting the progress to the student and for guiding her for further attainment of perfection.

3.8.9 Validating the tests: Validity is an appraisal of whether a test measures what it is intended to measure. Content validity is of greatest importance for criterion referenced test. Criterion related validity checks whether the questions in a test are so framed that they really measure the stated expected behavior.
The teaching learning material prepared for this study and all the tests were shown to several experts in the field of education and nursing. The experts were asked to validate the material for its content, coverage and relevance in terms of specifications (expected behavior) and construction of questions. The suggestions of the experts were considered and appropriate modifications were done.

3.8.10 Item analysis: Item analysis is one of the aspects of validity of items included in any test. Afolayan (2010) stated that the process of item analysis is essential particularly in the traditional norm-referenced test and using the traditional norm-referenced item analysis and selection techniques for criterion-referenced test is most likely to be conceptually and statistically inappropriate. (Afolayan, 2010). The primary purpose of using criterion-referenced tests is not to discriminate among students, and hence it is obvious that difficulty index or easiness percentage cannot be used with criterion-referenced tests in the same way, as it is used with norm-referenced tests. In most cases, criterion-referenced tests are constructed so that each item can measure the accomplishment of a particular objective. In present study prerequisite knowledge test, formative tests and summative tests were based on purpose of testing predetermined expected behavior. All these tests were criterion referenced. Hence, in the present study, item analysis was not performed for these tests.

3.8.11 Testing reliability of the tests: Any test is said to be reliable when one has reasons to believe that the score obtained in the test is consistent and trustworthy. The commonly used procedures for computing the reliability coefficient of a test are:
1. Test – retest,  
2. Alternative or parallel forms,  
3. Split – half technique, &
4. Rational equivalence.
According to Garret and Woodworth (1967), the method of rational equivalence is superior as compared to other methods. The method of rational equivalence is free from the objections raised against the other methods. One of its main advantages is that all data for computing reliability are obtained on one occasion and therefore, variance in different situations is conveniently avoided. In the test-retest method, there is a problem of interval between the two tests. In the alternate form method, there is also the administrative problem of time lag between the two tests. The split-half method is easy to use and eliminates the problems associated with the test–retest and parallel forms of the test but handicapped by the fact that different reliability estimates are obtained by using different splits. (Garret, & Woodworth, 1967). Thus, the researcher has used the method of rational equivalence for computing the reliability coefficient of the cognitive-based tests.

The formula for reliability coefficient used in the method of rational equivalence is:

\[ r_{1t} = \frac{n(\sigma^2_t - (\Sigma p q))}{\sigma^2_t}, \]

where

- \( r_{1t} \) = reliability coefficient of the whole test
- \( n \) = number of items in the test
- \( \sigma_t \) = The standard deviation (SD) of the test scores
- \( p \) = the proportion of group answering a test item correctly
- \( q = (1 - p) \) = the proportion of the group answering a test item incorrectly

A simple approximation to this formula, which is often used to determine the reliability of short objective classroom examinations, is

\[ r_{1t} = \frac{\sigma^2_t - M(n - M)}{\sigma^2_t (n - 1)}, \]

where

- \( r_{1t} \) = reliability of the whole test.
- \( n \) = number of items in the test
- \( \sigma_t \) = SD of the test scores
- \( M \) = The mean of the test scores. (Garret, & Woodworth, 1967)
Reliability coefficient for prerequisite knowledge test was found to be .67. This indicates that the test is adequately reliable. Summative test (cognitive based) has reliability coefficient of .78 and hence this test is adequately reliable.

For summative tests (psychomotor based), both intra-rater reliability and inter-rater reliability tests were performed.

