Introduction
CHAPTER-1
INTRODUCTION

Recent times have witnessed a change in the role of professional teachers. Professional teachers carefully design and plan for their teaching. They structure classroom environments and build series of experiences for students who have a wide range of abilities, interests, and needs. A good design for teaching grows out of a clear understanding of the needs of learners and the goals of education. Each design that a professional teacher creates is unique because different groups of learners have individual needs and different types of learning require specific instructional approaches.

1.1 TEACHING

Teaching is an activity for transmission of knowledge, skills and attitudes since time immemorial in one form or another. Though with the passage of time, objectives and strategies of teaching have changed but one thing is definite that it was never based on any one principle or theory for long. According to Hough and Duncan (1970), "teaching is an activity, a unique professional, rational and human activity in which one creatively and imaginatively uses himself and his knowledge to promote the learning and welfare of others."

Flanders (1970) says, "the act of teaching leads to reciprocal contacts between teacher and the pupils and the interchange itself is called teaching."

According to Good (1959), "the three major factors emerge; first, that teaching is an instructional activity which takes place in educational institutions; second, that it is a managerial activity which is concerned with organization of teaching-learning situation; and, third, that it is an interactive process between the teacher and the student which involves pre-active..."
decision-making activities like planning, designing, preparing the materials for the teaching-learning situations, and post-active redirections”.

Gage (1987) defined teaching, "as any interpersonal influence aimed at changing the ways in which other persons can or will behave." According to Joyce and Weil (1980), “teaching is a process by which teacher and students create a shared environment including sets of values and beliefs (agreement about what is improvement) which in turn colour their view of reality.” Thus a teaching situation necessarily involves the teacher, learner(s) and the teaching-learning environment.

The main focus of teaching is to bring about a desirable change in the behaviour of learner. It is brought about by the teacher using teaching strategies to achieve his objectives. But traditionally we have been using teaching methods for content presentation. But to be more effective, the teaching has to suit to different styles of pupil's learning. As an implication, the teachers have to use such strategies of teaching, which can match the objectives of teaching as well as pupil’s learning styles.

1.2 OBJECTIVES

The purposes of instruction are as broad as life itself, but at any moment in time, a teacher has a delimited set of objectives. Objectives have an orienting and organizing effect which dispose students to attend to and organize relevant information and thus facilitate performance on criterion test items constructed in accordance with the objectives (Merrill, 1974).

An instructional objective indicates instructional outcome expressed in terms of students learning. In general terms, it indicates those knowledge, skills, abilities and attitudes that the teacher expects the student to acquire as a result of instruction. In instructional designing, they provide a guideline for choosing subject matter content, for sequencing topics and for allocating
teaching time and standards for measuring student achievement. In short, they serve as a criterion for evaluating the quality and efficiency of instruction.

Bloom and his co-workers (1956) produced three 'taxonomies' for cognitive, affective and psychomotor domains of behaviour. Each taxonomy arranged categories of objectives in order, from simple to complex, with the underlying principle that objectives at any one level build upon the one preceding to it. Bloom's (1956) work has focussed attention on the distinction to be made between two broad categories of objectives in cognitive domain: 'Knowledge' (Class 1) and 'Intellectual abilities and skills' (Classes 2-6, including comprehension, application, analysis, synthesis and evaluation). Over the last three decades, the Bloom's taxonomy has prompted many teachers for the first time to seriously consider the variety of mental activity they might be assessing in their students.

Mager (1962) proposed the following standards for adequate and communicable instructional objectives:

a) specification of the kind of behaviour, which is acceptable, as evidence of successful instruction.

b) statement of the conditions under which behaviour is to occur.

c) Specification of performance standards, usually specification of acceptable accuracy and speed.

Michael Scriven (1967) makes in effect, the same two fold classification: knowledge and what he calls comprehension (to include, analyzing, synthesizing, evaluating and problem solving). The fine distinctions to be made among the higher processes will remain a matter for debate (Rowntree, 1977), because the processes somehow transform the remembered data to varying degrees and go beyond the information given.
Rowntree further stressed that taxonomies must be regarded as suggestive, illuminative and stimulating rather than as comprehensive, prescriptive and indubitable. Not so much from considering whether such - and - such objective belongs in this category or that but from speculating as to what might be going on in the mind of the student as he tackles the many questions and activities given as examples in the taxonomies.

Kropp and Stoker (1966) made an impressive attempt to examine the construct validity of the taxonomy. They designed four tests in two content areas: Science and Social Science. Each of the four tests contained six sub-tests, one for each of the major classes of the taxonomy. They concluded that, “there was a clear tendency for the empirical data to support the imputed hierarchical structure of the taxonomy”. Regarding the use of behaviorally stated objectives, Jenkins and Deno (1971) argued that:

a) unless a teacher knows exactly where he is going, he may find himself somewhere else.

b) behaviourally stated objectives reduce wasted time in temporary diversions, ephemeral entertainment or other irrelevancies and

c) stating goals in behavioural terms permits a more objective measurement of goal attainment. Rothkopf and Kaplan (1972) suggested that when instructional objectives were given to students of reading, substantial gain in instructional effectiveness was obtained.

According to Gagne and Briggs (1973), purposes for a course are defined and converted into operational terms by the process of defining performance objectives. These describe the planned outcomes of instruction, and they are the basis for evaluating the success of instruction in terms of its intended outcomes. Gagne and Briggs (1973) gave a 5-component guide to the writing of performance objectives, viz. situation,
learned capability, object, action, tools or other constraints. The specific
goal or purpose for the instructional system should be derived from an
analysis of environment of the system (Hannum and Briggs, 1982).

Taylor (1976) emphasized that students sometimes exhibited greater
learning achievement when they were given behavioural objectives...
description of the specific behaviours which they are expected to exhibit
after instruction. Royer (1977) reported that intentional learning was greater
when objectives were placed prior to lecture. Incidental learning was found
to be significantly higher than intentional learning for students receiving
objectives after the lecture. A review of research literature by Duchastel
(1979) showed that providing the learner with instructional objectives could
facilitate learning.

Veerkar (1980) conducted a study on the effect of Integrated
Approach of teaching Social Studies on the performance of the pupils of
fourth standard of the primary School in the state of Maharashtra. The
findings of the study were: the treatment resulted in better achievement as
far as total performance and performance related to knowledge,
comprehension, skill and attitude objectives were concerned.

Asencio (1984) used a meta analytic technique to quantitatively
synthesize the research from 111 studies reporting findings on the effects of
behavioural objectives. It showed that behavioural objectives have a positive
effect on student achievement.

Mehdi (1988) investigated instructional, developmental and social
objectives of education at the secondary stage. He reported that (a)
curricula in various subjects are far from balanced and were not conducive
to attaining the three sets of objectives; (b) teaching-learning strategies
should be geared to attainment of intellectual, social and developmental
objectives; these should be made skill-oriented, and (c) evaluation
techniques too hinder the attainment of these objectives.

Palanivelu (1989) conducted study on objective based teaching at primary level, here the objectives taken up were based on Bloom’s taxonomy. The teaching as well as testing material in Science, based on the cognitive, affective and psychomotor objectives were prepared. The performance of the students taught by the objectives based approach was better than those taught by the teacher of the controlled group.

Sachan’s (1991) study examined the validity of Bloom’s taxonomy of educational objectives in the cognitive domain in relation to teaching of Science and whether objective-based teaching results in better development of the category system of cognitive domains. He conducted his study on about 500 students of 6-18 year age group. The major findings were that a 4-tie hierarchy comprising, K,C,A and E exists in place of the 6-tier hierarchy (K, C, A, SA, S, E) and that learning is cumulative, not sequential.

Mehra (1992) reported that the class VII high intelligence group performed better than the corresponding low intelligence group at knowledge level than at comprehension level of objectives on Biology achievement test. On the whole, students attained more scores at knowledge than at comprehension level of objectives. High intelligence group attained more scores in authoritarian than in democratic school climate at both the knowledge and comprehension categories of objectives. Low intelligence group performed equally well in authoritarian as well as in democratic school climate at both the knowledge and comprehension categories. Retention was found to be equally effective for learning at knowledge as well as at the comprehension level of objectives.

Chang and Mao (1999) compared students’ science outcomes with Inquiry group versus Traditional Instruction. The individual items of the achievement test in earth science were classified into three levels
(knowledge, comprehension, and application) according to Bloom's (1956) taxonomy. Knowledge items involved recognition or recall of ideas; comprehension items emphasized the understanding of ideas or concepts and application items required students to apply solutions to an appropriate situation. Sub-level achievement investigation showed no significant differences for higher level achievement test items between the experimental group and the control group. The results did not support previous studies that recorded improved science achievement among pupils at higher cognitive levels of Bloom's taxonomy (Chang & Barufaldi, 1999; Geban, Askar, & Ozkan, 1922; Mulopo & Fowler, 1987). It appears that nature of the comprehension - and application-test items on the astronomy topic was too difficult for both groups of participants. Students usually have the most difficulty learning astronomy content because it involves numerous abstract and spatial concepts such as the earth-sun system and the apparent movements of stars, sun and the moon. Students in experimental group showed significantly more positive attitudes toward the subject matter than those in the control group.

Sharad (2000) reported that at knowledge category of objectives students taught by Inductive Thinking Model, Advance Organizer Model & Conventional Method of teaching yielded comparable mean gain on achievement scores. At comprehension category of objectives, Inductive Thinking Model and Advance Organizer Model yielded comparable mean gain on achievement scores; but students taught by Inductive Thinking Model and Advance Organizer Model yielded better mean gain as compared to those taught by Conventional Method of teaching.

At Knowledge category of objectives, students taught by Inductive Thinking Model and Advance Organizer Model retained comparably and also students taught by Advance Organizer Model and Conventional Method
retained comparably. But, students taught by Inductive Thinking Model, retained more than those taught by the Conventional Method. At Comprehension Category of Objectives students taught by Inductive Thinking Model, Advance Organizer Model retained comparably. But students taught by Inductive Thinking Model and Advance Organizer Model retained more as compared to those taught by the Conventional Method.

1.3 MODELS OF TEACHING

A model of teaching is a step-by-step procedure that leads to specific learning outcomes. Effective instructional models allow students to become active participants in the learning process, take students through specific sequential steps; and reflect research about thinking, learning and behaviour. If a teacher creates a single environment in the classroom or utilizes the same instructional approach over and again, only those students who learn well in that environment or with that approach will succeed. The teacher who utilizes a variety of instructional approaches is more likely to reach all students in the classroom; moreover, students are encouraged to learn in a variety of ways. A model of teaching approach emphasizes the need for variety in the classroom by developing a teacher's repertoire of instructional approaches, to meet a range of objectives (Singh, 1995).

Models of teaching are really models of learning. As teachers help students acquire information, ideas, skills, values, ways of thinking, and means of expressing themselves, they also teach them how to learn. In fact, the most important long term outcome of instruction may be the students' increased capabilities to learn more easily and effectively in the future, both because of the knowledge and skill they have acquired and because they have mastered learning processes. Thus, in a very real sense, increasing aptitude to learn is one of the fundamental purposes of these models.
Rather, they present powerful cognitive and social tasks to their students and teach the students how to make productive use of them.

