CHAPTER 2

REVIEW OF RELATED LITERATURE
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2.1 INTRODUCTION

A review of related literature is an essential and important step for scientific research projects. It helps the investigator to develop a deeper insight into problem and gain information on what has been done before in the field. Such reviews provide the basis for assessing the need for the study, and formulate the design and tools to be used.

The present study aims primarily at investigating the effectiveness of Mastery Learning Model (MLM) on the performance (cognitive and psychomotor) of nursing students with respect to selected drug administration and its retention. Hence, any research conducted on the effectiveness of Mastery Learning Strategy is relevant to the present investigation. In addition, other related literature includes those expositions made by theoreticians in education and psychology whose work forms the basis for instructional strategy developed for the present study. In chapter I, a detailed account of the theoretical basis and related review of literature emphasizing the need for this study has been presented.

This chapter deals with a detailed review of the studies that provide an empirical basis for the present investigation. The reviewed literature is organized under the following headings:
• Evolution of Mastery Learning Strategy.

• Studies related to effectiveness of Mastery Learning Strategy in cognitive domain at college level.

• Studies related to effectiveness of Mastery Learning Strategy in psychomotor domain.

• Studies related to effectiveness of Mastery Learning Strategy and retention.

• Research studies related to Mastery Learning Strategy for training nurses & health professionals.

2.2 EVOLUTION OF MASTERY LEARNING STRATEGY

A consideration of the historical antecedents of any educational practice can undoubtedly serve to enhance the awareness and understanding, which one brings to bear upon its genesis, development, and implications for current practice.

Over the past few years, a mastery approach to teaching and learning has been developing, and advocates of this approach assert that under appropriate learning conditions, nearly all students can and will learn what the schools have to teach. Actually, the theory is several hundred years old; its roots are found in writings as early as the 15th century. The basic tenets of mastery learning are hundreds of years old. The idea of mastery in different ways was stressed by Comenius in the 17th century, Pestalozzi in the 18th century, and Herbert Spencer in the 19th century. (Davis & Sorrell, 1995).
Mastery Learning Strategy started receiving greater attention during the 20th century after introduction of mastery learning concept in the American schools in 1922 by Washburne and others. (Davis & Sorrell, 1995). This format is called Winnetka plan of Washburne. In the same decade, in 1926, Morrison suggested the pedagogical technique, "Pre-test, teach, test the result, adapt procedure, teach and test again to the point of actual learning", which he identified as a mastery formula. (Morrison, 1926).

The basic common features in both of these plans were:

- Defining Cognitive, affective and psychomotor objectives.
- Division of each subject into units. A unit was typically conceived as a piece of work, based upon a certain quantity of related facts in a text book or other source. A unit is a generalization and its related facts were developed according to a sequence of steps.
- Mastery was to be attained on basis of specified objectives. Teaching of each unit would present a specific understanding with such thoroughness that most students achieve mastery. A unit was covered only when all or almost all students thoroughly understood the generalization, its factual origins, its probable reliability, and the kinds of situations in which it could be used in the future.
- Administration of an un-graded progress test at the completion of each unit to provide feedback.
- After diagnosis a variety of correctives such as re-teaching, tutoring, re-structuring the original learning activities and re-directing student study habits are to be used.
However, Mastery Learning Approach of teaching eventually disappeared due to the failure of educational technology to support such a methodological approach. The idea of mastery learning finally reappeared, however, during the late 1950 in association with programmed instruction. Although programmed instruction did function as a valuable tool for some students by virtue of its frequent drill and reinforcement; it did not provide a useful model upon which could be based a Mastery Learning Strategy for the vast majority of students. (Block, 1974).

Rebirth of Mastery Learning happened with the publication of "A Model for School Learning" by Carroll in 1963. According to Carroll (1963), learning is a function of time spent divided by time needed. One important variable related to time needed is student aptitude, which Carroll defines as the amount of learning time necessary for a student to master an objective under optimal conditions. In this model, all the variables that directly influence the learning of children in school could be defined in terms of time. According to Carroll, any learner succeeds in learning a given task to the extent that he/she spends the amount of time he needs to learn that task. (Carroll, 1963). The model considered degree of learning as a function of the amount of time the learner actually spends on the learning task to the total amount needed by that student.

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\text{Degree of learning} = f\left(\frac{\text{Time actually spent}}{\text{Time needed}}\right)
\]

To explain the degree of learning Carroll used five variables such as 1) aptitude, 2) ability to understand instruction, 3) quality of instruction, 4) opportunity to learn, and 5) perseverance.
1) Aptitude refers to a measure of ability to learn a particular subject. Carroll suggested that it could be viewed as a measure of learning rate. From this perspective, learners who need only a small amount of time are said to have high aptitude; learners who need a large amount of time are said to have low aptitude.

2) Ability to understand instruction refers to the students' knowledge of prerequisite skills and information needed to understand a unit of instruction.

3) Quality of instruction refers to the effectiveness with which the unit of instruction is actually delivered so that it will not require additional time for mastery beyond that required in view of aptitude.

4) Opportunity refers to the amount of time available for learning. It could include homework time as well as time in class.

5) Perseverance refers to the amount of time the learner is willing to spend in the learning process. (Carroll, 1963).

Carroll’s model advocates a ‘criterion referenced’ assessment procedure, as suggested by Tyler (1932), in which the student’s performance is judged according to how well he has done in comparison with some predetermined criterion. This contrasts with the traditional ‘norm referenced’ assessment in which a given student is judged against performance of his colleagues. Criterion referenced tests provide a standard against which all student performances can be measured, and can ensure a minimum standard of competence. A driving test is a good example of this kind of assessment. All drivers take the test and if they do not reach the criterion level, they fail but may repeat the test until they reach the set level of competence. Norm referencing of a group at a driving school may result in a good distribution of grades from fail to A-grade, but this would not necessarily mean that even the A-grade students were able
to reach the criterion level. It would mean that they could out-perform their colleagues, but the overall standard could still be below that required for safe driving. (Tyler, 1932).

Along with Carroll, Bloom is also considered as the father of the present day Model of Mastery Learning. Bloom acknowledged the fact that there were many different strategies for mastery learning, but that each strategy should deal effectively with the variables described by Carroll.

