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INTRODUCTION TO EXPERIMENTAL PSYCHOLOGY AND STATISTICS IN PSYCHOLOGICAL RESEARCH - I

Unit Structure

1.0 OBJECTIVES

At the end of this unit, learner should be able to –

1. Describe the characteristics of an Experiment.
2. Identify the I.V, D.V and CVs in an experiment
3. Describe the different Experimental designs with one IV and two IVs
4. Evaluate the different Experimental designs
5. Explain the concepts- Sampling, Randomization and Counterbalancing
6. Frame null and alternate hypothesis for experiments with one IV

1.1 INTRODUCTION

Psychology is a science of human and animal behaviour. It aims at scientifically building an organized body of knowledge. Another aim of psychology is to provide scientific explanation for behaviour.

The scientific method of organizing and explaining behaviour, requires following steps to be followed. This consists of ---

i. Observing the phenomena or behaviour

ii. Formulating Tentative Explanations

iii. Further Observing and Experimenting

iv. Refining and Retesting Explanations

Let us see it with an example. One famous experiment that was conducted by Elizabeth Loftus and John Palmer. This was known as the Car Crash Experiment.

Loftus and Palmer observed that our memory is not always right and it can deceive us. They hypothesized that the way in which the questions are worded can influence the participant's recall of the event. They further experimented to test this explanation or hypothesis.

In their experiment, participants watched slides of a car accident and were asked to describe what had happened during the scene. The participants were divided into five groups and each group was exposed to a different form of question.

Group I was asked --- How fast was the car driving at the time of contact?

Group II was asked – How fast was the car going when it smashed into the other car?

Group III was asked – How fast was the car going when they collided?

Group IV was asked – How fast was the car going when they bumped against each other?

Group V was asked – How fast were the cars going when they hit each other?

It was found that participants in the 'smashed' condition reported the highest speed estimate (40.8 mph), followed by 'collided' (39.3 mph), 'bumped' (38.1 mph), 'hit' (34 mph) and contacted (31.8 mph)

From this experiment it was concluded that the verb used in the question influenced the estimate of the speed of the car which impacted the perception of the eyewitness.

This was not the only experiment that Loftus and Palmer conducted. They further conducted several other researches to refine and further understand the Eyewitness Testimony.

Several such experiments have been conducted to understand the different mental processes. Let us now see the important characteristics of Experimental method.

Characteristics of Experimental Research:

Experimental research enables us to test hypothesis or the tentative explanation. This type of research has two important characteristics –

i. Manipulation of Independent Variables

ii. Control Over Extraneous Variables

Let us look into these characteristics in detail.

i. Manipulation of Independent Variables:

An independent variable is the variable whose values are set by the experimenter. For instance in the experiment by Palmer and Loftus, they manipulated or set different types of verbs in their questions. 'The type of verb used in the question' was the independent variable. They altered the verb in different groups of participants. In an experimental method, the Independent variable is artificially introduced and manipulated by the Experimenter. This is a very important characteristic of Experimental method which distinguishes it from Observational method.

Control Over Extraneous Variables:

Another characteristic of an Experimental research is that it involves controlling the various extraneous variables. Extraneous variables are those factors apart from the independent variable which may affect the behaviour that the experimenter wishes to study. For instance, in the experiment by Palmer and Loftus the way in which the slides were presented too would have had an influence on the memory. Hence they kept the slides same for all the groups. Similarly, if one group were presented the scene under noisy condition while another group in a quiet condition, that too may have had an impact on the participant's memory. This means that noise level, distraction level and any other conditions that are likely to affect memory, apart from the kind of verb (Which is our IV) should be controlled while conducting the experiment. Thus in an experimental method, all the factors that are likely to influence the behaviour under study, except for the Independent variable, we try to control them.

Thus Experimental research involves understanding the behaviour and testing the hypothesis through careful manipulation of the Independent variable under controlled conditions.

Check Your Progress:

1. What are the important characteristics of an Experimental Method?

2. State with reasons whether the following research involves Experimental Method

a. A researcher wanted to study whether use of mobile has an effect on the level of distraction of the students. The researcher measured the attention level of 100 students who possessed mobile and found that the level of distraction is high.

b. A researcher wanted to study the effect of training to use of imagery in improving memory. One group of participants were trained for use of imagery while another group was not. Followed by that both the groups of participants were taught a matter and memory for the material taught was measured for the two groups and compared.

Now that you have understood the two important characteristics of an experiment, we will see in the next section the different types of variables involved in the Experimental method.

1.2 VARIABLES

Experimental Research requires the understanding of the different types of variables. The three important types of variables in an Experimental method are –

Independent variable

Dependent variable

Control variable

We will now see each of them

1.2.1 Independent Variable:

It is the variable that is set by the experimenter and manipulated in the experiment. For instance, in order to study the effect of Information about Mnemonic device on memory, the experiment will involve two conditions

i. Condition with Mnemonic Device: This will involve training given to the participants about the different Mnemonic device.

ii. Condition without Mnemonic Device: This will involve no training given to the participants about the different Mnemonic devices.

One group will be exposed to one condition (Mnemonic device information condition) and the other group will be exposed to another condition (No Mnemonic device information condition). The first group of participants will be exposed to a training program where they will be given information about the different Mnemonic devices while the other group is not exposed to this kind of information. Followed by that, both

the groups will be given a task to test the memory. In this way the variable 'Information about Mnemonic device' is manipulated or set up by the experimenter. Thus 'Information about Mnemonic device' will be considered as the Independent variable in this experiment.

The set values of the Independent variable are called as levels. Thus in this experiment the Independent variable – Mnemonic device has two levels:

1. Information about Mnemonic device
2. No information provided about Mnemonic device.

Let us now see another example. Suppose the experimenter wishes to study the effect of Method of teaching on learning. In order to conduct the experiment, the experimenter will expose the participants to different methods of teaching – Lecture method/ Discussion Method/ Self- study method. The same topic may be taught to three groups of participants with different methods. Followed by that, the experimenter may check their level of learning through a test on the content. In this experiment, the 'method of teaching' will be the Independent variable and it will have three levels –

Lecture method condition

Discussion method condition

Self-study method condition.

Some important things to be remembered about Independent variable are :

1. It is a variable that is manipulated by the experimenter.
2. In an experiment the independent variable must have at least two levels. Although there can be more than two levels as well, minimal of two levels of the I.V. is required to undertake experimental research.
3. An experiment may have more than one independent variable.

We will now go to the second type of variable in the next section.

1.2.2 Dependent Variable:

In an experiment, the researcher manipulates a variable and observes its effect. The variable whose value is observed and recorded in the experimental research is called as the 'Dependent variable (DV). It is the variable which is measured in the experiment.

In the experiment by Loftus and Palmer, what they measured and observed was the estimate of speed that the participants mentioned. This estimate of the speed was their Dependent variable (D.V.)

In the experiment on effect of mnemonic device on memory, after manipulating the mnemonic device, the experimenter will measure the memory of the participant. Hence memory which will be measured in terms of the number of words that the participant is able to recall will become the dependent variable in that experiment.

In the next example where we wanted to study the effect of the method of teaching on the learning, after exposing the participants to different methods of teaching, the researcher may give the participants a small test to see how much learning has taken place. Thus, in this experiment 'The amount of material learned' will be the dependent variable.

Some important characteristics of dependent variables that must be kept in mind are :

1. It is a variable that is measured in an experiment.

2. In an experiment there can be more than one dependent variable

Another very important type of variable in an experimental method is the Control variable, which we will be discussing in the next section.

1.2.3 Control Variables:

One important characteristic of Experimental method is that it involves control over extraneous variables. It is important to control the extraneous variable because, if it is not controlled it may become difficult to establish cause-effect relationship. For instance if all the participants in the 'Mnemonic group condition' of our memory experiment are high on intelligence in comparison to those in the 'No Mnemonic group condition', it will be difficult to know whether the memory in the Mnemonic group condition is influenced by the use of mnemonic device or because of their high level of intelligence.

Those extraneous variables which are controlled in an experiment, are called Control variables.

In the experiment to study the effective of Method of teaching on learning, it is important that in all the conditions (Methods of teaching) the age and intellectual abilities of the participants are kept constant. If all the participants in the Discussion method are more intelligent as compared to those in the other two groups, we may not know whether the difference in the level of learning is due to the method of teaching or whether it is due to differences in the intellectual ability. This makes it necessary for the experimenter to control the influence of the extraneous factors. Also it is necessary that either the same topic is taught or the difficulty level of the matter taught should be kept constant. If these are allowed to vary, they may interfere with the results and make it difficult to know whether the differences in the learning was due to the method of teaching or not. Thus in this experiment some of the control variables to be considered would be as follows –

1. Age and abilities of the participant

2. Difficulty level of the material to be taught
3. Duration of the teaching period

There are two ways of controlling the influence of extraneous factors –

1. Holding the extraneous variable constant:

This involves keeping it constant so that it does not vary across the different levels of the independent variable. For eg., we may keep the same topic for the 3 groups with different types of teaching method so that the difficulty level of the topic will not influence the amount of learning.

2. Randomize their effects:

This involves randomly placing participants into different conditions. To control the effect of intellectual abilities of the participant, we may randomly assign participants to different groups. By doing this the effect of the differential intellectual ability may be distributed across the different groups and may even out.

1.2.4 Confounding Variables:

Controlling the extraneous variables is very important in an experimental method. When important variables which influences the behavior under study is not adequately controlled, there are chances that the study will have several alternative explanations. Let us understand this with an example. If in our study where we wish to understand the effect of method of teaching on learning, we fail to keep the difficulty level of the content constant, it is possible that the differences in learning in the three methods could be not only because of the method but also due to another reason-difficulty level of the content. Thus if discussion method is introduced using a easier topic while self-study method is introduced using difficult topic, we may not know whether the differences in the learning is due to the method of teaching (Discussion Vs Self-study) or due to difficulty level of the content (Easy Vs Difficult)

Under such circumstances it becomes very difficult to state the extent to which learning is due to the method of teaching and to what extent it is due to the level of difficulty of the topic. In this case, difficulty level of the content is considered as a confounding variable.

A confounding variable is a variable which systematically keeps varying along with the Independent variable and produces difficulty in separating the role played by the Independent variable on the dependent variable.

In an experimental method, it is necessary to identify the factors which may act as a confounding variable and make an attempt to control its effect. This is necessary since confounding variables can affect the internal validity of the experiment. However it is not possible to eliminate all the sources that can confound the study.

Check Your Understanding:

1. What are the two characteristics on an experimental research?
2. Define – Independent variable
3. Define – Dependent variable
4. Define – Control variable
5. Define --Confounding variable
6. What are the ways in which extraneous variables are controlled in an experimental research?
7. In the following examples, Identify the IV and DV and CVs --

a. A researcher wanted to know if there is a difference in the comprehension level of sentences in Active voice Vs. Passive voice. The participants were matched for age and language abilities. All the participants were then exposed to sentences which were either constructed in Active voice or Passive voice and the sentence comprehension was measured with the help of the number of errors committed in comprehending the two types of sentences.

b. A researcher wanted to understand whether there is a difference in the time taken to take the decision when an individual is working alone as compared to working with a team. A group of participants were chosen from the same age-group and educational level. They were given a situation and were asked to take a decision as an individually. The participants were then put into a group situation and asked to take a decision as a team. The time taken to take the decision in the two situation (Individual Vs Team) was compared.

All the above kinds of variables - Independent Variable, Dependent Variables and Control Variables should be operationally defined in a study. Let us now see what we mean by Operational definitions.

1.3 OPERATIONAL DEFINITION

A good research requires stating the problem or research question in such a way that it becomes possible for us to test it. This means that it should be stated precisely. Precision involves the specific definition of the variable and the way in which it will be measured in the study. In the experimental method as well, it is necessary to specifically state what the variables mean and the precise way in which it will be used in the experiment. Such specific and precise statement describing the variable and how it will be measured, is called as Operational definition.

For example, in our experiment, it is important to state the Operational definitions for the different variables. This helps us to frame the hypothesis more precisely, which can then be tested. For instance when we want to test the hypothesis that – 'There is a difference in learning as a

function of the method of teaching', it is necessary to state what exactly we mean by learning and what do we mean by the method of teaching. What do these variables mean in our experiment needs to be clearly stated. Thus the Operational definition of learning could be –

i. Number of questions based on the content that is correctly answered.

ii. Ratings given by the teacher at the end of the lecture on the quality of learning demonstrated by the participant.

iii. Ratings given by the participant on the amount of content understood by them.

Out of the different ways, the exact way in which we will be using it in our research, needs to be mentioned. Such operational definitions helps not only the researcher to formulate a testable hypothesis, but it also helps others who are reading the research and further conduct researches related to the same variable.

Check Your Understanding.

1. What do you mean by Operational Definition?
2. In the following example, Identify the I.V..D.V. and C.Vs and give one operational definition of each of the variable.