The models approach to teaching was first described by Joyce and Weil (1972) who defined a model as, "a plan or pattern that can be used to shape curriculum or course, to design instructional material and to guide teacher's actions." A model of teaching can be compared with a blueprint that an engineer follows in building some project. Just as a blueprint provides structure and direction for the builder, the model provides structure and direction for the teacher.

In a model of teaching, a teacher interacts with students in a classroom using instructional materials so that the students can learn selected educational outcomes consisting of knowledge, attitudes and skills. A model of teaching is merely a tool for thinking about classroom teaching. A good model is one that accomplishes its purposes with the fewest limitations.

In their book Models of Teaching, Joyce and Weil (1972) have defined the term model of teaching as an instructional design, which describes the process of specifying and producing particular environmental situations, which cause the students to interact in such a way that a specific change occurs in their behaviour.

According to Dunn (1972), "Schools usually do not capitalize on the existing knowledge of learning styles. Each pupil is not diagnosed to determine the teaching strategies through which youngsters could learn the best." Effective teaching strategies should find the ways into models of teaching. A model of teaching is characterized by well-defined and verifiable theory, specification of intended and unintended objectives, pedagogical syntax expressed in terms of well sequenced steps, explicitly described reactions of teachers and description of classroom support.
Models of teaching as applied to both curricular and instructional planning provide a unifying way of looking at the curriculum and teaching.

Flanders (1985) has described the model of teaching by stating that "a model is more than a description of teaching behaviour, it is a curriculum design in which instructional materials, learning activities, special objectives, class formation and patterns of teaching behaviour are synthesized into a coherent, understandable gestalten." Models, therefore, can be used in three ways for making curriculum plans, as a guideline for teacher pupil interaction, and as a rationale for selecting and arranging instructional materials. Each model is based on the ideas of a primary theorist. Some of the names are Ausubel, Bruner, Dewey Piaget, Schwab, Skinner and Taba.

According to Brady (1985):

- The models are guide to preparation and implementation of teaching and not highly developed theories. They are, as DeCecco (1968) suggests, forerunners to portable theories.
- The models are not highly discrete i.e. there is no definite boundary between each one.
- No single model is regarded as superior to others. No single model can realize the multiplicity of school and subject objectives.
- A thorough knowledge of all models leads to a greater flexibility and efficiency.

Models of teaching have been developed to help the teacher to improve his capacity to teach more children and create a richer and more diverse environment for them. Teaching models are also useful for teachers
for planning and organizing teaching activities. The teacher can make its use in planning curriculum, student teacher interaction, preparing an outline for guiding student's activities and to develop specific teaching aids. These models are also helpful in formulating, developing, and evaluating the theories of teaching.

A teaching model is not a substitute for teaching skill. A model cannot take the place of fundamental qualities in a teacher, such as knowledge of subject matter, creativity and sensitivity to people. Rather, it is a tool to help good teachers to teach more effectively, by making their teaching more systematic and efficient. It provides definite ideas for creating an environment from which students are likely to learn certain kinds of things, but it has to become a flexible, fluid instrument that is modified to fit different types of subject matter and which responds to students who are different from one another in many respects. Models provide the flexibility to allow teachers to use their own creativity. A teaching model is a design for teaching with which the teacher uses all the skills and insights at his or her command.

1.4 BASIC PROCEDURES FOR IMPLEMENTING A MODEL

The concepts for describing the operations of the model were invented as a way of communicating the basic procedures involved in implementing any teaching model. Each model is analyzed in terms of its concepts, termed as fundamental elements. With the help of these elements an outline of a model can be explained. These elements are:

(i) Focus
(ii) Syntax
(iii) Social System
(iv) Principles of reaction
(v) Support System
These descriptions are the operational heart of each model, they tell us what activities should occur and when appropriate, in what sequence.

(i) Focus:

A focus of a system refers to the frame of reference around which the model is developed. It determines combinations and relationships of various processes, conditions and factors built into the model. Objectives of teaching and aspects of the environment generally constitute the focus of the model.

(ii) Syntax:

The second element i.e. syntax refers to the description of the model in action. It is the sequence of steps involved in organization of the complete programme of teaching.

(iii) Social System:

The social system describes two elements, students and teachers' roles and relationships and the kind of norms that are encouraged. Some models use the teacher as the center of activity. Others provide equal relationship between teachers and students at the center. Thus, the models of teaching can be classified as highly structured, moderately structured and low structured.

(iv) Principles of Reaction:

Principles of reaction tell the teacher how to regard the learner and how to respond to what the learner does. These principles provide the teacher with rules of thumb by which to tune into the student and select model appropriate responses to what the student does.
(v) Support System:

It means to provide facilities to teachers and the students to successfully implement the strategy of teaching. For example, to implement individualization, a number of audio-visual aids, teaching machines, programmed text etc., can be provided. The support system includes two sources, the role specifications for the teacher and requirements of the substantive nature.

(VI) Application of the Model:

Some models are developed for some specific purpose whereas others have very wide general applications. For example, some models are designed to develop only social relationships, whereas some others are designed to develop social development along with academic and personal development.

The description of the effects of a model are categorized as the direct or instructional effects and the indirect or nurturant effects. The nurturant effects come from experiencing the environment created by the model.

1.5 FAMILIES OF MODELS OF TEACHING

Joyce and Weil (1980) have classified teaching models into four families that represent distinct orientation towards people and how they learn. These four families of models as given in their book are as follows:

(i) Information Processing Models
(ii) Personal Models
(iii) Social Interaction Models, and
(iv) Behaviour Modification Models

(i) Information Processing Models:

This family of models aims at fostering the information processing ability in the learners. Information processing is concerned with intellectual
functioning. Joyce and Weil (1980) define information processing as the ways people handle stimuli from the environment, organize data, sense problems, generate concepts and solutions to problems, and employ verbal and non-verbal symbols. The models of this family are concerned with the intellectual skills and acquisition of knowledge of students. The models included in this family are, Inductive Thinking Model, Inquiry Training Model, Scientific Inquiry Model, Concept Attainment Model, Advance Organizer Model.

(ii) **Personal Models:**

These models focus on personal development of the individuals and help them to develop positive relationship with the environment, construct and utilize their unique reality. They are concerned with human feelings and emotions and try to move towards the development of an integrated functioning self. The models included in this family are: Non-Directive Teaching, Awareness Training, Synectics, Classroom-meeting, etc.

(iii) **Social Interaction Models**

The models of this family emphasize the development of capabilities for interpersonal relationships. They stress the development of social skills, which help the individuals to engage in democratic process and to work productively in the society. The models in this family are Group Investigation, Social Inquiry, Laboratory Method, Role playing, Jurisprudential and Social Simulation

(iv) **Behaviour Modification Models:**

These models have evolved on the foundation work of B.F. Skinner and attempts to develop an efficient system for sequencing learning tasks and shaping behaviour by manipulating stimulus, response and reinforcement. These models are used in wide variety of applications from
teaching information, concepts and skills, increasing comfort and relaxation and decreasing phobias, changing habits and learning to control misbehaviour. Models included in this family are Contingency Management, Self-control, Relaxation, Stress Reduction and Assertive Training.

1.6 CONVENTIONAL METHOD OF TEACHING

Conventional method of teaching is the approach of teaching in which the teacher is the center of the classroom activities of teaching-learning process. According to Good (1973), Conventional teaching is that type of teaching, which is an outgrowth of custom or common practice. It is the teacher who presents the entire content to be learnt in the final form. In this approach, the student is not required to make any independent discoveries. An example of conventional teaching is the verbal instruction of the lecture hall.

The terms connected with conventional method are expository, traditional and lecture method. All these terms convey almost the same meaning. Most of the researches have taken Conventional Approach as that method of teaching where the lessons are not thoroughly planned, objectives are not thrashed out in behavioural terms, and planning is not used as a part of the teaching programme.

1.7 THE PROCESS OF INQUIRY

The model used in the present study is 'Inquiry Training Model'. This teaching model was developed by Richard Suchman (1962) and was further designed by Joyce and Weil (1972). As classified by Joyce and Weil (1972) this is the second information-processing model of teaching. They defined Inquiry Training as a "process for investigating and explaining unusual phenomena". Suchman once said that, "Inquiry is the way people learn when they are left alone".
Suchman developed this model by analyzing methods employed by creative research personnel, especially physical scientists. Although it was originally developed in the context of the natural sciences, its procedure has wide applicability in all subject areas.

Suchman's theory assumes that students acquire a firm grasp of subject matter by learning that all knowledge is tentative and that, as tentative knowledge is disconfirmed; it may be replaced with new knowledge. His emphasis is also on the complex concept formation. Here students are actively involved in the solution of a problem. The goals of Inquiry Training Model are to help students to develop the intellectual discipline necessary to search out data, process it and apply logic to it. Thus, Suchman is interested in helping students inquire independently, but in a disciplined way. Inquiry Training originated in a belief in the development of independent learners. Some features of inquiry learning are presented in Fig- 1.1
Learning through questioning, investing and problem solving is greater achievement gains than using expository teaching (Student ownership of learning. Teacher becomes the facilitator).

Inquiry skills need to be taught.
Activities are student centred.
Meaning is connected to Learning via the disciple of inquiry learning. (Gives value beyond the classroom.)
Greater achievement gains than using expository teaching (Student ownership of learning. Teacher becomes the facilitator).

Fig. 1.1 Features of Inquiry Learning
The defining feature of inquiry-oriented instruction is that students are not told explicitly the conceptual or meta-cognitive information that comprises objectives for instruction. Rather the teacher creates an intellectual and social environment within which students explore to discover both the essentials of subject matter and the cognitive strategies that are useful in those explorations. The principle underlying this orientation is that, by personally constructing plans to identify and acquire knowledge, the subject matter will be inherently comprehensible, tasks will be intrinsically motivating and meta-cognitive knowledge will develop naturally. Through the same process of exploration, students also gain a view of aptitude and knowledge as malleable, and they come to interpret process for learning as development successively building on and refining earlier methods for learning (Winne, 1995).

What is Inquiry?

At its simplest, inquiry implies students working with data and saying something about it.

Based on a given experience, facts are gathered which lead pupils to make statements, which they have derived from these facts.

![Diagram of Inquiry Process]

**FIG: 1.2: The Inquiry Process**
1.8 OVERVIEW OF THE INQUIRY TRAINING MODEL

Inquiry Training Model starts with a problem that is based on content included in the material being handled by the teacher. The teacher is responsible for formulating an interesting problem for pupils. The ultimate goal is to have the students experience the joy of knowledge, the confrontation is based on discoverable information. In this model, the responsibility for solving the puzzle lies with the students. After the presentation of a puzzling situation, they are encouraged to ask the teacher questions. The unique feature of this model is that students gather data to solve the puzzling situation. They ask questions to which the teacher provides the answer in the form of 'Yes' or 'No'. If the question or the student's response is such that it cannot be answered by 'Yes' or 'No', the teacher reminds him of the rule and asks the student to restructure his question so that the teacher could respond in the form of 'Yes' or 'No'. The students continue to ask questions. Over time, the students are taught that the first stage in inquiry is to verify the facts of the situation—the nature and identification of the objects, the events, and the conditions surrounding the puzzling event.

