**MODULE II**

**APPROACHES TO LEARNING**

**Theories of Learning**

Learning theories can be divided into various categories. Association theories or connection theories belong to the school of Behaviourism. They interpret learning in terms of connection or association between stimulus and response. Eg: Thorndike’s Theory of Trial and Error Learning, Classical Conditioning by Pavlov and Skinners theory of Operant conditioning.

Cognitive theories, belong to the school of Gestalt psychology or Cognitive psychology. In place of a purely mechanical or instrumental approach these theories emphasize the role of purpose, insight, understanding, reasoning, memory and other cognitive factors in the process of learning. It is due to the perceptual organization or re-organization of the field. Eg. Insight learning.

Observation of others behaviour may play a leading role in learning and acquiring various things concerning ones environment. The Cognitive psychologists who appreciate the role of observation in learning are termed as Social Psychologists and the theory as social learning theory. Albert Bandura’s social learning theory advocates most of what we learn is acquired through simply observing and imitating the behaviour of others who are taken as models.

Constructivism is basically a theory based on observation and scientific study. People construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. Eg. Piaget, Bruner and Vygotsky et al.

**2.1. Behaviourism**

Behaviourism came in to psychology in the year 1913 and it was propagated by John B.Watson. Behaviorists argued that psychology should focused on the observable behaviour of the organism. According to behaviorism, learning is any relatively permanent change in behaviour or behavioural potential produced by experiences. Learning occurs in different forms like classical conditioning, operant conditioning and observational learning. Classical conditioning is a form of learning in which two stimulus events become associated in such a way that the occurrence of one event reliably predicts the occurrence of the other. In Operant conditioning the organism learn association between behaviours and stimuli that precede them and follow them. Observational learning is a form of learning in which organism learn by observing the behaviours or the consequences of the behaviours.

**2.1.1. Theory of Thorndike -Trial and Error learning (Connectionism)**

According to Prof. **E.L. Thorndike** of Columbia University, learning occurs as a result of the ‘formation of bonds between stimuli and responses’. The learning process involves the stamping out of incorrect responses and the stamping in of correct ones in the course of successive trials. Motor learning is mostly effected through the method of trial and error. For example in learning to swim, many wrong movements and strokes are tried and discarded one by till after some months of practice, correct movements are established.

**Thorndike’s Experiment**

In a specially constructed cage called the ‘problem box’ or ‘puzzle box’, a hungry cat is kept. A piece of fish is kept outside the box. The box could be opened only by pressing down a lever inside the cage. Being hungry the cat tried to get the fish. It became restless and made all kinds of attempts to get out like clawing and biting at all the bars and shaking all the movable parts of the box. This kind of random activity characterizes the initial stages of the trial and error method. After some time by sheer chance, the cat handles the lever which opens the door. The cat comes out and it is allowed to eat a little bit of the fish. It is again taken and put into the box for a second attempt. During this second attempt also the cat goes on with the restless and random activity as before. In the same way the experiment is continued for several attempts. Thorndike noticed unnecessary and irrelevant activities of the animals were getting reduced. Gradually the errors became less till at last after a number of trials the animals learned to operate the lever straightaway.

**Features of Trial and Error Learning:**

Four characteristic features are involved in this type of learning.

**(1)**  **Motive**:

 Motives initiative and direct the activity of the individual. In Thorndike’s experiment the cat had two motives viz.

 (1) to satisfy its hunger and

 (2) to get out of the cage

**(2) Stimulus:**

 Thorndike’s cat tried to move all parts of the cage in its attempt to open it. Stimulus is the causal factor that evokes response. Repetition will decrease the number of stimuli.

**(3) Response:**

 Each stimulus will have response. Successful responses are retained and others are eliminated.

**(4) Reward:**

 Selection of the appropriate response will result in achieving the goal. This reward will persuaded one to habitualise that act of successful response.

Thorndike’s laws of learning:

*Primary laws:*

1. Law of readiness

2. Law of exercise

3. Law of effect

4. Law of belongingness

5. Law of spread of effect

*Subordinate laws*

1. Law of multiple response

2. Law of set or attitude

3. Prepotency of elements

4. Law of response by analogy and

5. Law of associative shifting

**1. Law of Readiness:**

 This law is indicative of learner’s state of readiness to participate in the learning process. It is the preparation for action. If the child is ready to learn he learns more quickly effectively and with greater satisfaction than if he is not ready to learn. It warns us not make the child learn till he is ready to learn and also not to miss any opportunity of providing learning experiences if the child is already prepared to learn. The right movements concerning the learning situation and the learner’s state of mind should be very well recognized and maximum use of this knowledge should be made by the teacher.

 **Classroom applications:**

 Teacher must wait till learner is ready to learn, and should give those experiences which help to enhance readiness. Preparatory experiences that will hasten the growth of readiness can be provided in primary classes. The learner’s interest, attitude, and mental preparation are essential for the progress in the teaching - learning process.

**2. The law of exercise:**

 This means that efficiency and durability of learning increase with practice and exercise. This law has two sub parts.

 (1) The law of use

 (2) The law of disuse

 The law of use refers to the strengthening of connection with practice while the law of disuse the weakening of connection or forgetting when the practice is discontinued. In brief, it can be said that law of exercise as a whole emphasizes the need of repetition, practice and drill work in the process of learning.

 **Classroom applications**

 1. More and more opportunities should be given to the students to use and repeat the knowledge they get in the class.

 2. To maintain the connections for longer period, review of the learned material is necessary.

 3. Drill strengthens the bondage between S.R. Drill plays an important role in elementary classes in the learning of multiplication table, alphabets and meanings of words.

