UNIT 1: LEARNING: MIRROR LEARNING, MAZE LEARNING, PART AND WHOLE LEARNING

UNIT STRUCTURE

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1.1 LEARNING OBJECTIVES:

After going through this unit, you will be able to

- define learning
- analyze different theories of learning
- compare the theoretical concept of learning with that of practical use in everyday life
- discuss how human learning takes place in the real sense by using different apparatuses like mirror drawing apparatus, punch board

maze apparatus, and different activities which lead to part and whole learning.

1.2 INTRODUCTION

This unit introduces you to the meaning of learning, its characteristics and the different theories of learning. Besides, you will also be able to clarify your doubt regarding the practicability of the concept of learning through different experiments presented in this unit. You will be able to visualize how human learning takes place in the real sense. Here in this unit, two main experiments of learning-one with apparatus and the other without apparatus- will be analyzed.

1.3 CONCEPT AND DEFINITION OF LEARNING

Learning in its simplified form may be described as the process of modification of behaviour in the environment. Most of what we do or do not do is influenced by what we learn and how we learn it. Every individual is born with certain biological and instinctive tendencies. Such tendencies are in the process of change, modification and improvement in environment. Experience, direct or indirect, is found to play a dominant role in moulding and shaping the behaviour of the individual from the very beginning. In this context, we can site an example that when a child touches a burning matchstick it gets burnt, and the next time, when he comes across a burning matchstick, he loses no time in withdrawing from it. When this happens, we say that the child has learned that if one touches a flame, one gets burnt.

Thus, learning identifies itself with change, modification and adjustment of individual throughout the whole life. We continue to change, modify, and improve biological instinctive behaviour and experiences in order to adjust ourselves with the new environment. Learning finds expression through such change and modification of behaviour.

The concept of learning discussed above may be clear on the basis of the following definitions:-

According to Gates, “Learning is the modification of behaviour through experience and training”.

According to Guildford, “Learning is any change in behaviour resulting from behaviour”.

According to Kimble, “Learning is a relatively permanent change in behavioural potentiality that occurs as a result of reinforced practice”.

According to Gardner Murphy, “The term learning covers every modification in behaviour to meet environmental requirements”.

1.3.1 Characteristics of Learning

The nature of learning may be understood with the following characteristics:

- Learning is an adjustment of individual in his environment. The favourable environment may help and unfavourable environment may affect in the process of learning.
- Learning is described as purposive and goal seeking. We use to learn always with a purpose or goal in mind.
- It is said to be the result of the connection or establishment of the bond between stimulus and response.
- Learning gives a definite direction to changes in behaviour.
- Learning is associated with habit and practice.
- Learning is dependent on and associated with maturation.
- Learning is an individualized activity that depends on individual interest, ability and aptitude.
- Success in learning depends on motivation. It is motivation that gives psycho-physical readiness to learn resulting in greater output.



LET US KNOW

Learning is central to all our behaviour. It is the key process in human behaviour as we learn to do various activities like speaking, writing, thinking and perceiving. Our attitudes and emotional expressions are also learnt behaviour. All our adaptive as well as unadaptive, our cognitive as well as affective behaviour are formed by

learning processes. These are of vital importance in helping the organism to adapt to its changing environment.



CHECK YOUR PROGRESS

Q1: Fill in the blanks-

a) Learning is modification of ……..…… through training.

b) Success in learning depends upon ……..……..……

c) Learning is the establishment of bond between……..

1.3.2 Theories of learning :

THE THEORY OF CONNECTIONISM

Connectionism is a theory of learning which is based on the importance of the association of ideas. It is based on the concept that bonds or connections are formed between situations and responses. It is because of this that it is also known as the bond theory of learning. In the words of Thorndike- "Learning is the establishment of bond between stimulus and response and it follows a mechanical process of blind trial and error". Thorndike also formulated his law of effect on this theory which implies that any action which produces satisfaction is likely to recur and any activity which produces dissatisfaction is less likely to recur in future. Hence, this theory emphasizes that the behavior begins with reflexes and natural responses and new behaviours result from the acquisition of new bonds through experience. Those factors which facilitate bond formation are frequency, recency, intensity, vividness, mood of the subject, resulting in satisfactions, and similarity of situations and capacity of the subject. This theory is also known as S-R theory.