Finally, the students try to develop hypotheses that can fully explain what happened. An hypothesis is an unverified generalization, but for young children it can be presented as a 'hunch' or an educated guess. Even after lengthy and rich verification and experimentation activities, many explanations may be possible, and the students are encouraged not to be satisfied with the first explanation. It is clear that the emphasis in this model is on becoming aware of and mastering the inquiry process, not on the content of any particular problem situation.

Students will want to ask questions when -
♦ they are able to interact easily and normally with others, i.e. seating arrangements allow everyone to see and hear.

♦ content and activities interest them.

♦ they are taught and encouraged to use a range of questions, and questions at different levels.

♦ they are helped to recognize and use those questions that will further their inquiry.

♦ sound discussion techniques are used.

♦ they feel confident to ask a wide range of questions.

♦ their responses are accepted.

It takes time to establish and develop this atmosphere among students and between students and teacher (S.S in New Zealand Curriculum, 1996).

Suchman proposed six rules or procedures that teachers have found helpful in conducting inquiry session. According to the inquiry model, students learn that in order to obtain information they must ask questions. Questioning becomes the students initial method of gathering data. Thus the climate of the inquiry classroom must foster the axiom, "there are no dumb questions". Students must come to believe that you will accept their questions – no holds barred. Once the event is presented the teacher must be sure the students understand the real problem. Once the problem is established, the students engage in the inquiry session to construct a theory to account for the focus event. The major portion of the inquiry session is devoted to the students asking questions to gather data, which is then used to formulate one or more theories. According to Welch, Klopfer, Aikenhead, and Robinson (1981), "Thus in an inquiry classroom there is a time for doing----a time for reflection-----a
time for feeling-----and a time for assessment." Some rules/ procedures for an
inquiry session are given in Table 1.1.

TABLE: 1.1

RULES/PROCEDURES FOR AN INQUIRY SESSION

<table>
<thead>
<tr>
<th>Rule</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule 1: Questions</td>
<td>The questions by the students should be phrased in such a way that they</td>
</tr>
<tr>
<td></td>
<td>can be answered Yes or No. This shifts the burden of thinking on to the</td>
</tr>
<tr>
<td></td>
<td>students.</td>
</tr>
<tr>
<td>Rule 2: Freedom to ask questions</td>
<td>A student may ask as many questions as desired once they begin. This</td>
</tr>
<tr>
<td></td>
<td>encourages the student to use his or her previous questions to formulate</td>
</tr>
<tr>
<td></td>
<td>new ones to pursue a reasonable theory.</td>
</tr>
<tr>
<td>Rule 3: Teacher response to statements of</td>
<td>When students suggest a theory, the teacher should refrain from</td>
</tr>
<tr>
<td>theory</td>
<td>evaluating it. The teacher might simply record the theory, or ask a</td>
</tr>
<tr>
<td></td>
<td>question about the student's theory.</td>
</tr>
<tr>
<td>Rule 4: Testing theories</td>
<td>Students should be allowed to test their theories at any time.</td>
</tr>
<tr>
<td>Rule 5: Cooperation</td>
<td>Students should be encouraged to work in teams in order to confer and</td>
</tr>
<tr>
<td></td>
<td>discuss their theories.</td>
</tr>
<tr>
<td>Rule 6: Experimenting</td>
<td>The teacher should provide materials, texts, reference books so that</td>
</tr>
<tr>
<td></td>
<td>the students can explore their ideas.</td>
</tr>
</tbody>
</table>

The outline of Inquiry Training Model can be explained with the help of fundamental elements. Joyce and Weil, 1995. These elements include: (a) Focus, (b) Syntax, (c) Social System, (d) Principles of reaction, (e) Support System and (f) Application, which are described as below:

(a) Focus:

The general goal of Inquiry Training Model is to help students develop the intellectual discipline and skills necessary to raise question and search
out answers stemming from their curiosity. Thus, Suchman was interested in helping students inquire independently, but in a disciplined way.

A teacher choosing inquiry would have as an important goal the development of the ability of the students to recognize problems, suggest tentative answers, identify and gather relevant facts and critically assess the tentative solution. These are the skills of inquiry and the developments of these skills are the explicit goals of the Inquiry Training Model.

(b) Syntax:

Inquiry Training Model has five phases, which are shown in table

<table>
<thead>
<tr>
<th>Phase One: Encounter with the problem</th>
<th>Phase Two: Data Gathering – verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present discrepant event Explain Inquiry Procedures</td>
<td>Verify the occurrence of the problem situation</td>
</tr>
<tr>
<td></td>
<td>Verify the nature of objects and conditions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase three: Data Gathering- Experimentation</th>
<th>Phase four: Formulating an Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolate relevant variables Hypothesize (and test) casual relationships</td>
<td>Formulate rules or explanations.</td>
</tr>
</tbody>
</table>

**Phase five: Analysis of the Inquiry Process**

Analyze Inquiry Strategy and Develop more effective ones.

Phase one is the students’ confrontation with the puzzling situation. It requires that the teacher presents the problem situation and explains the inquiry procedures to the students.

Phase two is of verification and is the process whereby students gather information about an event they see or experience. In experimentation in phase three, students introduce new elements into the situation to see if the
event happens differently. Although verification and experimentation are described as separate phases of the model, the students’ thinking and the types of questions they generate usually alternate between these two aspects of data gathering.

In phase four the students organize the information they obtained during the data gathering and try to explain the problem as best they can.

In phase five, the teacher and students work together to analyze one another’s way of thinking, the emphasis here is on the consequences of a particular way of thinking. In this phase, the students with the help of the teacher recognize their own knowledge.

(c) Social System:

The classroom climate required for inquiry training is one of open classroom, where the teacher acts as a facilitator, guide, helping person and organizer. Although inquiry training can be quite highly structured, with the social system controlled largely by the teacher, the intellectual environment is open to all relevant ideas; teachers and students participate as equals where ideas are concerned. Moreover, the teacher encourages the students to initiate inquiry as much as possible.

The role of the teacher in this model is to select the problem situation, to referee the inquiry according to inquiry procedures, to respond to students’ inquiry probes with the necessary information, to help beginning inquirers establish a focus in their inquiry, and to facilitate discussion of the problem situation among the students.

As the students learn the principles of inquiry, the structure can be relaxed so that in their pursuit of the explanation for a problem situation, they can alternate, in an open environment and time frame, between resource
material, dialogue with other students, experimentation and discussion with the teacher.

(d) Principles of Reaction:

In this model, the most important reactions of the teacher take place during the second and third phases. During the second phase, the teacher's task is to help the students to inquire, but not to do the inquiry for them. The teacher can, if necessary, keep the inquiry moving by making new information available to the group and by focusing on particular problem events or by raising questions. During the last phase, the task of the teacher is to keep the inquiry directed towards the process of investigation itself.

(e) Support System:

The optimal support is a set of confronting materials, and resource materials bearing on the problem. It is relatively easy for the teachers to develop inquiry materials themselves. Resource materials, ideal books, etc. form an essential part of the model.

(f) Application of the Model:

Though the Inquiry Training Model was initially developed for teaching the natural sciences, it can be used in any subject area, to teach any topic in which a discrepant event can be presented to the students to initiate the inquiry process. The use of this model essentially requires the teacher to transform the content into problems to be investigated. The selection and formulation of the discrepant event is the core around which the inquiry process runs.

The Inquiry Training Model can be used with learners of all age group but each age group requires suitable adaptation of the model so as to enable the learners to master the inquiry process and be competent in all the phases of the model. For very young learners, it is more appropriate to stress the discovering aspect and make use of visual stimuli if possible. Although the
Inquiry Training Model emphasizes the inquiry process, nevertheless the content in any subject area can be taught to elementary as well as secondary level students.

**Instructional and Nurturant Effects**

The model promotes strategies of inquiry and the values and attitudes that are essential to an inquiring mind, including:

- Process skills (observing, collecting and organizing data; identifying and controlling variables; formulating and testing hypotheses and explanations; inferring)
- Active autonomous learning
- Verbal expressiveness
- Tolerance of ambiguity, persistence
- Logical thinking
- Attitude that all knowledge is tentative

The chief learning outcomes of inquiry training are the processes involved: observing, collecting and organizing data, identifying and controlling variables, making and testing hypotheses, formulating and explanation and drawing inferences.

**FIG: 1.3: Instructional and nurturant effects: Inquiry Training Model**
Dewey proposed that inquiry is the "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends."

National Science Education Research Council (1996) proposed, "Teaching must involve students in inquiry-oriented investigations in which they interact with their teachers and peers-students..... engage in problem solving, planning, decision making, and group discussions"

1.9 ORIGIN OF MASTERY LEARNING

Although the basic tenets of mastery learning can be traced to such early educators as comenius, Pestalozzi, and Herbat (Bloom 1974), most modern applications stem from the writings and research of Benjamin S. Bloom of the university of Chicago. In the mid 1960's Bloom began a series of investigations on how the most powerful aspects of tutoring and individualized instruction might be adapted to improve student learning in group based classes. He observed that while students learn at different rates, virtually all learn well when provided with the necessary time and appropriate learning conditions. The questions that perplexed Bloom as they have perplexed others in education were, "Why there is such a wide range in student achievement?" Why does that a wide range persist?" Is it possible to reduce the degree of variation in achievement?" The mastery learning model of teaching provides answers to these questions and can shift the distribution of student achievement from the typical distribution when using conventional methods, to a distribution where 80% of students are achieving distinction level.
Bloom believed that if appropriate conditions are provided then nearly all students could reach the same high level of achievement that usually is attained by only a few, top students under more traditional forms of instruction.

The Bloom's strategy is based on Carroll's (1963) model of school learning. Carroll contends that most learning tasks in a school curriculum can be mastered by all students if each student is given the time he needs. The time needed by a student to learn a school task is viewed as a function of complexity of the task, the aptitude and prior learning of the student, his ability to understand instruction, his perseverance in mastering the task, and the quality of instruction. Carroll proposes that the quality of instruction depends on such elements as (1) how clearly the learning tasks are defined, (2) how well the materials are sequenced and graded, and (3)
how effectively tests are used to provide encouragement, praise and corrective feedback (Carroll, 1971). Bloom has incorporated these elements into his approach for mastery learning in the classroom. Carroll's model for school learning outlined major factors influencing the student's success in academic learning. The original statement of the Carroll model (1963) proposed the following.

\[
\text{Degree of learning} = f \left( \frac{\text{time spent to learn}}{\text{time needed to learn}} \right)
\]

The mastery model also incorporated principles and programmes derived from, Goodlad and Anderson's work with non graded elementary school and the open classroom (1959), the work in Computer Assisted Instruction by Suppes and Atkinson (Suppes, 1966, Atkinson, 1968) and Glaser's work in Individually Prescribed Instruction at the Pittsburgh Learning Research Development Centre (1968).

The mastery process was influenced by the work of Gagne and Paradise (1961), which suggested that same learning can be organized into a sequence in which mastery of each unit or task is a necessary prerequisite for mastery of the latter, more difficult or more complex tasks. The distinction between formative evaluation which yields information to be used in the course of learning and summative evaluation, which measures final achievement in the course, made by Michael Scriven (1967) was also incorporated.