A researcher wanted to understand the effect of Exercise on Stress level by keeping the Socioeconomic status constant.

Another important concept related to Experimental method is the design of the experiment. We will now see the different Experimental designs.

1.4 EXPERIMENTAL DESIGNS

We will see the different designs by categorizing them into two groups –

i. Experimental Designs with One IV and

ii. Experimental Designs with Two IV

We will now see the designs of an experiment in each of the above category.

1.4.1 Experimental Designs with One IV:

Any true experiment will necessarily have one independent variable and a dependent variable. Although it may have more than one independent variable or also more than one dependent variable, at least one is a necessity. Also the independent variable, which is manipulated in the experiment, will involve at least two levels. There can be no experiment with less than two levels of the independent variable. The different levels of the independent variable may be may be manipulated either by using one of the two experimental designs :

1. Random groups design
2. Repeated measures design.

We will now see these two types of design one by one.

1. Random group design:

This design involves assigning participants to different groups in a random manner. This means that different participants participate in different condition and any participant has equal chance of being put into any group.

Let us see this with the example of the memory experiment. If we want to study the effect of Mnemonic device on memory, we will have two levels of the Independent variable –

Mnemonic device condition

No Mnemonic device condition

Thus the experiment will be conducted on two groups of participants. Suppose we decide to conduct this experiment on 100 participants by having 50 participants put into the first condition (Mnemonic device condition) and train them to use mnemonic device and assign another 50 participants to the other condition (No Mnemonic device condition) with no training on use of mnemonic device. At the end of the session we may measure the memory for a list of ten words. This will involve random measures design or which is also called as between subjects design.

This method thus involves the following steps –

1. Sample a group of participants from general population
2. Randomly assign the participants into the different conditions of the experiment
3. Expose the participants to the treatment conditions
4. Compare the two groups by measuring the dependent variable

2. Repeated Measures Design (Within Subjects Design):

This design involves each participant to be exposed to all the levels of the independent variable. It is also called as the within- subjects design.

Thus rather than having different participants participating in the different treatment conditions, the same participant goes through all the conditions.

We will now see how the experiment on Mnemonic device can be conducting using the repeated measures design.

In order to understand the effect of Mnemonic device on memory, we may have a group of 100 participants and each of the participant may be first be exposed to a list of 10 words and asked to recall them (No Mnemonic

device condition). Followed by this the same participants may be trained for use of Mnemonic device and again exposed to another list of 10 words and tested on the number of items that they are able to recall. We will now be able to know the effect of Mnemonic device by comparing the number of words correctly recalled in the two conditions (Mnemonic device condition Vs No Mnemonic device condition)

In this design, the same participant participates in both the conditions of the experiment and hence involves the repeated measures design.

Both the designs have their own strengths as well as weaknesses. It is necessary to evaluate the variables before deciding on an appropriate experimental design.

Check Your Progress:

1. What is Random measures design?
2. What is Repeated measures design?
3. How will you conduct the experiment that we have discussed above on 'Effect of teaching method on learning' using the Random group design?
4. How will you conduct the experiment on 'Effect of teaching method on learning' using Repeated measures design?

1.4.2 Experimental Designs With Two Ivs:

Till now we have been discussing Experimental designs with one Independent variable. Let us now see research designs with experiments having two Independent variables.

Before seeing the designs with two IVs, we will see how the total number of conditions in an experiment is calculated when a design has 2 IVs.

When an experiment has two I.Vs, each of the I.V. may have different levels. For example, if we want to understand the effect of subject taught and method of teaching on learning, then this experiment now has 2 independent variables –

1. Subject – with two levels (Maths and Science)
2. Method of teaching – with three levels (Lecture method, Discussion method and Self-study method)

When there are more than one independent variables in an experiment, we need to first know how many conditions the experiment will totally consist of. This may be calculated by multiplying the levels of each of the I.Vs. Thus in this experiment, there will be (2 X 3) since the first IV (Subject) has two levels (Maths and Science) while the second IV (Method of teaching) has three levels (Lecture method, discussion method and Self-study method).

Since (2 X 3 = 6), this experiment will have 6 conditions which are as follows:

	Lecture method	**Discussion method**	**Self-study method**
Maths	Condition 1 Maths with Lecture method	Condition 3 Maths with Discussion method	Condition 5 Maths with Self-study method
Science	Condition 2 Science with lecture method	Condition 4 Science with Discussion method	Condition 6 Science with Self-study method

We will now consider another example. Suppose the experimenter wishes to study the effect of Emotional state of an individual (Relaxed Vs. Anxiety) and Type of stimulus (Abstract Vs. Concrete) on the recall of the words.

In this Experiment, there are two I.Vs and each of the IVs have two levels each.

1. Emotional state – Relaxed and Anxious

2. Types of Stimulus – Abstract and Concrete.

The number of conditions that this experiment will contain will be
= 2 X 2 = 4

The four conditions will be as follows

	ABSTRACT WORDS	**CONCRETE WORDS**
RELAXED STATE	CONDITION 1 Abstract words in Relaxed emotional state	CONDITION 2 Concrete words in Relaxed emotional state
ANXIOUS STATE	CONDITION 3 Abstract words in Anxious emotional state.	CONDITION 4 Concrete words in Relaxed emotional state

Now that we have seen how the total number of conditions in an experiment is computed when experiments have more than one IV, we will now discuss the different designs when experiment has two IVs. When an experiment has 2 I.Vs, the following designs are used –

1. Completely Randomized Design:

In this design different participants participate in all the different conditions of the experiment. In the above experiment with 6 conditions, if we are using Completely randomized design, then different participants will be randomly be assigned to any of the 6 conditions. This means that

the experiment will require 6 groups of participants and each group of participant will be exposed to one of the 6 conditions.

Similarly in the second example, since there are altogether four conditions and if we are using Completely randomized design, there will be four groups of participants and each of the group will be exposed to one of the four conditions.

2. Completely Repeated Measures Design:

In this design, the same participant is exposed to all the different conditions of the experiment. This means that in the context of the above experiment which has 6 conditions, the same set of participants will be exposed to all the 6 conditions and in each of the condition the content of the teaching will be of same difficulty level.

Similarly in the second example, where there are four conditions in all, if the experimenter uses completely repeated measures design, then the same participant will be exposed to all the conditions of the experiment.

Apart from these two designs, there are other designs that we can use when an experiment has two I.Vs.

Mixed Design

Factorial design

We will be seeing the Mixed design in Semester 6 (Section A)

Check Your Understanding:

1. What are the designs used when there is one IV in an experiment?

2. Describe Completely Randomized group design with an example

3. Describe Completely Repeated measures design with an example.

1.5 SAMPLING, RANDOMIZATION AND COUNTERBALANCING

While planning an experiment it is necessary to understand the role played by the characteristics of the participant and also that of the stimulus material that is used while conducting the experiment. In this section let us see important concepts related to the selection of the participants and the presentation of the stimulus material while conducting the experiment. We will be seeing three important terms - Sampling, Randomization and Counterbalancing.

1.5.1 Sampling:

In any research, it is not possible to include every member of the population. Hence we conduct it on a selected small group of participants. This small group of participant is known as the sample. The results become more conclusive when we conduct it on a random sample.

Random sampling means that every individual has equal chance of being a part of the study. When the sample is randomly selected or assigned, there are greater chances of obtaining conclusions which can be generalized to the population.

Let us now see what are the different types of sampling techniques that can be used.

i. **Simple Random sampling**: This means that we are going to select participants in such a way that any individual will have equal chance of being a participant in our experiment. For example, an experimenter may decide to involve every third person he or she comes across in the experiment. This is called Simple Random Sampling.

ii. **Stratified Sampling**: This kind of sampling involves including all the segments of the population in the study. For instance, in an experiment on parenting styles, it may be necessary to have participants from all the section of the society- Upper-class, Middle-class as well as Lower class. This kind of sampling is called as Stratified Sampling.

iii. **Proportionate Sampling**: In this form of sampling, all the sections of the society are included, but proportionate to their existence in the population. For example, if in India 50% of the population belongs to Middle-class, 25 % to Upper-class and 25 % to Lower-class, the same proportion should be reflected in the sample. The sample of the experiment too should have 50% of participants from Middle-class, 25 % from Upper and Lower- class. This type of sampling is called as proportionate sampling.

iv. **Cluster Sampling**: In researches that involve a larger population, the research becomes more meaningful if participants from different geographical areas or other relevant categories are included in the study. For instance to understand the importance of the type of parenting, it is necessary to have participants from different parts of the country, rather than only from one state or city.

Check Your Understanding

Explain the following:

i. Random sampling

ii. Stratified sampling

iii. Proportionate sampling

iv. Cluster sampling

1.5.2 Randomization:

From the earlier section it is seen that the sample that is studied is necessary to be representative of the general population. This brings us to

the importance of randomization. When experiments are conducted, since we conduct it on a sample of population, it is necessary to choose the participants randomly so that every individual has equal chance of being a member of the study. This helps in bringing out sample closer to the general population.

Similarly, when we use random group design in which different participant participate in different conditions, it is necessary that we assign participants to each of the conditions randomly. For instance if we are conducting the experiment related to the differences in learning produced by the three methods of teaching, it is necessary to randomly place participants into one or the other of three groups.

Another situation where randomization is required is in the presentation of the stimulus. When there are a number of stimuli or conditions in an experiment, it is necessary to take into consideration the effect of the position of the stimulus or conditions. For instance, if in an experiment where we want to understand the effect of the method of teaching on learning and we use repeated measures design, then all participants will participate in all the three method of teaching. Under that condition, if for all the participants the order of the method of teaching used is as follows

(1) Discussion method (2) Self-study method (3) Lecture method.

If the presentation is the same for all the participants, it is possible that the lecture method being the last one may either produce fatigue or practice, due to its position. Randomization can be used here so that for every participant any method can be randomly chosen for any position.

Thus randomization helps in controlling for many interfering factors. Another such method which helps in controlling for interfering factors is counterbalancing. Let us now discuss about counterbalancing.

1.5.3 Counterbalancing:

When repeated measures design is used, the same participant participates in more than one conditions of the experiment. This may result to a number of carryover effects like – fatigue, practice effect, habituation, sensitization, etc. For instance in the experiment on understanding the effects of 3 methods of teaching on learning, if we plan to use repeated measures design and all the participants are first exposed to discussion method, then to lecture method and finally to self-study method. In this case learning in the different methods may be different not only because of the inherent characteristic of the method of teaching, but it can also be the result of the position of the method. Those in the beginning are less likely to be affected by fatigue, while those towards the end are likely to be influenced by fatigue or practice or other factors.

In an experimental method, it is necessary to control the effect of the carryover effects. One way of doing this is through Counterbalancing. Counterbalancing involves assigning different participants to different order of the conditions so as to balance them across the positions. Thus for

the study on the effect of method of teaching on learning, we may have 3 groups of participants with each of them exposed to the 3 different orders as follows:

GROUP 1	GROUP 2	GROUP 3
Lecture method	Discussion method	Self-study method
Discussion method	Self-study method	Lecture method
Self-study method	Lecture method	Discussion method

Note that in this way the carryover effects are likely to get balanced. This is called as Counterbalancing.

Check Your Understanding

1. What do you mean by Randomization?

2. Explain Counterbalancing with an example.

In this unit we are seeing the important features and concepts in Experimental method. After having seen some of the concepts like Variables and designs, let us now see one more important term – Hypothesis.

1.6 HYPOTHESIS

Hypothesis is a very important aspect of an experiment. Before conducting the experiment, the experimenter may propose a possible relationship between the Independent variable and the Dependent variable. This proposed relationship is called as a hypothesis.

For instance, in the experiment on Mnemonic device, if the experimenter expects that recall will be better in the Mnemonic device condition rather than the No-Mnemonic device condition, then this expected relationship will have to be stated as a hypothesis.

Conventionally, in research, there are two forms in which hypotheses are written:

i. Null Hypothesis

ii. Alternative Hypothesis

We will now see these two forms of hypotheses one after the other.

1.6.1 Null Hypothesis:

The null hypothesis states that there is no relationship between the two variables.

For the experiment on Mnemonic device, the null hypothesis could be stated as follows:

There is no significant difference in number of items recalled as a function of Mnemonic device (i.e. There is no significant difference the in mean number of items that are recalled in the Mnemonic device condition Vs. No-Mnemonic device condition)

1.6.2 Alternative Hypothesis:

The alternative hypothesis is a hypothesis which states that there is a relationship between the IV and the DV and that IV has an impact on DV.

For the experiment on Mnemonic device, the alternative hypothesis could be stated as follows –

Mnemonic device has a significant effect on recall of items (i.e. The number of items recalled is significantly greater in the Mnemonic device condition as compared to the No-Mnemonic device condition)

An experimental hypothesis many be Non-directional or Directional. Let us now see Directional and Non-Directional hypothesis.

