CHAPTER - II

REVIEW OF RELATED LITERATURE

2.1 Introduction:

This chapter provides a thematic presentation incorporating research studies taken up in the area of Mastery learning. This has been done for two purposes. One, it may be worthwhile to review research and development efforts made in this area and two, tracing the trend in such research helps to provide a proper perspective for the present investigation. The studies have been presented under five sections. These are :

i) Research on Programmed Learning Material;

ii) Potential of various instructional inputs,

iii) Development of instructional systems and their validation;

iv) Learner characteristics and achievement

v) Research in the area of Mastery Learning.

2.2 Research on Programmed Learning Material:

Efforts to systematise the instruction can be traced to research carried out in the area of programmed learning. Various psychologists have contributed to the fundamental principles of programming. Thorndike (1912)

while studying stimulus - response system visualised the arrangement of logically sequenced stimuli in printed form for individualised instruction, completion of one step leading the learners to the subsequent one. Pressey (1926) designed the 'teaching machine' for scoring multiple choice items in order to lead the students forward on the basis of immediate performance. Skinner (1954) strengthened these ideas by generating the theory of 'operent conditioning' in instruction to come forward with the linear programmed learning material. The significant features of the linear PLM were self pacing, active participation of the learners, gradual approximation of the concepts through logically sequenced small bits of information and provision of positive feedback aiming at success experience on the part of the learners. Deviating from the linear path adopted in linear PLM, Crowder (1958) developed the branching PLM. Branching programme deviated from the linear in having intermittent alternative paths of instruction, relatively larger bits of information and the provision of corrective feedback wherever necessary. Since then, programmed learning material both linear and branching has been extensively used in instruction in variety of situations. As a

consequence of the generation of Programmed linear material and its use in instruction; various research studies were taken up on different aspects of these techniques. Virtually all research studies upto mid-nineteen sixties are abstracted by Lumsdaine and Glaser (1960). The studies reported by them mostly deal with development of mechanical devices and programmed learning material and validation of their instructional effectiveness. Schramon (1964) reviewed research on programmed instruction and provided an entire bibliography while Fry (1960) summarised 25 studies utilising teaching machines, all of them showing the effectinveness of teaching machines. A few studies compared the effectiveness of instruction through programmed learning material and teaching machines with that through standard textbooks (Porter 1959, Eigen and Komoski 1960 Roe et al. 1960, Hughes 1961, Fisher and Malpass 1963 and Hartman et al 1963). Most of these studies have shown that elements of programming in instruction result in improved pupil performance.

Various specific aspects of programming too have received the attention of researchers. Studies are taken up pertaining to pacing, variations in number of steps and step size, different forms of PLM; presentation of PLM and its utility, etc.

Briggs (1961) reported a study in which self pacing in the presentation of instructional material was compared with controlled or automatic pacing and found that there was no significant difference in the mean performance of the groups. Hangen (1978) studied student use of time in a large and small self paced classroom and found a time lag between the two.

Evans, Glaser and Homme (1959) revealed that with smaller size of steps in a programme less time per step was required though more total time and fewer errors occurred in the course of learning. Beyond a certain point, increasing the number of steps in a sequence did not seem to result in improved performance. Coulsen and Silberman (1959) also reported similar finding with regard to step size and number of steps in a programme.

Evans (1960) compared two forms of PLM, one constructed in the Rule system and the other constructed in a less systematic procedure. Both produced comparable degree of learning but the former took less learning time. Carpenter and Greenhill (1963) reported comparable effectiveness of three media of presenting the programmed material i.e. through teaching machines, through programmed texts and filmstrips, and through closed circuit Television.

The observation made by Payne et al (1967) on sequencing reads a dissatisfactory note as far as the programmed learning studies are concerned. In an area where the sequencing of frames had earlier been treated as significant, repeated studies showed, even random scrambling of the sequence had little or no effect on learning outcomes.