**3. The Law of Effect**

 It means that learning takes place properly when it results in satisfaction and the learner derives pleasure out of it. In the situation when the child meets a failure or gets dissatisfaction the progress on the path of learning is blocked. All pleasant experiences have a lasting influence and are remembered for long time, while, the unpleasant ones are soon forgotten. Therefore the satisfaction and dissatisfaction, pleasure or displeasure obtained as a result of some learning ensure the degree of effectiveness of that learning.

 In other words this law emphasizes the role of rewards and punishments in the process of learning. Getting reward as a result of some learning motivates and encourages the child to proceed, on the same path with more intensity and enthusiasm while the punishment of any sort discourages him and creates distaste and disattraction towards that learning.

 **Classroom applications:**

 1. The classroom experience should be satisfactory and pleasant. The teacher must enjoy his work.

 2. Learning experiences and other activities must be meaningful and understandable in terms of the personal life of the learners.

 3. School experiences and activities must be arranged in such a way that learners may have some degree of confidence and success in their work.

 4. School activities should be organized in increasing difficulty order so that the students may progress without any failure.

 5. Material should be provided in varied ways so that novelty may be maintained.

 6. Guidance, praise and encouragement that give pleasure and satisfaction of knowing that he is on the right path, should be properly used.

*Subordinate laws are:-*

Law of multiple response: Confronted with a new learning situation the learner responds in a variety of ways before arriving at the correct response

Law of attitude: A task is performed well if the student has an attitude set in the task.

Law of pre-potency of elements: The learner uses his insight, selects the pre-potent elements in a situation and bases his response upon these elements.

Law of response by analogy: The learner responds to a new learning situation on the basis of the responses made by him in similar situations in the past.

Law of associative shifting: The responses of the learner shifts with situation

**2.1.2. Theory of Pavlov -The Theory of Classical Conditioning**

Conditioning is the process where by the response to a natural stimulus is transferred to a substitute stimulus. Classical conditioning may be defined as the formation of an association between a conditioned stimulus and a response through the repeated presentation of the conditioned stimulus in a controlled relationship with an unconditioned stimulus that originally elicits that response. Ivan Petrovich Pavlov the Russian Psychologist carried out a series of experiments.

 In a classical experiment he gave a piece of meat to a hungry dog kept in a sound proof, windowless room, away from all external disturbances. He found that the dog secreted saliva. He made arrangement to measure the amount of saliva produced. Then he gave the meat along with the ringing of an electric bell. Pavlov noticed salivation in the dog. He repeated this, bell-food, many times. Then he rang the bell without giving the dog, meat. On hearing the bell alone the dog secreted saliva. Salivation got conditioned to the ringing of the bell.

 The presentation of food which originally produced saliva is the unconditioned stimulus (UCS) and the secretion of saliva, the unconditioned response (UCR). The ringing of the bell, the new stimulus that produced the same response is the conditioned stimulus (CS) and the secretion of saliva at the ringing of the bell alone is the conditioned response (CR)

 UCS (Food) UCR (Salivation)

 CS (Sound of the bell + UCS (Food) UCR (Salivation)

 CS (Sound of the bell) CR (Salivation)

 

Thus in classical conditioning we substitute a neutral stimulus in the place of

a natural stimulus. It is also know as signal level learning. Everything

depends on the mechanic conditioning of the natural stimulus with an

artificial stimulus.

Pavlov found that if the conditioned stimulus is presented repeatedly without the occurrence of the original stimulus, (Presentation of food) the conditioned response will be extinguished. The procedure of pairing the CS and UCS is called reinforcement because any tendency for the conditioned response to appear is facilitated by the presence of the UCS and the response to it. Here there is no reinforcement. This is called **extinction**. The conditioned response can be maintained only by presenting the original stimulus. Extinction does not actually destroy the conditioned response. After period of the rest extinct response can be revived even though no reinforcement is interfered. This return of the CR without reinforcement is called **Spontaneous recovery**. Again he found that the animal is capable of responding to any stimulus similar to the conditioned stimulus. Thus a dog conditioned to salivate to the sounds of a turning fork producing a particular tone, salivate to sounds of higher or lower tone in pitch without further conditioning. The more nearly alike the new stimulus is to the original, the more completely they will substitute for it. Pavlov called this stimulus **generalization**. A process complementary to that of generalization is discrimination, whereas generalization is reaction to similarities discrimination is reaction to differences. A dog conditioned to salivate to an oval shaped patch will not salivate to circular patch of light. This is **stimulus discrimination**. If the oval patch of light were to be made more and more circular, there will come a point, when the conditioned response will break down, because of the conflict in brain. This came to be known as experimental neurosis.

J.B. Watson performed experiments on a child named Albert. This child had no fear of rabbits. He was glad to handle it. The fear stimulus, a loud sound was given when he was just going to touch the animal. This conditioning process was repeated and the child began to show fear at the sight of the rabbit.

**Educational Implications**

Conditioning as a process of leaning has great educational value. Reading, writing, spelling are most effectively learnt through this process. The use of rewards and punishments are based on this theory. Principles of classical conditioning can be used for developing good habits in children such as cleanliness, respects for elders punctuality etc. It can be used to decondition anxiety and fear in maladjusted children. Most of our phobias are due to unfortunate pairing of a stimulus with unpleasant experiences. We hate arithmetic or we hate grammar, we fear snakes because of some unpleasant association of events in early life. Principles of classical conditioning can be used in deconditioning emotional fears in mental patients. Behaviour modification Therapy it is also used to develop favorable or unfavorable attitude towards learning, teacher and school.

**2.1.3. Theory of Skinner -Operant conditioning / Instrumental conditioning**

B.F. Skinner an American Psychologist developed the theory of operant conditioning. It is classified and included in the category of conditioning. But it differs a lot from the classical conditioning advocated by Pavlov and Watson. In classical conditioning, the presence of a stimulus is essential in producing a response. The behaviour cannot be emitted in the absence of a cause or stimulus. But Skinner revolted against this view. According to him the organism itself initiates the behaviour. A child, a dog does, behaves, operates on the environment and in return the environment responds to the activity. How the environment responds, rewarding or not, largely determines whether the behaviour will be repeated, maintained or avoided.