Since Bloom's mastery strategy is an adaptation of ordinary classroom instruction, it can be used at all grade levels and in all subject areas. Block (1971) has noted, however, it is most effective in subjects that have fairly stable contents, are highly structured, and stress convergent
thinking. The Bloom’s strategy has been widely adopted in American public schools and colleges and is being used in a number of other countries as well. In South Korea alone, the Bloom’s strategy has been used with over 50,000 students (Bloom, 1973). The ease with which it can be incorporated into regular classroom instruction and the lack of additional expense has probably contributed to its widespread use in United States and abroad.

Some modified MLS have also been tried like Co-operative Mastery Learning or Modified Bloom’s MLS (with only one cycle of feedback correctives). In the recent span of twenty five years more than one thousand articles were written on mastery learning (Guskey and Pigott, 1988). Despite occasional controversies and criticism, results of numerous studies have supported the basic philosophy of mastery learning.

In 1971, Bloom presented an additional model for school learning (Bloom, 1971, 1976) which proposed that the amount a student learns is directly proportional to the amount of time he actually spends in learning. Two models presented by Carroll (1963a; 1971) and Bloom (1971) were incorporated by Torshen (1977) into the theoretical school performance model as shown in Fig. 1.5.
Fig 1.5: School Performance Model
Bloom outlined a specific instructional strategy to make use of feedback and corrective procedure. He labeled the strategy "Learning for Mastery" (Bloom 1968), and later shortened it to simply "Mastery Learning" (Bloom 1971). In this strategy, the concepts and material students are to learn are first organized into instructional units. For most teachers, a unit is composed of the concepts presented in about a week or two of instructional time. Following initial instruction on the unit, a quiz or assessment is administered to students. Instead of signifying the end of the unit, this assessment is used primarily to give students information, or feedback, on their learning. In fact, to emphasize its new purpose Bloom suggested it be called a "formative assessment," meaning "to inform or provide information." A formative assessment identifies for students precisely what they have learned well to that point, and what they need to learn better. Also included with the formative assessment are explicit suggestions to students as to what they might do to correct the learning difficulties identified on the assessment. Because these suggested corrective activities are specific to each item or set of prompts within the assessment, students need to work on only those concepts not yet mastered (Guskey 1996).

When students complete their corrective activities, usually after a class period or two, they are administered a second, parallel formative assessment. There are two major reasons for this second assessment. First, it is necessary to check on the effectiveness of the correctives in helping students overcome their individual learning difficulties. Second, and more important, a second formative assessment offers students a second chance at success. Hence, it serves as a very powerful motivational device. Through this process of motivational assessment, combined with the systematic, correction of individual learning difficulties,
Bloom believed all students could be provided with a more appropriate quality of instruction than is possible under more traditional approaches to teaching.

To use mastery learning, a teacher must offer students regular and specific information on their learning progress. That is, the information or "feedback" students regularly receive should; (a) reinforce precisely, what was most important to learn in each unit of instruction (b) recognize, what was learned well and (c) identify what students need to devote more time. This feedback also must be appropriate for students' level of learning if it is to be effective. Feedback, correctives, and enrichment procedures are crucial to the mastery learning process, for it is through these procedures that mastery learning "individualizes" instruction. To be truly effective, feedback, correctives and enrichment procedure should be combined with congruence among instructional components. These are the essential elements of mastery learning process (Guskey, 1996).

Bloom brought together the findings from research into a variety of factors concerning the relationship between students, teaching, and achievement, and developed these into general theory or model. It is important to be aware that Bloom's model is not a psychological theory of learning, but an input-output model of learning. In other words, Bloom didn't speculate on what may or may not be taking place in the mind of student, i.e., their psychological process during learning activities. Instead he concentrated on identifying what he thought were the major input variables, and then correlating these with achievement in tests and examinations. (McCabe, 1995).

Based on Carroll's Model of school learning (1963), Bloom (1976) synthesized researches, relating to classroom instruction into a theory of
school learning. This theory is based on research on mastery learning, research using mastery learning as research tools, and review of research literature related to schooling, learning and human characteristics. This theory attempts to explain school learning in terms of a small number of interdependent variables. These interdependent variables mainly account for much of the variation in school learning. The three inter-dependable variables which are central to Bloom's Model of school learning are:

1. Pupil entry Characteristics (Cognitive Entry Behaviour and Affective Entry Characteristics)

2. Quality of Instruction

3. Learning outcomes

FIG. 1.6: MASTERY LEARNING MODEL
Cognitive Entry Behaviour (CEB)

Cognitive entry behaviour represents the pre-requisites for the new learning task. Without the availability of these pre-requisites the learning of new task becomes difficult, thereby adversely affecting the achievement of pupils.

Affective entry characteristics refer to pupil interest and attitude towards the subject, the class and the school with which he approaches the new learning task. His own academic self-concept is also covered in this set evidence of significant relations between affective characteristics and related measures of school achievement are available (Block 1970, Anderson, 1973, Arlin 1973, Ozcelik, 1974, Levin 1975).

The effect of variations in CEB on the distribution of achievement are presented in fig 1.7.

---

**FIG 1.7: THE EFFECTS OF VARIATIONS IN COGNITIVE ENTRY BEHAVIOUR**
Quality of Instruction

Quality of Instruction is defined in terms of interaction between instruction and pupils, the extent to which instruction can be adjusted to pupil aptitudes, cues, participation, reinforcement may be stressed as the major characteristic in instruction and their effects on pupil learning. Use of feedback and corrective procedures is one means of ensuring that each pupil gets as good a quality of instruction as he needs.

Quality of Instruction has four components and they are presented in the fig. 1.8.

You can see from the diagram that quality of Instruction refers to more than just how well you transmit the subject content of a lesson. Quality of Instruction is an approach to developing high quality inter-action between a lecturer and students, i.e. high quality teaching.
The amount of P & P is a direct indicator of QI.

Fig. 1.8: Components of quality of instruction

Improving self-confidence
Improving motivation
Developing responsibility

Assessment for learning

Teaching methods

Type I
Designing the instructional message
Directing the student's effort

Type II
The amount of P & P is a direct indicator of QI.

Participation & Practice
Feedback & Correctives

Instructional Cues

Reinforcement
Learning outcomes refers to the level of achievement, rate of learning and level of motivation of the students.

Based on Carroll's model of school learning, Bloom developed the concept of Mastery Learning for optimizing pupil's learning in different curriculum areas, which demonstrated that classes suffer from under-achievement and through appropriate teaching strategies practically all students can be helped to achieve the desired mastery level (Bloom, 1971). Bloom (1971) maintains that 95 percent of the content can be mastered by 95 percent of pupils by Mastery Learning Model. The maintenance of 95 percent of the mastery level produces maximum cognitive learning, but may affect adversely the 'affective domain' of the learners. However, 85 percent mastery level offsets their adverse effects (Block, 1971).

The 'Test + Remediation' procedure for correcting learning errors is shown in fig. 1.9

![Flowchart](image)

**FIG. 1.9: TESTING + REMEDIATION' PROCEDURE IN MASTERY LEARNING (MC CABE, 1995)**
The mastery Learning model is based on four hypotheses proposed by Bloom. These are:

**Hypothesis No. 1:** "A normal person can learn anything that teachers can teach."

In other words, if something can be taught, it can be learned by any normal person, if enough time and effort can be devoted to both the teaching and the learning of the subject matter.

**Hypothesis No. 2:** "Individual learning needs vary greatly."

People learn best when the content to be learned and the conduct of the learning activity match their individual learning styles. When the material to be learned and the activity do not match their preferences for learning in specific ways they will learn less effectively.

**Hypothesis No. 3:** "Under favourable learning conditions, the effects of individual differences approach vanishing point, while under unfavourable learning conditions, the effects of individual differences is greatly exaggerated."

The major causes of variation in student achievement are mostly man-made and not the result of unchangeable factors such as:

- differences in IQ
- differences in Aptitude
- differences between Fast Learners and Slow Learners

Bloom is not pretending that such differences don't exist. What he is saying here is that these differences do not have to condemn many people to poor performance in academic attainment. If the conditions under which learning takes place are favourable to each individual, then the effects of such differences can be eliminated to a large extent.
Hypothesis No. 4: "Uncorrected learning errors are responsible for most learning difficulties."

Teaching which is designed to detect and correct learning difficulties as they are arising is, with all other things remaining unchanged, bound to produce superior learning than teaching which is not designed to correct errors and misconceptions. If we build only this one element into our teaching, it will significantly improve the performance of our students (McCabe, 1995).

1.10 THE VARIABLES FOR MASTERY LEARNING

A learning strategy for mastery may have roots in the work of Carroll (1963a) influenced by the idea of Skinner (1954); Goodlad and Anderson (1959); Bruner (1966); Suppes (1966), Glaser (1968) suggested following five variables which all mastery learning strategies generally take into account.

1. Aptitude and Learning Rate
2. Ability to understand Instruction
3. Quality of Instruction
4. Perseverance
5. Time Allowed for Learning

1. Aptitude and Learning Rate:

Aptitude, according to Carroll (1963a), is the amount of time required by the learner to attain mastery of learning task. Carroll (1963) indicated a strong relationship between the college students' foreign language (Mandarin Chinese) aptitude scores and both the levels to which they were learned and also the rate of learning. Further, it was found that when time was held constant, then individual differences in aptitude played an unusually great role in students' achievement. Aptitudes for particular
Learning tasks are not completely stable and that they may be modified by appropriate environmental conditions or home and school learning experiences (Hunt, 1961; Bloom, 1964). Sjogren (1967) found a significant positive relationship between the ratio of time spent to the time needed, and the learning measures (the achievement test and the aptitude scores). Hence, instructional treatment may be developed to interact with student aptitudes (Cronbach and Snow, 1969). It has also been concluded that alignment and aptitude positively affect student's outcomes (Koezor, 1984).

Particular aptitudes were related to learning rate for each task. Kim (1968) found that memory prognosticated learning rate for German words, reasoning, number facility and spatial prognosticated learning rate for statistical concepts, operations and logical syllogisms respectively. Airasian (1969) stated that aptitudes are most clearly predictive of students' learning rate for initial or lower level skills.

Stone (1984) concluded that difference in the rate of mastery between high and low aptitude students not only decreased, but the trend lines crossed so that for the final mastery task, the low aptitude students took less time to complete the final task. Bachmann (1985) found that cognitive aptitudes did account for less variance in predicting learning rates in the Computer Managed Courses. Blakemore (1985) and Salim (1988) also reported that low aptitude students were benefitted from the conditions of mastery learning.

2. Ability To Understand Instruction

The ability to understand instruction may be defined as the ability of the learner to understand the nature of the task he is to learn and the procedures he is to follow in his learning (Block, 1971).

Yates and Pidgeon (1957) reported results of seven years inquiry into
the efficiency of the procedures by which primary school students were allocated to secondary schools in England with the conclusions that ability to understand instruction as measured by verbal intelligence tests is an important determinant of level of achievement in secondary schools.