The technique of programming was initiated in India in the early sixties itself. Since then, large number of programmes for various subjects and different levels have been developed. Sharma (1974) reviewing the researches in programmed learning at the Meerut University report the development of 35 programmes for various subjects at different levels. Yadav and Govinda (1976) provides a list of sixteen programmes developed at the Centre of Advanced Study in Education, M. S. University of Baroda. These programmes are meant to be used by the students of different classes at primary and secondary levels. Most programmes developed in the country, have been written in the linear style.Hussain (1974) has developed a programme in Geography, in both linear and branching styles. Similarly, Krishnamurthi (1974) wrote a programme in Physics in seven forms including linear and branching styles. The programmes developed so far,

for the school level have been for individual units, here and there, in some subject or the other and not covering a set of syllabus for any full course. However, with the increasing recognition of the effectiveness of PLM in several such instructional situations over time, led to its adoption in instruction on a larger scale for full courses.

In order to study the effectiveness of programmed learning, a number of experiments were carried out where one group of subjects were taught through PLM and the other through traditional methods (Shah 1964, Sharma 1966, Desai 1966, Shah 1969, Mehta 1973, Pandya 1974, Reddy 1975, Govinda 1975). The relative effectiveness of different forms of PLM were also studied. Shah (1971) investigated into the relative effectiveness of four response modes, while Krishnamoorthy (1972) studied seven different forms of PLM adding branching, skip programme and hybrid (linear and branching) to the list of Shah (1971). Kulkarni and Yadav (1966) attempted to study the relative effectiveness of linear, branching and simple programme (without providing immediate knowledge of results).

The programmed learning material developed were used by various researchers for different purposes.

These purposes included method of revision of the course taught (Kulkarni 1969, SIE 1970b), remedial teaching (Joshi 1972 and Kapadia 1972) and teaching correspondence course (Mullick, 1964).

Taking stock of researches in programmed learning, it may be deduced that although PLM is found to be an effective instructional component, it cannot be considered as a self-sufficient method of teaching for all types of learning. With the study conducted by Govinda (1975) the limited potential of PLM slowly started surfacing in India. Such a finding is reflected in the initiation of multimedia packages which involve a variety of instructional inputs; one among these being PLM. Yadav and Govinda (1977) combined other methods of teaching along with PLM to attain better effectiveness when compared to PLM alone. This does not, however, indicate any devaluation of the potentiality of PLM. Rather, the trend is indicative of the more comprehensive way in which instruction has begun to be perceived and a combination of various instructional components have been visualised. Later, in quite a few studies like Sansanwal (1977), Shah (1981), Ankleswaria (1981), Jaylakshmi (1977), Ravindranath (1982), Bhat (1983), Joseph (1983) Vardhini (1983) and Menon (1984) PLM has been developed and utilised as a major component along with other components.

In the light of the various research findings regarding the potential of PLM and various structural aspects of the technique it may be concluded that PLM which was earlier thought of as a self-sufficient method of teaching, was found to be rather inadequate in the attainment of all instructional objectives. This recognition is reflected in the later developments where one finds the greater usage of PLM as only one component of the instructional process.

2.3 Potential of Various Instructional Inputs:

While the theory of operent conditioning from the behavioural sciences gave rise to the technique of PLM, other principles from behavioural and physical sciences have been slowly finding their application in the instructional process in the form of various methods and media. Group dynamics from social psychology gave rise to the whole set of techniques involving group interaction. With the application of principles of physical sciences such as electronics, media like broadcast, telecast, audio-tape recorder, video tape recorder, etc.; started entering the classrooms. Such a trend led to the study of the potential of various methods and media which form inputs in various instructional situations.

Bligh (1972) reviewing research conducted on the potential of lecture method, reports the effectiveness of the method in providing basic knowledge to the learners. Chandrakala (1976) compared the effectiveness of lecture method and PLM in learning Sanskrit grammer and revealed that both are equally effective for the purpose. Govinda (1975) found structured lecture to be as effective as linear PLM in the teaching of 'educational evaluation' to B.Ed. students. Sodhi (1977) reports lecture to be as effective as linear PLM and branching PLM in all six categories of Bloom's taxonomy of objectives. Both lecture and lecture-cum-discussion methods were useful and suitable methods for teaching 'educational psychology' (Julk et al, 1974). Roy (1977) reports lecturing and questioning - response styles to be equally effective as far as knowledge and application objectives are concerned.