Skinner started his studies based on the ideas of Thorndike especially on the law of effect. The reward of a response leads to repetition of an act and strengthening of S-R bonds. Skinner experimented and came to the conclusion that behaviour is shaped and maintained by its consequences. It is operated by the organism and maintained by its results. Such behaviour is called as operant behaviour and the process of learning as operant conditioning.

He proposed a distinction between two kinds of behaviours which he called respondent and operant behaviours. The former is elicited and the latter emitted. Respondent behaviour is learnt according to Pavlovian model of conditioning. It is directly under the control of a stimulus, as in the unconditioned response of classical conditioning. Since it is concerned with stimulus it is called S-type conditioning. The relation of operant behaviour to stimulus is somewhat different. The behaviour often appears to be emitted that it appears to be spontaneous rather than a response to a specific stimulus and it is known as R-type conditioning. Skinner changed the usual S-R formula into R-S formula.

The word operant derives from the fact that the behaviour which operates on the environment to produce some effect. It is also called as instrumental behaviour. An operant is a response which is emitted by a stimulus without any particular forcing stimulus rather elicited by a reinforcing stimulus (UCS) as in classical conditioning. Operant behaviour is external. It can be observed. Respondent behaviour is internal and personal.

Operant conditioning refers to increasing the probability of a response in a particular stimulus environment by following the response with reinforcement. A large part of human behaviour may be classified as operant-turning a key in a lock, driving a car, writing a letter, carrying on a conversation etc. Such activities are not elicited by an unconditional stimulus of the Pavlovian type. But once the behaviour occurs it can be reinforced according to the principles of operant conditioning.

According to the R-S formula when a response is emitted, a reinforcing stimulus is presented. Thus a response is conditioned by constantly reinforcing it. The reinforcement must come after the response has been made and not before it. If the response is not reinforced, it results in the extinction of the response (operant).

A reinforcer is the stimulus whose presentation or removal increases the probability of a response. Food is reinforcing to a rat or pigeon. Knowledge of correctness is reinforcing to learning in school. Reward strengthens the behaviour which precedes it but punishment does not permanently reduce a tendency to respond.

Skinner conducted a large number of experiments on rates and pigeons in a specially designed box, the Skinner box or Pigeon box. There is a disc in the box (CS). By pressing (CR) the disc the pigeon gets a pellet of food (UCS) which the pigeon eats (UCR) which reinforces the response (CR) to be emitted.

Here the important point is that the CR (pecking of the disc) produces UCS (food). In other words CR, the pecking of the disc is instrumental in obtaining the UCS (pellet of food) and in producing reinforcement. Further it is not the sight of the disc (CS) that is important. It is the pecking (CR) that is of at most importance. In classical conditioning the food (UCS) invariably follows the bell (CS) whether saliva (CR) occurs or not. On the other hand in the case of Skinner’s conditioning, (UCR) pellet of food does not occur unless (CR) pecking occurs. Here the reinforcement is contingent (dependent) upon response.

 Disc Pecking Food Eats

 (CR Produces UCS)

 CS CR UCS UCR

**Educational Implications**

Our educational system suffers from many weakness. The whole atmosphere of our schools is dominated by fear and unpleasant experiences. Though Corporal punishment is prohibited, still teachers use punishments of various types. Students work out of fear. The schools can use the principles of operant conditioning to eliminate the elements of fear from school atmosphere by using positive reinforcement.

There is a wide gap between behaviour and reinforcement. The delay of reinforcement destroys the effect of reinforcing stimulus. Suppose a child scores high marks in the test and he is not immediately reinforced by the teacher, but reinforcement comes after a day or two. This reinforcement has no effect on the behaviour of the child. Reinforcing stimuli should follow the response immediately for an effect on the behaviour. Though in present teaching-learning system where a teacher handles 30 to 50 students at a time it is not possible for the teacher to reinforce the behaviour of each student in the class, but the use of programmed material in the form of a book or machine makes provision for immediate reinforcement.

In **programmed learning** an information to be learnt is broken into small sequential units or ‘frames’. To each of these the learner makes a response. If the material is properly organized he will make the correct response and will be immediately informed of its correctness. There is therefore immediate positive reinforcement which fixes the response and permits movement to the next frame. This way the student can move at his own pace without waiting for other members of the class. This way Skinner has revolutionized the whole teaching learning process. As a result, mechanical learning in the form of teaching machines and computer assisted instruments have replaced usual class room instructions.

**Differences between Classical Conditioning and**

**Operant Conditioning**

 **Classical Operant**

1. Developed by Pavlov and is Developed by Skinner and is

 called S-type conditioning called R-type conditioning

2. Deals with elicited responses Deals with emitted responses

3. Reinforcement is correlated Reinforcement is correlated

 with stimulus with response

4. The C.R. is forced by the UCS The response is more voluntary

 and spontaneous

5. The UCS is given whether Reward is dependent upon the the CR occurs or not occurrence of the response

6. The UCS and CS are paired There is pairing of response and

 reinforcement

7. Controlled by autonomous Controlled by central nervous

 nervous system system

**Reinforcement**

According to Skinner there are 3 types of reinforcers (1) Positive reinforcer, (2) Negative reinforcer, (3) Punisher.

1. **Positive Reinforcer (Do something to get something done)**

 Positive reinforcer is any stimulus which an individual will work to obtain as food, money etc. Its serves to strengthen or maintain the response. In human beings food, water, praise, money, social approval etc. work as reinforcers. In positive reinforcement we do something to get something done by the organism.