Bloom's contribution to the development of mastery learning was to transform the conceptual model of school learning developed by Carroll into a working model for mastery learning. In Carroll's model, aptitude was predictive of the rate at which, rather than the level to which, a student could learn.

Bloom argued that if students were normally distributed with respect to their aptitude for a subject and were provided uniform instruction in terms of both quality and time, then their achievement at the subject's completion would be normally distributed. This situation can be represented as in figure 2.1.

![Figure 2.1: Aptitude-Achievements for Uniform Instruction](image)

**FIGURE 2.1: APTITUDE-ACHIEVEMENTS FOR UNIFORM INSTRUCTION**
However, if students were normally distributed with respect to aptitude but learning time was allowed to vary to suit the characteristics and needs of each learner then majority of students could be expected to attain mastery. This situation can be represented as in figure 2.2.

![Aptitude-Achievement Diagram](image)

**FIGURE 2.2: APTITUDE-ACHIEVEMENTS FOR OPTIMAL INSTRUCTION**

To determine how this result might be practically achieved, Bloom searched various sources of information. He studied ideal teaching learning situations where an excellent tutor paired with an individual student and tried to determine the critical elements in one-to-one tutoring that can be transferred to group based instructional settings. He also tried to collect information regarding the strategies employed by academically successful students.

Based on the series of studies conducted, Bloom et al. (1971) outlined a specific instructional strategy labeled as 'Learning For Mastery’ and later shortened it to simply ‘Mastery Learning’. The essentials for this strategy are:

- Teacher must make clear to each learner about the nature of the task he/she is to learn and the procedure he/she is to follow in learning it.
- Teacher must formulate specific instructional objectives for the learning task.
• Teacher should break the entire course into small and convenient units of learning.

• Teacher should conduct formative tests at the end of each unit and should provide feedback on the learner’s particular errors and difficulties after each test.

• Teacher should find ways such as providing alternative learning opportunities, allowing weaker students to spend more time on learning units and conducting interactive sessions in small groups etc.

• When the students complete their corrective activities they must be reassessed to gauge whether the performance is improved or not. This is necessary to check on the effectiveness of the correctives in helping students to overcome their individual learning difficulties. It also offers a second chance for the students to succeed and hence serves as a motivational device.

Bloom believed that through this process of formative assessment combined with the systematic correction of individual learning difficulties, all students could be provided with a more appropriate quality of instruction than is possible under more traditional approaches to teaching. (Bloom, Hasting, Madaus, Nat, & Susan, 1971).

While Bloom turned his attention to develop the theory of Mastery Learning, a number of his students and colleagues devoted their attention to develop the practice. Since publication of Bloom's ideas, extensive mastery learning research has been carried out and successful strategies have been easily and inexpensively implemented at all levels of education and in subjects ranging from arithmetic to philosophy to physics.
At first, the efforts of some of the researchers were concentrated on applying the theory and related practices to the improvement of classroom and then of entire school. Soon it became apparent that interest in the evolving Mastery Learning Approach had spread far beyond the classroom and school level. Entire local, regional, and even national school systems desired to examine the potential of the evolving Mastery Learning Approach for their particular problems. (Block, 1974). As a consequence, the efforts of many individuals shifted to the improvement of system wide practices. Since system wide applications of mastery learning practices require the co-operative efforts of many individuals at many levels, a network of mastery learning practitioners was formed in the United States. This network, known as the network of outcome-based schools, is affiliated with the American Association of School Administrators. Its primary purpose is to encourage the discussion, summarization, and dissemination of mastery-related strategies, practices and materials. In nutshell, since the mid 1970’s mastery learning has been applied to an ever increasing variety of school subjects and has extended beyond the secondary school level.
2.3 STUDIES RELATED TO EFFECTIVENESS OF MASTERY LEARNING STRATEGY IN COGNITIVE DOMAIN AT COLLEGE LEVEL

In extensive review of literature, it was found that many investigations were conducted at school level and only a handful studies were found at higher level of education. As the present study is focused at collegiate level, the researcher was interested in reviews related to the effect of Mastery Learning Approach on sample studying at higher level. The review of few of these studies is presented below.

Laws (1986) conducted a quasi-experimental approach to test the effects of using three-dimensional models in a competency-based format in teaching of drafting. Hypotheses were formulated and tested for significant differences between the experimental group and the control group in amounts of time (time-score data), numbers of work checks (check-score data), and correlations between them for each of ten competency-based tasks. The subjects were students in four basic mechanical drawing classes at Trenton State College. The subjects were mostly freshmen who were matriculated in several technical disciplines. The sample size was 86. Several characteristics for equating the groups were evaluated and no significant differences were found between the groups on any of the characteristics important to the study. Both groups developed competency-based laboratory task activities. The experimental group used three-dimensional models for each of the ten tasks while the control group did not. Data of amounts of time and numbers of progress checks each group required for mastery of each of the tasks were collected. Students were given procedure instructions, devices appropriate to the study, and task sheets. The developed views were judged as correctly constructed when the plotted points and
lines were within acceptable limits of the solution overlay keys. Analysis of variance tests of significance were used. A clear, strong, and significant association was found between time taken to mastery and number of checks needed. In 8 of the 10 tasks, the experimental group required significantly less time. In 5 of 10 tasks, the experimental group required significantly fewer work checks for correctness. For those check-scores and time-score comparisons not showing a significant difference, the consistent trend of experimental subjects being quicker on average and requiring fewer checks on average than controls was observed. The analysis of the data thus concluded that three-dimensional models could be used effectively for faster student performance (conservation of time) and fewer progress checks (increased instructional efficiency) in mechanical drawing competency-based laboratory task activities. (Laws, 1986).

Zapico (1991) investigated the effect of quasi-mastery learning instructional system for community college chemistry. This system is an adaptation of Bloom's Mastery Learning, possessing the major elements of the Mastery Learning except that instead of unlimited time there was a time limitation of a semester (approximately 15 weeks). The treatment received by the control group (111 students taking General Chemistry with Qualitative Analysis I, CHM 1045C) was a traditional lecture approach. The treatment received by the experimental group (116 students taking General Chemistry with Qualitative Analysis I, CHM 1045C) consisted of the Quasi-Mastery Learning system of instruction. Presentation of the material in the Quasi-Mastery Learning system was aided with Ausubel's organizers; the tone of lecture was non-threatening and relaxed, educational objectives were distributed at the beginning of each topic. Summative and formative evaluations were administered in a timely fashion. Four different types of remedial/tutorial strategies, viz. (1) group review sessions, (2) tutorial software, (3) tutoring center, and (4) reference books, were
prescribed to the students on an as-needed basis. It was found in this study that Quasi-Mastery Learning system of instruction is significantly more effective than the traditional method in terms of greater achievement and better retention. (Zapico, 1991).