Students who are high in certain given abilities are likely to perform better if the material is presented in a mode, which emphasizes those abilities. Similarly, persons who are low in certain abilities may be put at a disadvantage if the mode stresses those abilities (Behr, 1967; Davis, 1967). Cronbach and Snow (1969) concluded that verbal ability facilitates the ability to learn verbal instruction or tasks, spatial ability to learn spatial tasks. The phonics instruction appeared to be the best for low ability children, while whole word treatment best served high ability children. Cullen (1989) found a positive relation between a student's attitude towards a subject area and his ability to learn.

Mastery learning strategy plays vital role for different ability levels of children. Chen (1992) concluded that MLS promoted the learning outcomes of Mathematics for non-disabled children, for learning disabled children and for educationally mentally retarded children.

3. Quality of Instruction:

Carroll (1963) defined the quality of instruction in terms of the degree to which the presentation, explanation and ordering of elements of the learning task optimized for a given learner. Anthony (1967) suggested that use of variety of instructional approaches improve the quality of instruction. Carroll and Spearitt (1967) found no interaction between intelligence and quality of instruction, suggesting that poor quality of instruction affected high as well as low intelligence students. Quality of instruction may be thought of as the relevance of the particular form of instruction to the particular

Instructional methods should both maximize each learner's performance and minimize the time he requires to obtain optimal performance (Behr, 1967). Mastery Learning resulted in better scores with the use of alternative procedures (Fuchs, Fuchs and Tindal, 1986); textbook format integrating verbal and visual information (Jones, 1986); various instructional conditions (Tenenbaum, 1986; Jantjes, 1988); and positive school climate (Zeanah, 1986). Ethnic match between teacher and learner affecting the quality of instruction as measured by student's perception, student time on task and student's mastery level, was not supported by Delong (1987).

Cronbach and Snow (1969) emphasized on the fact that improving the quality of instruction can optimize the learning of particular learners. Mastery learning is a promising approach and its effectiveness has been proved for different I.Q. students (Kim et al. 1969); disadvantaged group (Thakur, 1987, 1990); high, average and low socio-economic groups (Chaudhary and Vaidya, 1991); and educationally disadvantaged group (Lai and Biggs, 1994).

Guskey (1987) noted that an instructional program that does not include implicit feedback and corrective procedures can not be considered under mastery learning. Obando and Hymel (1991); Senemoglu and Fogelman (1995); Takashima (1995) reported the positive effects of feedback as an important component of mastery learning.
4. Perseverance

Carroll (1963a) defined perseverance as the time the learner is willing to spend on learning. Thornton (1939) in his report provided evidence for a trait called 'persistence' and characterized this factor as 'keeping on at a task'. Frequency distribution of the study indicated that individual differences existed in this trait.

Seashore and Bavelas (1942) reported positive relationship between persistence at a task and some form of external reinforcement and suggests that this relationship may be especially important when there are objective criteria of success (grades) which the subject is able to perceive as indications of his success or failure, or when the source of the external reinforcement is some one of importance to the subject (e.g. a child's mother).

Weiner (1965) indicated the importance of success and failure as an influence on persistence. Subjects high in achievement motivation persisted longer i.e. took more trials in the failure condition than in success condition. Subjects in the lowest quartile on achievement motivation persisted longer when placed in the success condition.

Carroll and Spearitt (1967) found an interaction between intelligence and quality of instruction with respect to the students' willingness to persevere on a difficult post experimental task. Students who used high quality of instruction spent more time on the post task if they were in the high or the low, but not in the middle intelligence groups. Thus, poor quality of instruction decreased perseverance for high and low intelligence students and increased it for the average intelligence students. Husen (1967) concluded that perseverance is also related to student attitudes and interest in learning. However the research literature provided sufficient evidence to
conclude that mastery learning increases the perseverance of the students (Duncan, 1976; Sharma, 1984; Yadav, 1984; Evans, 1985).

5. Time Allowed For Learning:

Only when achievement replaces time as the constant factor in the schools, instruction can be individualized to meet the needs and capacities of the child (Washburne, 1922). Individualized methods save student's time, especially for the faster students as compared to the traditional methods (Washburne, Vogel and Gray, 1926) but speed of learning varies from subject to subject (Smith and Eaton, 1939).

Carroll (1963) emphasized that if time is held constant, then individual differences in aptitude play important role in achievement, although, Airasian (1967) reported less variability over time in achievement on formative evaluation. But, time criterion was significantly related to intelligence and ultimately to achievement (Carroll and Spearitt, 1967; Atkinson, 1968; Glaser, 1968; Yeager and Kissel, 1969).

Sjorgren (1967) reported a significant relationship between variation in time needed to complete a learning task (since time spent was fixed) and both general intelligence and achievement measures Wright, (1967) investigated the relationship between subject matter mastery and time, and indicated the following results:

♦ A large percentage of students eventually attained the predefined mastery level.

♦ Some students reached mastery faster than others.

♦ The time taken by majority of students to reach mastery varied for the different subject matter subjects.
Maintenance of high level of mastery makes students learning increasingly efficient without the need for spending time for feedback/corrective procedures. Like a crutch, these procedures might be discarded (Block, 1970; Merrill, Barton and Wood, 1970).

Mastery learning strategy has shown its effectiveness over time also when the more material was provided to mastery learning students, they still learned this material in less time as compared to control group (Merrill, Barton and Wood, 1970). However, Holz in 1978, and Henderson in 1993 proved that if the time was held constant, no significant difference would exist between mastery learning and control group.

1.11 MASTERY COMPONENTS

The mastery model contains six components: Objectives, Pre-assessment, Instruction, Diagnostic assessment, Prescription and Post-assessment. Each component of the mastery structure has an important function in helping students to learn the basic skills, concepts and facts, ensuring that students enter at their own level and progress at their own pace. It also provides each student the greatest possible exposure to the instructions most likely to help him in reaching at his goals (Torshen, 1977).

Objectives:

Objectives are the first component of the Mastery model. The objectives are specific statements of the outcomes or goals that students in the instructional program are expected to reach at. They define the specific skills, the key concepts and the ideas, or the specific facts that a student must learn in order to complete the program successfully. In each skill, concept, and fact area the minimum level of performance essential for each student to attain is identified. These performance levels are called mastery levels or minimum pass levels.
Pre-assessment:

The pre-assessment component of the mastery model determines each student’s starting point and methods of instruction, which the teacher uses in the program. This assessment identifies each student’s capacity relative to the outcomes he is expected to reach by the end of the program. It incorporates the student’s prior performance on achievement and ability tests in prior courses or in previous units, observations and judgements of the teachers, and the other informations supplied by the student himself.

Instruction:

The third component is instruction. In selecting the instruction for a program, the crucial question is: ‘Can the student use this instruction to proceed from his initial status to mastery of the objectives?’ There is no restriction on the type of instruction that can be used in a mastery program. When more than one appropriate instructional method is available, then the teacher or the student can select the instructional option he prefers.

Diagnostic Assessment:

The diagnostic assessment component provides information concerning how well the instructional program is working while the instruction is in progress. This assessment procedure measures what each student has learned and what he has failed to learn at regular intervals throughout the instructional program. The information is used to pace the student’s learning and ameliorate those segments of the instruction that have not been effective. This component of the structure is crucial in adapting the instruction to the needs of the individual students.

Prescription:

The prescription component of the mastery structure consists of the instructional activities recommended on the basis of the diagnostic
assessment. When the diagnostic assessment shows that a student needs further instruction, the prescription is remediation. According to the diagnosis of the problem, the student is provided with additional instruction or alternative instruction, or he repeats the instruction he has just completed.

Relocation is prescribed for a student when the diagnostic assessment indicates that he doesn’t have the pre-requisite needed to perform successfully in this instruction or when it becomes apparent that a different objective would be more appropriate. The student can proceed to another topic, or he can receive special instruction to develop his prerequisite skills before he continues in the program.

Enrichment materials and instructions are prescribed for the student when the diagnostic evaluation indicates that he has performed successfully and would benefit from continued instruction at this level in the program. Enrichment is composed of additional learning activity at approximately the same skill level as the instructional activity, the student has recently completed.

When students complete their prescribed remedial instruction then an alternate form of the diagnostic assessment is administered. The student continues recycling through the remedial and diagnostic evaluation until he performs at the minimum pass level. Recycling should be continued until the student has mastered the crucial skills, or the student should be placed in another objective sequence. If more than one objective is included in an instructional sequence, then the instruction and diagnostic evaluations for the other objectives in the sequence are completed in the manner described above. When the sequence has been completed, the final assessment procedure is administered.
Post-assessment:

The post-assessment, the final component of the mastery model, measures whether each student has reached the outcomes identified in the objectives. Each student’s mastery of each of the Crucial skills, concept and facts defined in the objectives is measured. If a student has failed to master a crucial objective, the student is either recycled through the instructional program or additional instruction is prescribed for him as part of his next instructional program. The student continues to receive instruction until he reaches at the minimum pass level. The components of mastery learning have been presented in fig. 1.10.

1.12 BASIC TASKS FACING DEVELOPERS OF MASTERY LEARNING PROGRAMS:

Bloom’s mastery learning strategy (B-MLS) consistently helps most students to learn excellently, quickly and self-confidently (Bloom, 1974). It is a group-based and teacher-paced approach. Students learn cooperatively with their classmates and the teacher controls the delivery and flow of instruction. The prototype for this approach is Bloom’s “Learning for Mastery” (Block and Anderson, 1975). The approach has evolved from within the field of education and has had a major impact at the elementary and secondary levels of schooling (Eraut, 1989).

Some of the basic features of B-MLS have been summarized by McNeil, (1969) as:

♦ the learner must understand the nature of the task to be learned and the procedure to be followed in learning it;

♦ the specific instructional objectives relating to the learning task must be formulated.
Fig. 1.10: Components of the Mastery Structure

I. Objective
II. Preassessment
III. Instruction
IV. Diagnostic Assessment
   Sufficient Progress?
   Yes
   Continue I-IV
   Until instruction is completed
   VI. Postassessment
   No
   Enrichment
   Prescribe corrective
   Instruction
   Remediate
   V. Prescription
   Modify objective or select different objective
   Relocate
it is useful to break a course or subject into small units of learning and to test them at the end of each unit;

the teacher should provide feedback for each learner's particular errors and difficulties after each test;

the teacher must find ways to alter the time some individuals have available for learning;

it may be profitable to provide alternative learning opportunities;

student’s effort is increased when small groups of two or three students meet regularly for as long as an hour to review their test results and help one another to overcome the difficulties identified by means of the test.

Block and Anderson (1975), have summarized the conceptual framework of Bloom's learning for Mastery strategy as:

a) Defining mastery

- by formulating a set of course instructional objectives.
- preparing a 'final' or 'summative' examination over these objectives and determining the course mastery performance standard which the students will be expected to achieve on this examination.
- sequencing the learning units and determining the course objectives to be covered in each unit.

b) Planning for mastery

- the teacher prepares lesson plans by using his customary group-based teaching methods.
- develops 'feedback/correction' procedures.
- develops a set of alternative instructional materials.
c) **Teaching for mastery**

- the teacher provides orientation to the students regarding mastery learning procedure.
- teaches the first learning unit, administers the unit criterion/formative test, identifies the non-achievers and asks them to use the appropriate corrective measures to complete their unit learning.

d) **Grading for mastery**

- administering of summative/criterion test.
- awards 'A's to the student who performed equal or above to the course mastery performance level.
- competition of the students is with themselves, rather than with their classmates.