1.6.3 Directional Hypothesis:

This is a one-tailed hypothesis which specifically predicts the direction or nature of effect that the IV will have on the DV.

For the example on Mnemonic device, the Directional hypothesis may be stated in the following way:

Mnemonic device significantly enhances the recall (i.e. the mean number of words recalled is significantly higher in the Mnemonic device condition as compared to the No-Mnemonic device condition.

Thus in this hypothesis, the experimenter is specifically stating the direction in which he or she expects the difference to occur.

1.6.4 Non-Directional Hypothesis:

This is a two-tailed hypothesis which predicts that the IV will have an effect, but does not specify the direction in which the effect will be seen.

For the experiment on Mnemonic device, the Non-Directional hypothesis may be stated as follows –Mnemonic device significantly influences the recall (i.e. the mean number of words recalled is significantly different in the two conditions – Mnemonic device condition and the No Mnemonic device condition.

Writing the hypotheses clearly is very important for any research. Let us see some of the important steps to be followed for writing hypotheses precisely and clearly in a research.

How To Write A Hypothesis For A Research:

The following steps may be followed in writing a research hypothesis:

i. First identify the key variables of your research. Identify what will be your I.Vs and the D.Vs.

ii. It is then necessary to operationally define the Variables. If you say you want to measure memory, be specific about how will you measure memory – are you going to use the method of recall, or the method of recognition. It is necessary to specific about how the variable is being used in the experiment. This is called as Operational definitions.

iii. Decide on the Direction of the relationship between the IV and the DV. For this it is essential to look into the literature of the topic. If the literature supports a specific direction of effect, a directional hypothesis may be stated. However sometimes, the earlier researches and literature may have inconsistent findings. At such times a non-directional hypothesis may be stated.

Check Your Understanding:

1. What is the difference between a null hypothesis and an alternate hypothesis?

2. How does a directional hypothesis differ from a non-directional hypothesis?

3. State a null hypothesis, directional hypothesis and non-directional hypothesis in the following examples.

a. A researcher wishes to study whether motivational level (High Vs Low) has an impact on the performance of an employee.

b. A researcher wishes to study the level of anxiety in the individual (High Vs Low) affects their reaction time.

1.7 SUMMARY

Experimental method is one of the research method that is used in psychology to understand behaviour. Two main characteristics of experimental method are that the Independent variable is manipulated by the experimenter and there is control over the extraneous factors.

Experimental method involves 3 important types of variables-

1. **Independent variable:** It is the variable that is manipulated by the experimenter.

2. **Dependent variable:** It is the variable that is measured by the experimenter.

3. **Control Variable:** It refers to those variables that are kept constant by the experimenter.

An experimenter needs to design the experiment before conducting it. The designs of the experiment when there is one IV in an experiment are –

Random group design and Repeated measures design. In Random group design there are different participants participating in different conditions. On the other hand in the Repeated measures design, there is one group of participant which participates in all the conditions of the experiment.

When there are two IVs in an experiment, each of the IV may have more than two levels and hence it is necessary to first determine the number of conditions that the experiment involves. The total number of conditions can be determined by finding out the product of the levels of the IVs. In this kind of situation, there are different designs possible – Completely random group design, Completely repeated measures design, Factorial design and Mixed design.

In Completely random group design, there are different participants participating in each of the different conditions of the experiment. Whereas Completely repeated measures design consists of the same group of participants participating in all the conditions of the experiment.

The participants and the stimulus material that is involved in the experiment can also affect the results of the experiment. Hence it is necessary to consider the aspects of experimentation like- Sampling, Randomization and Counterbalancing.

Sampling is the procedure used to plan the sample on whom the experiment will be conducted. It may involve Random sampling in which any participant has equal chance of participating in an experiment. Other forms of sampling involves Stratified sampling (involving all the segments of the population), Proportionate sampling (all segments covered proportionate to its prevalence in the society) and Cluster sampling (Covering different geographical areas)

The material and conditions planned in an experiment may affect the results through its order of presentation and carryover effects. Randomization involves presenting the material and conditions in such a way that any stimulus material or condition has equal chances of being presented in any position. Counterbalancing involves presenting the material or condition so as to have a balanced position.

Another important term in experimental method is – Hypothesis. Hypothesis is a statement of proposed relationship among the variables in the experiment. While a null hypothesis states that there is no relationship, the alternative hypothesis states that there is a relationship. An experimental research may either state the direction of relationship(Directional Hypothesis) or may not state the direction of relationship (Non-directional).

Framing the hypothesis clearly and precisely helps in expressing the relationship between the variables and makes it possible to test it through experimentation.

Thus Experiments have to be properly designed with clear description of the variables, planning its design and stating the direction of relationship expected between the variables through hypothesis.

1.8 REFERENCES

- Bordens, Kenneth S and Bruce B. **Abbott**, **Research** Design and **Methods**: A Process Approach. New York, NY: McGraw-Hill Education, 2014.
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2

INTRODUCTION TO EXPERIMENTAL PSYCHOLOGY AND STATISTICS IN PSYCHOLOGICAL RESEARCH - II

Unit Structure

2.0 OBJECTIVES

After learning this unit the learner should be able to-

1. Distinguish between Descriptive statistics and Inferential statistics
2. Explain the experimental situation where t-test and F-test is appropriate
3. Explain the concept of Statistical significance

2.1 INTRODUCTION

In the earlier unit we saw the different characteristics of Experimental method and some important concepts which needs to be considered while designing the experiment. One more important aspect of planning an experiment is the planning of statistical analysis of the data that will be collected through the experiment. In this unit we will discuss the statistical analysis of the data.

2.2 STATISTICAL ANALYSIS

Once the experiment is designed and planned with a systematic methodology, the experiment is conducted to collect the data. Thus in the experiment to understand whether use of Mnemonic device influences the recall, after designing the experiment, the experimenter actually conducts the experiment to collect the data.

The collected data thereafter needs to be organized, summarized and described before we can draw conclusion. This may be done by coding the

information and using different statistical methods. Although the summarizing and describing happens after the data is collected, it is important that the experimenter plans how to effectively summarize, describe and the method to be used to draw conclusions, during the planning stage itself.

The different statistical methods that are used are of two categories –

Descriptive Statistics and

Inferential Statistics

We will now discuss these two categories of statistical method.

2.2.1 Descriptive Statistics:

This involves different statistical methods that enable us to describe the data that has been collected. Graphical representations, Measures of Central tendency (Mean, Median and Mode), Measures of variability, are some of the commonly used statistical procedures which help us to describe the data.

Thus, after conducting an experiment on several participants, we will have the recall scores of participants in the No-Mnemonic device group and those from the Mnemonic device condition. If we conduct the experiment on several participants, we will have the data of all the participants. This data that is collected from one or more participants needs to be properly organized so that we will be able to describe it more effectively. The experimenter will be able to summarize the findings with the help of the graphs, mean, standard deviation (SD) and other descriptive statistics. With this we will be able to understand the data. For example, consider the table given below.

Mean recall scores and SD of 20 Participants of the Mnemonic device condition and the No Mnemonic device condition:

	Mnemonic device condition	**No Mnemonic device condition**
Mean recall scores	8.5	4.2
SD	2.1	1.2

After conducting the experiment on 20 participants, if the experimenter puts the information in a tabular form like this and even plots a bar graph, it will help the experimenter to explain the data that has been collected from the experiment.

Statistical methods like these form what is considered as Descriptive Statistics. However this is not sufficient for drawing conclusions. Although the mean recall score is greater for the Mnemonic device condition than the No Mnemonic device condition, we cannot draw a conclusion that 'Mnemonic device facilitates memory'. To draw conclusions the researcher needs to use Inferential Statistics.

Let us now see what is Inferential statistics.

2.2.2 Inferential Statistics:

Descriptive statistics does not help us to assess the reliability of our data and hence inferential statistics is required. Inferential statistics enables us to assess the extent to which our findings are reliable.

While conducting an experiment we cannot conduct it on the entire population. Hence we select a sample of population and conduct experiment on that sample. Inferential statistics help us to know the extent to which we will be able to infer from the data that we have collect from the sample to the entire population.

For example, in our experiment where we wanted to investigate the effectiveness of Mnemonic device, we conducted the experiment only on 20 participants. These 20 participants form our sample. However a researcher does not want to know what happens with only these 20 participants. We would want to draw conclusion about the entire population. We would want to know the probability of the two means of the two conditions (Mnemonic device condition and the No Mnemonic device condition) being obtained due to chance factor. The statistical methods which enable us to draw such inferences are called as inferential statistics.

There are different types of inferential statistical techniques used. These are classified into – Parametric Statistics and Non-parametric statistics.

Parametric statistics are those statistical methods which involves making certain assumptions about the sample. These methods are useful when the sample is normally distributed. However if the data is not normally distributed, we cannot use Parametric tests. Instead we can use Non-parametric tests which do not make any assumptions about the sample. Some of the important parametric tests are – t –test and F-test. Some of the non-parametric tests that can be used are inferential statistical methods like Chi-square, Wilcoxcin Sign Rank Test, etc.

Check Your Understanding:

1. What is the difference between Descriptive and Inferential Statistics?
2. Why is Inferential statistics important in a research?
3. How does Parametric statistics differ from Non-parametric tests?

Let us see some of the important Inferential Statistics –

2.2.3 The t-test:

This is the inferential statistical test that is used when the experiment includes only two levels of I.V. and so there are two means to be compared.

In the experiment on the effect of Mnemonic device on recall, there are two levels of a single I.V. This means that we have two means that we have to compare (Mean recall score of the Mnemonic device condition Vs Mean recall score of the No Mnemonic group condition). Even if we find the mean recall scores to be higher in the Mnemonic group condition as compared to the No-Mnemonic group condition, we cannot draw conclusion only on the basis of the means. We will have to use t-test since there are two means to be compared.

There are different types of t-tests to be used based on the design of the experiment.

Repeated measures t-test: This is used when there are two means to be compared and the D.V lies on the interval or ratio scale of measurement and the design used in the experiment is Repeated measures design

Random measures t-test: This is used when there are two means to be compared and the D.V. lies on interval or ratio scale of measurement and the design used in the experiment is Random measures design.

Thus if the experiment on Mnemonic device is conducted using the same participant exposed to both the condition (No-Mnemonic device condition and Mnemonic device condition) then the inferential statistics that will be appropriate will be Repeated measures t-test. On the other hand if the experiment is conducted using the random group design, then the inferential statistics that will be used will be Random measures t-test.

The following steps are to be followed while using t-test ---

1. Calculate the degrees of freedom (Number of scores that are free to vary). When we use Repeated measures t-test, degrees of freedom is calculated as (N-1) where N is the total number of participants in the experiment and for Random measures t-test it is (N-2)
2. Then the formula for t-test is applied, which gives us a score (t-value)
3. We find the critical value for the calculated degrees of freedom
4. The statistical table for t-value is referred to find out the critical value for the desired alpha level.
5. If the obtained t-value (In step 2) is greater or equal to the critical value in the table, it means that the difference between the two means is statistically significant.

Check Your Understanding:

1. When do we use t-test in a research?
2. In the following experiments, state which type of descriptive and inferential statistics will be appropriate and why -

a. A research wishes to study the effect of type of family on perceive family cohesiveness level. Participants from Joint and Nuclear family were assessed on their level of perceived family cohesiveness.

b. A researcher wishes to study the effect of kind of words (Abstract Vs. Concrete) on recognition. Participants were exposed to a list of words (consisting of randomly arranged abstract and concrete words) and were then given a recognition task to compare the number of words recognized in both the categories.

2.2.4 F-test:

Another Inferential statistics that is used when the DV lies on the interval or ratio scale is the F-test or ANOVA (Analysis of Variance)

This test is used when there are more than two levels of I.V. and there are more than two means to be compared. For instance, in the experiment where we wanted to study the effect of three different methods of teaching (Lecture method, Discussion method and Self-study method), there will be three means that we need to compare. T-test will not be appropriate over here. Instead the inferential statistics that will be appropriate will be F-test.

F-test helps us to compare more than two means. The type of ANOVA to be used depends upon the number of IVs and the design. When there is only one IV, the appropriate inferential statistics is known as One-factor or One-way ANOVA while in an experiment with two IVs, the appropriate inferential statistics will be Two-Factor or Two-way ANOVA.

Based on the design of the experiment we will have to use repeated measures or randomized measures ANOVA.

The steps to be followed while using ANOVA are –

1. Calculate the F-ratio using the appropriate formula.
2. Calculate the degrees of freedom for the numerator and the denominator
3. Using the two degrees of freedom, the critical value for the required alpha value will be identified.
4. Check whether the calculated F-value (In step 1) is equal to or greater than the critical value.
5. If the calculate F-value is greater than or equal to the critical value, we conclude that the means are significantly different.
6. However with F-ratio being statistically significant it only tells us that there is a significant difference in the means, but it fails to tell us where among the possible comparisons the reliable differences occur. For example, in the experiment regarding the 3 methods of teaching, if we find that the F-ratio is statistically significant, we do not know between which pairs of means (Lecture method Vs. Discussion

method), (Discussion method Vs. Self-study method) and (Discussion method Vs. Self-study method) there exists reliable differences.