Another set of studies tried to examine the potential of audio, visual and audio-visual media in achieving various instructional objectives. The media comprises a wide variety of material, namely, charts, models, pictures, films, tape recorded message, slide presentations, language laboratories, etc. The significant investigations in the field may be categorised as

falling into audio, visual, audio-visual and comparative studies.

Research attempts in the use of audio medium have been mainly in the area of language teaching. Cutler (1958) found instruction through telephone was as effective as face to face instruction. Lorge (1963) demonstrated that the use of language laboratory in learning French pronounciation and comprehension resulted in greater effectiveness. Cook (1964) found the effectiveness of radio in the teaching of Spanish.

Research attempts made in the late sixties in respect of visuals are mostly on the use of pictures and the utilization of these in the teaching of language and paired associate learning (Rohwer et al, 1967, Jenkins et al,1967; Shepard 1967, Jenkins 1968, Paivio et al, 1968). Samuels (1967) showed the suitability of using pictures as prompts for the recognition of unfamiliar words but also found that at times pictures may misguide or divert attention from textual material. Reviewing evidence related to the effects of pictures upon children's acquisition of sight vocabulary, Samuels (1970) concludes - that pictures often interfere with learning how to read by providing distracting stimuli particularly for the poorer

students. Allen (1967) and Baker and Popham (1965) found that use of pictures increased the interest and enjoyment in learning. However, pictorial illustration increased learning only when subject matter content consisted of material having concrete references. Twyford et al (1964) showed that sometimes instruction using visual material can be as effective as other classroom activities. Gropper (1966) concluded that visual/verbal order of presentation is appropriate for concept learning tasks. Comparison of motion pictures with parallel static forms of pictorial materials usually show no difference in learning except when the concept to be learnt deals with motion and change in which case the motion version is superior (Silverman, 1958). Allen and Weintranb (1968) reported the superiority of motion pictures as compared to equivalent still pictures over a range of subject matter content and instructional objectives.

Comparative studies have been made with audio, visual and other forms of presentation. Popham (1960) and Newman and Highland (1956) compared the effectiveness of tape recordered lectures with conventional lecture-discussion method and an instructors teaching respectively. In both the studies appreciable differences were not revealed. Twyford et al (1964) demonstrated that sound

films were twice as effective as filmstrips in providing learning in a general science course.

A large number of investigations are available where the auditory and visual channels of communication in instruction have been compared. Schulz and his associates (1969) attempted a large number of comparisons of auditory and visual presentations in a variety of experimental tasks, including serial learning, verbal discrimination, etc. Majority of these studies did not show any significant difference of effectiveness while in certain other studies auditory superiority was found about as frequently as visual superiority. Schulz and Kasschau (1966) reported visual presentation to be superior for items low in meaningfulness while auditory presentation was superior when items were high or medium in meaningfulness. With regard to verbal discrimination tasks Schulz and Hopkins (1968) also reported a similar finding. Several researchers (Craik 1969, Margrain 1967, Murdock 1968) have investigated into the relative effectiveness of auditory and visual presentation of verbal information in short term retention. Reviewing the studies in the area of bichannel versus single channel presentation; Travers and his associates (1970) concluded that the two sensory modalities had no advantages over the use of a single modality

when both the channels present the same words. When the visual channel consists of pictorial material the effect of two channel communication is more complex.

The generalisations that have been pointed out in the review by Travers (1970) suggest that instructional situations call for the selective use of audio, visual and audio-visual media. In order to select the appropriate medium, criteria such as abstraction and complexity of concepts, prior knowledge of the learners, etc., have to be considered. If an audio or a visual presentation alone would suffice, it may conveniently be employed. The usage of audio-visual presentation may be justified only when each would supplement and reinforce the other.

Techniques involving group interaction help a participant in strengthening his view point as well as gradually developing in him higher cognitive abilities and affect attributes (Yadav et al 1979, Menon and Bhat 1983). The component of discussion has been used profitably along with other components in various research and development studies (Yadav and Govinda 1977; Sansanwal 1977, Shah 1981, Joseph 1983, Bhat 1983, Ravindranath 1982, Vardhini 1983, Menon 1984).