2. **Negative Reinforcers (Do something to avoid something)**

 Negative reinforcers are those unpleasant stimuli which the learner will readily terminate if given the opportunity to do so, for example social disapproval or condemnation by the peer group. Negative reinforcement is a means of forcing behaviour to occur. It strengthens avoidance response. Hence an organism does something to avoid something.

3. **Punisher**

 A punisher is an aversive stimulus which follows a response and frequently serves to suppress it. Negative reinforcer and punishers are sometimes confused with each other - A negative reinforcer precedes the response and forces its occurrence to eliminate the unpleasant condition where as the punisher follows the response and decreases the likelihood of the recurrence of the response. If disapproval or annoying stimulation follows immediately after behaviour, punishment has taken place, on the other hand when disapproval or scolding is directed at an individual in an effort to force behaviour to occur and his behaviour can avoid this condition (scolding or disapproval) negative reinforcement is used. Negative reinforcers and punishers are grouped together as aversive stimuli.



**2.2. Constructivism**

Constructivism means encouraging students to use active techniques to create more knowledge and then reflect on and talk about what they are doing and how their understanding is changing. The constructivistic teacher provides tools such as problem solving and inquiry - based learning activities with which students formulate and test their ideas, draw conclusions and inferences, pool and convey their knowledge in a collaborative learning environment. Constructivism transforms the student from a passive recipient of information to an active participant in the learning process.

**Ideas of Constructivism**

1. Discovery Learning : Provide opportunities that prompts the learner to discovery is important.

2 Learning through Debate : Debate is sharing of ideas. New ideas can be developed by asking for the explanations contributing ideas, internalizing ideas and analyzing ideas in debate.

3. Learning through problem solving: Frame some problems considering, the abilities, cognitive level and practicability so that the students will find out some solution by remaining active.

4. Collaborative learning: This is a form of learning which shares the learning responsibility among members of a group which works towards a common objective.

5. Co-operative learning: The students are divided into small groups and each person is given a responsibility. It is a need based interaction providing support for learning at all stages. Achievement will be evaluated on the basis of the performance of the group members.

6. Zone of Proximal Development (ZPD)

 According to Vygotsky, there is a level of achievement that can be reached by all learners of their own and another higher level which can be achieved with help from teachers or peers. The area between the level achieved by own efforts and the which can be achieved with the help of others is called zone of Proximal Development.

7. Scaffolding

 The student needs help from teacher in many learning activities. The teacher should provide hints, tips, give examples, and ask questions to direct thinking in the right way. By scaffolding, the student must be equipped to take up and complete the task assigned to him fruitfully. Scaffolding highlights the foremost role of the teacher in the learner centered education. Scaffolding provides support, extends the range of what a learner can do, and allows the learner to accomplish tasks otherwise impossible.

8. Learning as an active mental process

9. Internal motivation

**Advantages of Constructivism**

1. Children learn more and enjoy learning more when they are actively involved, rather than passive listeners.

2. Education works best when it concentrates on thinking and understanding, rather than on rate memorization. Constructivism concentrates on learning how to think and understand.

3. Constructivist learning is transferable. Students can create organizing principles that they can take with them to other learning settings.

4. Constructivism gives students ownership of what they learn, since learning is based on students’ question and explanations. Engaging the creative instincts develops students’ abilities to express knowledge through a variety of ways.

5. By grounding learning activities in an authentic, real - world - context, constructivism stimulates and engages students. They learn to question things.

6. It promotes social and communication skills by creating a classroom environment that emphasize collaboration and exchange of ideas. They work on group projects exchange ideas, learn to negotiate with others and to evaluate their contributions in a socially acceptable manner.

**2.2.1. Social Constructivism (Vygotsky)**

It considers learning as a social and communication process whereby knowledge is shared and understandings are constructed in culturally formed social settings. It emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding. Vygotsky’s social constructivism is based on the following four basic principles: (a) Children construct their knowledge (b) Development cannot be separated from its social context. (c) Learning can lead to development (d) Language plays a central role in mental development. The major components of this theory are (1) Construction of knowledge occurs only when the learner interacts in a social context. (2) Learning occurs through the internalization of a socially negotiated mental function (3) Language is a tool for understanding outer world and constructing knowledge (4) Intentional learning is limited to the Zone of Proximal Development (ZPD)

The ZPD is the difference between the child’s capacity to solve problems on his own and his capacity to solve them with assistance. ZPD is the gap between what a given child can achieve alone (Actual development) and what he can achieve through problem solving under adult guidance or in collaboration with more capable peers (potential development). In Vygotsky’s view peer interaction, scaffolding and modelling are important ways to facilitate individual cognitive growth and knowledge acquisition.



**Educational Implications**

1. Enhances interaction of the learner in social context.

2. The primary role of the teacher is to create situation for students that will foster their making the necessary mental constructions.

3. Educational process should be framed in tune with the culture of the society.

4. Teacher is the facilitator, guide and mentor.

5. Students need to be guided by the adults.

6. This theory advises peer instruction, co-operative learning, social negotiation, collaborative learning as specialized method of teaching and learning.

7. Physical environments should be provided.

**2.2.2. Cognitive Constructivism**

**2.2.2.1. Piaget - Individual Constructivism (Psychological Constructivism)**

**Piaget** (1896-1980) a Swiss Biologist turned Psychologist dedicated his life to the question, How does knowledge grow? He concluded that humans learn through the construction of progressively complex logical structures, from infancy to adulthood. Constructivist education is based on this premise of successive knowledge - building that increases in depth and complexity from stage to stage.

Before a child becomes an adult his mental structures need to go through many stages of development. It is a process of restructuring, resulting in qualitatively new organizations not just an accumulation of knowledge and skills.