Athens (2011) conducted the analysis of self-directed mastery learning of honors physics. The three research questions pursued in this study were: How many students achieved concept mastery and how did they spend their time? What self-directed learning activities did honors physics students choose in their self-directed mastery learning environment? Did successful and unsuccessful students perceive the self-directed mastery learning environment differently? It was found that only 7 of 24 students were successful in passing the similar concept-based unit tests within four tries. A successful self-directed students invested more time on meaningful learning with focus on understanding concepts rather than the rote learning. The self directed learning activities such as studying learning material to improve knowledge deficit, discussing academic doubts with instructors and peers were chosen by these students. This study found that parallel instruction in content and self-directed learning skills could be important for improving learning outcomes and better equipping honors physics students for college and life in general. Mastery learning principles and self-directed learning activities appear mutually reinforcing and yield dual benefits in concept mastery as well as self-efficacy. (Athens, 2011).

Rowe (2010) conducted research to find out whether a mastery learning environment promotes students' intrinsic motivation for learning? The objective of the study was to determine whether college students placed in mastery learning environments would
become intrinsically motivated college learners. The investigation used a quantitative approach, and the project was quasi-experimental. A within subject design was utilized, where the same individual's intrinsic motivation to learn was measured at two points using a pretest-posttest format. Community college students were randomly assigned to either a treatment group or to a control group. The participants assigned to the treatment groups had their level of intrinsic motivation measured prior to being placed in a mastery learning environment utilizing the academic motivation scale questionnaire. The control group attended traditional lecture oriented instructional classes. Both the mastery learning environment group and the control group were administered the academic motivation scale questionnaire prior to the beginning of classes and at the end of the semester. To determine if there were any preexisting differences between the randomly assigned groups, a comparison was made between groups' pretests. There was no difference in initial pretest scores between groups indicating that the random assignment resulted in equal levels of intrinsic motivation at the beginning of the semester. A within groups comparison was conducted to determine if there was a significant difference in academic motivation scale values between pretest and posttest scores in the control and treatment groups. The mastery learning environment group demonstrated a positive and significant difference while the control group showed no significant difference. The research findings in this investigation indicate that there is a relationship between students' learning environment and the development of intrinsic motivation. (Rowe, 2010).

The study conducted by Wambugu and Changeiywo (2006) was aimed at finding out the effects of Mastery Learning Approach (MLA) on students' achievement in Physics. The study was Quasi-experimental and design used was Solomon four group
design. The target population comprised of secondary level students in Kenya. Purposive sampling was used to obtain a sample. A total of 161 students were involved. These students were distributed in to control group and experimental group which were further divided on the basis of gender. The students were taught the same Physics topic of Equilibrium and Centre of Gravity. In the experimental groups MLA teaching method was used while the Regular Teaching Method (RTM) was used in the control groups. The experimental groups were exposed to MLA for a period of three weeks. The researchers trained the teachers in the experimental groups on the technique of MLA before the treatment. Pretest was administered before the treatment and a posttest was administered three weeks after the treatment. The instrument used in the study was Physics Achievement Test (PAT) to measure students' achievement. Data was analyzed using t-test, ANOVA and ANCOVA. Hypotheses were accepted or rejected at 0.05 level of significance. The results of the study showed that gender has no significant influence on their achievement but MLA teaching method results in higher achievement. (Wambugu, & Changeiywo, 2006).

Kazu et al. (2005) conducted the study to assess the effect of Mastery Learning Model on the success of the students who attended teaching of unit “Usage of Basic Information Technologies”. In this study, control group was taught by the conventional methods, and the experiment group was taught by the Mastery Learning Model by the researchers. Teaching strategies evolved by researchers for Mastery Learning Approach caused a significant difference between the pre test and final test results. It was also seen that the experimental group to which the Mastery Learning Model was applied, had a better achievement rate than the control group. (Kazu, Kazu, & Ozdemir, 2005).
Francis et al. (2009) tried an experiment to implement Mastery Learning in first year physics course of Australian National University. The results of the final examination showed no significant benefits of Mastery Learning Approach. However, they have reported that the mastery approach had a number of unexpected benefits, such as students started doing more work with less complaints, students spontaneously started asking for help and student learnt to solve problems collaboratively. (Francis, Figl, & Savage, 2009).

Oloyede (2010) examined the effect of enhanced Mastery Learning Strategy on achievement and self-concept in senior secondary level chemistry. He employed a quasi-experimental pretest, post test control group design with three experimental groups namely; Enhanced Mastery Learning Strategy (EMLS) group, Mastery Learning Strategy (MLS) group and control group (CM). The sample consisted of 127 students (86 males, 41 females). During the treatment phase, the experimental group one (EMLS) received Mastery Learning Strategy combined with cooperative learning method, while the experimental group two (MLS) students had Mastery Learning Strategy only. The students in the control group (CM) received instruction through the conventional method of teaching chemistry. Two instruments were used to collect data for the study. Chemistry Self Concept Questionnaire (CSCQ) and Chemistry Achievement Test (CAT). The researcher has reported that EMLS produced the highest means score of 30.59 while the mean scores of MLS and CM were 28.40 and 21.95 respectively. This indicates significant difference in the mean post test scores of students exposed to the three methods of teaching with regards to achievement in chemistry and with respect to self concept in chemistry. From these results the researcher concluded that students in both MLS and EMLS performed significantly
better than their counterparts in the CM. Thus, better teaching approach would correspondingly increase the chemistry self-concept of students. (Oloyede, 2010).