7. To isolate which means differ significantly, comparisons should be made between the different pairs of means. This may either involve a planned comparison or an unplanned comparison.

8. Planned comparisons are made if we have some specific hypothesis about some pairs of means. In case of no specific hypothesis, the unplanned comparisons are made where all the possible comparisons are undertaken using Post-hoc tests.

Post- hoc tests are not required in t-test since in t-test there are only two means to be compared. However F-test is conducted when there are more than two means and hence there are multiple comparisons involved.

Some of the commonly used Post-hoc tests are –

Scheffe test

Dunnett test

Tukey-a HSD test

Duncan test

Fisher test

Check Your Understanding:

1. When do we use F-test?

2. What are the different types of F-test?

3. What is a Post-hoc test? Where is it used?

4. What Descriptive statistical and Inferential statistical methods will you use in the following examples? Why?

a. A researcher wanted to know the effectiveness of three types of psychotherapy (REBT, Psychodynamic and Behavioral) on Generalized Anxiety disorder. Three groups of participants diagnosed with Phobic disorder were randomly exposed to one of the three types of psychotherapy. The level of anxiety of the three groups was compared after 10 session of the therapy with the help of scores on Beck's Anxiety Inventory.

b. A researcher wishes to understand the effect of emotional state (neutral, anxious and depressed) on recall of words. All participants were exposed all the three emotional states (which were induced experimentally) one at a time. List of 10 words (different for each condition) were presented and they were asked to recall and write down the words immediately after presentation. The number of words recalled in the three condition were compared.

In the previous sections of this unit we saw the types of statistical methods and some of the commonly used Inferential statistical method (t-test and F-test). The Inferential statistical methods helps us to know whether the data that we have obtained is statistically significant or not. In this section let us understand what we mean by the term Statistical significance.

2.2.5 Statistical Significance:

The inferential statistical tests are important because they help us to determine the probability of our data is obtained due to chance. If the probability of the data being obtained out of chance factor is high we consider the data as being not statistically significant. However if the probability of the data being obtained out of chance factor is low, we consider it as statistically significant. This probability is symbolized with alpha. Thus if alpha is .05, it means that the probability of the data being obtained out of chance factor is 5 times in 100 cases. This is indicative of high chances that the data is not obtained due to any chance factor. Similarly, if alpha is .01 it means that the probability of the data being obtained out of chance factor is 1 out of 100. This kind of a data is statistically even more significant than when alpha is at .05 level.

How does one find out whether the data is statistically significant or not?

To determine this we have to look into the table of significance for that particular inferential statistics. These tables contain information about the required statistical value for statistical significance. There are different tables for t-test, F-test and other inferential statistics.

Let us now see this with an example. After having conducted an experiment to study the effect of Mnemonic device of memory if the data obtained is as follows:

	Mnemonic device condition	**No Mnemonic device condition**
Mean recall scores	8.5	4.2

Merely on the basis of means we cannot conclude that the mean differences between the two conditions are not due to chance factors. This makes it necessary to conduct inferential statistics – in this case it will be t-test. With the calculated t-value we get the data as follows,

$$t\ (28) = 4.16\ (p < 0.05)$$

It means that the obtained t-value is 4.16 and ($p< 0.05$) means that the probability of this data being obtained out of chance factor is less than 5 out of 100. This shows that the difference in the recall in the two conditions is not due to chance alone. The difference is greater than what can be obtained due to chance factors. Hence we say that the difference is statistically significant. From this we will now conclude that 'Use of Mnemonic device can facilitate recall'.

Let us now consider another example.

A researcher wanted to study whether lecture method produces better learning in comparison to discussion method. Two groups of participant were taught the topics through two different methods and then they were tested on a test. The obtained results were as follows:

	Lecture Method	**Discussion method**
Scores on the test	7.8	8.6

t (28) = 0.78 (n.s.)

In this example, although the mean scores on the test were different, the obtained t-value was not significant. This means that the probability of the data being obtained due to chance factor was greater than .05. In social sciences we consider the data as not significant, if the probability of the data being obtained due to chance factors is greater than 5 out of 100. Hence in this case the conclusion that we will be drawing is ' The difference in the leaning through Lecture and discussion method is not statistically significant'.

Check Your Understanding:

1. What do you mean by Statistical significance?

2. How will you interpret the following results in terms of statistical significance?

i. An experimenter conducted a study to compare the reading level of participants in anxious and non-anxious condition and obtained the following results.

	Anxious condition	**Non-anxious condition**
Mean no of words read per minute	16	22

t(18) =1.1 (n.s.)

ii. An experimenter wanted to know whether there is a difference in the number of errors committed while listening to sentences in active Vs passive voice. Participants were exposed to the two kinds of sentences and the number of errors committed was recorded.

	Active Voice	**Passive Voice**
Mean no. of errors	3	6

t(28)= 2.98 ($p < 0.05$)

2.3 SUMMARY

Once the data is collected from an experiment, it needs to be analysed statistically. Statistical methods are required to describe and organize the data (Descriptive Statistics) and to draw inferences on the basis of the obtained data (Inferential Statistics). Inferential statistics enables us to draw inferences from the sample on which we conduct the experiment. When the data is normally distributed and the DV lies on the interval or ratio scale, we use inferential statistical methods which are called as Parametric tests. Non-parametric tests are used when the data is not normally distributed and also when DV lies on Nominal and ordinal scale of measurement.

Two important Parametric tests are- t-test and F-test. T-test is used when there are two means to be compared while F-test is a parametric test which is used when there are more than two means to be compared.

Inferential statistical methods enable us to understand the probability or the extent to which the data is obtained due to chance factor. When the chances of the data being obtained due to chance factor is low (Less than 5 out of 100) it is said to be statistically significant.

2.4 REFERENCES

- Bordens, Kenneth S and Bruce B. **Abbott**, **Research** Design and **Methods**: A Process Approach. New York, NY: McGraw-Hill Education, 2014.
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3

INTRODUCTION TO EXPERIMENTAL PSYCHOLOGY AND STATISTICS IN PSYCHOLOGICAL RESEARCH -III

Unit Structure

3.0 OBJECTIVES

After reading this unit, learner should be able to

1. State the four types of scales of measurement
2. Identify the scales of measurement

3.1 INTRODUCTION

In any research that is undertaken it will involve measurement of the variables that are included in the research. The same variable can be measured in different ways and the researcher needs to reflect upon what is the best way in which it can be done. The way in which the variable is measured should be determined by what suits the purpose of the study or research.

For instance, in our experiment related to the role of Mnemonic device in memory, we would want to measure memory. Memory may be measured here in many different ways – qualitatively as well as quantitatively.

- On the basis of the number of items that they are able to reproduce, we may categorise it into ‘good’, ‘average’ and ‘poor’
- We may ask the participants to recall and reproduce as many as possible items that they were exposed to (Method of Recall)
- We may give a sheet of paper with many items, which includes some items from the list along with some extra items and ask the participants to place a tick mark against those items that they were exposed to. (Method of recognition)

Let us now discuss the different scales of measurement in the next section.

3.2 SCALES OF MEASUREMENT

Based on how the variable is measured, Stevens (1946) identified four basic scales of measurement. We will now discuss these four scales of measurement:

1. **Nominal Scale**: This is the lowest level of measurement which involves defining the variable by identifying the different types.

For eg.,

i. When we classify gender into Males and females

ii. Classifying personality into Introverts, Extroverts and Ambiverts

When our variable lies on Nominal scale, it is not possible to apply any mathematical operations on them. Hence we count the number of observations and then we will be able to further apply mathematical operations on them.

For eg., if the researcher wishes to find out the gender differences in students pursuing Psychology, he or she will find out the count of cases in each type – Males, Females, Transgender. The counts in each of the categories will then make it possible for us to further analyse the data statistically.

2. Ordinal Scale:

The next level of measurement involve measuring the variable by putting them into categories and further ranking it according the quantity.

For eg., if we administer a scale of introversion and classify the participants into 'High', 'moderate' and 'low' on introversion.

In this scale of measurement, we know that 'Low' is the lowest category while 'High' is the highest category. However we do not know the distance between 'Low and Moderate' or 'Moderate and High' and it is not necessary that the distance will be equal.

3. Interval Scale:

This is the level after the Ordinal scale of measurement. In this the distance or spacing between the values on the scale is also known to us. With respect to variables on this scale of measurement, we are able to not only know which one is smaller and greater but we also know how much is the gap between the two.

For example, If we ask the teachers to rate students on the level of introversion on a rating scale from 1 to 7, with 1 indicating low level of introversion and 7 indicating high level of introversion, then the data that we will be receiving, will lie on Interval scale.

Another example of variable which lies on Interval scale is IQ.

4. Ratio Scale:

This is the highest level of scale of measurement. In this scale of measurement, like in Interval scale, we know which one is larger and smaller. Like in Interval scale we are also aware of the distance and gap between successive points of the scale. In addition to that it also has a zero point. Having a zero point is the factor that distinguishes ratio scale from Interval scale. Zero refers to complete absence of the variable. Some of the variables that fall in the ratio scale of measurement are –

When memory is measured in terms of number of items recalled by the participant. In this case it is possible that a person may score a zero.

Ratio scale differs from Interval scale with respect to another characteristic – possibility of ratio comparison. When a variable lies on Interval scale we cannot make ratio comparison whereas if in the example that we saw for ratio scale, if one individual (A) is able to recall 6 items and another individual (B) is able to recall 3 items, we can make ratio comparison and state that the number of words recalled by A is double than that of B.

In research it is very important to understand the scale of measurement on which our variables lie, since it helps us to decide the descriptive and inferential statistics that can be used to understand and analyse the data. While planning a research it is important to choose the right scale of measurement since it determines the amount of information that we will be able to obtain.

When a variable lies on nominal or ordinal scale it provides us with very little and crude information in terms of the count, but fails to provide precise information. Hence as far as possible a researcher will adopt interval or ratio scale. However it also depends upon the research question as well as the variable in question.

Check Your Understanding:

Explain the following with examples

1. Nominal scale of measurement
2. Ordinal scale of measurement
3. Interval scale of measurement
4. Ratio scale of measurement

Let us know see how a researcher analyses the data based on each of these scales of variables.

3.2.1 Nominal Scale Exercise:

Exercise No.1:

A researcher wants to know which game 'Cricket' or 'Football' is more popular among adolescents. Suppose the researcher collects data from 20 adolescents and gets the following data:

Participant	Game Preferred (Cricket/ Football)
1	Cricket
2	Cricket
3	Football
4	Football
5	Cricket
6	Football
7	Cricket
8	Cricket
9	Cricket
10	Cricket
11	Cricket
12	Cricket
13	Football
14	Cricket
15	Cricket
16	Cricket
17	Cricket
18	Football
19	Cricket
20	Cricket

Now since this data lies on Nominal Scale, we will describe the data by finding out the counts of each category.

Preference for Cricket – 15

Preference for Football – 05

The Inferential statistics that will be used will be Non-parametric tests like Chi-square. Using chi-square we will be able to find out whether there is a statistically significant difference in the number of adolescents preferring Cricket to Football.

Exercise 2:

The researcher wishes to find out the social media site (Facebook/ Instagram / Twitter) that is liked by adults. The data collected from 20 participants are as follows:

PARTICIPANTS	Facebook / Instagram/ Twitter
1	Instagram
2	Facebook
3	Facebook
4	Twitter
5	Facebook
6	Facebook
7	Instagram
8	Instagram
9	Twitter
10	Facebook
11	Facebook
12	Facebook
13	Twitter
14	Instagram
15	Facebook
16	Facebook
17	Twitter
18	Instagram
19	Instagram
20	Facebook

Q1) On what scale of measurement does the variable lie?

Q2) What will you describe the data ?

Q3) What Inferential Statistical method will you use to draw inference from the data?

3.2.2 Ordinal Scale Exercise:

Exercise 3:

The researcher wishes to understand the level of education of individuals diagnosed with Anxiety disorders. The data was collected from 19 individuals diagnosed with Anxiety disorders.

PARTICIPANTS	EDUCATION Primary School / High school/ Graduate
1	High school
2	Primary school
3	High School
4	High School
5	Graduate

6	Graduate
7	Graduate
8	High School
9	High School
10	Primary School
11	Graduate
12	Graduate
13	Graduate
14	Graduate
15	Graduate
16	Primary School
17	Primary School
18	Graduate
19	Graduate

The variable lies on an Ordinal scale of measurement

Descriptive statistics used will be Median Rank.

To calculate the median rank we use the following steps:

Median rank =(N+1)/2 th Score (Where N is the total number of scores)

= (19+1)/2th Score

= 10th score

We now have to arrange the level of education in either ascending or descending order and find the 10th score. If we arrange in the ascending order, there are 4 cases in the Primary school category, 5 cases in the High school category and 10 cases in the Graduate category.