THE THEORY OF CLASSICAL CONDITIONING

This theory has been presented by the Behaviourists Psychologists like Watson and Pavlov. This theory maintains that learning is the

result of conditioning of our natural, unlearned responses to some other stimulus. We make a natural response to stimulus in which there can be no question of learning taking place. Such natural physical response, if connected to some other stimulus and then repeated again and again, may result in a new response or a new behaviour. Such a behaviour or response is called unnatural or conditioned response. This conditioned response is said to be the result of learning.

OPERANT CONDITIONING THEORY

This theory of learning was subscribed by Prof. B.F. Skinner of Harvard University of the U.S.A. It was a slight modification of Pavlov's conditioning theory. It maintains that response or behaviour of the organism in learning is not mechanical, passive, or involuntary, but active, purposive and goal oriented. Skinner had emphasized the fact that, "Behaviour operates in the environment to generate consequences". Our behaviour that generates in learning situation may called Operant rather than mere physical reflex behaviour occurring due to mechanical conditioning.

GESTALT THEORY

Gestalt theory is based on perception. It is another important theory of learning. According to Gestalt Psychologists, learning takes place neither as a result of trial and error nor as a conditioned response to a conditioned or artificial stimulus. Two Gestalt Psychologists Kohler and Koffka are of the view that all learning consists in perception of the total situation or whole by insight. To show what is meant by learning by insight, Kohler conducted several experiments on the learning process of Chimpanzees. He confined the Chimpanzee in one closed room with a bunch of banana hanging from above which cannot be reached. There were two sticks in the room which can be joined. At first the Chimpanzee vainly tried to get the banana aimlessly. After sometime, all of a sudden, it got an idea to fit one stick in the hole of another and dragged down the bananas. This occurred due to insightful learning in which the solution came to the

mind as a sudden flash of light. Gestalt psychologists criticize the conditioning theory and the theory of connectionism and put emphasis on interrelation and interdependence of the aspects of learning situation.

FIELD THEORY OF LEARNING

Field theory is propounded by Lewin. According to the advocates of this theory, "Learning is the organization and reorganization of behaviour which result from many interesting influences on the developing organism acting in its shifting environment." This theory emphasizes the phenomenon of perception and organization.

GUTHRIE'S THEORY OF SUBSTITUTION

This theory propounds that when an individual is performing activities due to the simulation of a stimulus then in future also the same stimulus will help in repeating the activity.

HALL'S THEORY OF REINFORCEMENT

This theory advocates that the essence of learning lies in what occurs between the stimulus and the response. In other words, the diminution in need reinforces the Stimulus-Response (SR) connections which are present at the time of diminution.

TOLMAN'S THEORY OF PURPOSIVISM

This theory emphasizes the importance of purpose or goal in learning. Tolman's theory is also known as sign or cue learning.



LET US KNOW

Some of the important tips to make learning more effective are as follows:

- In any learning the student should have a clear goal in view.
- One must also have conscious assurance that he is making progress towards his achievement.
- There must be distribution of practice periods.

- If a topic is easy to learn, then the whole method should be adopted, and if the topic is difficult in relation to the learner's ability part method should be adopted.
- Instead of learning by heart or rote memorisation, one should try to grasp meaning and idea of the text.



CHECK YOUR PROGRESS

Q2: What do you mean by learning?

.....

Q3: What are the different theories of learning?

.....

1.4 CONCEPT OF MIRROR LEARNING

The mirror learning task has historically been used to study learning and the effects of distributive practice. The task has also been used as a classic experimental activity designed to illustrate the effects of learning in many undergraduate laboratories for decades. More recently Psychologists like Goldstein, Hopkins and Strube (1994) used the task to demonstrate the observer. Although this activity is designed to provide students with an experience that will allow for comparison of the task done by left and right hand, and this activity may also be used to illustrate the effects of distributive practice and effects upon the observer.

1.4.1 Application of Mirror Learning in the field of Education

Mirror learning is not only important for teaching people; it can also improve basic human interaction. There is no evolutionary advantage in having a mirror learning system, except for the ability to interact. If humans were not social creatures, we would still have digestive and motor systems, but mirror systems only become useful in social beings.

Education is highly dependent on the proper functioning of mirror learning. The goal of teaching is to establish and improve the functionality of the parts of the brain and skills associated with them. Another cause for interest is the psychological implications of mirror learning. There is evidence of the fact that empathy is directly linked to the mirror system, basic human interaction, understanding, intuition, social behaviour, relationships, and caring which in turn may develop from the mirror system.