**1.13 MASTERY LEARNING MODEL**

In India, a mastery learning strategy was adopted to Indian conditions (Jangira 1988, 1983 a,b and Hooda, 1983). The operating procedures have been divided into various steps. These steps are as follows:

**Step-I. Development of sequential teaching units and mastery tests**

The curriculum to be covered is divided into convenient teaching units. In preparing the teaching unit, the hierarchical order of different concepts is to be followed. These units are developed keeping in view the cognitive entry behaviour (pre requisites) of the pupil. Such units contain good illustrations for pupils. Notes for teacher's guidance are also included in the units. The units so developed provide:

- a) Interview
- b) Instructional objectives
- c) Pre requisites to learning the unit
d) Instructional procedures

e) Instructional materials

f) Differential learning settings

Out of the decided content, four forms of mastery tests (formative tests) for each of the unit are prepared along with the sequential teaching unit. The purpose of these tests is two fold. Firstly, to assess if the pupils have reached the decided mastery level and secondly to diagnose pupil's difficulties with a view of providing feedback to them. These tests are administered at the completion of each learning unit.

**Step-II. Deciding the mastery criteria (Mastery level)**

The mastery levels are then decided. It may indicate the percentage of pupils acquiring the percentage mastery of content covered. It may be decided from 85 percent to 100 percent learning by 85 percent to 100 percent pupils.

**Step-III. Making the objective explicit to the pupils**

Pupils are told about content (units) to be covered. The concept, rules processes are told specifically. Instructional objectives are made explicit to the pupils at this stage. They are also told about the mastery level decided.

**Step-IV. Assessment for Prerequisites**

Prerequisites for a learning task are those types of knowledge, skills and competencies which are essential to the learning of that particular task or set of tasks. The lack of necessary prerequisites for a learning task makes it very difficult for pupils to adequately learn the task according to criterion.

The prerequisites constitute a necessary link between the learner and the accomplishment of the learning task. If all the pupils possess the necessary prerequisites they are supposed to be ready to learn the task. If
they do not possess them, they are provided with the necessary assistance in terms of references and assignments and it is assured that all of the pupils possess the necessary prerequisites.

**Step-V. Core-teaching session**

First unit out of the decided content is taught to the class as a whole, using the usual techniques of teaching suiting to the individual differences among pupils, with a view to achieving maximum learning for maximum number of pupils.

**Step-VI. Performance Assessment-I**

Mastery test is then administered to the pupils. It helps the teacher in classifying the pupils in different groups according to their mastery levels. Pupils who attain 85% mastery or above in the content-taught are kept in one group called the mastery group. The number of pupils in this group may vary from class to class and from topic to topic. Rest of the pupils are kept in another group called non-mastery group.

**Step-VII. Differential teaching session**

The non-mastery group pupils are again divided into several groups. Pupils who are very near to mastery that is having mastery level from 60% to 90% are provided more practice with additional material related to the learning task to reach the target of mastery level. The pupils in learning range of 40 to 60 percent are divided into smaller groups and small group per instruction is provided to them by pupils of mastery group, the pupils in the mastery range of 20 to 40 percent are tutored individually by peers. Pupils below 20 percent learning are intensively coached by the teacher using simpler material for practice. The teacher provides guidelines to the peers to assist peers in the light of the feedback from the formative test. The pupils are also told of their strengths and weaknesses based on test
results. They are also provided guidelines for correctives to achieve mastery.

**Step-VIII. Performance Assessment-II**

The pupils are then administered mastery test. Again mastery and non-mastery groups are formed. The performance assessment results are utilized for planning further strategy to improve mastery level of the non-mastery group of pupils.

**Step-IX. Intensive teaching sessions**

The size of non-mastery group may reduce considerably at this stage. Both peer tutoring and teacher tutoring techniques using additional instructional material are followed. The teacher works with the most difficult pupils. They are given assignment for more practice and drill. The type and amount of drill depend on learning difficulty of the pupil concerned.

**Step-X. Performance Assessment-III**

The test of mastery learning expected that most of the pupils attain the decided mastery level at this stage. The pupils who are still unable to attain the mastery are helped outside the class hours as special cases by teacher tutoring or peer tutoring as may be feasible.

**Step-XI. Teaching the next unit**

Second unit is then taken up. Steps I to XI are repeated in the same manner with a view to achieving the desired level of mastery. The procedure continues till the whole curriculum is covered.

It is important to note that mastery of each unit is ensured before pupils are allowed to proceed to the next unit. This feature is especially important for a subject with sequential structure based on hierarchical nature. Researches indicate that mastery approaches have produced best results in subjects which required either prior learning or previous learning.
which most learners already possessed (Bloom, 1968; Airasian, 1969; Blook, 1970; Marrill, 1970). For example, mastery methods have been more effective for the first grade arithmetic (Blook, 1970). In this way, the time needed to learn the task in the beginning is more than the task which comes later in this sequence.
PHASE I
Selecting content to be taught Developing Teaching Units deciding goals in terms objectives (deciding Mastery Level)
Sequential of specific

Teaching for Learning task: Pre-requisite
- Pre-requisite available
- Pre-requisite Not available
Providing necessary assistance in terms of reference and home assignment

Core teaching session

PHASE II

PHASE III
Group Attaining Desired Mastery Level(M)
Performance Assessment Administering Unit Formative Test-I
- Group not attaining desired mastery
  differential Teaching Session
  - 60-70% (g₁)
  - 40-59% (g₂)
  - 20-30% (g₃)
  - 0-19%
    - Self-study with different materials
    - Peer Tutoring
    - Peer Tutoring
    - Teacher Tutoring

PERFORMANCE ASSESSMENT
U.F.T. -II
- Group not attaining Desired mastery
  - Intensive Teaching Session
  - Peer and Teacher Tutoring
  - Performance ASSESSMENT
    - U.F.T. - III

PHASE IV
Group Attaining Desired Mastery Level(M)
Not attaining mastery
Special Tutoring by Teachers and Parents

U.F.T. IV

Fig. 1.11: Mastery Learning Model
1.14 COGNITIVE STYLE

It is generally observed that individuals differ in their way of dealing with environmental situations and each individual shows some consistent mode of functioning which is reflected in his behaviour and personality. Witkin (1954) has reported that each individual shows a self consistent mode of functioning which characterizes his perceptual and intellectual activities and also defends his personality and Witkin (1954) referred to it as a cognitive style. It may be defined as "--- the characteristic, self consistent functioning which individuals show in their perceptual and intellectual activities. These cognitive styles are manifestations, in the cognitive sphere, of still broader dimensions of personal functioning which cut across diverse psychological areas" (Witkin et al, 1972)

The term 'cognitive' is a general term covering all the various models of knowing, perceiving, imagining, remembering, conceiving, judging, reasoning, understanding and problem solving. Cognitive area is primarily concerned with intellectual growth of the individual. It involves acquisition of basic intellectual skills such as reading ability, addition and subtraction, learning of facts, etc.

Cognition includes the process of perception, thinking, reasoning, understanding, problem solving, and remembering. Studies of cognitive style originated in attempts to understand individual differences in these processes which might account for the wide variation in outcome among children and adults ostensibly faced with the same task or demands.

There is no universally accepted definition of cognitive style but most researches have emphasized three features, viz., styles are intellectual characteristics of individuals, they describe processes which are relatively
stable over time, and intra-individual stabilities are consistent across tasks having similar requirements (Satterly, 1990).

Cognitive style is seen as an individuals' preferred and habitual approach to organizing and representing information (Riding & Rayner, 1998). Cognitive style involves ways in which an individual thinks about and internally represents situations in the external world (Riding and Craig, 1998).

The background to cognitive style has been extensively reviewed by Riding & Cheema (1991), and Rayner & Riding (1997), who concluded that the various style labels could be accommodated within two fundamental style dimensions, the Wholist Analytic and the Verbal - Imagery, which may be summarized as follows:

1) The Wholist-Analytic dimension of whether an individual tends to organize information in wholes or parts;

2) The Verbal Imagery dimension of whether an individual is inclined to represent information during thinking verbally or in mental pictures.

One way as was seen, is to view cognitive style as self-consistent characteristic modes of cognition. Another way views them as individual differences in structural properties of the cognitive system itself, such as degree of differentiation, of discrimination or articulation, and of hierarchic integration of cognitive units, which together comprise the style of cognitive complexity versus simplicity (Messick, 1976). Another view-point conceives of styles as consistent intra-individual contrasts of abilities or of cognitive controls, as in converging versus diverging styles of thinking (Hudson 1968). Good (1959) defined the term cognitive as concerned with the process of gaining information and understanding of the world through personal experience.
Broverman (1960) conceptualized cognitive style as an expression of different responses, probably of response strengths in certain types of classes of behaviour. According to Kogan et al. (1960), "The cognitive style indicates the cues the individual will use, but not necessarily the level on which his intelligence functions. It is the preferred use of a specific class of conceptual responses."

According to Harvey (1963), cognitive style is the way an individual filters and processes stimuli so that the environment takes on psychological meaning and is representative of the mediation. As such cognitive representation modify the one to one relationship between stimuli and responses. If it were not for these cognitive representations stimuli would either be irrelevant for the individual or the individual would respond to stimulation in a robot like fashion.

Bieri (1971) too noted that a process of information transformation is a basic assumption of the cognitive theorist. He maintained that individuals learn "strategies, programs, or other transformation operations" to translate objective stimuli into meaningful dimensions. Bieri termed these strategies "cognitive structures."

Coop and Sigel (1971) used the term cognitive style "to denote consistencies in individual modes of functioning in a variety of behavioral situations." In this definition cognitive style is equated with behaviour rather than mediating processes. Common to all theory and research on cognitive style is an emphasis on the structure rather than the content of thought. Structure refers to how cognition is organized, content refers to what knowledge is available.

Left, Gordon and Ferguson (1974) defined cognitive style as an in-built plan or programme to select specific types of data for processing or to
perform specific mental operations on information processed. Messick (1976) defined cognitive style in terms of consistent individual differences. He maintains that cognitive structures mediate between environmental input and the organism's output. He adds that cognitive structures organize behaviours as well as input.

Sharma and Agarwal (1980) defined cognitive style as a term that refers to stable individual performance in a mode of perceptual categorization of external environment. Schilling (1981) conceptualized cognitive style as the characteristic reference that individuals have for different types of information. It refers to the modes an individual employs in perceiving, organizing and labeling various dimensions of the environment.

According to Entwistel (1985), "Cognitive style is the term used to describe different ways in which people process information, including preception, storage, transformation and utilization or information from the environment. It describes habitual processes of perceiving and thinking which are qualitatively distinct."

According to Ganihar (1991) "Each child has his own way of processing information. This unique way of processing information in the course of learning is referred to as cognitive style."

Agarwal (1987) defined cognitive style as "sum total of individuals preference for physical, social, emotional and environmental elements in the course of learning.

In the words of Verma and Sangeeta (1992) Cognitive styles are generally defined as stable preferences, attitudes or habitual strategies.
which characterize a person's modes of perceiving, remembering, thinking and problem-solving."