A few researches are available with regard to the use and potential of Library work. Sudame (1974) found a significant positive relationship between involvement in library work and academic achievement among post-graduate students of M. S. University of Baroda. Sansanwal (1977) made use of library work as a component in teaching at M. Ed. level while Yadav and Govinda (1977) Shah (1981) and Bhat (1983) used library work as a component in teaching at the B.Ed. level. Menon (1984) made use of library work as component in teaching at M.Ed. level.

2.4 Development of Instructional systems and Their Validation:

The varying potential of different instructional inputs towards the achievement of various instructional objectives led to a thinking among researchers in educational practice to perceive instruction as a system with constituent interrelated components. During the recent past, attempts were made to view instruction with a systems perspective leading to the designing of several instructional systems. The suggestions offered by Gagne (1965) and Glaser (1965) regarding a whole class of experimental investigations led to the generation of scientific principles for instructional designs.

Gagne (1965) proposed a taxonomy of behavioural objectives and a related taxonomy of types of learning which have implications for the selection of media for instruction.

Briggs et al (1960) suggested ways to use a single medium for the optimum length of time for the most appropriate set of objectives and decide among the alternative of group instruction, teacher conducted instruction and individualised instruction. Keislar and McNeil (1962) used devices like Cuisinaire blocks along with programmed instruction for teaching mathematics to first grade children. Smith, Schgrin and Poorman (1967) developed an instructional system in physics involving various types of media along with programmed texts and available commercial films and field tested and evaluated its effectiveness.

In Indian context several studies have been reported in instructional system development. Using PLM as major component, Yadav and Govinda (1977) evolved an instructional strategy for teaching a one semester course on 'educational evaluation' to B.Ed. students of M. S. University of Baroda. This strategy incorporated apart from PLM, discussion sessions, Library work and practical work. This strategy has been further evolved and

institutionalised in B.Ed. programme of the M. S. University of Baroda (Yadav et al 1983). Shah (1980) developed an instructional strategy for the course 'educational evaluation' at B.Ed. level on the line of Govinda (1975), and validated its effectiveness in another learner group. Other studies designed on similar lines using PLM as a major instructional component along with other components are those by Sansanwal (1977), Seshadri (1980), Jayalakshmi (1977), Joseph (1983) and Menon (1984).

Sansanwal (1977) evolved an instructional strategy for teaching a course on 'Research methodology' to M. Ed. and M. Sc. (Home Science) students of the M. S. University of Baroda. PLM was used as a component to impart basic knowledge and components namely, library work, discussion and feedback sessions were used additionally.

Jayalakshmi (1977) attempted to develop an instructional strategy with PLM as the major component for teaching educational psychology at the B. Ed. level.

Seshadri (1980) developed an instructional system, using PLM as the major component for teaching Algebra at secondary school level. She used other components too in the instructional system, viz., introductory lecture,

exercises and assignments, tutorials, summary, mathematical games and group activities and feedback sessions. Joseph (1983) used three forms of PLM along with other components for teaching English grammer at high school level.

Studies conducted by Ravindranath (1982) and Vardhini (1983) aimed at the development and validation of instructional modules for the teaching of science at the secondary school level. Alternative components have been compared for their effectiveness in both these studies. Similar studies towards development of instructional modules have been reported by Mian (1980) and Hopper (1982).

Ankleshwaria (1981) and Bhat (1983) attempted to compare alternative instructional strategies. Ankleshwaria studied the relative effectiveness of alternative strategies for teaching 'nutrition' to undergraduate students in Home Science, while Bhat attempted to develop alternative strategies for teaching 'educational psychology' to the B.Ed. students. Menon (1984) attempted to evolve a multimedia strategy for teaching 'educational technology' at the postgraduate level.

2.5 Learner Characteristics and Achievement:

Systematisation of instruction through the use of programmed learning material, multimedia approaches, instructional strategies or instructional modules is expected to make instructional process more effective in terms of learners' achievement. Such systematisation procedures are required to provide lots of flexibility of time and increased quality and quantity of instruction. These features are expected to minimise or even neutralise the effect of differential aptitude of learners in a specific area (Carroll 1963; Bloom 1971). Thus, these systematisation procedures are expected to improve the achievement of all levels of learners leading to mastery learning. Hence, it was thought worthwhile by a considerable number of researchers to investigate into the potential of programmed learning material or instructional systems developed by them in minimising the effect of various learners characteristics on achievements.