**A) Intra-rater reliability:** All observation checklists for psychomotor based tests were assessed for intra-rater reliability. For the estimation of intra-rater reliability, a single evaluator evaluates and re-evaluates the student performance in skills. When single person has to evaluate the performance of a student, the student will have to give the performance twice. However, in case of human beings, it is likely to happen that two performances may not be identical. This may affect the intra-rater reliability quotient. To avoid this error, the researcher used video recording technique. In this technique, the evaluation of first performance was done by direct observation method. The performance of the student was video recorded while it was being evaluated by the evaluator. The recording was shown to the same evaluator, with the gap of a day and was asked to evaluate the recorded performance. The two scores, one given by direct observation and other given by observing recorded performance, were then used to compute intra-rater reliability quotient of an observation checklist using the Spearman-Brown prophecy formula. (Garret, & Woodworth, 1967). The computed reliability quotients were as below:

- Intra-rater reliability of summative test [psychomotor (intramuscular drug administration skill) based] was found to be .75. This shows that the test is adequately reliable.
• Intra-rater reliability of summative test [psychomotor (subcutaneous drug administration skill) based] was found to be .77. This shows that the test is adequately reliable.

• Intra-rater reliability of summative test [psychomotor (intradermal drug administration skill) based] was found to be .93. This shows that the test is highly reliable.

B) Inter-rater reliability: Inter-rater reliability addresses the consistency of the implementation of a rating system. All observation checklists for summative tests (psychomotor based) were assessed for inter-rater reliability. The Inter-rater reliability quotients for various psychomotor based tests were calculated using Spearman – Brown formula. (Garret, & Woodworth, 1967). The computed reliability quotients were as below:

• Inter-rater reliability of summative test [psychomotor (intramuscular drug administration skill) based] was found to be .96. This shows that the test is highly reliable.

• Inter-rater reliability of summative test [psychomotor (subcutaneous drug administration skill) based] was found to be .95. This shows that the test is highly reliable.

• Inter-rater reliability of summative test [psychomotor (intradermal drug administration skill) based] was found to be .96. This shows that the test is highly reliable.
3.9 DATA COLLECTION PROCESS

A detailed description of the data collection process followed in the present work is given below:

Permission was sought to conduct the study from the Principals of Tehmi Grant Institute of Nursing Education (TGINE) and Maharshi Karve Stree Shikshan Samstha’s Smt. Bakul Tambat Institute of Nursing Education (MKSSS’s BTINE). Principals of both the institutions were kind enough to grant the permission. The permission letters are attached in Annexure 7.

Following this, the researcher approached the class coordinators of second year basic B.Sc. nursing programme to plan the timetable for the interventions. Both the class coordinators assured their full cooperation. The intervention commenced in the month of August 2011 and finished by the month of May 2012. The data collection was carried out in three phases namely,

- Pre-treatment phase.
- Treatment phase.
- Post-treatment phase.

3.9.1 Pre-treatment phase: Information about student’s achievements such as scores in Higher Secondary Certificate Examination (HSCE), scores in first year basic B.Sc. nursing course university examination, was collected from all the students of both the groups. On the request by the researcher, college authorities provided copies of HSCE mark sheets and first year basic B.Sc. nursing university examination mark sheets. The researcher transformed the entire data into data sheet. This data was useful to
check whether a particular student is meeting the inclusion criteria or not, which in turn helped in finalizing the sample.

After this, the researcher collected information concerning previous knowledge regarding drug administration through the prerequisite knowledge test which was administered to the students from both the experimental group and the control group. The scores of this prerequisite knowledge test were used to check whether the two groups are statistically equal as far as prerequisite knowledge base is concerned. The tests namely, test of normality, critical ratio (CR) test, Fisher’s $F$ test ($F$), and independent sample $t$ test were applied to the scores of the students in the two groups. It was found that both the experimental group and the control group are normally distributed. It was also found that the experimental group and the control group are equivalent regarding prerequisite knowledge. Hence in order to equate the two groups, the researcher did not have to exclude any student from any group. More details about the results of these statistical tests are given in chapter IV.

In case of the control group, as it is done in traditional teaching method, the teaching of new unit of parenteral drug administration was started without going in to details of whether the students have adequate prerequisite knowledge or not. On the other hand, the experimental group was treated differently. All the students were called individually and the researcher gave them the feedback about their performance in the prerequisite knowledge test. The students were given notes on prerequisite knowledge content for further study and were guided about how to improve their prerequisite knowledge. The researcher conducted viva-voce of every individual student and
confirmed that all the students have acquired adequate prerequisite knowledge that is needed for learning of topic parenteral drug administration.