The psychological implications of mirror learning affect education as well. Teachers have been picking out students based on character traits for a long time, but there may be a better way of pinpointing students with specials skills or needs. With more advanced diagnostic tools that are more reliable, special classes could become more prudent. There may be classes for students with particularly developed mirror learning systems, and others for students with weaker mirror responses. Even if the classes remain mixed, it would certainly be beneficial for teachers to know more about their students' learning habits.



CHECK YOUR PROGRESS

Q4: Name some psychologists who had used the mirror drawing apparatus for the purpose of learning on the part of the students.

.....

1.4.2 Experimental finding through Mirror Learning Apparatus

Experiment I

Title: : Mirror Learning

Objective: : To observe how learning takes place through trial and error method.

Hypothesis: : The procedure of trial and error eliminates errors ads to improvement in human learning.

Apparatus and materials: The apparatus and materials used in the experiment are:

- Mirror drawing apparatus
- Star pattern cards drawn in parallel line
- Record sheet
- Stop watch
- Graph paper
- Stationery

Subject : Name:
Age:
Sex:
Academic Status:
Time:
Date:
Place:

DESCRIPTION OF THE APPARATUS:

The apparatus which is to be used for the experimental purpose is called “Mirror Drawing Apparatus”. The apparatus consists of a mirror which is vertically fixed on one side of a wooden board. The subject cannot observe the board directly as it is prevented by a screen fixed at a height from the board. The star pattern is placed and fixed on it. As the subject cannot see the screen directly, the subject can see the reflection of the star on the mirror. The subject is required to trace the star with the stylus which is connected. While tracing the star the error is indicated by the sound of a buzzer and at the same time the kind of error is also recorded.

The diagrammatic representation of the mirror drawing apparatus is shown below:

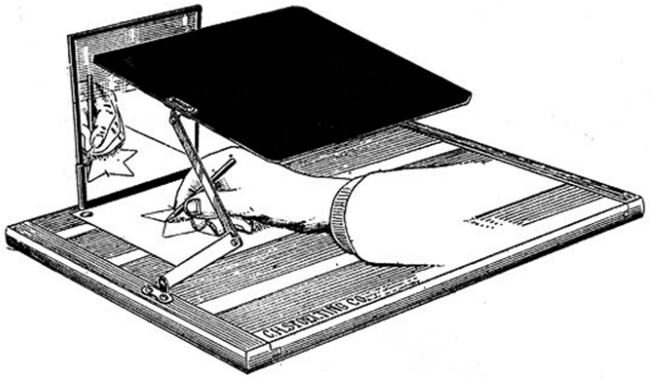


Fig :Mirror Draving Apparatus

Source: http://vlp.mpiwg-berlin.mpg.de/vlpimages/images/img7897.jpg

Stoelting, C. H. 1930. Apparatus, Tests and Supplies for Psychology, Psychometry, Psychotechnology, Psychiatry, Neurology, Anthropology, Phonetics, Physiology, and Pharmacology. (p. 0143, fig. 31213)

PROCEDURE:

At the very beginning, the experimenter systematically arranged the materials for the experiment. Then the experimenter prepared the worksheets and the serial number of the trial noted beforehand. After making the entire arrangement ready, the subject was invited to the laboratory room and formal instruction was given:

"This is a simple experiment and this apparatus is known as "Mirror Drawing Apparatus". In this apparatus there is a star pattern. You can see the star on the mirror. Your task is simply to trace the inner and outer boundaries of the star, with an electrically connected stylus, only by looking at the reflection on the mirror. You cannot leave the stylus while drawing the star. Touching the outer boundary of the star will be treated as an error. Errors will be calculated by the sound of the buzzer, so please try to concentrate so that you can make less error. Do you understand my instruction? Shall I start my experiment now?"

After getting positive reply from the subject the experimenter started the experiment after giving 'Ready' signal. The subject was requested to draw the star. The subject was allowed to draw for a number of

trials until and unless it became perfect. The experimenter had to note down the time taken and the number of errors for each trial by taking the help of the stopwatch, and recorded the error in the apparatus.

After finishing the experiment, the subject was requested to give his introspective report which was recorded by the experimenter. Then the subject was given thanks for his co-operation.