The main characteristics of cognitive styles are as follows:

1. Cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences in how one perceives, thinks, learns and solves problems.

2. Cognitive styles are pervasive dimensions. They cut across the boundaries traditionally.

3. Cognitive styles are stable over time. This does not imply that they are unchangeable, indeed some may easily be amended.

4. With regard to value judgements, cognitive styles are bi-polar.

Many sets of dichotomies have been used to describe aspects of cognitive style with a corresponding variety of methods of measurement. Messick (1976) has described 19 such terms, while Goldstein and Blackman (1977) have summarized the more important approach to their measurement. Some of the well-known cognitive styles are: Field Independence Vs. Field Dependence, Reflection Vs. Impulsivity - Convergence Vs. Divergence, Leveling Vs. Sharpening, Verbalizers Vs. Visualizers, Serialists Vs. Holists etc.

Satterly (1990) gave chief features of the 10 styles most extensively studied are:

a) Field independence vs. field dependence. The tendency to be analytic in perception and thought versus the tendency towards global appraisal. Field independent children are superior in mathematics and science, field dependent children find it easier to form social relationship.
b) Reflection vs. impulsivity. The tendency to evaluate potential responses versus the tendency to respond quickly with the first "reasonable" answer that comes to mind. Reflectives make fewer errors, for example, in reading.

c) Convergence vs. divergence. A bias towards effectiveness in tasks demanding a single correct answer versus performance in tasks where a number of different responses are required. This style appears to distinguish maths/science from arts students.

d) Leveling vs. sharpening. The tendency during perception and in memory to minimize differences between stimuli versus the tendency to be sensitive to them.

e) Verbalizers vs. visualizers: preference for sensory modality. The relative reliance on visual, verbal or kinesthetic modes of adjustment to the world. "Verbalizers" prefer to store information in verbal codes, "visualizers" in images.

f) Serialist vs. Holist: Contrasts a linear, sequential approach in problem solving with one which attempts to deal with the whole problem.

g) Confidence vs. Caution: A risk-taking dimension in which a chance is taken to increase the likelihood of success versus an approach in which caution is exercised to reduce the risk of failure.

h) Conceptual style. The type of class concept formed among disparate stimuli.

i) Category width. Consistency of cognitive range. The tendency to include a wide range of instances in a category or concept group versus a tendency to exclude those which deviate from a central tendency.
Cognitive complexity. The tendency to use multidimensional constructs when organizing environmental stimuli versus a preference for the use of simpler constructs. This dimension seems to be more domain specific than other cognitive styles investigated. A person could use complex concepts when understanding scientific subjects, for example, and simple ones when dealing with political issues.

Witkin et al. (1954) stated that among the cognitive styles identified to date, the field independence-field dependence dimension is one which has the largest research base and appears to have obvious implications for educational issues. They hypothesised that field independent persons achieve a higher level of differentiations than field dependent persons as identified by Rod and Frame Test (RFT) and Embedded Figures Test (EFT). The adequate performance on RFT and EFT requires differentiation of experiences. The individual must perceive his environment in a discrete fashion in order to separate one item from the entire figuration. The field independent person is able to break-up the total field and attend to the relevant items while with holding attention from the irrelevant items.

The field-dependent students are more attentive to the social aspects of learning situations, being more responsive to social cues, depending more on external referents and being more influenced by criticism. They are relatively passive, low in self-esteem and self-reliance, and ready to submit to external authority. Field independent students respond better to material with impersonal content and can readily learn material that lacks structure and organization. They are active, socially independent, ready to struggle for mastery, able to come to terms with themselves and to analyze their perceptual performance.
### TABLE 1.3
**LEARNING CHARACTERISTICS OF FIELD DEPENDENT AND FIELD INDEPENDENT**

<table>
<thead>
<tr>
<th>Field Dependent</th>
<th>Field-Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Are better at learning material with social content</td>
<td>♦ May need help in focusing attention on material with social content</td>
</tr>
<tr>
<td>♦ Have better memory for social information</td>
<td>♦ May have to be taught how to use context in understanding social information</td>
</tr>
<tr>
<td>♦ Require externally defined structure, goals and reinforcement.</td>
<td>♦ Tend to have self-defined goals and reinforcement</td>
</tr>
<tr>
<td>♦ Are more affected by criticism</td>
<td>♦ Are less affected by criticism</td>
</tr>
<tr>
<td>♦ Have greater difficulty learning unstructured material</td>
<td>♦ Can impose their own structure on unstructured situations</td>
</tr>
<tr>
<td>♦ May need to be taught to use memory aids</td>
<td>♦ Can analyze a situation and reorganize it</td>
</tr>
<tr>
<td>♦ Tend to accept the organization given and be unable to recognize</td>
<td>♦ Are more likely to be able to solve problems without explicit instructions and guidance</td>
</tr>
<tr>
<td>♦ May need more explicit instruction on how to solve problems</td>
<td></td>
</tr>
</tbody>
</table>

### 1.15 SELF-CONCEPT

An important prerequisite to the valid use of self-concept in educational research is a thorough understanding of the nature of the self-conceptualization of self-concept within a theoretical framework. The origin of the term "self" can be traced as early as the discussion of human personality found place in literature.

The term ‘self’ is the sum total of a person’s ideas and attitudes about who and what he is. It comprises of properties of his body, the qualities of his mind, his personal characteristics and all the experiences that constitute awareness of his existence. These ideas and attitudes have been evolving
since his earliest childhood. Our self-perceptions vary from situation to situation and from one phase of our lives to another.

Especially as we grow older, many acquired motives are influenced by our most significant endowments over other species—the capacity to think. We can imagine and interpret the world in a way apparently impossible for other organisms, and a critical factor here is the self-concept, which is the way a person thinks about himself or herself in a global sense. It includes a person’s most important self-feelings and self-attitudes. In our culture, especially for males, the self-concept is enhanced through achievement, but people also strive to think well of themselves by being charitable, social, creative, beautiful, or just different from others (Fernald & Fernald, 1999).

**Self-concept defined**

Self-concept is a person’s perception of his or her own strengths and weakness (Slavin, 1997). Its development begins at birth and is continuously shaped by experience.

Mead (1934) claims that the person responds to himself with certain feelings and attitudes as others respond to him. He becomes self-conscious (aware) by the way people react to him as an object. Further, various selves can be differentiated by the specific set of responses in different social settings. Home attitudes expressed towards him create a home-self, school attitudes, expressed by teachers and classroom experiences create school self, and social attitudes expressed by peers and others in social settings create a social self.

According to Lewin (1936) the self-concept is expressed by a life space region, which determines present belief about the self. The term “life-space” is a psychological concept to be distinguished from physical space. It includes the individual’s universe of personal experience as a space in...
which he moves. Goals, evaluations, ideas, perceptions of significant objects, future plans and events all from a part of the life space of the person. Life space can be considered as a complex internal mechanism which produces behaviour. All the variables that determine the direction of behaviour lie in the life space of the individual. If one is to predict behaviour, one must know the life-space of a person at the time the behaviour is to be predicted. By the same token, if one desires to change behaviour, one must alter the valences of the subject's life space. Lewin's (1936) life-space closely parallels the meaning of an objectified form of self.

Lundholm (1940), another self-psychologist, distinguishes between a subjective self and an objective-self. Not mentioning the functional, motivational, or process dynamics of the self-explicitly, the subjective self is mainly what a person comes to think about himself. Lundholm (1940) views the subjective self as alterable from the experiences one has in interaction with others in the pursuit of various tasks. This theory is similar to Mead's (1934) in that the self is primarily an object of awareness.

Sherif and Cantril (1947) vaguely assert that the self is an object and the ego is a process. They conceive of the ego as a constellation of attitudes that include personal identity, values, possessions, and feelings of worth. Although they do not clearly differentiate self as object and ego as process they do imply that when the ego becomes involved in a given task it will energize and direct the person's behaviour. For instance, if self-esteem is at stake, the ego attitudes are aroused and tend to motivate the person to work much harder.

Sartain et al, (1958) defined self as the beliefs, ideals, attitudes and feelings, whether conscious or unconscious, which an individual has concerning himself.

Smith (1961) defined the self of a person as perceived, felt and
thought of by himself. As he can perceive other objects and persons, so he can perceive himself, but as his perceptions of others are never entirely accurate, so his perceptions of himself are never entirely complete and accurate. Jourard (1963) added that the self-concept comprises of all the beliefs that the individual holds concerning what kind of person he is.

In general terms self-concept is our perception of ourselves; in specific terms, it is our attitudes, feelings and knowledge about our abilities, skills, appearance and social acceptability (Jersild, 1965; West & Fish, 1973).

Gale (1969) states that man creates the world from experiences around him. The development of self is a social product. According to him self-awareness does not come-up suddenly. It is a mental process that begins during infancy and early childhood and continues until death.

La Benne and Greene (1969) observed that self-concept is a person's total appraisal of his appearance, background and origin, abilities and sources, attitudes and feelings which culminate as a directing force in behaviour.

According to Eysenck, Arnold and Meili (1972), self-concept is the totality of attitudes, judgements and values of an individual relating to his behaviour, abilities and qualities. Self-concept embraces awareness of these variables and evaluations, self-concept means what an individual thinks about himself. It is his own conception of his intelligence, abilities, academic status, behaviour, temperamental qualities, mental health, emotional tendencies and socio-economic status.

In 'Dictionary of Education' by Good (1973), self-concept is defined as "the individual's perception of himself as a person, which includes his abilities, appearances, performances in his job and other phases of daily living."
Although there appears to be wide acceptance of the above definitions among self-theorists, yet, a review of the literature reveals no clear, concise and universally accepted operational definition of 'self-concept' (Hansford & Hattie, 1982). In fact, Shavelson et al., (1976) in their attempt to amalgamate operational definitions from many self-concept studies, distinguished 17 conceptual dimensions on which the multiplicity of self-concept definitions could be classified. In their extensive review of the literature, Shavelson and his colleagues concluded that seven characteristics can be attributed to self-concept, each crucial to its construct definition. Accordingly, self-concept can be described as organized, multidimensional, hierarchical, stable, developmental, evaluative and differential.

In the various attempts made to understand and explain the nature of self-concept, notable psychologists and self-theorists have developed different theoretical models. In his literature, Byrne (1984) reviewed four theoretical models:

a) Introduction and Theoretical Foundations nomothetic model.

b) Hierarchical model

c) Taxonomic model, and

d) Compensatory model

a) According to Soares and Soares (1983), the first and oldest perspective model may be referred to as the nomothetic position. In this model, self-concept is perceived as unidimensional construct. Accordingly, characteristics descriptive of self-concept are used to explain one's behaviour in various settings.
b) Another theoretical perspective of self-concept has been termed as the hierarchical model. This theoretical position holds that self-concept has multidimensions and that the multiple facets of self-concept may be ranked in a hierarchical order (Shavelson, et.al., 1976; Shavelson and Straurt, 1981).