Iron and Briggs (1957) reported little relationship between intelligence and retention after auto instructional learning teaching while Foster and Sapon (1958) revealed no relationship between aptitude and achievement. Porter (1959) also reported no significant correlation between intelligence and achievement for

learners using spelling programme. Stolurow (1956,1962) found that mental age did not correlate significantly with achievement score based upon self-instructional material in logic, mathematics and statistics. Stolurow (1964) conducted a study where a few gifted students were taught through programmed learning material over a six week period and found that mental age of students did not correlate significantly with post-programme achievement scores.

However, a considerable number of studies are reported where achievement of learners who studied through programmes has been significantly related to intelligence in the programmed learning situation (Lambert 1962, Evans 1963, Creswell 1964, Larkin and Leith 1964, Fite 1966). Reviewing these studies Suchatt and Kaye (1972) have suggested the following.

i) There should be an increasing use of programme specific test of ability made rather than having constant recourse to the standard I.Q.tests.

ii) Studies should be carried out using programmed instruction for a longer period.

iii) Studies should be attempted where programmed instruction is a normal feature of the instructional situation.

iv) In attempting to assess the influence of student ability the experimental groups should possess a far wider range of ability than is usual in most studies.

A couple of studies, have attempted to examine the relationship between learners' attitude towards programmed instruction and their level of learning. Eigen (1963) found that attitude of high school students towards programmed instruction did not bear any significant relationship with the amount learnt through the programme. Eigen and Feldhusen (1963) also concluded that attitude towards programmed learning were not consistently related to students' level of leafning.

In the Indian context too a number of studies have tried to explore how particular learner characteristics relate with achievement through programmed learning material (PLM) and planned instructional strategies.

Singh (1972) found that PLM on fractions was more effective on students having a favourable attitude towards programmed learning than on those who did not have a favourable attitude. He further reported a positive significant relationship between achievement through programme and intelligence of learners.

Kapadia (1974) reported that intelligence was positively and significantly related to achievement on both linear and branching styles of programmes. She revealed a significant negative correlation between anxiety of learners and their achievement through linear programmes while there was no significant relationship between anxiety and achievement through branching programmes. There was no significant relationship either between self-sufficiency and achievement or between introversion-extroversion and achievement on both the types of programmes.

Kuruvilla (1976) studied academic motivation, adjustment, attitude towards PLM, reading comprehension and dependancy as factors which may have a relationship with academic achievement of students taught through four forms of programming namely, linear overt, branching, skip and response prompt. Except on skip form where a positive significant relationship existed, on all other forms no significant relationship was found between achievement and academic motivation. Significant positive relationship was observed between achievement and adjustment with linear overt form only. No significant relationship was revealed between achievement and attitude towards programmed learning as also between achievement and dependency. However, a positive significant relationship was observed between achievement and reading comprehension.

Govinda (1975) developed a linear PLM to teach a one semester course on 'educational evaluation' to B. Ed. students and studied their achievement in relation to intelligence, attitude towards programmed learning, academic motivation and English reading comprehension. The results indicated that all these learner characteristics were positively and significantly related to achievement.

In all the preceding studies the achievement considered for studying the relationships was through a programmed learning material or an equivalent auto instructional material. A few later research attempts developed instructional systems for teaching entire courses in various subject matter and the resultant achievement scores of learners were related to their characteristics. Sansanwal (1977) developed an instructional strategy to teach 'Research Methodology' course at master's level and studied the relationship between achievement of learners through the strategy and learner characteristics, viz. intelligence, academic motivation and English reading comprehension. The findings of the study indicate that intelligence was significantly related to achievement. Neither academic motivation nor English reading comprehension was related to achievement through the strategy.

Seshadri (1980) found that after teaching high school learners Algebra through an instructional strategy, the achievement of learners showed positive significant relationship with intelligence when the effect of academic motivation and study habits were partialled out. Such a relationship was not observed between achievement and academic motivation and study habits seperately. The researcher concludes from her findings regarding the positive influence of intelligence on achievement that the instructional strategy should incorporate alternative approaches, remedial teaching and increased flexibility in order to expect mastery learning in the students.