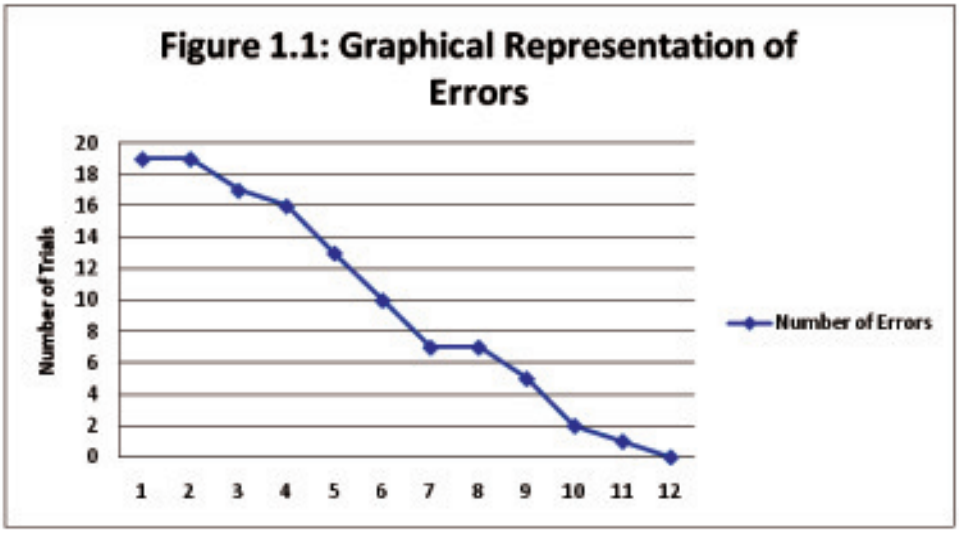
The recorded time taken and the error occurred would be written in the worksheet prepared by the experimenter for all the trials. Then, the experimenter prepared two graphs. In one graph he/she would present the number of errors and in other graph, he/she would represent the time taken by the subject.

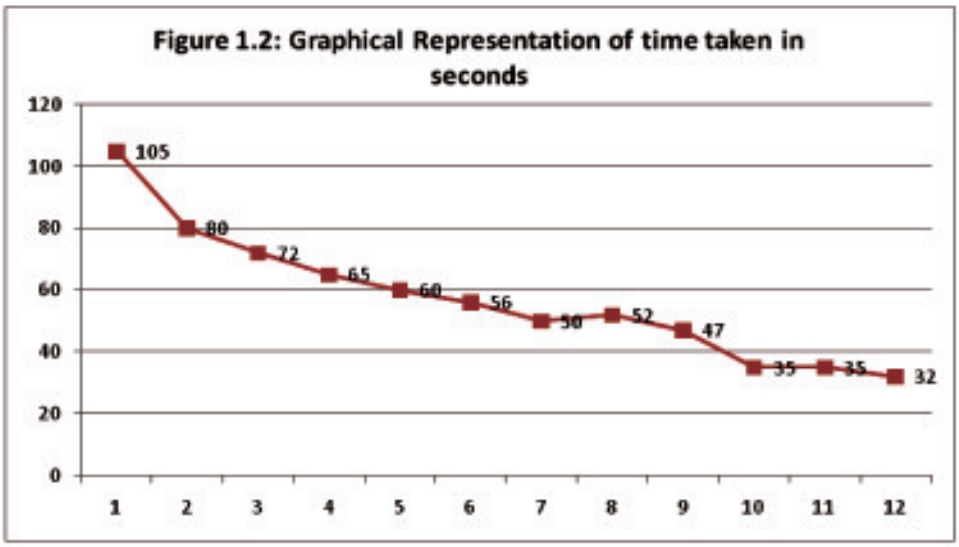
INTROSPECTIVE REPORT:

"The experiment is very easy one. It is not an easy task to draw by looking at the reflection. But I felt that errors were really decreasing while doing it continuously."