Sadeghi and Sadeghi (2012) investigated the effects of Mastery Learning Approach on the learning outcomes in students in learning English and on the cognitive skills. The participants of this study consisted of 240 students in different faculties in Guilan University. Non-equivalent control group design was employed to conduct investigation. At the beginning of the investigation, the learning process questionnaire was given to all students. The scores were coded as deciles scale scores. On the basis of these scores, the students were classified into two categories namely surface learners and deep learners. Deciles scale score of surface learners is greater than deciles scale score of deep learners by two. Results showed that over repeated trials the divergence in the performance shown by the students in the two categories went on increasing. Surface learners go on doing better each successive trial while deep learners go on doing worse. On the other hand, surface learners of low ability seem to be motivated to study as they are given more chances. The results of this study also suggested that students who recognize that they can think and react to Mastery Learning Approach are more likely to report greater use of these learning strategies. Author has recommended use of teaching methods such as participation and interaction. He has suggested further research to show the connections between classroom tasks and Mastery Learning. (Sadeghi & Sadeghi, 2012).

The above discussed studies show that the Mastery Learning Approach of teaching is significantly superior to the conventional approach of teaching. However there are few studies which point out that there is either only marginal or no significant
difference between the effectiveness of two approaches. For instance, Tse (1983) has studied the utilization of Bloom’s Mastery Learning to teach introductory accounting. The study used non equivalent control group quasi-experimental design. Total sample enrolled for study was 45, with 22 in experimental group and 23 in control group. Experimental group was taught by Mastery Learning Approach and control group was taught by conventional approach. Both experimental and control group were given pretest and posttest. The study used multivariate analysis of covariance for analysis of data. Study findings revealed that the mastery learning technique is dysfunctional in terms of attrition rate or dropout rate. Also, no correlation between pretest scores and posttest scores was found. (Tse, 1983). In yet another study, Adeyemi (2007) examined the effectiveness of mastery approach on students’ performance in social studies. Only posttest control group research design was used in the study. The subjects for this study were purposively selected from State College of Education and university centre of undergraduates. 60 students participated in the study, 30 from each category. Total two experimental groups and two control groups were made. Sample was randomly assigned to experimental group and control group. The experimental groups were taught with Mastery Learning Strategy while the control groups were taught with the conventional strategy. The students were given a posttest. The $t$ test analysis was used to compare the posttest mean performance scores of the two groups. The result of study found that experimental group had a marginal but non significant gain over the control group. (Adeyemi, 2007).
2.4 STUDIES RELATED TO EFFECTIVENESS OF MASTERY LEARNING STRATEGY IN PSYCHOMOTOR DOMAIN

Research studies on investigating the effects of Mastery Learning Approach in cognitive domain have been discussed in the previous section. There are few studies where focus has been on psychomotor domain. Below discussed are some of these studies where Mastery Learning Approach is compared with conventional approach in the context of development of certain skills.

Study by Blakemore and Goldberger (1984) was focused on investigating the effects of Mastery Learning, as proposed by Bloom, on learner achievement in the psychomotor domain. In this investigation the definite standards of achievement, enough time to learn, and appropriate corrective help for unsuccessful students were used as the identifying factors of the model. Students at Temple University in Philadelphia, Pennsylvania were selected as subjects. 43 subjects were in experimental group and 44 subjects were in control group. The experimental group was taught racquetball skills by Mastery Learning Methods and control group was taught by non-mastery learning method. Achievement was evaluated by racquetball tests before start of the treatment, during the treatment, and after the treatment. A statistical test of repeated measure of covariance revealed that the achievement of the mastery group was significantly higher than the non-mastery group in the mid-treatment test. By the time of the post test the non-mastery group had improved to the point where both groups were statistically equal. It was also found that low aptitude students, especially the low aptitude female got benefitted from the conditions provided by mastery learning methods. The results of this study indicate that when it
comes to teaching fundamental psychomotor skills, mastery learning techniques are useful especially to low aptitude students. (Blakemore, & Goldberger, 1984).

Dobrosks (1981) compared traditional approach to conducting instruction with two mastery learning instructional paradigms namely Keller’s Personalised System of Instruction (PSI) and the Bloom's Learning For Mastery (LFM) model of teaching and learning. The findings suggested that mastery based corrective strategies had a positive effect on students’ achievement in transposition and psychomotor conducting skills, and also on students’ rating of increased conducting competence. Furthermore, the Bloom type learning for mastery corrective strategy appeared superior to the other two treatment strategies in terms of positive effect on the learning outcomes and attitude of students assigned to that group. (Dobrosk, 1982).

Blakemore et al. (1992) analyzed effectiveness of Mastery Learning as a means of teaching psychomotor skills. For this purpose they made a comparison between students who were taught basketball skills using mastery and non-mastery learning methods. Two physical education classes of seventh-grade boys were randomly selected as treatment and control groups. Treatment group of 39 boys was taught using a Mastery Learning Model while the other treatment group of 32 boys was taught using non-mastery methods. The same instructor taught both the classes. Instructions were carried out for six weeks with duration of 50 minutes a day and five days a week. Students in the mastery treatment were taught using Bloom’s Mastery Learning Model. The mastery group’s routine included warm-ups (5 minutes), diagnostic tests (10 minutes), corrective and enrichment practice with feedback (10 minutes), and competitive game play (10 minutes). Each session’s diagnostic test
confirmed whether or not 80% or more of the class had achieved mastery which was the trigger to move onto a new skill unit. The tests also served as a means of evaluating and providing feedback about a student’s progress toward skill attainment. Instruction in basketball skills in the non-mastery class included the same skills taught in the same order, but followed a predetermined instructional plan and schedule that included warm-ups, skill instruction, practice, and game play with timing based on the planned schedule. Both isolated skills (dribbling, shooting, and layups) and game play ability (based on shots taken, shots made, and turnover game statistics) were assessed in pretests and posttests for students in both groups. Pretests confirmed that the groups were of equivalent starting skill ability. From pretest to posttest, only the mastery group demonstrated statistically significant improvement in the three skills assessed. The finding of this study suggested that individualized feedback with information about learner performance results and suggested corrective strategies delivered immediately following skill testing may enhance skill development beyond presentation and practice alone. (Blakemore, Hilton, Harrison, Pellett, & Gresh, 1992).