Research attempts are made to correlate achievement through instructional systems for teaching various subjects and learner's characteristics like intelligence risk taking behaviour etc. (Ravindranath 1982; Joseph 1983; Bhat 1983, Menon 1984).

2.6 Research in the area of Mastery Learning:

Mastery learning is a philosophically based approach to teaching and learning. The roots of this philosophical perspective actually go back several hundred years. Bloom (1974), found the idea that all students can learn well; in the writings of such early educators

as Comenius, Pestalozz and Herbert. But it has only been within approximately the last twenty years, with the development of specific teaching strategies which attempt to put this philosophy into practice that these ideas have come into the limelight of current educational thought.

The important theoretical impetus to the development of mastery learning strategies was the work of John B. Carroll. In 1963, Caroll published a manuscript entitled "A model for School Learning", in which he suggested an alternative perspective to the concept of student aptitude for a given subject. Carroll stressed that student aptitude has traditionally been seen as an index of the level to which a child could learn in a given amount of time. From this perspective, children tend to be viewed as either good or poor learners. The alternative perspective suggested by Carroll was to view aptitude as an index of the amount of time required by a child to learn the subject to a given level. Thus instead of seeing aptitude as a measure of ability to learn a particular subject or of specific learning potential, Carroll suggested that it can be viewed as a measure of learning rate. From this perspective, children are seen as being fast or slow learners, rather than as good or poor learners.

He defined the degree of school learning as a function of the time spent by the child in learning ~~re~~ relative to the time needed by the child to learn. Thus;

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

Building upon Carroll's work, Benjamin S. Bloom took up the task of transforming this conceptual model for school learning into a working model for classroom instruction. Thus the teaching learning strategy by Bloom (1968) came into existence which was labelled as 'learning for mastery' which later on shortened to simply 'mastery learning'.

Since the conception of this concept, two different approaches to the application of mastery learning strategies have developed. The first can be labelled as a teacher/development approach. Under this method teachers are trained in the theory and techniques of mastery learning and then individually or in terms develop materials for the implementation of these strategies in their classrooms. This method has been widely employed in many school systems across the United States.

The other approach is a curriculum/materials approach. By this method, a team of curriculum specialists

writers, artists and mastery learning experts work together to develop packages of materials which can then be used by teachers in adapting their instruction to a mastery learning format. Such materials are usually closely tied to a school system's established curriculum and sometimes represent a complete instructional package. This method has been used in a few school systems in the United States, but is developed on a very large scale in Korea, the Netherlands and several South American countries.

One of the first attempts to implement mastery learning strategies on a continuing basis took place at Olive-Harvey college in Chicago by the teacher/development approach. The success of this attempt at Olive-Harvey college (1972) led to the development of a country wide mastery learning programme which included the inservice training of instructors from all eight junior colleges in the Chicago city college system. Within this programme, mastery learning strategies were applied in nine different subject areas (biology, English composition, history, mathematics, nursing, psychology reading, and spanish) and in a wide variety of educational settings. In a study of the city college Mastery Learning Programme; Guskey and Monsaas (1979) found that the results of these efforts were similar to those experienced at Olive-Harvey College. In nearly every subject area, students enrolled in mastery

classes; received higher final grades, did better on common final examinations, and were less apt to withdraw than were students in non mastery sections of the same course.

It was not long before similar mastery learning programmes began appearing in public school systems across the United States. Extensive programmes have been developed in Chicago, Denver, New York City, and Lorain, Ohio, to name only a few. Most of these programmes use the teacher/development approach in which groups of teachers have worked together to devise the materials necessary for them to implement mastery learning in their classrooms.

The other method of applying mastery learning is the curriculum/material approach. The major advantage of this approach over the teacher/development approach is the speed with which large-scale implementation can be achieved. In Korea, for example, several former students of Bloom organized curriculum team which developed packages of mastery learning materials for subject taught at the elementary and middle school levels. The wide spread use of mastery learning in Korea has resulted in dramatic changes, both in the achievement levels of children in the schools and in the country as a whole. For instance, where once only a small percentage of children scored high enough on a national examination to enter the most

prestigious high schools, now a majority of children are qualifying. Thus not only the educational system, but the entire social structure of the country is being affected (Kim et al, 1974).