Piaget used certain terms like scheme, operation, equilibration, reversibility, assimilation and accommodation in order to explain his theory. Schemata are critically important basic building blocks of intellectual development. They are the mental representation of an experience. Ex. Sucks the breast of the mother. Operation is acting on an object, changing it, comparing it and relating it to others. Mental manipulation of Schemata or shuttling of schemata is known as operation. Development of cognitive structure depends upon the number of schemata, quality of schemata and operations. Reversibility is the process of back tracking the experiences. Cognitive development takes place in 4 stages.

1. **Sensory-motor stage (birth to 2 years)**

Actions are governed by sensations. Simple learning occurs. But the child does not think at this stage. This is a period of practical intelligence. According to Piaget these early sensory-motor experiences have profound and probably irreversible effects on his later perceptual and intellectual abilities. This period is marked by four characteristics.

1. **Object concept formation**

According to Paiget between 18 and 24 months the child comes to realise that the objects have substance, occupy space and are permanent. This is known as the concept of permanence of the object or object permanence.

1. **Co-ordinated space**

The child acquires the spatial concept. He understands the relationship among objects and relationship between objects and his own body. He learns to use his hands to grasp objects and thus becomes aware of the spatial relations between objects.

1. **Objectified causality**

Any action of the child which brings about an effect is taken as the cause of that event. For example when the child kicks a ball, it rolls off. Then he relates kicking casually with the effect produced.

1. **Objectification of time**

The child gets the perception of time, but is concerned with the present i.e. today.

1. **Pre-operational Stage (between 2 to 6 years)**

A major feature of the Pre-operational thought is that it is egocentric. He has no need to justify his reasoning by logic, or to look for any internal consistency in his thoughts. He is unable to consider other features of the situation, he concentrates on a single feature of an object and neglects other important aspects (centration). He attends to superficial features of events, particularly those which attract his attention. He concentrates on static states rather than on the dynamic transformations. (Conservation) For example: when a child is presented with equal amounts of liquid in two glasses A & B of the same dimensions and when the contents of B are poured into a taller and thinner glass tube E, the child fails to compare the amount of liquid in A & E. That is, he fails to see the transformation and reacts as if they are two dissimilar glasses filled to different levels.

The pre-operational child is capable of symbolic representations instead of only direct action which is significant feature of the sensory motor stage. He is able to use the language to express his needs and to establish relation with his parents siblings and other adults and children in the neighbourhood. He is irreversible i.e. he is not capable to work backwards to his starting point.

1. **Concrete operational stage (7 to 11 years)**

This stage is characterised by the stability and integration of his cognitive system. It is at this level that the child can add, substract, multiply, and divide. He can focus on the whole set of successive changes,that occur in the process of transformation. He is now capable of classification of concrete objects. This process is known as “Operation”.

From simple association child reaches to logical operations. These operations are concrete because they relate directly to objects; they are not yet verbally stated hypotheses involving abstract thinking.

1. **Formal operational stage (11 to 15 years)**

The child frees himself from the concrete and the present to the abstract and non-present and future. This is the age of great ideas and the beginning of theories. He is now capable of handling hypotheses and of reasoning with propositions removed from the concrete and the present. He is capable of drawing conclusions from truths which are merely possible. Another significant feature of this stage is the spontaneous development of the “experimental spirit”. This is impossible at the level of concrete operations. For example, a child is shown five colourless liquids in test tubes and is asked to discover what combinations of the five will produce a yellow liquid. The child in this stage however will go about the problem systematically, for example combining the first and second, then first and third and so on.

Every organism would like to maintain a particular stage which is most comfortable. If the equilibrium is disturbed the organism is in a stage of distressing affairs. As a result it tries to maintain equilibrium. This is known as equilibration.

According to Piaget the Schemata which are acquired in infancy are exercised and changed in the later life by two psychological process called as assimilation and accommodation. Assimilation implies incorporation of something from the environment. New ideas, concepts, and stimuli are taken in and incorporated into one’s existing set of schemata.

Accommodation involves modification or changes in some elements of an old scheme or learning a new scheme which is more appropriate for the new object Ex. Breast sucking baby accommodates to the objects like finger, pencil etc. placed in his mouth. Thus a baby assimilates when he understands and perceives the new in the light of his old perceptions. A baby forms a new scheme when he modifies or changes his old perception

to suit the new. In this way a baby forms new structures or new schemata and consequently develops cognitivity.

**Adaptation = Assimilation + Accommodation**

Adaptation is the mental process of extension and modification of schemas by the interaction with the environment. Piaget believed that the development of qualitatively different cognitive structures occurred through the processes of assimilation and accommodation. When a qualitative change occurs, the infant/child enters a new stage of development

**Educational Implications**

Piaget’s system is of great value to education. It helps in the arrangement of subject matter in the curriculum and organization of various activities in the classroom and outside the classroom. His theory implies that children should be provided a great deal of direct experience before they can be expected to cope with abstract ideas and concepts. It also stresses the importance of readiness. We should not expect the children to work at the level of formal operations when the child is still at a pre-operational stage. Piaget’s work has stressed that knowledge is an active process and students should interact with the environment. Learning will not take place unless the child is active in the learning situation. The teacher’s task is to ensure that the child remains an active participant and to provide him with the appropriate physical and mental environmental stimuli so that intelligent adaptation can take place.

Piaget supports the need of motivation for the development of intellectual ability. He also stresses the importance of socialization and group methods. Piaget’s principles have been found particularly useful in working with children from poor or ‘disadvantaged’ families. Use of appropriate audio-visual aids will give concrete experiences to children and will help them develop right concepts. Piaget correlates the language skill of the child with his intellectual development.

**2.2.2.2. Bruner’s Theory of Learning (by Discovery) & Cognitive Development**

Prof. Jerome S. Bruner worked as Director, Centre for Cognitive Studies Harward. He is the exponent of discovery appraoch to learning. He considers learners as inquirers of knowledge. Learners should be presented a problem situation to which they would have to seek alternative solutions. Learning in a problem solving situation has 3 aspects - activation, maintenance and direction. Activation means a stimulus which could generate action, maintenance could imply that the action should be sustained and direction would mean movements which promote realization of a goal.