Larsen and Janeen (1987) presented the paper entitled “Teaching Basic Jazz Piano Skills: A Mastery Learning Approach” at the Annual Meeting of the American Educational Research Association. A course designed on principle of Mastery Learning has specific objectives which were organized into small, sequential units in which student’s mastery is carefully monitored. Based on a review of Mastery Learning Theory, 15 hour course was designed, developed, and taught to two groups of four adult students. An evaluation of student achievement was conducted after completion of the course. The important results of this study are: (1) all students
reached the mastery level of achievement on the posttest; (2) 75% of the students reached the predetermined mastery level of performance concerning seventh chords; (3) 88% of the students achieved mastery level in improvisation; and (4) all students acquired more positive attitudes toward their own improvisational ability. (Larsen, 1987).

May and Kahnweiler (2000) studied the effect of a mastery practice design on learning and transfer in behavior modeling training. This study employed a pretest-posttest control group design in a field setting with 38 supervisors and managers to test the design for interpersonal skills training. The mastery practice protocol was drawn from recent research in cognitive and educational psychology on complex skill acquisition. Dependent measures included knowledge retention, behavioral skill demonstration, and far transfer to the workplace. Qualitative data was collected using a semi-structured interview process. The use of mastery practice design when compared with the conventional behavior modeling workshop practice showed improvements in retention and behavioral demonstration measures but failed to document any effect on transfer. (May, & Kahnweiler, 2000).

Hill-Miller (2011) has worked on studying the effectiveness of mastery learning instruction on developmental reading. The sample consisted of 73 students of an urban community college. A Solomon four-group research design was employed. One instructor taught two sections using Mastery Learning and another instructor taught two sections with non-mastery learning instruction. Each section included identical course objectives, course content, and unit exams. The independent variable was the instructional method. The dependent variables included academic
achievement, reading skill, and reading attitude. Quantitative data were collected in the forms of final grades, unit exam scores, reading skills assessment scores and reading attitude survey results. The statistical analysis revealed that there was no statistically significant difference in the reading attitudes of students in the mastery and non-mastery learning conditions. However, statistically significant difference was found between two groups on three of the five unit exams and retest opportunities resulted in improved academic achievement in the mastery learning conditions. (Hill-Miller, 2011).

2.5 STUDIES RELATED TO EFFECTIVENESS OF MASTERY LEARNING STRATEGY AND RETENTION

Advocates of Mastery Learning Strategy assume that practically all students can learn well if each student receives appropriate instructions and gets time that is needed to learn. Retention or permanence of what is learnt is almost always an integral part of the learning. As well as on other side forgetting is too obvious. The rate of retention may differ from individual to individual. Hence, many researchers found this topic of learning and retention to be worth investigating. The following section presents a review of some of these studies in this field.

Stangl et al. (2006) explored the impact of progressive mastery testing on the learning and retention of introductory statistics at Duke University. 101 undergraduate students from Duke University were the sample of study. The Progressive Mastery Learning Method showed short term benefits of higher exam scores but the benefits were lost within two semesters of taking the course. The study also reports that the professor
had to work extensively for implementation of the strategy. Students’ perception about the exercise was also not favorable. They felt that they had to do unnecessary extra work and which in turn resulted in undue stress. (Stangl, Banks, & Reiter, 2006).

Gruskey and Gates (1985; 1986) conducted a synthesis of research papers on the effect of Mastery Learning in elementary and secondary classrooms. 27 group based mastery learning studies were considered for synthesis. Amongst 27 studies 3 studies [Block, (1972); Wentling, (1973); and Anderson, Scott, & Hutlock, (1976)] were on investigation of effect of mastery learning in the area of retention. The results of these studies showed that group based mastery learning strategies do appear to have a positive effect on student learning retention, although not quite as large an effect as upon initial levels of achievement. Gruskey et al. (1985) highlight the need of many more studies on retention over a longer period of months or a year. (Guskey, & Gates, 1985; Guskey, & Gates, 1986).

Sut (1990) investigated mastery learning and its effect on science achievement, retention attitude and self-concept with special focus on educationally disadvantaged students. The mastery learning group scored significantly higher than the non-mastery control group in immediate summative achievement test and also in long term retention test. Interestingly, the disadvantaged students were seen to be getting benefitted more than the non-disadvantage students. (Sut, 1990).

Research paper by Romberg et al. (1970) reports results of two retention studies. In each study, tests were given some time after instruction to a class of students whose
initial level of performance was quite high. Results of these studies are summarized in terms of evidence related to the following questions: (1) to what extent are performances immediately following learning correlated with performances measured later?, and (2) How much retention was there? For the first study on retention of probability concepts, the correlation between achievement scores immediately after learning and those obtained four weeks later was 0.78. Retention ratios were calculated and were found to be (0.60 to 1.05) for individuals, (0.96) for total test, (0.43 to 1.09) for each objective, and (0.43 to 1.10) for each item. For the second study on recall of mathematical proofs, the correlation between achievement scores immediately after learning and those obtained two weeks later was 0.75. Retention ratios were found to be (0.33 to 1.25) for individuals, (0.93) for the total test, (0.97) for prerequisites, (0.79) for proofs, and (0.96) for correct steps within the proofs. Results indicate that high initial performance may contribute to high retention. (Romberg, Thomas & Wisconsin, 1970).

Wentling (1973) compared mastery learning and non-mastery learning to know how feedback relates to achievement and long term retention. This study examined four specific areas: immediate cognitive achievement, attitude toward instruction, time spent on instruction, and delayed cognitive achievement. Each group received feedback in one of the three forms: no feedback, partial feedback (knowledge of correctness of response) and total feedback (knowledge of correct response). The findings from this study showed superior achievement for both immediate achievement and long-term retention in groups with partial feedback. (Wentling, 1973).
Guskey and Gates (1986) conducted a meta-analysis that contained 46 studies that they have cited. 7 of the 46 studies investigated retention of learnt material over a four-week to four-month period. The results showed that group-based Mastery Learning Strategies do appear to have a positive effect upon students' retention of the material. However, these authors also have suggested that more studies are needed involving short-term retention as well as long-term retention. (Grusky & Gates, 1986).

The meta-analysis by Kulik et al. (1990) carried a meta-analysis of 11 studies conducted on mastery learning. This meta-analysis is focused mainly on research related to retention of learning in mastery learning group. This meta-analysis followed effect size techniques for calculating the findings. This effect size is calculated by subtracting the mean score of the non-mastery group from the mean score of the mastery group and dividing this difference by the standard deviation of the non-mastery group. The average effect size gain for mastery learning groups was found to be 0.71. From the analysis they concluded that the benefits obtained from mastery learning were enduring as after eight weeks of instruction mastery scores remained consistently higher than those of students in traditional classes. (Kulik, Kulik, & Bangert, 1990).