In reporting on Chicago's Mastery Learning Reading Programme; Smith and Katim (1977) note that these new materials are providing to be a great aid to teachers in enhancing the learning progress of students in reading. Furthermore, since the materials are closely matched with an established curriculum with which teachers have become familiar, they can be readily adopted with relatively little explanation and training in very different setting, across the city.

In a small pilot programme the possibility was explored of combining the teacher/development approach and the curriculum/materials approach in applying mastery learning strategies. The programme was conducted in two phases. The results of this programme indicated that the teachers who simply revised the materials experienced, very similar kinds of success in implementing mastery learning strategies as did those teachers who originally developed the materials (Guskey et al, 1978).

Thus it seems that both of these approaches to the application of mastery learning strategies have merit, and that they can be used together.

All mastery strategies are designed to take into account individual differences among learners in such a way as to promote each student's fullest cognitive and affective development. Typically, they accomplish this task by manipulating either the learning time allowed to each student and/or the quality of his instruction through various feedback/learning corrective devices.

Airasion (1967) in his Master's thesis reported an attempt to apply a modified version of Carroll's 'Model of School Learning' to a graduate level course in test theory. The intent was to produce mastery of the subjects in the largest proportion of students (n=33) within a ten week learning period.

In spite of the varying backgrounds possessed by the subjects, this strategy was effective in bringing most of the students to a high degree of achievement by the end of the course.

Biehler (1970) developed a mastery learning strategy for teaching introductory undergraduate

educational psychology. The strategy's purpose was to reduce examination pressure and competition among students, to counteract the negative impact of poor early test performance on a student's subsequent learning to maintain a respectable level of student learning, and still to assign grades within a A-to-F system.

The strategy seemed to be especially effective, both cognitively and affectively, for students whose performance on the first course examination might ordinarily have led them to give up. These students found that they still had a chance to do well in the course if they were willing to spend additional review time and relate the test. The procedure has been revised for subsequent use. Over 90 % of the students registered for the new course have chosen to learn under the mastery rather than the letter grading option.

Collins (1969) in his study investigated the effectiveness of Bloom's mastery learning strategy for the teaching of freshman college mathematics.

Colling (1970) in his study investigated the effectiveness of the different variables in Bloom's mastery learning strategy for teaching modern mathematics at the junior high school level. The results indicated

major differences in the effects of the various treatments in helping students to learn to the mastery criterion of an A or B grade. The diagnostic problems and review prescriptions were so effective here that the alternative learning resources were apparently superflous. The combined use of the objectives, diagnostic problems, and review prescriptions, systematically increased the percent of students attaining mastery from 40 % under control conditions to 80 % under mastery conditions.

Gentile (1970) describes a mastery approach to the teaching of a course in introductory educational psychology. The strategy's main purposes were : (a) to guarantee that all students mastered the course concepts (b) to demonstrate how instruction which emphasized cooperative rather than competitive learning could be organised in the classroom and (c) to maximise interactions among students, student proctors and the teacher.

Students' favourable response to the strategy was attributed mostly to the approach, the almost guaranted 'A' the responsiveness of the proctors and the availability of the instructor was observed in this study.

Green (1969) describes an effective, inexpensive mastery learning approach to the teaching of introductory

physics. In this study the mastery approach's success is attributed to the use of student tutors, who added a very valuable personal-social dimension to the course and to the sparse use of the tools of educational technology (e.g. Filmstrips, tapes).

In the study conducted by Kersh (1970) regarding effectiveness of a strategy based on John Carroll's 'Model of School Learning" to increase the proportion of students attaining mastery (grade of A or B) in one year in fifth-grade arithmetic; it was found out that; "The same achievement test and using the same mastery standard, there were significant increases in the proportion of experimental students (mastery class) attaining mastery compared to the proportion of the same teacher's students from the previous year (control class) attaining mastery. These increases ranged for one advantaged class from 19 % mastery in the 1966 control class to 75 % mastery in the same teacher's 1967 mastery learning class. Moreover, a disadvantaged class increased from 0 % attaining mastery in 1966 to 20 % attaining it in the 1967 mastery learning class. Note, in these examples, that the disadvantaged mastery class performed as well as an advantaged control class.