In a problem solving situation the problem is a stimulus which initiates action. Exploring various alternatives maintains the activity and the learner would need feedback to select movements which would lead to the solution of the problem and prevention of random movements. Feedback would indicate relevance of tested alternatives for the achievement of the goal. Such feedback must come exactly at the time of the problem solving episode.

**Educational Implications**

1. Building and maintaining predispositions required of learners, the structure of knowledge, the sequening of teaching learning experiences and nature of reinforcement should be considered in all academic activities like writing a text book, preparing a lesson plan, preparing self instructional material etc.

2. Learners are active participants (discoverers) in the acquisition of knowledge

3. Avoid presenting established facts and knowledge in a product oriented manner in teaching learning situations.

4. Feedback should be given wherever necessary.

**Meaningful Learning**

Learning is an active process in which learner constructs new ideas or concepts based on past knowledge. Bruner advocated that if students were allowed to pursue concepts on their own they would gain a better understanding. He urged discovery learning which involves the teacher providing guidance or scaffolding, organizing the curriculum in a spiral manner so that the students are continually building upon what they have already learnt. this involves the teacher teaching the same content in different ways depending on the students’ developmental level.

1. The instruction must be concerned with the experiences and contexts that make students willing and able to learn. (readiness)

2. Instruction must be structured so that it can be easily grasped by the student (spiral organization)

3. Instruction should be designed to facilitate extrapolation and fill in the gaps (going beyond the information given)

Burner views intelligence as developing through a series of stages. Burner gives more emphasis to the process of thinking, and stresses the role of language. He has given three modes of learning or three ways in which an individual represents knowledge. These modes of learning are as follows:

1. **Enactive mode (Learning by doing)**

 Here the child understands his environment only through the medium of actions not through words, Eg. biting, touching, catching, etc.

2. **Iconic mode (Learning by seeing)**

 The child learns by means of his own actions and perceptions and represents what he has learned through actions visual images.

3. **Symbolic (Verbal and book learning)**

 The use of language comes through symbolic operations. It is the archetype of symbolic representation. It is the tool of reflective thinking. In symbolic mode of representation a person is able to consider propositions rather than objects. A person grows up through the process of internalising the ways of acting, imaging, and symbolizing that exists in his culture. In ordinary language we may call the three levels as those of action, image and word. A very young child will learn principally by the enective mode and as he grows older, the iconic and then he symbolic become more important.

**Educational Implications**

According to Bruner the child is at first at the level of motor performance and then starts constructing the images and in the end learns the use of words and his language learning beginnings. In our modern education the main difficulty is this that education begins with the word or with the abstract forms of experience. Education which begins with the sensation - (enactive) motor period will be more effective. The teacher can plan out the curriculum and methods of teaching and choose books in keeping with the mental maturity of the child.

1. Bruner has clearly emphasised that there is a need of theory of instruction. Children in the primary school stage should be provided concrete objects, materials and phenomena. At this stage symbols are less effective than things.

2. Bruner gives importance to heuristic methods (discovery) where children learn themselves. They get a chance to interact. It increases intellectual ability.

3. There is a need for sequencing or structuring the learning material. Children should be provided with new experiences and the use of instructional material is of immense utility. Interaction with other persons has cognitive as well as affective values. So it is important to provide necessary atmosphere.

**Concept Attainment (Bruner):** Bruner used a set of cards to study the strategies people use in acquiring concepts. He has identified 4 strategies.

**1. Simultaneous Scanning**

 The subject uses each positive instance; to deduce which combinations of attribute values are no longer valid. He has to keep in mind simultaneously all the rejected combinations in order to narrow down the range of subsequent alternative.

**2. Successive Scanning**

 The subject test search hypothesis about the correct characteristic one at a time in succession.

**3. Conservative Focusing**

 Each attribute is tested by selecting a card that is different from a focus card in only one attribute.

**4. Focus Gambling**

 The subject focuses on a correct card but varies more than one attribute at a time. It depends on chance.

**2.2.3. Constructivistic methods of Teaching and Learning**

**Cooperative Learning or Collaborative Learning:** It is the instructional use of small groups through which students work together to maximize their own and each other’s learning. Main characteristics of constructivist method are small group, learn together, a common goal, pro –active and pro –social interaction, student centered, positive interdependence, sharing among members of the group, individual accountability on learning, and face –to face promotive interaction.

**Collaborative Learning** increase students’ motivation, retention and helpful for higher achievements. It Enhance students’ satisfaction in learning and promote the practice social skills, also develops interpersonal relationships. It is a method to reduce class room anxiety and text anxiety. On the other side it is time consuming, demand training for teachers, provide less control over the learner, individual difference affects the learning, and it is not suitable for traditional class rooms.

**Brainstorming:** It is a group creativity technique designed to generate a large number of ideas for the solution of a problem.In 1953 ,the method was popularized by  Alex Osborn in a book called “Applied Imagination”. Brainstorming is an idea generating technique of informal approach to problem solving. This ensures active participation by all members and there is no corrections during the process

The steps in Brain Storming are:1) Presentation of problem 2) Provide relevant information 3) Elicit ideas 4) Record the idea 5) Organize and Combine similar ideas 6) Evaluate each idea or solution.

The principles of Brain Storming includes:

- Freewheeling: The expression of opinion should be possible without interruption**.**

- No criticism: It must be ensured that expressions and gestures do not reflect a critical attitude.

- Quantity breeds Quality: The more number of ideas generated , the number of qualitative ideas should be collected.

- Hitch Hiking: It is a way of arriving at the destination by travelling free by any mode of transportation available on the way.