Peladeau et al. (2003) examined the relative benefits of mastery learning, accuracy-oriented over learning, and fluency-oriented over learning for academic performance and long-term retention. 168 college students participated in the study. They were randomly assigned to three experimental conditions: (a) mastery learning only, (b) accuracy-oriented over learning, and (c) fluency-oriented over learning. They were asked to practice every week with a computerized flash-card program until they
attained various mastery criteria. Mastery learning group students in the mastery condition had to practice a specific unit until they reached a stable level of 85%. This level was attained when the last performance in a specific week was above 85% and was followed the next week either by an initial performance at least as good or by an average of at least 85% on the first two trials. When the student reached that criterion for a given practice unit, was automatically removed from his or her weekly practice load. Comparisons between students who did and did not reach the mastery criterion lead researcher to conclude that practicing until mastery does provide a substantial benefit. The results confirmed that practicing until mastery improved individual exam scores, group success rates, and long-term retention. Moreover, over learning provided additional benefits, especially in long-term retention. However, fluency-building instructions did not further increase academic achievement or long-term retention. (Peladeau, Forget, & Gagne, 2003).

Barsuk et al. (2010) conducted a study on long-term retention of central venous catheter insertion skills after simulation-based mastery learning. Initial training by mastery learning was received by 61 participants. The Mastery Practice Standard (MPS) was previously set at 79.1% by a multidisciplinary expert panel. In post test all the participants met the Mastery Practice Standard (MPS). These participants were subjected to follow up testing after 6 months and after 1 year. 49 of 61 subjects completed follow up testing. Although performance declined from posttest where 100% met the MPS, 82.4% to 87.1% of trainees passed the exam and maintained their high performance up to one year after training. Thus they concluded that the skills acquired from simulation based mastery learning were retained during one year. (Barsuk, Cohen, McGaghie & Wayne, 2010).
2.6 RESEARCH STUDIES RELATED TO MASTERY LEARNING STRATEGY FOR TRAINING NURSES & HEALTH PROFESSIONALS

As discussed in chapter I, the research topic of the present researcher is in the field of health science in general and nursing education in particular. The researcher feels that this review of various works on investigations about effectiveness of Mastery Learning Approach should have a separate and concluding section on the works carried out in this area. The researcher is presenting the reviews related to Mastery Learning Approach for training health professionals in this last section.

Dunkel and Sondra (1984) conducted evaluative survey to find out disadvantages and advantages that physical therapy and allied health programs have encountered in utilizing a Mastery Learning Approach. In this survey, the researchers covered experiences regarding Mastery Learning Approach by the following disciplines: physical therapy, nursing, medicine, and social work. Survey result reported certain disadvantages and advantages of Mastery Learning. Disadvantages of Mastery Learning include: time commitment for developing a Mastery Learning curriculum, faculty resistance to change and lack of knowledge about developing learning packages, costs of producing modules, and difficulties in measuring all unit objectives in one unit exam. Advantages of Mastery Learning include: competencies and standards for mastery are preset and clear; the use of competencies encourage faculty to develop relevant learning experiences; faculty has to spend less time lecturing and become resource persons and managers of educational processes; and increased frequency of testing provides feedback and redirects learning efforts. (Dunkel & Sondra, 1984).
In the process of developing a national training system, JHPIEGO (1995) published manual entitled ‘Clinical Training Skills for Reproductive Health Professionals’ in 1995. This manual, which had been under development since 1991, describes a competency-based approach towards training clinical skills. It was designed to help expert service providers in becoming effective clinical trainers who can then train other service providers in clinical reproductive health skills. The manual has emphasized that Mastery Learning Approach be implemented for training. (JHPIEGO, 1995).

According to McIntosh (1992, 1996), Mastery Learning Approach is more effective approach to both classroom didactic and clinical training. It is based on the assumption that all students at the undergraduate and graduate levels can master the required knowledge, attitudes and skills, provided sufficient time and appropriate learning methods are used. This approach focuses on learning by seeing and doing rather than by preaching and scolding. Moreover, it is an approach with which medical faculty can be comfortable and which does not require learning to become an “educator” or mastering educational jargon. (McIntosh, 1992; McIntosh, 1996).

Wayne et al. (2006) study focused on ‘Mastery Learning of advanced cardiac life support (ACLS) skills by internal medicine residents using simulation technology and deliberate practice’, used pretest posttest design without control group. 41 PGY-2 internal medicine residents in a university-affiliated program were participants of this study. Participants underwent baseline pretesting. Then they received a 4, 2-hour education sessions with deliberate practice of ACLS events and procedures using a medical simulator. After training these participants were retested and were expected
to meet or exceed a minimum passing score (MPS). Those who failed to meet the MPS on any ACLS scenario were reengaged in more deliberate skills practice until the MPS is reached. The differences from pretest (baseline) to post test were analyzed using paired t tests. The researchers found that 33 of 41 participants (80.5%) achieved mastery with 8 hours training while remaining 8 participants (19.5%) needed extra time to reach mastery. Also, the students who needed more amount of practice to reach the MPS scored relatively poor in the posttest than those who needed less amount of practice. Interestingly, the participants appreciated the education program and rated it very high. (Wayne, Butter, Siddall, Fudala, Wade, & Feinglass, 2006).

Wayne et al. (2008) assessed Mastery Learning of thoracentesis skills by internal medicine residents using simulation technology and deliberate practice. This study implemented pretest-posttest mastery learning design without a control group. After baseline testing, residents received 2-hour education sessions featuring a videotaped presentation and deliberate practice with the thoracentesis simulator. Skill mastery was defined as meeting or exceeding the minimum passing score, (MPS) set by an expert panel at thoracentesis post-test. Those who did not achieve the MPS had additional deliberate practice and were retested until the MPS was reached. Study revealed that performance improved significantly, by 71%, from pretest to posttest. All residents met or exceeded the mastery standard. (Wayne, Barsuk, O'Leary, Fudala, & McGagh, 2008).