Starting from the Primary school category if we keep counting till we reach the 10th score, we will find the 10th score in the Graduate category.

Thus we may say that the median educational level of individuals with anxiety disorder is up to graduate level.

The Inferential statistics used here will again be a Non-parametric tests such as Kolmogorov-Smirnov test.

Exercise 4:

A researcher wanted to study the level of language ability of children living in an orphanage. The following is the data collected from 20 children from different orphanages. The children were assessed on their understanding of English and categorized into 3 levels – Beginner, Intermediate and Fluent.

PARTICIPANTS	LEVEL OF LANGUAGE ABILITY (Beginner/ Intermediate / Fluent)
1	Beginner
2	Fluent
3	Beginner
4	Beginner
5	Intermediate
6	Beginner
7	Beginner
8	Intermediate
9	Intermidiate
10	Beginner
11	Beginner
12	Beginner
13	Intermidiate
14	Intermediate
15	Beginner
16	Beginner
17	Beginner
18	Intermidiate
19	Fluent
20	Beginner

Q1) On what scale of measurement does the variable lie? Why?

Q2) Use the appropriate descriptive statistics and describe the data.

Q3) What inferential statistics will you use?

3.2.3 Interval Scale Exercise:

Exercise 5:

A researcher wishes to study whether there is a difference in the extent to which students like two subjects (Maths and Science) . The data is collected from 20 students by asking them to rate the extent to which they like the two subjects, on a rating scale from 1 to 7. The data obtained is as follows

PARTICIPANTS	RATINGS Maths	RATINGS Science
1	4	2
2	5	3
3	3	4
4	1	5

5	5	4
6	7	3
7	6	5
8	5	3
9	3	4
10	5	5
11	4	4
12	3	3
13	5	2
14	6	4
15	3	5
16	7	4
17	5	3
18	4	6
19	3	5
20	1	4

This data lies on Interval Scale of measurement.

The descriptive statistics that can be calculated are – Mean, Median, Mode, Range, SD

The inferential statistics that we can use here is t-test since the data lies on Interval scale. If the t-value is significant, we can say that there is a statistically significant difference in the extent to which students like the two subjects.

With data on Interval scale we can use Parametric tests like t-test or ANOVA depending upon the number of means to be compared.

Exercise 6:

The researcher wanted to compare the level of numerical ability of adolescents from 3 types of family (Joint family / Nuclear family/ Single child family) and see whether there is a statistically significant difference in the numerical ability of the three groups of participants. The test of numerical ability was conducted on 20 individuals of each group. The scores were as follows-

PARTICIPANTS	**Joint Family**	**Nuclear Family**	**Single child Family**
1	21	37	27
2	34	46	36
3	54	34	43

4	34	33	27
5	23	31	32
6	43	28	38
7	23	30	39
8	21	39	40
9	23	42	12
10	33	39	12
11	35	40	14
12	45	31	35
13	43	34	32
14	23	36	34
15	21	39	32
16	23	40	34
17	34	42	35
18	34	39	37
19	23	34	34
20	23	39	35
Mean			
Median			
Mode			
Range			
SD			

Q1) On what scale of measure does the dependent variable lie?

Q2) What descriptive statistics will you use to describe the data?

Q3) What Inferential statistics will you use to know whether there is a statistically significant difference in the mean level of numerical ability of the three groups of participant?

3.2.4 Ratio Scale Exercise:

Exercise 7:

The researcher wished to understand the time taken to solve a problem by 2 groups of participants (Expert Vs Novice). The time taken by 20 participants in each group was compared.

PARTICIPANT	EXPERT (Time in Secs)	NOVICE (Time in Secs)
1	90	35
2	45	45
3	60	53
4	125	54
5	25	65
6	35	60
7	45	70
8	65	80
9	60	65
10	80	45
11	70	40
12	75	60
13	65	70
14	60	60
15	45	55
16	40	50
17	60	60
18	75	75
19	66	90
20	54	40
Mean		
Median		
Mode		
Range		
SD		

The dependent variable in this study is the time taken to solve problem. This lies on the Ratio Scale.

Hence Mean, median, mode, range and SD can be computed to describe the data for the two groups.

To know whether there is a statistically significant difference in the time taken by the two groups of participant, we can use Parametric test (t-test) since there are two means to be compared (Mean time taken by experts and mean time taken by novice)

Exercise 8:

The researcher wishes the understand whether there is a statistically significant difference in the number of days child attends school- with respect to the 3 socioeconomic status–Upper/Middle/Lower. The average number of days attended in a month was found and tabulated as follows:

PARTICIPANT	UPPER-CLASS	MIDDLE-CLASS	LOWER CLASS
1	23	16	12
2	25	19	10
3	14	20	14
4	20	26	10
5	26	23	9
6	23	25	5
7	22	24	12
8	12	26	13
9	19	23	14
10	23	22	12
11	22	24	16
12	21	25	25
13	19	23	23
14	23	24	12
15	24	25	14
16	20	23	12
17	23	21	10
18	22	24	11
19	21	23	12
20	20	25	13
Mean			
Median			
Mode			
Range			
SD			

Q1) What is the Dependent variable?

Q2) On what scale of measurement does the Dependent variable lie?

Q3) What descriptive statistics will you use to describe the data?

Q4) What Inferential statistics will you use to answer the research question? Why?

3.3 SUMMARY

Dependent variable is the variable that is measured in an experiment. The dependent variable may lie on one of the four scales of measurement. When the dependent variable is measured by categorizing, it is said to lie on Nominal scale. When dependent variable involves ranking, it is said to lie on an Ordinal scale. Dependent variable that involves expressing the spacing between different levels of the DV is said to lie on Interval scale. On the other hand when the DV involves equal intervals between all the levels of the DV, it is said to lie on Ratio scale.

Scales of measures on which the DV lies is important to decide the Descriptive and Inferential statistics that will be used to analyse the data.

3.4 REFERENCES

- Bordens, Kenneth S and Bruce B. **Abbott**, **Research** Design and **Methods**: A Process Approach. New York, NY: McGraw-Hill Education, 2014.
- Myers, Anne, and Christine H. Hansen. Experimental Psychology. Pacific Grove, CA: Wadsworth/Thomson Learning, 2002.

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4

INTRODUCTION TO EXPERIMENTAL PSYCHOLOGY AND STATISTICS IN PSYCHOLOGICAL RESEARCH - IV

Unit Structure

4.0 OBJECTIVES

After reading this unit learner should be able to -

(i) State the important elements of the Report of Experiment as per APA guidelines

(ii) State the important elements of an abstract as per APA guidelines

(iii) State the important elements of

4.1 INTRODUCTION: REPORT WRITING APA FORMAT

Experimentation involves collection of the data which then has to be communicated through the report that is written. In this section let us see how report has to be written.

In Psychology and many other social sciences, most of the journals follow the style prescribed by the American Psychological Association (APA) in its Publication Manual of the American psychological Association (7th Edition, 2020)

Let us first see the general format that is suggested by APA

4.2 GENERAL FORMAT

Before typing the report it is necessary to keep some information of the general format of the report in mind. We will now see some of the important elements to be kept in mind while formating a report:

1. Manuscript to be typed , double-spaced on a standard –sized paper (8.5 X 11 inches)
2. 1 inch margin to be kept on all the sides of the paper.
3. Double-spacing to be followed between sentences, throughout the text.
4. APA recommends choosing either Times New Roman or Courier
5. Font size recommended is 12 points.
6. The following order should be following while preparing the content of the report:

- Title page
- Abstract
- Main text
- This will include Introduction, Method, Results, Discussion
- The tables and figures may be included wherever applicable in the discussion or in the end
- References to be provided in the end of the report
- Appendices.

Although this is the general order, certain other contents may also be required as prescribed by the institution. This may include – Acknowledgements, Index, List of tables and figures.

Now that we have seen the general format, we will see the guidelines for the individual elements of the report, one after the other.

4.2.1 Title Page:

The title page is the first page of a report. Some important aspects to be kept in mind while setting the title page is as follows –

1. The title should be typed in bold.
2. It should appear in the centre of the left and right margin and in the upper half of the page.
3. It should be typed in title case.

4. The first alphabet of every word of the title should be in capital, except for the articles, prepositions and conjunctions.
5. After the title, the title page should include the name/s of the authors and the institutional affiliation
6. There should be four spaced between the title and the author(s) name.
7. The order in which the authors name should be written is -– First name, Initial of the middle name and last name.

Some of the things to be considered while deciding and typing the title are:

1. The title should be able to give the precise information of the content of the report
2. Too long titles should be avoided.
3. The recommended length is 10 to 12 words.
4. The title should be self-explanatory
5. There should be no use of abbreviations in the title
6. It is better to avoid words such as 'Methods', 'Results', 'A study of ', 'Experimental investigation' in the title.

The next page after the title page is the page which contains the abstract of the experiment. Let us now see some of the important guidelines suggested by APA for writing an abstract.

4.2.2 Abstract:

Although in a research report this appears in the beginning of the report, it is the last part that is prepared. This is because it is section of the report which includes the summary of the entire report. Hence it cannot be prepared unless all the sections of the report is prepared.

1. The abstract should begin with the heading 'Abstract' being written in bold and in the centre of the page.
2. An abstract should be very specific and concisely written.
3. It should not contain more than 250 words.
4. It should be typed in a single paragraph.
5. Generally an abstract should include the following

- Problem that is studied
- Characteristics of the sample
- Method of collecting data – equipment, tests, procedure used to gather information

- Finding of the study with the levels of statistical significant
- Conclusion of the study
- Application or implications of the findings.

After the abstract, the next important element of a report of an experiment is the introduction of the topic. Let us now see the guidelines provided by APA for writing an introduction.

4.2.3 Introduction:

This will be the next page of the report, after the abstract. The main aim of this part of the report is to provide a logical justification to the study being conducted.

It is better to go from a general to specific approach. This includes first giving a general introduction to the topic, followed by review of the literature. The literature may then be linked to the topic and followed by stating the hypotheses of the study.

- It should provide a fair and balanced view.
- Written in a comprehensive manner
- With the entire body of the report, both active and passive voices are acceptable.
- The APA 7th edition allows the use of first person. The authors may use the words 'I' and 'we' while writing the report.

Some of the things to be kept in mind while formatting the introduction are:

1. Start the introduction on a fresh page
2. The title of the research to be typed on the top of the paper
3. It should include the important problem that is studied and the theoretical views on the problem.

The next section of the report after the introduction is the section on the method. We will now see the guidelines for writing the methodology.

4.2.4 Method:

This part of the report should communicate to the reader the exact method that has been used by the researcher. Although APA style allows flexibility in describing the method, some important things that should be included in this part are:

i. Participants

ii. Apparatus and materials used in the study

iii. Procedure

This section involves writing in detail the characteristics of the participants who participated in the experiment, all the apparatus and the material that were used in the study and a detailed and precise view of the procedure that was followed in the experiment.

This section should begin immediately after the introduction and need not be started on a fresh page.

Followed by the method section, the report involves communication of the results of the experiment. We will now see the important guidelines for reporting of the results.

4.2.5 Results:

This part of the report involves the expression of the findings of the study. Some of the important things to be considered from framing this section of the report are:

i. All the relevant data and information should be reported.

ii. The raw data that is not analysed is not to be put up in this section, unless it is of some significance.

iii. This section should include the results of descriptive as well as inferential statistics. For inferential statistics, the alpha level should be mentioned.

For example, the results of t-test should be written as follows –

$$t(56) = 4.96, p < .05$$

For Analysis of Variance it should be written as follows –

$$F(1, 85) = 5.96, p < .01$$

iv. The results may be represented in a tabular or figural manner.

v. There should also be a written narrative about the result and not just in form of tables and figures.

The results that are expressed needs to be interpreted by the experimenter so that the reader is able to understand how the experimenter explains the trend that is observed in the result. We will now see the important guidelines for writing the discussion.

4.2.6 Discussion:

This part of the report consists of interpretations of the result, the conclusions drawn by the research and the relation of the present study with the previous researches and theories related to the concept.

It should also bring out the implications of the study, methodological concerns of the study and the further studies that are required.

It should proceed from specific to general – Starting with the main findings of the study, then going to the previous studies and finally coming to broader implications of the study.

After the discussion, a very important section of the report is the references. Let us now see what the references section entails.

4.2.7 References:

This part of the report includes the list of all the articles and books that have been cited in the report. It should not include all the books read by the person, but rather what is cited in the report.

APA provides specific guidelines for citing the different types of material.

For instance the guidelines for journal article is as follows –

Horowitz, L. M., & Post, D. L. (1981). The prototype as a construct in abnormal psychology. Journal of Abnormal Psychology, 90(6), 575-585.

The format for citing books is as follows –

McCandless, B. R., & Evans, E. D. (1973). Children and youth: Psychosocial development. Hinsdale, IL: Dryden Press.