Brainstorming makes the pupil creative and innovative. It gives opportunity for pupils for analyzing and solving problem so it is more useful in problem oriented themes. This method encourages participation of each member and can be used by all students. It is very Difficult to select a problem oriented topic. Brain storming may cause problem of discipline. Brain storming is a democratic and problem centered technique. In this technique the content is largely determined by the children. Brain storming creates situations for student and teacher interaction and both remain active in teaching.

**Concept Mapping/Knowledge mapping/ Mind mapping** is theGraphical/ pictorial tool for knowledge. It is a summarizing technique developed by Novak in vidu1972. It provides visual representation of the hierarchy and relation among concepts within an individual’s mind and a graphical representation of persons’ knowledge of a domain. The development of Concept Mapping involves different steps like 1.Selection of the matter 2. Ranking / hierarchic order formation of the content 3. Cluster formation of similar matter 4. Arrangement of content matter in a précised form 5. Linking with each other. This method is important because it establish meaningful relationship among different concept and connect ideas.it is helpful for the planning for studies and provide a overall idea about content matter. It is very helpful for revision

**Reciprocal Teaching** is one of the method to develop the ability to comprehend a reading passage. It is an instructional activity that takes place in the form of a dialogue between teachers and students in which participants take turns assuming the role of teacher to improve student’s ability to learn from text through the practice of four skills: summarizing, clarifying, questioning, and predicting. The different stages are:

1. - Teacher Demonstration
2. - Student Learning and Practice
3. - Teacher - Student groups
4. - Student Groups (Instructor phases out)
5. - Student Self-Regulation

This method is helpful to improve the reading comprehension level, learners can understand more complex text and content areas and they acquire more self-confidence and motivation. It reinforces the social relationship in the class and improve leadership skills and communication skills

**2.3. Social Learning/ Social Cognitive Learning/ Modeling/ Observational Learning Theory of Albert Bandura**

Observational or vicarious learning (learning through indirect experiences) rather than the learning based on direct experiences is the basis of social learning theory. Most of what we learn is acquired through simply watching and listening to other people. Children keenly observe the behaviour of others especially their parents, member of the family, teacher, the older members of society etc. They try to imitate and do what they observe. He may also incorporate and imitate the behaviour of the characters he reads in novels, learns about over the radio or sees on T.V or in movies. The persons whose behaviour s/he observes and often initiates are known as models and **observational learning** is referred to as **modeling.** Learning the consequences of an action by observing its consequences is known as vicarious conditioning.

Social learning theory was renamed as social cognitive theory by Bandura. The modelling process involved 4 steps (1) Attention - the learner pays attention to the modelled behaviour. It is influenced by the characteristics of the model and the characteristics of the learner. (2) Retention - the learner register the observed behaviour in his memory in the form of mental images or verbal descriptions (3) Reproduction - It involves converting symbolic representations into appropriate actions. The observed relevant and accepted aspects of the model’s behaviour are reproduced (imitated) by the learner. A persons’ ability to reproduce a behaviour improves with practice. (4) Reinforcement - to imitate a behaviour, the person must have some motivating factor behind it, such as internal or external incentives. These incentives act as reinforcers.

**Educational implications**

1. Since students learn a great deal simply by observing and imitating other people, there must be provision for demonstrating experiments and skills, perform arts, display.

2. It stresses the importance of rewards and punishments in learning.

3. There is a need of minimizing the gap between the teacher and the taught in their socio-cultural and economic realms.

4. It emphasizes the importance of Audio-visual aids such as T.V. in learning.

5. Consequences of model’s behaviour affect the observer’s behaviour vicariously. This is known as Vicarious reinforcement. So  it stresses the imporatnce of reward and punishment in the classroom to instill appreciable behaviours and to decrease undesirable behaviour

6. It emphasizes the importance of integrating practice with theory in learning.

7. Students attention and interest must be maintained by organizing various learning activities.

8. Learning values, good habits etc. can be achieved by this type of learning.

**2.4. Cognitive Theory- Insightful Leaning- Gestalt School (Perceptual Organization)**

Gestalt psychology was first started by German-born Max Wertheimer in 1912. ‘Gestalt’ is a German word which means “an organized whole in contrast to a collection of parts”. Wolfgang Kohler and Kurt Koffka were his followers. They were the pioneers of Gestalt movement. The meaning of the German term ‘Gestalt’ is form or ‘pattern’ or ‘configuration’. Gestalt psychologists consider the process of learning as an organized whole. A thing cannot be understood by the study of its constituent parts but only by the study of it as a totality is the basic idea behind this theory. In the practical sense Gestalt psychology is primarily concerned with nature of perception. A thing is perceived as a relationship within a field which includes the thing, the viewer and a complex background, incorporating the viewer’s purposes and previous experience. Gestalt psychologists are of the opinion that unless a person sees some meaning in that object he will pay little or no attention to it. Furthermore to them, the meaning of perception is always related to the total situation.

Gestalt psychologists tried to interpret learning as a purposive exploratory and creative enterprise instead of trial and error or simple stimulus - response mechanism. Learner while learning, always perceives the situation as a whole and after seeing and evaluating the different relationships takes proper decision, in an intelligent way. Gestalt psychology used the term ‘insight’ to describe the perception of the whole situation by the learner and his intelligence in responding to the proper relationships. This theory stresses the importance of motivation, previous knowledge, thinking, action etc.

**Cognitive Theories-Insight Learning**

Sudden appearance of the solution is an essential characteristic of insightful learning. “A sudden coherent pattern of solution appears at once”. This is Gestalt’s view point. The individual does not perform random activities, but he perceives the situation as a whole and intentionally reaches the goal through awakened insight. We learn not by associating bits of experiences but by forming new Gestalts by seeking new patterns and by organizing them into a meaningful whole in the total situation. When we struggle with a problem, the solution may come to us all on a sudden. This quick change in our perception is called insight.