Record sheet: I

Number of Trials	Time Taken in Seconds	Number of Errors observation	Remarks and
11	105	19	Nervous
2	80	19	Uneasy feeling
3	72	17	Nervous
4	65	16	Excited
5	60	13	Excited
6	56	10	Excited
7	50	7	Easy feeling
8	52	7	Easy feeling
9	47	5	Comfortable
10	35	2	Comfortable
11	35	1	Confident
12	32	0	Confident





OBSERVATION:

From the result of the experiment it is clear that trial and error procedure help in reducing error and leads to the improvement in learning. The subject takes 12 trials. In the 1st trial he took the highest 105 seconds and made 19 errors because in this trial the subject was quite nervous. In the 2nd trial, due to uneasy feeling, the subject again made 19 errors and took 80 seconds. Similarly, in the 3rd and 4th trials, he made 17 and 16 errors and took 72 and 65 seconds respectively. As the trials increased the subject felt quite easy and made less error taking less time. In the 10th trial, he made only 2 errors and took 35 seconds. The subject became very confident

and took only 35 seconds and made 1 error in the 11th trial. Finally, in the last 12th trial, he took 32 seconds and completed his task very carefully and confidently without making any error.

From the worksheet it is clear that learning occurs by trial and error method. It also helps to accept the hypothesis that trial and error procedure eliminates errors and leads to improvement in learning. This can be well understood from the graphical representation of errors made by the subject from trial in figure 1 where $\overrightarrow{OX}$ axis represents number of trials and $\overrightarrow{OY}$ axis represents number of errors. And figure 2 shows the time curve where $\overrightarrow{OX}$ represents the number of trials and $\overrightarrow{OY}$ the time taken in seconds. Both the time curve and error curve show the improvement in learning through trial and error method.

Experiment: II

Title: Mirror Drawing or Cross Education or Bilateral Transfer from Right hand to Left hand

Objective: To study the nature of bilateral transfer of learning from right hand to left hand and vice versa.

Objective: Practice with right hand in mirror tracing influence the level of performance of the left hand.

Apparatus and Material: The materials used here are:

- Mirror drawing apparatus
- Stop watch
- Star outlines
- Graph paper
- Stationery

Subject: Name:

Age:

Sex:

Academic Status:

Time:

Date:

Place:

Description of the Apparatus:

The apparatus which is to be used for the experimental purpose is called “Mirror Drawing Apparatus”. The apparatus consists of a mirror which is vertically fixed on one side of a wooden board. The subject cannot observe the board directly as it is prevented by a screen fixed at a height from the board. The star pattern is placed and fixed on it. As the subject cannot see the screen directly, the subject can see the reflection of the star on the mirror. The subject is required to trace the star with the stylus and the stylus is connected with electric switch board. Every error of the subject while tracing the star indicated by the sound of a buzzer and at the same time error is also recorded.

Procedure:

For this experiment the experimenter invited the subject to the laboratory room and asked to sit in the chair and mirror drawing apparatus was presented in front of the subject. The subject was instructed as follows:

“This is a stylus which you have to place in the starting point of the star pattern. On hearing the word “start” you have to start moving the stylus in the pattern of seeing it on the mirror. Taking care that you should not touch the inner and outer boundary of star pattern.As soon as you reach the end point your one trial will be completed. Do you understand?”

After getting confirmation from the subject the experiment was started. The subject was asked to make 3 attempts with the left hand. The experimenter will record the error and time in seconds, with the help of a stop watch. After 1 minute rest the subject was asked to make another 10 trials with the help of right hand. In the same manner the time taken in each trial and mistake was recorded. Then again after giving rest for 1 minute the subject was given another 3 trials with left hand. In the same manner error and time would be recorded.

Precaution:–

In doing the experiment the following precaution has to be taken:

- To enquire whether the subject is left handed or not.
- To develop quite and calm environment in the laboratory room.
- A stop watch should be used in a proper way.
- At least one minute rest should be provided to the subject for each trial.

INTROSPECTIVE REPORT:

"The experiment is very interesting one. It is quite difficult to draw with the left hand. But after a number of trials it becomes easier for me."

Record sheet - II

	Number of trials	Time taken in seconds	Errors	Hand	Test
Phase I	1 2 3	58 70 66	14 22 9	LEFT	Initial test or pre-test
Phase II	1 2 3 4 5 6 7 8 9 10	40 36 28 27 37 29 33 32 36 30	7 2 4 4 7 2 3 4 1 0	R I G H T	P R A C T I C E
Phase III	1 2 3	40 45 36	7 9 4	LEFT	Final Test or Post-test