3.9.2 Treatment phase: During this phase the topic parenteral drug administration was taught to the students from both the groups. The students from the control group were taught by conventional method while the students from the experimental group were taught by using Mastery Learning Model.

While following the Mastery Learning Model of teaching, the researcher used various instructional strategies such as using 1) audio-visual aids, 2) practicing interactive teaching, 3) giving demonstrations of procedures and 4) asking students to practice the same on mannequin under supervision, 5) providing work sheets etc. The copies of lesson transcript and teaching material used are attached in Annexure 8. Each theory class was of 90 minutes duration. For demonstration with interactive teaching, duration required was about 180 minutes. As and when needed, the researcher and the students worked even after the college hours.

After each unit, formative test on that unit was administered to the students. The students who did not achieve mastery in specific entry behavior were given individual guidance and remedial teaching in the form of peer group teaching and giving workbook for self-study. The copy of workbook is attached in Annexure 9. After this, the students were again assessed for the level of mastery in specific entry behavior. When all the students attained mastery, the group was moved to the next learning unit. During this process, the students who had attained mastery were asked to engage themselves in helping the non-masters to get elevated to mastery level. Time taken by
a student to reach mastery level in a specific unit was measured in terms of the number of attempts required by that student to achieve mastery in that unit. The schematic representation of the treatment phase is given below in figure 3.2

![FIGURE 3.2: THE MASTERY LEARNING INSTRUCTIONAL PROCESS](image)

**3.9.2.1 Strategies implemented during treatment phase:** There are individual differences within the group as far as learning ability is considered. According to Bloom (1968), quality of teaching activity is the basic and very important factor that influences learning output in Mastery Learning Strategy. He further states that the teacher should incorporate different teaching techniques considering the individual differences in the class (Bloom, 1968). Assuming the individual differences, the researcher used variety of teaching strategies. The different teaching strategies implemented by the researcher while teaching whole class were lecturing and discussions (for cognitive based units), lecturing and demonstrations (for psychomotor-based units) and interactive study sessions for both cognitive and psychomotor based units. In addition, various remedial measures were also implemented for guiding those students who could not achieve mastery. These remedial measures included providing learning material in the form of notes and workbook, peer tutoring, individual tutoring, re-teaching and re-demonstrations.
A) Lecturing and discussions: For each unit, learning specifications were identified and stated in behavioral terms. Lesson transcripts were prepared and validated for their content from experts in nursing education. Planned lessons for a unit were conducted in three stages. In the first stage, prerequisites were reviewed by doing recapitulation of previous learning. Students were made aware of the expected behavior that are to be achieved from learning of that particular unit. In the second stage, various learning activities were provided. For this purpose, audio-visual aids were used and activities requiring students’ involvement were included for internalizing the concepts. For instance, for unit - 1 namely ‘introduction to parental drug administration’, the researcher prepared charts and flash cards and used them to explain the concepts. Real models of different types of syringes and needles were shown to students. The researcher explained the construction and working of syringe, needle, and students were made to get involved actively in assembling and identifying the different kinds of syringes and needles. Few sample photographs taken during these activities are given in figure 3.3. In the last stage, summarization of learnt material was done.
FIGURE 3.3: PHOTOGRAPHS SHOWING VARIOUS ACTIVITIES DURING LECTURING AND DISCUSSIONS
B) **Lecturing and demonstrations:** The skills involved in psychomotor-based units of parenteral drug administration consist of many tasks such as preparation of drug, withdrawing drug in syringe through needle, selection of appropriate anatomical site to inject drug with appropriate angle of needle insertion etc. The scientific principles involved in these tasks were explained by lecture method. These lectures were then followed by actual demonstrations by the researcher. Audio-visual aids were used extensively for this purpose. Few sample photographs taken during these activities are given in figure 3.4.