Wolfgang Kohler conducted a large number of experiments on chimpanzees. The four classical experiments are described as follows:

A Chimpanzee named Sultan was confined in an iron barred cage. There was a stick in the cage and outside the cage, some bananas were kept. In the first instance, on seeing the bananas chimpanzee showed restlessness and tried his best to reach the bananas but he could not reach without the help of the stick. All of a sudden the Chimpanzee perceived the stick and established relationship between stick and the bananas. He got the bananas with the help of the stick. (Refer Pandey’s Advanced Educational Psychology)

Then experiments by Kohler show that the animal must perceive the total situation and relationship among all relevant parts of the problem. The second point, these experiments point out, is that insight follows a trial and error behaviour on the part of the animal. Once the animal learns to solve a problem by insight there is every possibility of high degree of transfer to similar problems.

The main factor in this, theory of learning is the development of insight. The individual and his environment form a psychological field. The perception of the field and gradual restructuring of it is insight.

**Educational Implications**

This theory brings the following important facts into lime-light.

1. The whole is greater than the part and therefore the situation should be viewed as a whole.

2. The use of blind fumbling and mechanical trial and error should be minimized. The learner should try to see relevant relationships and act intelligently.

3. The purpose or motive plays the central role in the learning process. Teachers are required to pay attention to the following aspects.

 (a) Subject matter should be presented in gestalt form. The problem of Mathematics requiring solution should be presented as a whole and after grasping it as a whole it should be tried for the solution.

 (b) In the organization of the syllabus and planning of the curriculum, the Gestalt principle should be given due consideration. A particular subject should not be treated as the mere collection of isolated facts or topics. It should be closely integrated into a whole. The curriculum comprising of different subjects and activities should reflect unity and cohesiveness.

 (c) This theory has made learning an intelligent task requiring mental abilities instead of blind fumbling and automatic responses to specific stimuli. It emphasizes that the learner must be given opportunities for using his mental abilities. Instead of telling him how to do a work or solve a problem, he should be placed in the position of an independent discoverer. This theory discourages spoon-feeding. Scientific and progressive methods like Heuristic method, analytic and problem-solving, which advocate the learning by insight should be made more popular.

**2.5. Gagne’s Hierarchy of Learning –Eight types of Learning**

Robert.M.Gagne proposed a model of sequential learning which is particularly useful in organizing lessons of principle learning and problem solving. He found that abstract principles can be learnt easily when more simple things are learnt first. There are 8 conditions of learning and Gagne arranged it in the form of a hierarchy from simple to complex. Each higher order of learning depends upon the mastery of the one below it. Mary people consider this as a synthesis of various learning theories.

1. Signal Learning:

 It is also termed as classical conditioning. It is learning to respond to a signal. It is in voluntary in character eg. Response to bell, signals etc.

2. Stimulus Response Learning:

 This consists of establishing a single connection between a stimulus and a response. The connectionism of Thorndike and operant conditioning of skinner belong to this category. This type of learning is also called motor learning.

3. Chaining:

 In this the individual associations are chained in sequences S - R S - R and so on.

 An example of chaining is unlocking a door by a child who has not learned the sequence of unlocking operations. The following stimulus response connections from the process of unlocking a door are given.

 1. Key in hand

 2. Facing the lock

 3. Taking the key right side up

 4. Inserting it into the lock

 5. Turning it until the stop is reached, and

 6. Pushing the door open. It should be remembered that a chain cannot be established unless the individual is capable of performing the individual links.

4. Verbal Association Learning:

 It is a case of chaining with words, putting together different words. A child is shown an object as a doll. The next time if he sees the particular object he will be able to say that it is a “doll”.

5. Multiple Discrimination:

 In the development of discrimination we take one aspect of the environment and reinforce selectively some response to it. Child learns the difference between the feeding bottle and simple bottle. Discrimination involves higher mental processes.

 When there are several models and names, linking the appropriate name with appropriate model is discrimination learning. Calling of each student with correct name is multiple discrimination learning.

6. Concept Learning:

 Concepts have concrete references even though they are learned with the use of language. In learning a concept, one responds to stimuli in terms of abstract characteristics like colour, shape, member, position etc. example.

 Example the concept tree. This may include all tall and short, mango and orange, etc. These all share some characteristics in common. We discriminate them from other objects classed as dog, house or people. Thus we form concept by finding properties which a class of objects shares in common. We learn generalization within classes - and discrimination between classes.

7. Learning of Principles:

 (Rules Learning) Here two or more concepts are related. Principles are chains of concept. Knowledge is learning of rules or principles. If the student has learned the component concepts and principles the teacher can use verbal instruction alone in leading the student to put the principles together. Example: when water freezes its volume becomes larger - concept of freeze, volume, larger. To learn this well they should be broken down into simpler parts and then finally put together as the total principle.

8. Problem Solving:

 Problem solving comes at the highest state in the hierarchy of learning process. It involves thinking. Two or more previously acquired principles are somehow combined to produce a new capability. Here the individuals use principles to achieve some goal.

Gagne revised this classification by retaining the first four and replaced the

remaining four with five varieties of capability. These are:

 - Intellectual skills (discriminations, concrete concept and defined concept, rule or principle and learning hierarchy)

 - problem solving and cognitive strategies

 - verbal information

 - motor skills

 - attitudes

Gagne considers problem solving skill is the highest level in learning. This depends on lower levels of learning. Criteria suggested by Gagne to achieve problem solving skills are (1) reveal the objectives of learning (2) presenting the stimulus (3) increase the span of attention (4) help the learner to recall past experience (5) provide learning activities for the learner (6) determine sequence of learning (7) motivate and give guidance to the learners.

**2.6. Experiential Learning-**

**Refer Kolb’s Experiential Learning –( I st Unit)**