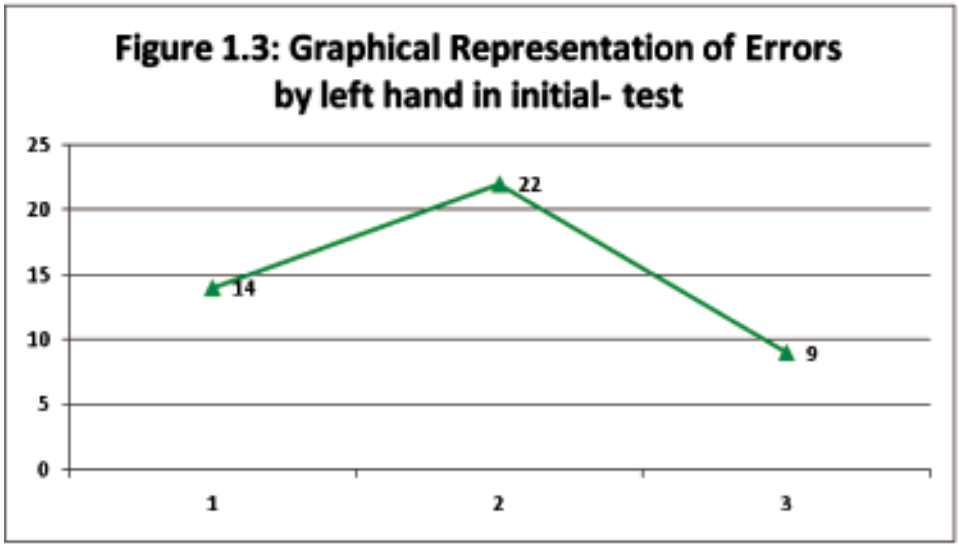


Figure 1.3: Graphical Representation of Errors by left hand in initial- test

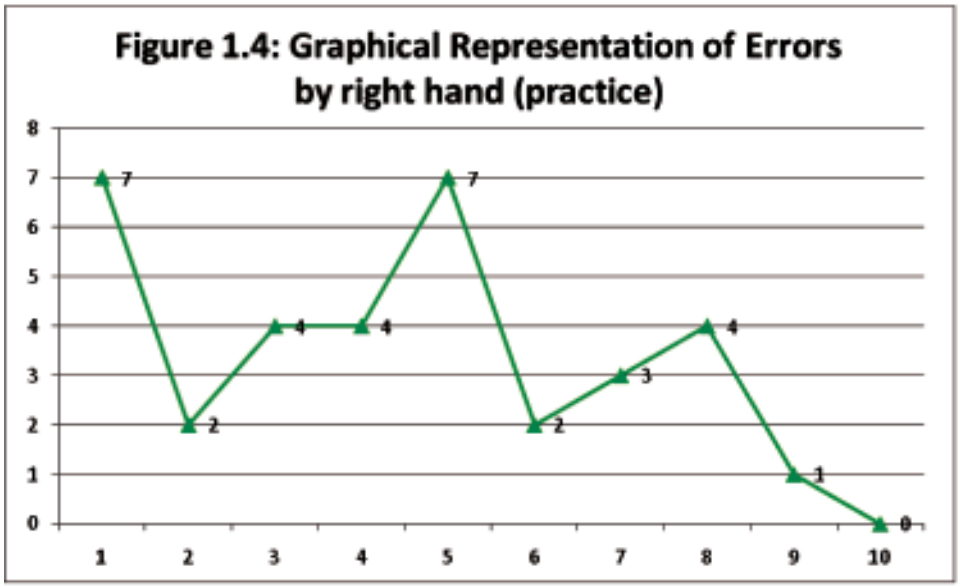


Figure 1.4: Graphical Representation of Errors by right hand (practice)