Barsuk et al. (2009) published an article on their pretest/ posttest study exploring the effect of mastery based simulation training on temporary hemodialysis catheter insertion skills. 18 nephrology fellows participated in the study; 12 participated in
simulator training while 6 did not. All subjects were posttested using a task specific checklist. Data were analyzed using Mann-Whitney U test. The simulator-trained group had significantly higher post-test scores than the control group at 0.001 level of significance. However, the authors acknowledge the small sample size as a limitation of their study. Additionally, the control group was not pre-tested to ensure homogeneity of the sample prior to the intervention. (Barsuk, Ahya, Cohen, McGaghie, & Wayne. 2009).

Barsuk et al. (2009) conducted observational cohort study of an educational intervention. The study was aimed to determine the effect of a simulation-based Mastery Learning Model on central venous catheter insertion skill and the prevalence of procedure-related complications in a medical intensive care unit over a 1-year period. It was found that a simulation-based Mastery Learning Program-increased residents’ skills in simulated central venous catheter insertion and decreased complications related to central venous catheter insertions in actual patient care. (Barsuk, McGaghie, Cohen, O’Leary & Wayne, 2009).

Butter et al. (2010) explored whether the effect of simulation-based mastery learning improves or not cardiac auscultation skills in medical students. 108 students (77 third-year students and 31 fourth-year students) participated in the study. Baseline scores of third-year students were found to be close to that of fourth-year students. Third-year students were trained with simulation and fourth-year students were trained traditionally. After training, third-year students were found showing improved scores significantly and also performed better than fourth-year students. Also, no significant difference was found in performance between males and females. The most important
finding of this study is that the third-year students who were trained for mastery showed improved accuracy when examining actual patients when compared to traditionally trained fourth-year students. (Butter, William, McGaghie, Elaine, & Cohen, 2010).

McGaghie et al. (2011), in their article entitled ‘Medical Education Featuring Mastery Learning With Deliberate Practice can Lead to Better Health for Individuals and Populations’ have very high praise for Mastery Learning Approach. They mention that Mastery Learning (ML) is an especially stringent form of competency-based education where learners acquire essential knowledge and skill measured rigorously against fixed achievement standards without regard to the time needed to reach the outcome. Mastery indicates a much higher level of performance than competence alone, and evidence shows that ML leads to longer skill maintenance without significant decay. Educational outcomes are uniform in ML with little or no variation, whereas educational time varies among trainees. In medical education, ML has been used chiefly for acquisition and maintenance of clinical procedural skills such as advanced cardiac life support (ACLS), thoracentesis, and central venous catheter (CVC) insertion. Work is now under way to evaluate these and other clinical mastery outcomes. (McGaghie, Issenberg, Cohen, Barsuk, & Wayne, 2011).

Barsuk et al. (2012) studied the effect of simulation-Based Mastery Learning (SBML) on internal medicine residents’ lumbar puncture (LP) skills. The study implemented pretest posttest control group design. All the participant residents completed pretest. After pretest experimental group received training by SBML approach and control group got training by simulation-based conventional approach. After training session,
all residents appeared for posttest. It was found that residents in the experimental group improved from a mean of 46.3% to 95.7% after SBML. All the students in the experimental group met the minimum passing scores at final posttest. The mean score (65.4%) of residents trained by simulation-based conventional approach was significantly lower than residents trained by SBML (Barsuk, Cohen, Caprio, McGaghie, Simuni, & Wayne, 2012).

All above mentioned studies in this section are conducted on resident doctors. However regarding training of nursing population, the researcher could find very few studies. These studies are discussed below.

Pinkney-Atkinson (1980) applied Mastery Learning Model for an in-service nurses training program for the care of hypertensive patients. Implemented model was modified Mastery Learning Model which was individual based self pace model. The study was conducted on the group of nurses with different qualifications and who had practicing experience of 15 years or more in medical-surgical area. Before starting, all the learners completed the necessary prerequisites. All participants were given 10 modules of teaching. These modules consisted of the particular objectives, the associate mastery level criterion and many forms of assessments. To move to next module, a learner has to achieve mastery in the earlier module. Teacher role was as a guide at the time of remedial measures. The author found that the rewards of experiment have been considerable for the learners, teachers as well as patients. (Pinkney-Atkinson, 1980).
Mathur (1987) investigated the effects of mastery level learning programme in statistics on the achievement, self-concept and attitude towards statistics of nursing students. A pretest-posttest single group design was used and the study was replicated on another batch of post-graduate and under-graduate nursing students. Replication was adopted as the tactic of the study to establish the validity of the results. A sample of 114 nursing students from two consecutive batches i.e., 1984-85 and 1985-86, of final year under-graduate and second semester post-graduate nursing courses was chosen for the experiment. Another batch (1986 & 87) of 42 final year under-graduate students was taken as the ‘contrast group’. A pretest in arithmetic skills was given to check the entry level behavior. Students were then instructed with a programmed text on arithmetic skills to equate them on their entry level. This was followed by a posttest in arithmetic skills. Before administering the self-instructional manual (SIM), pretests in self-concept and attitude were administered to the students. Intelligence and achievement tests were also administered before the outset of Mastery Learning Programme. Unit formative tests were administered after the completion of each of the four units of SIM. Formative tests were repeated till a student demonstrates mastery level achievement. To enable the students to overcome their weak areas, strategies such as corrective instruction in the form of re-reading the SIM, peer group discussion, and discussion with the researcher were employed. Summative tests in self-concept and attitude were administered after a gap of one week after completion of the Mastery Learning Programme. Completion of SIM including administration of tests took 20 to 25 hours time. For data analysis, study used descriptive-comparative and inferential statistics. Study has observed that, majority (75 per cent or more) of the nursing students from both
Rahmani et al. (2008) conducted the study to assess the effect of adapted Mastery Learning Model on cognitive and practical learning of nursing students. Author used quasi-experimental study design. 52 nursing students were grouped in 6 experimental groups and 6 control groups. Each group consisted of 4 to 5 participants. Both experimental groups and control groups received practical and cognitive pretest. Control groups received clinical training by traditional method while experimental groups received clinical training by adapted Mastery Learning Approach. The experimental teaching went on for 12 clinical days. The finding of study revealed that the average scores of experimental groups were significantly higher than that of control groups, even at 0.01 level of significance. All students from the experimental groups reached mastery level while only few students from the control groups reached mastery level. (Rahmani, Aghdam, Azar, & Roshangar, 2008).