In India less attention is given to the researches on 'Mastery Learning', Few researches have been conducted in the field of 'Mastery Learning' in India. Some of them are mentioned below.

Hooda (1983) conducted a project on the 'effect of mastery learning strategy on pupil's achievement'. This study was conducted for VI grade pupils in a boys' govt. middle school; for eight units only in Mathematics. In this study it was found that experimental groups significantly achieved higher score than that in control group. It was concluded that 'Mastery Learning strategy' helps in improving the achievement of pupils.

Omkar Singh (1983) studied "Effects of mastery learning strategies on certain non-cognitive variables of high school students". This study was conducted to study and compare the effect of : (i) (a) Programmed Instruction, (b) Bloom's Mastery Learning Strategy and (c) Conventional method of Teaching; on self-concept of high school students after taking instruction in social studies;
(ii) (a) Programmed instruction, (b) Bloom's Mastery Learning Strategy and (c) Conventional Method of Teaching on achievement motivation of high school students; after taking instruction in social studies; (iii) (a) Programmed instruction (b) Blooms Mastery Learning Strategy and (c) conventional method of teaching on test anxiety of high school students after taking instruction in social studies.

Finding of this study shows that Bloom's mastery Learning strategy was found to be a superior instruction

strategy in comparison to programmed instruction is significantly increasing the achievement motivation of high school students. Programmed instruction does not seem to be suitable instructional strategy in Indian conditions, due to the cost and time required for the development of programmed texts. On the other hand Bloom's mastery learning strategy seems to fit well in traditional classroom situations as it does not involve that cost and time which programmed instruction does. Moreover, it is so designed that it does not require extra teaching material but makes use of those books which already stand prescribed for conventional method of teaching and ensure to cover the syllabus in the academic session.

Romesh Chand (1984) studied 'Effect of personalised system of instruction and Bloom's Mastery learning strategy on the Retention of High School students in a segment of science.

From this study it was revealed that PSI and Bloom's Mastery learning strategy have equal effect on immediate and delayed retention. Thus both these strategies help the students equally well in retaining the material for a long time. In the light of this it would

be worthwhile for a teacher to make use of these strategies in the classroom situations. However, it may be pointed out that the introduction of PSI may need a lot of finances because for every discipline additional material in the form of study guides has to be prepared. The schools which can afford to spend some extra finances in the proper presentation of material can safely make use of this strategy. But the schools which can not afford extra expenditure, can make use of Bloom's mastery learning strategy because this strategy needs an extra effort on the part of the teacher and no financial implications are involved.

2.7 The Place of The Present Investigation In The Context of Literature Reviewed:

The present investigation involves systematisation of instruction in 'Mastery learning' at elementary /school level through the development of an instructional strategy developed for fifth-grade Geometry. The experiment has been conducted in the real classroom setting for a period of almost one month; each one in two different schools of same status. It is a developmental research, the significance and organisation of which have been discussed in the subsequent chapter. The systematisation has been attempted in the real instructional context without exercising any strict experimental control. In this investigation various methods and media have been selected and sequenced to

constitute the strategy for mastery learning. This aspect of the study was carried out against the rationale that the potential of most of the selected methods and media to achieve various instructional objectives has been established through several studies conducted mainly in controlled conditions. The section 2.3 of this chapter provides several of such studies.

Research literature review with respect to learner's characteristics and achievement after learning through one input or combination of inputs, indicated significant relationships in many instructional contexts. While multiple learner characteristics operating in specific instructional contexts would speak more meaningfully of achievement, it may not be feasible to include for study all these characteristics in a single research investigation. However, even the study of certain characteristics can contribute towards knowledge generation with regard to the relationships between learner characteristics and achievement. It is against such a rationale drawn from literature reviewed on this aspect that the present investigation has attempted to study the relationship between intelligence and scholastic achievement after learning through the developed strategy. This aspect of the investigation is expected to generate some insight into the extent to which the developed strategy