Check Your Understanding:

1. What are the important elements of report of an experiment?
2. What are the guidelines suggested by APA for the general format of a report?
3. What are the guidelines suggested by APA for the following elements of a report:

i. Abstract

ii. Introduction

iii. Method

iv. Results

v. Discussion

vi. References

4.3 SUMMARY

Report-writing is a very important aspect of any research. A report should be precise and complete so that it helps in communicating the purpose, method and results of the experiment or any research to others. It is a very important aspect of scientific communication. APA has provided specific guidelines for report writing and for every aspect of the report. Following

the guidelines can enable a researcher to express the findings of the research to other fellow researcher and thereby help in scientific progress.

4.5 REFERENCES

- Bordens, Kenneth S and Bruce B. **Abbott**, **Research** Design and **Methods**: A Process Approach. New York, NY: McGraw-Hill Education, 2014.
- Myers, Anne, and Christine H. Hansen. Experimental Psychology. Pacific Grove, CA: Wadsworth/Thomson Learning, 2002.

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5

PRACTICE EXERCISES

Unit Structure

5.0 OBJECTIVES

With the help of the exercises, at the end of this unit, learner should be able to:

1. Identify the IV, D.V and C.Vs in the experiment
2. State the hypothesis of the experiment
3. Explain the design used in the experiment
4. Explain which Inferential statistical method will be appropriate for the experiment

5.1 EXERCISE 1

The experiment was conducted to study the effect of positive and negative emotions on logical reasoning. In this experiment, one participant was randomly selected to experience positive emotion by giving them a manipulated positive feedback and the other participant was selected to experience negative emotion by giving them a manipulated negative feedback. Each participant was first asked to answer Positive and Negative Affect Scale - PANAS (Watson et.al., 1988) questionnaire to measure the baseline emotional state of the participant. Followed by this the participant was asked to solve the 10 verbal and mathematical problems, 5 each, in 10 minutes. The questions on the verbal and mathematical problems were of very high difficulty or with no definite answer. To boost the effect of the emotion manipulation, E also told them that the test was especially developed to predict academic success and that an average student solves approximately 50% of the items correctly. After finishing the test, the participants received a manipulated verbal feedback on their performance to influence their emotional state. Half of the participants receive positive feedback and half of the participant received negative feedback irrespective of whether the answers to the test were correct or incorrect. participants were not told that their emotional state was to be altered with a success-failure-method and they were randomly assigned to the “success group” and “failure group.” After this the emotional state of the participant was assessed again using PANAS to see whether the mood induction was successful. Finally, they were given task of solving 12 problems on logical reasoning and participant was asked to solve it in 12 mins. It was expected

that participants experiencing positive emotion would score more on the logical reasoning problems as compared to the participants experiencing negative emotion.

Questions:

Q1. What is the hypothesis of the experiment?

Q2. What is the Alternative directional hypothesis of the experiment?

Q3. What is the Alternative non directional hypothesis of the experiment?

Q4. What is the Null directional hypothesis of the experiment?

Q5. What is the Null non directional hypothesis of the experiment?

Q6. What is the design of the experiment?

Q7. What is the Independent Variable and Dependent Variable of the experiment?

Q8. What are the levels of the Independent Variable?

Q9. State important control variables of the experiment? And explain why it was controlled?

Q10. State the reason for getting the contrary result in the Emotion and Logical Reasoning experiment?

Q11. State the reason why Participant who was made to experience negative emotion would score more Logical reasoning problem as compared to the Participant who was made to experience positive emotion?

Q12. Which inferential statistics will you use to calculate the group data of this experiment and why?

5.2 EXERCISE 2

The experiment was conducted to study the effect of the type of cue presented before the presentation of the stimulus on the RT to detect the stimulus. The type of cue, viz. Valid cue (the arrow pointed to the direction where the target would appear), Neutral cue (an uninformative cue) and Invalid cue (the arrow pointed to the wrong direction) before presentation of the stimulus were randomly presented. Participant was told that he/she has to stare at the middle of the screen and after pressing the spacebar a cue would be presented and after the cue disappears a target i.e. a red square would appear. Participant was told to respond by pressing the 'n' key on the keyboard. The target appeared equally on left and right side, i.e. on 40 trials the target appeared to the left and on the remaining 40 trials the target appeared to the right side. For 80% of the trials the cue was a valid cue and for 20% of the trials the cue was invalid. The physical properties such as color, size and shape of the cue as well the target, were

same for all the trials. After responding to one trial, to begin the next trial he/she was told to again press the spacebar. The time duration between the cue and the target presentation was not consistent. After presenting the Participant with all the 80 trials, the data for each trial, i.e. the mean reaction time for three types of cues were recorded for further analysis. The reaction time was measured in msec. If P responded wrongly to any of the trial, then that trial was repeated towards the end. It was expected that the mean reaction time to detect the stimuli for invalid cues is highest followed by the neutral condition and least for valid condition.

Questions:

Q1. What is the hypothesis of the experiment?

Q2. What is the Alternative directional hypothesis of the experiment?

Q3. What is the Alternative non directional hypothesis of the experiment?

Q4. What is the Null directional hypothesis of the experiment?

Q5. What is the Null non directional hypothesis of the experiment?

Q6. What is the design of the experiment?

Q7. What is the Independent Variable and Dependent Variable of the experiment?

Q8. What are the levels of the Independent Variable?

Q9. State important control variables of the experiment? And explain why it was controlled?

Q10. State the reason for getting the contrary result in the Spatial Cueing task?

Q11. State the reason why Participate reaction time was highest for valid cues as compared to invalid and neutral cues?

Q12. State the reason why Participate reaction time was moderate for invalid cues?

Q13. State the reason why Participate reaction time was lowest for neutral cues as compared to valid?

Q14. Which inferential statistics will you use to calculate the group data of this experiment and why?

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6

PRACTICE EXPERIMENT

Unit Structure

6.0 OBJECTIVE

After this practice we will be able to:

- Understand experimental process

6.1 INTRODUCTION: WORD SUPERIORITY EFFECT

Letters are recognized better when they are presented as words than when they are presented alone or presented as a part of a nonword. For instance if asked to identify a letter, it is easier to recognize a letter 'R' when it is a part of a words like (CARE) than when it is a part of a pseudoword like (RCEA) or when the letter 'R' is presented alone.

One model that explains the Word Superiority effect is the Interactive-Activation model. According to this interactive-activation model, the WSE is explained with the help of different detectors that are used by the reader while being exposed to a word alone in comparison to when it is exposed in the context of a word or a pseudoword. When the target letter is presented within a word, the feature detectors, letter detectors and word detectors will all be activated. Due to the activation of multiple detectors, there is an addition to the weight to the final recognition of the stimulus. However, when only the letter is presented, only the letter detector level will be activated. Therefore, we may remember the presented stimulus word more clearly, and thereby be more accurate in identifying its component letters, as observed in the WSE.

Another model for explanation of the Word Superiority Effect is the Activation Verification model. This model explains the phenomenon of WSE with the help of three processes- encoding, verification, and decision operations. When a stimulus is exposed, the first stage involves encoding of the letters. Encoding results to unconscious stimulation of learned units in memory. After encoding comes the stage of Verification. Verification often leads to the conscious recognition of a single lexical entry. This process involves top-down analysis of stimulus that is guided by the stored, or previously learned, representation of a word. The third stage involves taking a decisions are based primarily on information from encoding or verification. WSE is the result of the effect that words have on the encoding and the verification stage and in turn influencing the decision.

Reicher-Wheeler paradigm is generally used to study the Word Superiority Effect. This involves presenting the participants with a word or nonword string that is followed by a mask. After that two alternatives are given from which the participant has to recognize the right alphabet that was present in the earlier string forming word or nonword or the alphabet.

PROBLEM: To study the recognition of alphabets in the context of word condition as against non-word condition and only alphabet condition.

HYPOTHESIS: Recognition of alphabets will be better for the words condition in comparison to the non-word condition or alphabet condition. (The mean scores of correct recognition for the words condition will be greater than that for the non-word condition or the alphabet condition)

INDEPENDENT VARIABLE: Context of exposure with three levels (Word condition, Non-word context and Alphabet condition)

Word Condition :The string of letters presented forms a meaningful word

Non-word condition:The string of letters presented does not form a meaningful word

Alphabet condition:Presentation of a single alphabet from English language

Dependent Variable: Number of items correctly recognized

Control Variables:

1. Each stimulus was exposed for 2 secs
2. Visual noise was produced for 5 secs (This consisted of a slide filled with X's)
3. The time for recognition for each stimulus was kept constant for 5 secs
4. There were 5 stimulus for each condition (Word, Non-word and Alphabet)
5. No feedback was given to the participant
6. Ready signal was given before presenting the stimulus

Design:

Repeated measures design with one IV having 3 levels (Word condition, Non-word condition and Alphabet condition)

Material:

1. Screen to present the material

2. Powerpoint presentation with every slide consisting of the stimulus letter or string of letter and every slide being followed by a slide with visual noise. The visual noise was followed by the slide consisting of two alphabets for recognition task.

3. Slides for trial session (3, one for each condition)

4. Stop-watch

5. Paper and pencil

Procedure:

In this experiment, there will be stimulus presented to you, on this screen. The stimulus will be either a single alphabet or sometimes it may be a string of alphabet. This stimulus will be shown to you only for 2 secs. Please look at it carefully. After that there will be a slide which will appear for some time. A short while after that, there will be another slide which will have two alphabets. Your task is to state which of the alphabet was shown to you in the stimulus slide and write down the alphabet that according to you is correct, on this sheet of paper. You will be given 5 secs to write down the response. Let us see an example. The experimenter demonstrates the task with 3 examples.

STIMULUS	ALPHABETS
LOCK	O S
M	V L
OKOB	N K

After ensuring that the Participants have understood the procedure and the task, the experiment was started. The 15 stimulus card were presented one after the other in the following sequence –

1. Ready signal

2. Stimulus card for 2 secs

3. Visual noise consisting of a pattern for 5 secs

4. Pair of Alphabets for recognition

5. Participant to recognize and write down the response on the recognition sheet within 5 secs.

In this way the 15 cards were presented with random presentation of word, non-word and alphabet alone.

Sr. No.	STIMULUS	STIMULUS FOR RECOGNITION	RESPONSE OF THE PARTICIPANT	CORRECT/INCORRECT
1	WORK	R, G		

2	DLAY	F, L		
3	F	H, N		
4	EGAM	B, G		
5	SPOT	T, M		
6	S	B, G		
7	OBOK	V, B		
8	MAKE	L, E		
9	OFRM	N, R		
10	D	Q, J		
11	TKIE	H, K		
12	RSAE	J, S		
13	SNAP	Q, A		
14	U	V, T		
15	VICE	I, X		

Results:

Individual Data:

TABLE NO.1 Comparison of the number of correct recognition in the three conditions - Word-condition, Non-word condition, Alphabet condition.

	Word-Condition	**Non-word Condition**	**Alphabet condition**
No. of correct responses			

Group Data:

TABLE NO.2 Comparison of the number of correct recognition in the three conditions - Word-condition, Non-word condition, Alphabet condition of 20 participants

	Word-Condition	**Non-word Condition**	**Alphabet condition**
1			
2			
3			
4			
5			
6			
7			

8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
TOAL			
MEAN			
RANGE			
SD			

Discussion:

* Comparison of the total number of stimuli correctly recognized in the three conditions (Word, Non-word and Alphabet) in the individual data and the group data.
* Plotting the graph and interpretation of the figure for the data.
* Is the data in trend with the hypothesis or not.
* Reasons for the trend seen in the data.
* Comparison of the data with the previous research.
* Theoretical explanation for the data
* Inferential statistics that will be appropriate for the study.
* Evaluation of the research.
* Suggested modifications

Conclusion:

Whether the data from the study is in trend with the hypothesis

6.2 REFERENCES

- Chase, Christopher H.; Tallal, Paula (1990). "A developmental, interactive activation model of the word superiority effect". Journal of Experimental Child Psychology. **49** (3): 448–487

- McCelland, J.; Rumelhart, D. (1981). "An interactive activation model of context effects in letter perception: part 1. An account of basic findings". Psychological Review. **88** (5): 375–407
- Reicher, G. M. (1969). "Perceptual recognition as a function of meaningfulness of stimulus material". Journal of Experimental Psychology. **81** (2): 275–280.