C) **Interactive study sessions:** The physical arrangement of the classroom is important for interactive session to be a success. For skill demonstrations, classroom was arranged in such a fashion that small groups of students can work together to get hands on practice. Big screen was arranged in front of tables for easy visualization of skill demonstrations. Students were instructed to follow the steps demonstrated in the video clips. The researcher moved around the class for the purpose of close supervision and monitoring of each activity and to see that every student is understanding and performing all the steps without any difficulty. Few sample photographs taken during these activities are given in figure 3.5.
FIGURE 3.4: PHOTOGRAPHS SHOWING VARIOUS ACTIVITIES DURING LECTURING AND DEMONSTRATIONS

FIGURE 3.5: PHOTOGRAPHS SHOWING VARIOUS ACTIVITIES DURING INTERACTIVE STUDY SESSIONS
D) Remedial measures for non-masters: After completion of each unit, formative test on that particular unit was conducted. The students were given immediate feedback on their strengths and weaknesses to boost their confidence in learning. In case of the students who have not achieved mastery, remedial teaching measures were implemented so that student masters the specific expected behavior. The remedial measures used are described below:

- Providing learning materials in the form of notes and workbook,
- Peer tutoring,
- Individual tutoring,
- Re-teaching and Re-demonstrations.

a) Providing learning material in the form of notes and workbook: Based on the discussion of a unit, the researcher provided study notes and workbook on that particular unit to students and asked them to go through it thoroughly. The workbook is a supplement to classroom learning. It has been developed by the researcher to enable a student to test her knowledge of facts, to confirm understanding of basic concepts developed and to gain practice in the skills of solving problems.

b) Peer tutoring: Feedback after every formative test and assignment was given to students. Those students who have failed in an assignment and have not attained mastery in a formative test were paired with those students who have successfully completed that assignment and have attained mastery in that formative test. These peer-tutoring sessions were conducted under the supervision of the researcher. The researcher noticed that non-masters are more comfortable in asking their doubts and difficulties to the peers. This helped them a lot in improving upon their understanding through peer discussions. These peer tutoring sessions were conducted under the supervision of the researcher.
c) **Individual Tutoring:** Each of the three modes of drug administration namely intramuscular drug administration, subcutaneous drug administration and intradermal drug administration comprises of many steps, which are interrelated to pre-learnt skills. This complexity makes learner prone for mistakes. Hence, to prevent mistakes in performing above mentioned skills, the researcher felt that individual tutoring would be the most appropriate method for teaching these skills. Hence, the researcher used this technique for all the three psychomotor-based units as a remedial measure for non-masters.

**d) Re-teaching and re-demonstration:** Whenever the researcher noticed that the number of students failing in a formative test is significant, the researcher did the re-teaching and re-demonstration of the respective unit.

As stated earlier pre-learnt content of drug administration, the copies of lesson transcripts, lesson notes and teaching material prepared and used by the researcher during the experiment are attached in Annexure 8.

**3.9.3 Post-treatment phase:** The post-treatment phase was started after the completion of teaching of last unit. The students of both the experimental group and the control group were tested for cognitive aspects as well as psychomotor aspects of the contents learnt during treatment phase through the summative tests (cognitive based and psychomotor based).

The students from both the groups were again tested for the retention of the knowledge and skills acquired. For this purpose, the summative tests (cognitive based and psychomotor based) were administered to them after a time gap of 15 days and a time gap of 6 months.
3.10 PLAN FOR DATA ANALYSIS

Expert consultation for the use of statistical tests revealed that independent sample / test would be most appropriate for inferential statistics. Besides inferential statistics, descriptive statistics such as the frequency distribution of the students in terms of the number of attempts required by each student to achieve mastery, frequency distribution according to the percentage scores of the students etc. was used to analyze the data. Mean and standard deviation of the scores, number of students reaching mastery, from both the groups were compared as a part of descriptive-comparative approach. The detailed analysis of the data done by using relevant statistical methods has been described in the next chapter.

3.11 SUMMARY

After a brief introduction, the researcher has given the short overview of the pilot study done before conducting the final main study. This is followed by detailed description of the research approach and the research design. The same has also been represented in the form of schematic. The variables of the research and setting where the study has been conducted are mentioned. The researcher has also discussed about the population, samples and sampling techniques used. The tools developed to collect the data and the process of collecting the data with the help of these tools has been discussed in minute details. The researcher has mentioned about the plans for the data analysis in this chapter and has mentioned that the actual data analysis is described in the next chapter.
REFERENCES