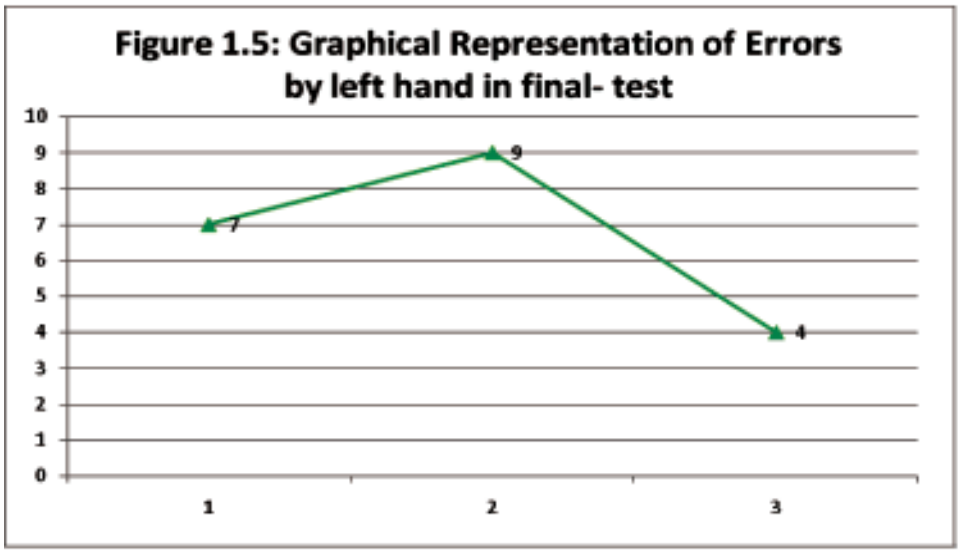


Figure 1.5: Graphical Representation of Errors by left hand in final- test

RESULT:

The result of the experiment can be found out by through inspection of the curve

By comparing the errors, that is comparing the difference between the average of trials and the average for trials for the unskilled hand with the difference between the corresponding averages of trials with skilled hand. (From record sheet-II)

RESULT SHEET

MEAN	INITIAL TEST	FINAL TEST	DIFFERENCE
Time	194/3 = 64.66	121/3 = 40.33	64.66-40.33 =24.33
Error	45/3 = 15	20/3 =6.66	15-6.67 =8.33

OBSERVATION:

After careful observation it is clear that there are some differences between pre-test and post-test. In this experiment there are 3 phases. In the 1st phase, the subject took the highest time (70 seconds) and made the highest number of errors (22) as he had to do this task with the left hand. In the 2nd phase, the subject practiced 10 trials with the right hand in which the highest time taken was 40 seconds and the lowest time taken was 27 seconds. The subject made the highest 7 errors in 1st trial and makes 0 error in the 10th trial. And in the 3rd phase, it is observed that the time taken by the subject decreased to 36 seconds, and errors also minimized to 4 errors when the subject again gone through this phase with the left hand.

Again, in the result sheet, the mean of time in the initial test is found as 64.66, and in final test, it is 40.33 and the calculated difference is 24.33. On the other hand, the mean of error for the initial test was found to be 15, and for the final test it was 6.66. So, the calculated difference is 8.33. Thus, we can easily conclude by observing the mean differences of time and error that learning by mirror drawing

apparatus with right hand facilitates the learning by left hand and thus the hypothesis can be proved.



ACTIVITY: 1.1

How mirror drawing apparatus can help in learning by an individual? Conduct an experiment by of own with the help of the apparatus to prove "practice improves human learning."

1.5 CONCEPT OF MAZE LEARNING

Maze learning is the process of learning a route (typically by rats or mice) through a maze in order to obtain reinforcement. This process is a popular experiment in psychology laboratory and it is the main method of studying spatial learning. When the rat makes its way through the entire maze it is rewarded with food.

Psychologists have also studied maze learning in human subjects, usually students. A typical maze experiment on students consists of tracing finger mazes while blindfolded, according to the Online Psychology Laboratory was conducted. This type of maze experiment was first conducted in the early 1930s, and computerized variations of the same are still used today.

1.5.1 Application of Maze Learning in the field of education

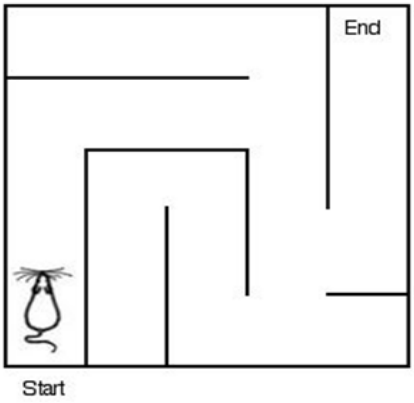
Maze learning helps the teachers to explore the minds of every student in the classroom learning. It helps the teachers to know about their behavioural aspect and helps to detect their cognitive and emotional areas too. It helps in the use of sensory integration movement processes with students with academic and behavioural deficiencies who do not receive special education services.

Rats have been used in experimental mazes since the early 20th century. Thousands of studies have examined how rats run through different types of mazes, from T-mazes to radial arm mazes to water mazes. These maze studies are used to study spatial

learning and memory in rats. Maze studies helped uncover general principles about learning that can be applied to many species, including humans. Today, mazes are used to determine whether different treatments or conditions affect learning and memory in human beings or not, and even in rats.