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7

EXPERIMENTS IN COGNITIVE PROCESSES - I

EXPERIMENT NO.1

PRIMING AND RETRIEVAL FROM SEMANTIC MEMORY

Unit Structure

7.0 OBJECTIVES

After studying this experiment you will be able to:

- Conduct the psychological experiments

7.1 INTRODUCTION: WHAT IS PRIMING?

In psychology, the term priming is generally used for pre-activations or facilitations. Priming is defined, for example, as "the improvement of the processing of a stimulus as a function of a previous presentation." (Anderson, 2001, p. 471) Stroebe, Jonas, and Hewstone (2003, p. 138) defined priming in a result-oriented fashion as well: Priming is "the finding that a pattern will be activated with higher probability if it was presented recently or if it was used in the past." In the same vein, Major (2008, p. ii) wrote: "Priming is the benefit that an event receives when its processing has been preceded by the processing of a related or identical event." A more extended definition, which differentiates between the phenomenon of "priming" and the method or technique of "priming" (i.e., the priming paradigm) was given by Chartrand und Jefferis (2004, p. 854):

An individual's experiences in the environment temporarily activate concepts that are mentally represented. The activation of these concepts, which can include traits, schemata, attitudes, ste-reotypes, goals, moods, emotions, and behaviors, heightens their accessibility. These concepts are said to be primed; that is, they become more likely to influence one's subsequent thoughts, feelings, judgments, and behaviors. Priming also refers to an experimental technique that is used to simulate the activation of concepts that usually occurs through real-world experiences.

The central point, therefore, is that a stimulus or event A has an effect on what follows, which can either be something internal (an emotion, a

decision etc.) or concern something external (a further event B and its processing). Departing from one of the definitions cited above, the effect does not have to be invariably positive. In fact, there is also negative or inverse priming (e.g., auch Krüger, Klapötke, Bode, & Mattler, 2013; sometimes also called contrast effect, anti-priming or reverse priming, e.g., Fiedler, 2003; Glaser, 2003), where the presentation of a stimulus leads to reduced performance or to opposite effects and evaluations of subsequent identical or similar stimuli (e.g., Negative Priming: Frings, Bermeitinger,& Gibbons, 2011; Neill, 1997)

Levels of Priming : Macro, Mid and Micro:

Essentially, anything can be a prime, that is, anything can be a stimulus or feature influencing what follows. To this effect, a person can be a prime for another person, the person's behavior can be a prime, what the person says can be a prime, the person's clothing can be a prime etc. Any event that we perceive, but also our own movements or thoughts are able to influence us and the perception, processing, evaluation etc. of following internal or external events (see also Bargh, 1997).1 Based on this very broad conception, one could ask, for instance, how the way a participant is treated (e.g., friendly vs. unfriendly) makes a difference in terms of their ability to solve crossword puzzles, their general mood, their music preference, etc. In this **macro** sense, each stimulus, each context, each action could be a prime that has an effect on subsequent thoughts, actions, and feelings. Such a macro conception is often combined with the assumption that the prime does not only pre-activate semantic concepts, but rather that it activates longer-lasting motivational processes (e.g., Sela, & Shiv, 2009).

On a more specific level of conception (at the **mid-level**) of priming, the interest is no longer in the general actions and feelings of a person. The question at the mid-level is whether the prime activates specific other concepts (still relatively globally). For example, many memory and recognition experiments can be located at this midi level: For instance, when participants are given some words in the first experimental phase and are asked to produce words in the next experimental phase. Without any instructions to that effect, participants produce words in the second phase (e.g., when participants should complete word stems, e.g. HOU_ _) that are identical or semantically related to words processed in the first phase, and they do so with an increased probability relative to a control condition that does not involve the first phase (e.g. Warrington, & Weiskrantz, 1970, 1974; see also e.g. Bassili, Smith, & MacLeod, 1989).

The principle of pre-activation of specific concepts (or specific actions, etc.) is also relevant in the even more specific conception of priming at the **micro-process level**. At this micro level, researchers are interested in time scales of fractions of seconds up to a maximum of approximately two seconds. This level corresponds to the narrowest interpretation of priming, which is the dominant understanding of the term in cognitive psychology. In the so-defined priming paradigm, most often sequential priming is used; that is, a prime (which is not part of the participant's task and can be

ignored) and a target stimulus are presented in rapid succession. The prime is usually shown for a maximum of a few hundred milliseconds only. Typically, participants are required to react to the target, for example by classifying it according to a given criterion (e.g., as positive/negative, living/ non-living, word/non-word, left/right, etc.). Originally, it was only used in cognitive psychology, but is now used for various questions in social (e.g., Degner, & Wentura, 2010), personality (e.g., Frings, & Neubauer, 2005; Wentura, Kulfanek, & Greve, 2005), developmental, emotional (e.g., Bermeitinger, & Kappes, 2013; Kappes, Bermeit-inger, & Greve, subm.) motivational (e.g., Leipold et al., subm.), and clinical (e.g., Weisbrod et al., 1999) psychology. At the micro level, priming is (also) related to the pre-activation of specific concepts, reactions, goals, attitudes, or valences.

Types of Priming:

Macro-level priming is often subdivided into perceptual priming, semantic / Categorical, behavior priming, and goal/ motivational priming. Semantic priming implies that a prime leads to quicker responses to semantically related concepts, or to a higher rate or speed of these concepts being associatively generated. In behavior priming it is the participant themselves that reacts more in line with the prime (e.g., more aggressively, more friendly); this could also be taken to include mood induction and emotional priming. Finally, goal and motivational priming refers to a prime that increases one's motivation to actively pursue a behavior that is associated with the prime (e.g., Bargh, 2006; Loersch, & Payne, 2011). Generally, primes in both micro and macro-level priming can affect almost any behavior and almost any cognitive process (e.g., Fockenberg et al., 2008).

Priming and the identification of Subsequent Stimuli:

The effect of Priming on the subsequent identification of stimuli have been examined extensively in recent years. In the cognitive literature, most research on priming effects has involved presenting subjects with a word or group of words (the prime), followed quickly by a target letter string that subjects must name or classify (e.g., as a word vs. a non- word). These studies found that naming or classifying the target is facilitated when the prime is semantically related to or associated with the target (e.g., Forbach, Stanners, & Hochhaus, 1974; Meyer, Schvaneveldt, & Ruddy, 1975; Neely, 1977; Warren, 1977). In their classic study, Meyer and Schvaneveldt (1971), subjects were to decide whether or not two simultaneously presented letter strings were words. They found that subjects' RTs were significantly faster when the two letter strings were associatively related words (e.g., nurse-doctor) than when they were unrelated words (e.g, nurse-bread). Subsequent studies, including those cited above, showed similar effects when the two words were presented in succession, even when requiring decisions only to the second member of each pair (e.g., Neely, 1976, 1977). This effect of semantic context on lexical decision RTs has been termed the semantic facilitation or semantic priming effect.

In the social cognitive literature, most research on priming effects has involved presenting subjects with a word or group of words as part of one study, followed a few minutes later by a separate, unrelated study in which subjects read a behavioral description of a target person and formed an impression of him or her. These studies found that subjects tend to characterize the target person information in terms of the construct that had been previously primed (e.g., Bargh & Pietro-monaco, 1982; Higgins, Rholes, & Jones, 1977; Rholes & Pryor, 1982; Srull & Wyer, 1979). In addition to these effects of recent priming on subsequent stimulus identification, there is also evidence that frequent priming increases the impact of priming on subsequent processing (e.g., Hayes-Roth, 1977; Reder, 1983; Srull & Wyer, 1979, 1980). Thus, it has been well established that both recent and frequent priming influence the identification of subsequent stimuli. But what mechanism underlies such priming effects? What is the relation between recent and frequent priming, and how do their relative effects change over time?

With respect to the effects of priming on categorization, it is known that the priming of an applicable construct increases the likelihood that it will be used to process a subsequent stimulus, that the likelihood of utilization increases as the frequency of priming increases, and that the likelihood of utilization decreases as the temporal delay between priming and stimulus presentation increases. Currently, two types of models (or, more appropriately, metaphors) have been proposed in the literature to explain such priming effects: mechanistic models, where the explanation is in terms of the arrangement and the working of component parts, and excitation transmission models, where the explanation is in terms of the heightening and the dissipation of excitation or energy levels.

The clearest example of a mechanistic model that has been specifically used to interpret priming effects on categorization is Wyer and Srull's (1980) **"storage bin" model.** They proposed that the constructs in each bin are stored in layers in the order in which they were previously activated. When stimulus information is interpreted, the relevant bin is searched from the top down so that constructs at the top are more likely to be retrieved and utilized. Thus, when several constructs are potentially applicable for stimulus processing, the most recently activated construct is most likely to be used. A construct will remain at the top of the bin for a substantial period as long as other constructs in the bin are not activated during the interval. Typically though, other constructs in the bin are more likely to be activated as the delay between priming and stimulus presentation increases. Thus, as the delay period increases, the primed construct is less likely to remain on top and so is less likely to be utilized in subsequent processing. When a construct is frequently activated, however, it is more likely to have been recently used, and thus it is more likely to remain on top to be utilized subsequently. In this model, therefore, the effect of frequent activation is reinterpreted in terms of its relation to recent activation. A very similar conceptualization of priming elfects also has been proposed by Forbach et al. (1974).

Priming effects on categorization also have been interpreted in terms of various forms of **excitation transmission** (see Higgins & King, 1981; Marcel & Forrin, 1974; Reder, 1983; Warren, 1972; Wyer & Carlston, 1979). These models have generally included the following basic postulates: (a) The priming of a construct increases its excitation level; (b) a construct's excitation level must reach a certain, minimal threshold for that construct to be used in stimulus processing; (c) the more frequently a construct is primed, the more likely it is that this minimal threshold will be maintained; and (d) the excitation level of a construct decreases over time, and thus the longer the period since the final priming, the less likely it is that the minimal threshold will be maintained.

Another related explanation is that of **spreading activation**. Spreading activation, is assumed to be an automatic consequence of encoding a lexical stimulus (Collins & Loftus, 1975; Schvaneveldt & Meyer, 1973). On this account, encoding a word activates the feature detectors in lexical memory that represent words with features similar or equivalent to those of the stimulus. When activation occurs at any memory location, activation spreads from that location to others nearby. Assuming that lexical memory is organized by semantic or associative relatedness, nearby locations will be words related to the stimulus. The activation that spreads to those related words facilitates subsequent processing of the words.

The current experiment is situated in the above domain of Semantic/ Categorical Priming and how it impacts the identification of subsequently presented stimiuli.

Problem: To study the effect of Priming on retrieval from Semantic Memory

Hypotheses:

Null:

There is no difference between the time taken to complete target words in the priming condition as compared to absence of priming condition

There is no difference between the number of correctly completed target words in the priming condition as compared to absence of priming condition

Alternate:

The time taken to complete target words would be lesser in the presence of priming condition as compared to absence of priming condition

The number of correctly completed target words would be more in the presence of priming condition as compared to absence of priming condition

Methodology:

Design of the Experiment:

Repeated Measures design with a Single IV having two levels

Variables:

Independent Variable:

Priming (manipulated at two levels):

- Presence of Priming (where the first word in the pair is a prime word)
- Absence of Priming (where the first word in the pair is a non-prime word)

Operational Definition Independent Variable:

- Presence of Priming achieved through a presentation of categorically related word pairs For example, DOCTOR-NURSE
- Absence of Priming achieved through a presentation of Categorically unrelated word pairs For example, DOCTOR-BREAD

Dependent Variable:

a. No. of errors in the Word Completion task

b. Time taken for the Word Completion task

Operational Definition of Dependent Variable:

a. Time taken in seconds to complete the target words with missing alphabets

b. No. of errors- errors made by the participant in completing the target words with missing alphabets

Control variables (past tense)

1. The number of word pairs presented was the same (15) across conditions
2. The exposure time of the first word (prime/non-prime word) was 3 seconds across conditions
3. The first word in the pairs was a five letter concrete noun across conditions

Material:

- In case of manually presented stimuli:

- 15 cards with categorically related words written on either side. (Complete Prime/non-prime words on one side and Incomplete target words on the other side)
- 15 cards with categorically unrelated words written on either side. (Complete Prime words on one side and Incomplete target words on the other side)

In case of computerized presentation:

- 30 slides for the categorically related words condition (Complete Prime word on one slide which has been auto-timed for 3 seconds followed by a slide with the incomplete target word)
- 30 slides for the categorically unrelated words condition (Complete non-prime word on one slide which has been auto-timed for 3 seconds followed by a slide with the incomplete target word)
- Record sheet with word pairs from both conditions to note down time and errors

Tables

Wooden screen

Stopwatch

Stationery

Procedure & Instructions:

The E arranged the material and brought the participant in the laboratory. The participant was seated comfortably and rapport was established. The participant was shown 30 pairs of words where the first was either a prime or non-prime word followed by the word to be completed by the participant. The participant was then asked Post-task questions and duly debriefed. Any queries raised by the participant were clarified and she was thanked before escorting her out of the laboratory

Following **instructions** were given, "This is a simple experiment. I will present you some words one at a time on this screen. Each time I will present you one complete word followed by one incomplete word. Your task is to complete the incomplete word as fast as possible. Have you understood? Shall we begin?"

The E ensured that the following **Precautions** were taken:

- The cards/slides of both conditions are presented in a random order.
- The participant was shown the priming word for 3 seconds, followed by the incomplete target word.
- The time taken to recognize the target word and the errors made are noted.