The hierarchical model parallels in many ways to Vernon's (1950) model of intelligence.

c) The third theoretical view of self-concept supports the notion that self-concept is structured like a series of several specific factors. This perspective has been termed as the taxonomic model (Soares and Soares, 1983) and analogous to Spearman's (1927) and Thurstone's (1943) theories of intelligence. Here, facets of self-concept may be relatively independent of each other.

d) Winne and Marx (1981) proposed the compensatory model. This perspective, in agreement with the hierarchical and taxonomic models, supports the notion of general facet of self-concept. However, the compensatory model suggests that the specific facets are inversely related, rather than proportionally or independently, as proposed by the hierarchical and taxonomic models respectively. Hence, lower status on one specific facet of self-concept might be compensated by higher status on another specific facet of self-concept.

In the study by Nurius (1986), self-concept has been viewed as dynamic and future oriented, including self-knowledge about goals and motive, personal standards, values, rules and strategies for regulating and controlling one's behaviour (Nultin, 1984; Higgins, Strauman and Klein, 1985; Gollwitzer and Wickland, 1986). The sense of what is possible constitutes an important dynamic component of the self-concept. Ideas and
associated motives and feelings about what is possible for one to be, to think, to feel or to experience, provide a direction or an impact for action, change and development. According to Markus and Nurius (1986a, 1986b), on the basis of past experiences, one's motives, aspiration, goals and fears are also cognitively represented within the self-concept in the form of possible selves may represent either future goals to strive for or feared possibilities to avoid. This approach to self-concept extends to work of Rogers (1961) and other researchers. Thus, as within any theoretical evaluations, the emerging cognitive analysis of the self-concept builds on and reformulates important earlier models, taking recent advances into account.

According to "Dictionary of Education", by Taneja (1989), "Self-concept refers to the picture of image a person has of himself."

The developing self-concept of the child is influenced by parents and other family members in the early years and by friends, schoolmates, and teachers as the child grows. School clearly plays a major role. As children grow, their views of themselves become more differentiated; that is, their self-concept comes to have many sides. During the school years, the self-concept seems to become organized along both academic and non-academic lines, probably because school is such an important part of the child's world (Byrne & Shavelson, 1986; Marsh & Shavelson, 1985). Research on self-concept has shown that views of self inside and outside school are not necessarily highly correlated. Shavelson has also suggested that the self concept evolves through constant self-evaluation in different situations (Shavelson and Bolus, 1982).

One view of the self-concept is shown in the fig. 1.12. At the top level is the person's general view of self. This general view is made up of other,
more specific concepts, including the view of the self-outside school (nonacademic self-concept), the view of the self in English, and view of the self in mathematics. (Only English and Mathematics are listed because only these have been studied using Shavelson's model). The more specific self-concepts at the school level are based on many experiences and events. Research on self-concept has shown that views of self-inside and outside school are not necessarily highly correlated. Also self-concepts in different subjects are not strongly related either. A more positive self-concept is related to more favourable attitudes towards school (Met Calfe, 1981) and more positive behaviour in classroom (Reynolds, 1980). It may be that high achievement leads to positive self-concept, or vice-versa.

Bloom (1973) has said, "Successful experiences in school are no guarantee of a generally positive self-concept, but they increase the probabilities that such will be the case."

Kash and Borich (1978) gave following suggestions for encouraging the development of positive self-concept of pupils:

1. Value and accept all pupils, for their attempts as well as their accomplishments.
2. Create a climate that is physically and psychologically safe for students.
3. Become aware of your own personal biases (everyone has some biases).
4. Make sure that your procedures for teaching and grouping students are really necessary, not just a convenient way of handling problem students or avoiding contact with some students.
5. Make standards of evaluation clear.

7. Avoid destructive competition and encourage students to compete with their own prior levels of achievement.

8. Accept a student even when you must reject a particular behaviour.

9. Remember that positive self-concept grows from success in operating in the world and from being valued by important people in the environment. It takes both kinds of experiences to build a positive self-concept.

**Behaviour Characteristics of high Self-concept Pupils**

Researches about behavioural indicators of self-concept development suggest that the following behaviours correlated positively with academic achievement. The pupil (i) is unafraid of a new situation, (ii) makes friends easily, (iii) experiments easily with new materials, (iv) trusts the teacher even when a stranger, (v) is cooperative and usually follows reasonable rules, (vi) is largely responsible for controlling his or her own behaviours, (vii) is creative and imaginative, (viii) talks freely, (ix) is independent, and (x) seems for the most part to be a happy individual. These behaviours serve as supportive conditions for continued enhancement of self-concept and it becomes difficult to determine if self-concept can be identified as the cause or effect of academic achievement. Wattenburg and Clifford (1964) clarified the relationship between self-concept and achievement and suggested that levels of self-concept can induce differences in school performance. Pupils with high self-concept are characteristically confident in their communication skills and social interaction, talk less about themselves, have an optimistic attitude towards competition and express and respond to compliments and criticisms in a graceful, accepting manner (Purkey, 1970). Bloom (1973) has said, "Successful experiences in school are no guarantee of a generally
positive self-concept, but they increase the probabilities that such will be the case."

Behaviour Characteristic of low self-concept Pupils

Pupils with low self-concept use stereotyped cliches and verbal expressions, are pessimistic about competitive situations and have difficulty in giving and accepting praise or criticism. Such pupils are experts in the art of self-put-down, a self-destructive behaviour.

1.16 RETENTION

Remembering plays an important role in our daily life. Our life becomes richer if we are able to remember past experiences which makes living pleasant and enjoyable. This ability to remember plays an important role in the process of learning which is essential for our intellectual life. With the help of thinking, we attempt to do new things and solve the numerous problems that we face in our daily life. But all thinking is based on remembering. Thus, remembering is an important aid for progress in learning and constructive thinking.

Learning implies a relatively permanent change in behaviour that results from practice or activity and thus involves a three-step sequence of initial acquisition, retention and use. Effective teachers are concerned about the extent to which material learned during a day, week or month will be remembered later, because that will help in meeting new or different situations. In fact, formal education is based on the assumptions that human beings can transfer what they have learned in one situation to another, either in school or in outside the school setting. Two factors are essential for this:

1) Retention can occur only if something has been acquired initially.
ii) Transfer of acquired outcomes to a new situation can occur only if the outcome has been retained (Klausmier and Goodwin, 1966)

The following teacher behaviour helps students to retain learned material longer:

- Fostering intent to learn and remember.
- Helping learner to identify meaningful relationships.
- Providing for satisfying consequences of correct response.
- Emphasizing concept and facilities.
- Providing opportunities for applications of newly learned concepts, principles and abilities.
- Providing for sequential, cumulative, learning.

Forgetting results from disuse, interference, recogonization, obliteratorive subsumption and motivated forgetting. Retention is usually measured by use of tests which the pupils had taken on some previous occasion during the experimental period, either as a pre-test or as test of immediate learning at the end of instructional period.

Berlyne (1954) showed that retention of factual statements was enhanced by prior exposure to questions that the statements answered. Berlyne (1966) explained that retention depends upon two distinct facts, intelligence and motivational disposition. Rothkopf (1965) ascertained that presentation of questions at various points in learning process can increase retention of facts, answering questions and produced a generalized improvement in retention of other facts. He concluded that, questions give rise to "inspective behaviour" or "mathemagenic responses" which facilitated retention of meaningful learning.
Rothkopf (1966), Frase (1967) Rothkopf and Bisbicos (1967) showed that, questions improve retention of both relevant and incidental material when they occur after the prose paragraph to which they relate. Post questions serve more than a review function- they produce non-specific facilitation of retention over the succeeding material.

Levonian (1967) concluded than even for continuously presented materials, forgetting occurs if information is learned under low arousal.

Lee (1977) advocate that, high kinetic structure was a predominant factor in producing greater knowledge, acquisition and retention. Also, high structure with visuals did not produce greater retention than high structures without-visuals and low structure with visuals did not produce greater retention than two structures without visuals. Effects of humour and humorous example were studied upon the comprehension and retention of lecture material by Kaplan and Pascoe (1977). Results indicated that immediate comprehension was not facilitated by humorous examples. Lecture with humorous examples illustrating concepts was retained for more time. It was concluded that, concept illustrated in a humorous manner might be learned and retained more easily than a concept presented in a dull style. Alexander (1977) reported that non-written cognitive organizers facilitated learning and retention of oral instructions.

Wae (1977) discovered that neither Bloom's strategy for Master Learning nor Keller's personalized system of instruction resulted in greater achievement of retention on tests administered at the end of instruction. On a test administered one month later to the instruction time, Bloom's strategy resulted in significantly greater retention and also greater transfer than Keller's strategy.
Houndoumadi (1977) reported that a set of question in the test that tested retention of facts presented humorous version of an article showed the highest retention.

Gupta (1978) investigated the role of organizing strategies and methods of presentation on short-term retention. The study reveals that the visual mode of presentation is significantly better than auditory mode in effecting retention.

Nagar (1979) studied the role of note-taking, rehearsal and test events on immediate and delayed production of verbal materials and found the roles positively affecting retention.

A study by Duchastel and Nugester (1982) revealed that practice of following a learning period with a test situation can dramatically enhance long-term retention of what has been learned. An initial short-answer test is not superior to an initial multiple choice test for over-all retention purposes. In another study on retention Nungester and Duchastel (1982) indicated that when high school history students after studying a brief either took a test on the passage, spent equivalent time reviewing the passage or went on to an unrelated task, the retention test given two weeks later indicated that the test condition resulted in better retention than either the review or the control condition.

Koul and Chand (1985) studied that mastery learning strategy was useful in enhancing retention of student's especially belonging to culturally deprived and educationally backward groups, and thus, improved the total learning outcome.

Bal (1992) found that - (1) The variable of intelligence had a significant effect on acquisition and retention of higher level writing skills in English (2) The variable of cognitive style had a non-significant
effect on acquisition; a significant effect on retention as measured by last totals and scores on supply type items but not when measured by scores on selection type items. (3) intelligence and cognitive style had a non-significant interaction effect on acquisition and retention of higher level writing skills in English.

Mehra (1992) reported that retention is dependent upon intelligence and that the low intelligence group exhibited more forgetting as compared to the high intelligence group. Retention is exhibited more in the democratic than in the authoritarian school climate. Forgetting is exhibited more in authoritarian school climate. Retention is equally effective for learning at knowledge as well as at the comprehension level of objectives.

Empirical evidences pertaining to retention indicate that practice of following a learning period with a test situation can also enhance long term retention. Motivation and intelligence also play a predominant role in facilitation of greater retention of learned material.

Baker, M.A. (1999) examined in his study the relative effects of two different types of learning and relearning opportunities on retention of meaningful material by fast and slow learners. A key finding is that the mastery learning opportunity led to greater retention than the non-mastery one. However faster learners out-performed slower ones, regardless of the type of learning opportunity. This was most pronounced for the non-mastery condition, in which significant correlations between learning speed, memory abilities, and intelligence were obtained for both stories.

Johnson, S.L.S. (1999) conducted a study to examine three ideas, First, the relationship between learning style preferences and the level of cognitive development of preservice teachers who are currently enrolled in a content course in mathematics was investigated. Second the effect of using
a learning style model for structuring instruction of teaching preservice teachers and the study involved determining whether teaching strategies improved retention rates of materials presented. The results indicated that regarding retention of material, the groups were compared using a form of equivalent tests for probability and statistics. Unlike the results of the achievement test, the results of the tests taken to measure retention indicate that there was no difference between the two groups.