Ye Yansheng and Xuan Y (2010) have explored the effect of Mastery Learning used in teaching skills in Fundamentals of Nursing. Total 89 nursing students participated in the study. They were randomized into a control group (44 students) and an observation group (45 students). The control group was taught by traditional teaching methods, while their counterparts in the observation group adopted Mastery Learning Approach. They were taught the fundamental skills of making an unoccupied bed, aseptic technique, removal and donning the gown, oral hygiene and measurement of vital signs. Findings of the study revealed that the scores of observation group were
significantly higher than those in the control group. The students in the observation group appraised teaching method positively as they felt that the Mastery Learning Approach boosted their learning initiative and enthusiasm. (Ye Yansheng, & Xuan Y, 2010).

2.7 MOTIVATION BEHIND PRESENT STUDY

From the extensive review of related literature carried out, the researcher noticed several important aspects about the research studies done in the past. In the field of nursing services, drug administration is one of the very common and important activities that nurses have to do. Large number of errors does occur during drug administration, many of which can be fatal for patients. Suggested solutions talk mainly about ‘electronic solutions’, which sometimes have been found to be non-effective and also difficult rather almost impossible to generalize in Indian setup. Noting that knowledge deficit of nurses is the root cause behind these errors, some of the researchers have rightly suggested to undertake research on how one can enhance cognitive and psychomotor abilities of nursing students by employing novel teaching methods. In spite of this, the best of the researcher’s knowledge, there are hardly any studies in the field of education of nurses. While reviewing, the researcher also noticed that large number of research studies have found that Mastery Learning Approach is more effective than conventional method in several areas of education. However, some studies have found that the difference is marginal or non-significant. All the above mentioned facts motivated the researcher to undertake the present study, since, to best of researchers knowledge there are no such studies done in past.
2.8 SUMMARY

In the preceding sections of this chapter, evolution of Mastery Learning Strategy has been discussed and several research studies have been reviewed. The studies reviewed were classified into studies in cognitive domain at college level, studies in the area of psychomotor domain, studies on effect of Mastery Learning Strategy in retention of knowledge and skills, and studies in the area of training of nurses and health professionals. Below presented is a brief summary or gist of these reviews.

Mastery learning concept was introduced in 1922 in the American schools by Washburne and others in the format of the Winnetka plan. During 1960s, Carroll put a learning plan named as model of school learning which was based on the idea of mastery learning. This learning plan had a large effect on the building up of Bloom’s strategy for mastery learning. Bloom’s learning for mastery focused new attention on the philosophy of mastery learning. This philosophy arises from the belief that possibly as many as 80% or 90% of the pupils could achieve that which is expected of them if given the opportunity, enough time, and diagnostic feedback based on formative tests. Since late 1960s when Bloom outlined his mastery teaching strategy, Mastery Learning Programs in various forms have been implemented, and several experiments have been carried out to test whether the Mastery Learning Technique has an effect on students’ achievements.

Many studies were conducted at school level. However few studies were conducted also at college level. Majority of them are in the area of cognitive domain. In almost all of these studies, the researchers have chosen a certain topic for the purpose of
experiment. The students selected for the experiment are typically divided into control group and experimental group. Students from control group are taught by conventional method and students from experimental group are taught by Mastery Learning Approach. Posttest is administered to students from both the groups and results are compared to come at conclusion about the effectiveness of the Mastery Learning Strategy. In some of the studies, pretest is also administered and pretest-posttest comparison was used as a base for comparison between the two groups. Most of the studies have found the Mastery Learning Strategy to be more effective than the conventional methods. However, exceptions to this have also been reported, where in the researcher have not found differences to be statistically significant.

Besides gaining knowledge or enrichment of cognitive domain, development of skills or psychomotor domain is an equally important aspect in education. There are many fields where one has to perform many skills and psychomotor activities. For doing so, to have the knowledge is an essential but not sufficient criterion. The researchers hence were also interested in studies in testing the effectiveness of Mastery Learning Approach also in the psychomotor domain. The research methodology used was similar to that described above which was followed by the researchers who worked in the cognitive domain. The only difference was in the form of assessment tests used. In these studies observation checklists were used to assess the performances of the participants. Here also the researchers have found that the Mastery Learning Approach is effective way of teaching variety of skills.

Retention of learnt knowledge or skill is integral part of learning. Because there are many situation where the learnt knowledge and skills are required for application.
Hence the acquisition of knowledge and skills and recalling or reproducing of the same knowledge and skills as and when required are two separate aspects of learning. A few investigations have been conducted to find out whether Mastery Learning Approach of teaching helps in the retention of learnt material. The research methodology used was similar to that described above which was followed by the researchers who worked in the cognitive and psychomotor domain. The only change was that the researchers, interested in studying effects on retention, administered additional test with a predefined time gap after completion of last summative test. Almost all studies have found that Mastery Learning Approach has significant positive impact on retention of knowledge and skills acquired. However, many authors have also highlighted the need of many more studies on retention.

Last section of reviewed literature deals with investigations carried out to assess the effect of Mastery Learning Approach in training health professionals. Most of these studies were carried out on resident doctors while hand full of studies were found in training nursing students. Majority of these studies are in the area of psychomotor domain and have used simulation based Mastery Learning Approach. The research methodology used was similar to the methodology followed by the researchers working in other areas. The results of these studies were affirmative. The students who learnt through simulation based Mastery Learning Approach were found to demonstrate learnt skills significantly better than their counter part.

In the review done, it was found that none of the studies, except one, in the field of training of health professionals have studied the effect of mastery learning on retention of knowledge and skills acquired. However, retention of knowledge and
skills acquired is very important in health industry in terms of providing quality safe care to the patients. Also, to the best of the researcher’s knowledge, there are no studies in Indian setup amongst health professionals for clinical training by Mastery Learning Approach. Thus the researcher got motivated to undertake the present investigation entitled “A Study of the Effect of Mastery Learning Model on the performance of the Nursing Students with Respect to Selected Drug Administration”. For this purpose, the researcher decided to check whether Mastery Learning Approach is more effective than the conventional approach in imparting knowledge and skills related to three modes (intramuscular, subcutaneous and intradermal) of drug administration. The effect on retention of the knowledge and skills acquired was also planned to be studied.
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