For example:

The classic maze



This is the kind of maze everyone thinks of when they think of rats and mazes. The maze consists of a large platform with a series of vertical walls and a transparent ceiling. The rat starts in one location, runs through the maze, and finishes with a reward in another location.

How many trials does it take for a hungry rat to run the maze to the food rewarded at the end with no mistakes? How quickly does the rat complete the maze each time? Does the rat get faster over multiple trials? Over time, rats tend to run the maze with fewer and fewer errors, more quickly. By graphing the number of errors over time, you can generate a learning curve for the rats.



CHECK YOUR PROGRESS

Q5: How maze learning helps the teacher in the classroom teaching?

……..……

……..

~~Objective:~~

1.5.2 Experimental Finding through Maze Learning

Experiment III

Title: Maze learning by punch board

Objective: : To determine whether learning time and error decrease with the increase in the number of trials.

Hypothesis: : Learning time and error decrease with increasing number of trials.

Apparatus and Materials Used: The apparatus and materials used are:-

- Punch board maze
- Stop watch
- Screen
- Newspapers
- Graph paper

Subject: Name:
Age:
Sex:
Educational Status:
Date:
Time:
Place:

DESCRIPTION OF THE APPARATUS USED

The apparatus used in this experiment is known as "Punch Board Maze". It consists of two pieces of wooden boards of identical size is around ten to twelve rows of holes are drilled into the upper piece of board, each row consisting of three holes. There is also one single hole at the top and another at the bottom. For one hole of each row in the upper piece there is a hole in the corresponding position in the lower piece which is randomly distributed over its surface. One of the top and bottom holes too have a hole in the corresponding position in the lower piece. For each trial a newspaper is placed under the upper piece and the subject is required to insert a pencil, starting with the top hole, in that hole of each row that has

a corresponding hole in the lower piece. The diagram of the 'Punch Board Maze' is presented below:

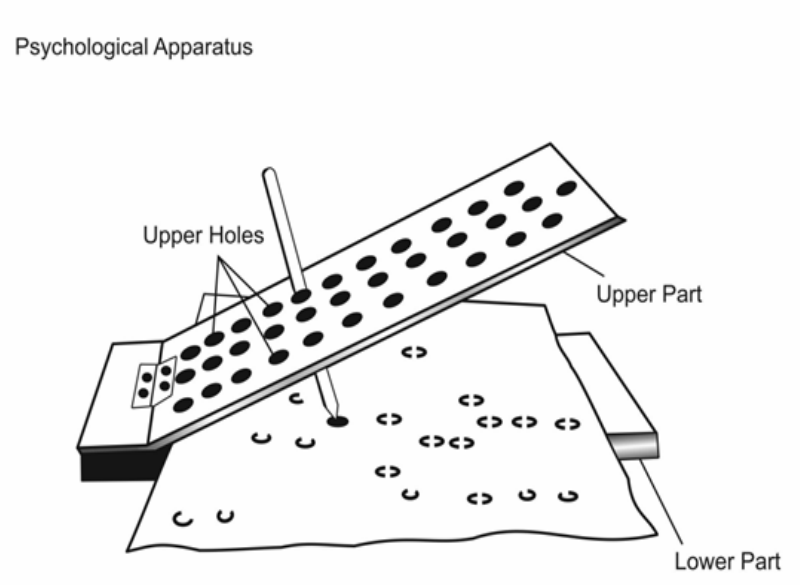


Fig. 2– Punch Board

PROCEDURE

After making all the arrangement the experimenter invited the subject and asked to sit and gave the following instructions-

"This is a punch board maze. It consists of two pieces of wooden board which consists of 10 rows of holes, each consisting of 3 holes. There is a starting hole and an exit hole. Your task is to insert your pencil starting with the top hole. In each row there is only one correct point. You will never be given opportunity of looking at the lower piece. If you hit the pencil at the correct hole, your pencil will pierce through the paper and pass into the lower piece; otherwise the pencil would only make a mark in the newspaper. For each trial I will give you a start signal and then you are to move your pencil. Do you understand? Shall I start now?"

With this the experimenter started the experiment. The experimenter used the stop watch to record the time for each trial taken by the subject. The experimenter also found out the error score from the newspaper.