Post task Questions:

- How do you feel about the task we just did…
- What do you think the experiment was about…
- Did you find certain words easier to complete …If yes, why…..
- Do you think any of the complete words helped in recognizing incomplete words…. Tell me more about them…? Give me some examples….

Analysis of Data:

Tables:

Table I- Record sheet of participant's performance in categorically related and unrelated word conditions

Card No	Word Pair	Time Taken	√ /x
1			
2			
30			

Table II- Summary table of Participant's Performance in both the conditions

	Total Time Taken	**Total No. of correctly completed words**
Presence of Priming (Categorically related words)		
Absence of Priming (Categorically unrelated words)		

Table III : Total time taken and errors made by 30 participants across both conditions

Participant number	**Time Taken be participant to complete target word**		**No. of correctly completed words**	
	Presence of Priming	Absence of Priming	Presence of Priming	Absence of Priming
1				
30				
Total				

Mean				

Statistical Treatment :

The difference between the means of both the dependent variables was assessed for its significance using the t test. Hence two t tests were conducted: (i) to study the significance of the difference between the mean time taken to complete words across both conditions and (ii) to study the significance of the difference between the number of words correctly completed across both conditions

Graphs:

Graph I indicates the comparison of time taken by the participant in both the conditions(bar graph)

Graph II indicates the comparison of errors made by the participant in both the conditions. (bar graph)

Graph III indicates the comparison of time taken by 30 participants in both the conditions(bar graph)

Graph IV indicates the comparison of errors made by 30 participants in both the conditions(bar graph)

Discussion:

The current experiment was conducted to study the effect of Priming on retrieval from Semantic Memory. The experiment utilized a repeated measure design with one IV having two levels. Priming was manipulated at two levels, whereby the first word in the pairs shown to participants was either categorically related or unrelated to the following target word. The time taken and the number of errors made while performing the word completion task were measured.

Individual data:

In the current experiment it was hypothesized that_____(write the hypothesis). Hence it was expected that the participants' overall performance on the word completion task would be better in the presence of priming condition as opposed to the control condition.

Table 1 is a Record sheet of participant's performance in categorically related and unrelated word condition. (Describe the results obtained on the dimension of both time and error, in as much detail as possible) The E observed that_____(please write your observations of the participants' performance on the task)

Table 2 is a summary table which compares the participant's performance across both conditions. As can be seen from the table the participant's _____(compare the number of errors and time taken by the participant in both conditions and discuss which one was

higher/lower)Thus, the participant's performance was better in the presence of priming condition than that in the control condition(or vice-versa?) and the data is as/not as expected.

The participants responses in the PTQs also reveal that_____(quote relevant responses to indicate support to the hypothesis or vice-versa)

Graph 1 is a graphical representation of the time taken by the participant in both the conditions. Through the two bars, the graph shows how the time taken by the participant was more in the _____condition indicating that the participants performance was better in _____condition.

Graph 2 is a graphical representation of the errors made by the participant in both the conditions. Through the two bars, the graph shows how the number of words correctly identified by the participant were higher in _____condition indicating that the participants performance was better in _____condition.

Overall, the individual data is in / not in line with the hypothesis.

Group Data:

In a similar vein as above, discuss Table 4 which shows the total time taken and errors made by 30 participants across both conditions. What are the total scores? What are the mean scores? Does the t test reveal any significant difference between the two group data means? What is level of significance of the difference? Thus, In which condition have participants performed better? Are the group data results as expected?

Thereafter discuss the trends seen in the Group data graphs. Which of the two bars is taller…? What does that indicate?

Finally, using the findings from both individual and group data, comment on whether the hypothesis is supported or not.

Conclusion: does the data validate/invalidate the hypothesis? What does that indicate about the role of priming in aiding retrieval from semantic memory?

Application value: Priming can be consciously used to accentuate encoding, storage and especially retrieval of information in long term memory. It can used in combination with mnemonic devices and in order to cue recall. It can be used in elaborative rehearsals in order to facilitate multiple meaningful linkages with the information to be remembered.

7.2 QUESTIONS

1. Explain the concept of Priming.
2. What is Macro, Mid and Micro Priming?

3. What are the various types/kinds of Priming?
4. What is Semantic Priming?
5. Name any two studies on Priming and their findings.
6. What is the Storage bin model?
7. What is Behavioural Priming?
8. What is the IV and DV of the Experiment?
9. What are the different CVs of the Experiment?
10. What are the various explanations for priming effects on retrieval?
11. What Inferential statistical method is appropriate for the experiment? Why?

7.3 REFERENCES

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7.4 APPENDIX

Material

Categorically related word pairs			
	Prime Words	Target Words	
1	TRAIN	S_ _T	SEAT
2	CREAM	M_L_	MILK
3	SMILE	TE __H	TEETH
4	MOUTH	L_PS	LIPS
5	WOMAN	M_O_ _ _R	MOTHER
6	COINS	RU_ _ES	RUPEES
7	CAKES	O_EN	OVEN
8	PANTS	JE_ _S	JEANS
9	APPLE	S_ ED_	SEEDS
10	BREAD	BU_ T _R	BUTTER
11	PHONE	C__L	CALL
12	HOUSE	_ _OR	DOOR
13	NIGHT	DR_ _M	DREAM
14	MOUSE	C__	CAT
15	CANDY	S_ _A R	SUGAR

Categorically Unrelated words			
1	CLOTH	F_ _H	FISH
2	HAPPY	BAL_ _ _N	BALLOON
3	PIZZA	CH_ L_	CHALK
4	BRAIN	B_ DG_	BADGE
5	FRUIT	D_U_	DRUM
6	DANCE	SOC_ _	SOCKS
7	MONEY	T_B_ _	TABLE
8	PURSE	D_ _ L	DOLL
9	LOTUS	PAP_ _	PAPER
10	TRUCK	GR_ _S	GRASS
11	CLOUD	C__ RK	CLERK
12	HONEY	COF_ _E	COFFEE
13	SCARF	B_ AR_	BEARD
14	WATER	SH_ _S	SHOES
15	CHAIR	PE_ _IL	PENCIL

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8

EXPERIMENTS IN COGNITIVE PROCESSES -II
EXPERIMENT NO. 2
ISOLATION EFFECT (VON-RESTORFF EFFECT)

Unit Structure

8.0 OBJECTIVES

After studying this experiment you will be able to:

- Conduct the psychological experiments

8.1 INTRODUCTION: WHAT IS THE ISOLATION EFFECT?

In her classic 1933 study, Hedwig von Restorff demonstrated the powerful effect that "difference" can have on memory. In the study, von Restorff presented a series of three lists to participants over a span of 3 days. On the first day, everyone saw a list of 10 unrelated items (e.g., a symbol, a number, a word, a photograph, etc.). On Days 2 and 3, participants received separate lists in which 1 item was different (isolated) from the remaining list items. These isolated lists consisted of either 9 numbers and 1 nonsense syllable or 9 nonsense syllables and 1 number. The isolated item occurred in either the second or third serial position. Delayed recall results revealed better memory for the isolated items compared to the average recall of the remaining list items. This effect has since been termed the "von Restorff effect" (or isolation effect) and can be defined simply as the enhancement of memory for events that differ, or deviate, from their context. In the years since von Restorff initial article, a considerable amount of research has been devoted to the investigation of this phenomenon and the effect has proven robust, having been replicated with a wide variety of designs and materials (for reviews, see Cimbalo, 1978; Hunt, 1995; Schmidt, 1991; Wallace, 1965).

Variations in the Isolation Paradigm:

Historically, investigators have achieved isolation by physically changing, or augmenting, the stimulus in some manner. Cimbalo (1978) identified a number of such isolation techniques, including size, shape, colour, intensity, and voice. However, other techniques have been used to isolate items as well, such as meaningfulness, underlining, spacing, background colour, and electric shock (Cimbalo, 1978). Investigators have typically placed the isolated item, or items, near the middle of the list, but significant effects of isolation also have been found for items placed at the beginning and at the end of the list (Bellezza & Cheney, 1973; Pillsbury & Raush, 1943; Experiments 1—4). Traditionally, researchers have assessed retention with tests of free recall, comparing recall performance for the isolated item either against the average recall of the remaining list items or against the recall of a comparable item in a non-isolated list. When the middle items of the list are isolated, the first method of comparison has the problem of underestimating the size of the isolation effect because primacy and recency items are included in the average recall of the non-isolated items. The second method does not have this problem and is the preferred technique. Other retention measures used in the isolation effect literature include recognition and serial recall.

A number of factors influence the magnitude of the isolation effect. For example, the nature of the isolate plays an important role in determining the size of the effect. Cimbalo, Capria, Neider, and Wilkins (1977) reported that size, colour, and spacing are the most effective isolation techniques. Gumenik and Levitt (1968) showed that the degree to which an item differs from the rest of the list is also important. In their study, the isolated item was displayed in one of four sizes, each being *Rio of the next largest size. They found that the size of the isolation effect increased as the difference between the isolate and the background items increased. This held true both when the context stimuli were small and the size of the isolate increased and when the context stimuli were large and the size of the isolate decreased.

Why does the Isolation effect occur?

1. **Perceptual Salience:**

The von Restorff effect is known to most psychologists as the generic label for the effects of distinctiveness on memory. Distinctiveness, is a descriptive term for events that violate the prevailing context— that is, for events that are perceptually salient. The intuitive explanation of the isolation effect in particular and distinctiveness effects in general is that the perceptual salience of the distinctive event attracts additional processing. This intuition is most readily realized through the mechanism of selective attention. Jenkins and Postman (1948) were the first to propose that differential attention could be a necessary condition for the isolation effect. The reason why perceptual salience intuitively appears to be necessary for the isolation effect is that most studies place the isolate around the middle serial position of the list. If the goal is to study

distinctiveness or vividness as an independent variable, this methodology makes perfect sense. Preceding the isolate with some number of homogeneous items maximizes the probability that the isolate will be perceptually salient.

2. **Attention:**

Generally speaking, the effect has been attributed to attention; if an isolate is seen in a list, one focuses one's attention to the isolate and it is hence recalled better due to a higher level of encoding. If one has seen several common elements, one might have established an expectation about what the common features are. Green (1956) argued that the isolation effect resulted from surprise induced by the change from preceding items: "Surprise increases the attention paid to the item and hence the likelihood of recall" (p. 340). Surprise, the emotional response to perceptual salience, explicitly elicits attention to the item in Green's theory. However, several researchers (e.g. Fabiani and Donchin 1995; Hunt 1995; Hunt & Lamb 2001; Sikström 2006) have pointed out that the effect cannot solely be a matter of attention. If an isolate is presented early in a list there has not been any time to build up an expectation of how the elements should look; leading to that there is nothing to draw attention.

3. **Gestalt Explanation:**

Along with Koffka (1935), Restorff offered the Gestalt interpretation of the isolation effect. Similarity among the massed items of either a homogeneous list or the non-isolated items of the isolated list resulted in aggregation of those items. The isolated item doesn't get aggregated to the homogeneous items because of its lack of similarity. Thus, the isolated item stands out as figure against the ground of the homogeneous items. Using the metaphor of perception, the isolation effect in memory was thus explained essentially in terms of the discriminability of the isolate.

Isolation and the Learning of Lists:

Not only has the Isolation paradigm been used for understanding how isolated items are retained better, but also how it could enhance the learning of lists(). The classic 1933 paper by Restorff has never been published in English and is likely to surprise the contemporary reader on several dimensions. For example, the first page is devoted to defending studies of memory that use lists of nonsense materials against charges of ecological invalidity. Even though Titchener (1915) had proclaimed Ebbinghaus's innovation of nonsense syllables as the most important advance in the study of memory since Aristotle, criticism of the technique had gained momentum by 1933 on the grounds that memorization of lists was a meaningless activity and consequently would yield no useful information about real-world memory (see, e.g., Bartlett, 1932). Von Restorff 's rejoinder is unique: "After all, we do not want to fool ourselves: Millions of people remain in the same work situations day after day, even though their tasks are no more meaningful than the experimental tasks. One would hardly criticize the classical psychology of memory for

being too far removed from everyday experience, just because the subjects were engaged in meaningless tasks" (von Restorff, 1933, p. 300)

In their work on the phenomenon of set size(a proportional increase in the total number of words retained due to the introduction of isolation), Donchin and Fabiani (1995) propose a model based on three different phases of memory organisation; the encoding, the rehearsal and the retrieval phase. Herein, they claim that there are two different levels of the encoding phase. In the first one, there is a parallel analysis of elementary stimulus features. In the second one, there is a more elaborate processing of the stimulus features. It is here that Donchin and Fabiani propose that isolation enhances both the kind of processes leading to a higher retrieval of the items on the isolation list as compared to the items on the non-isolated list.

Using the gestalt understanding researchers have tried to explain how isolation transforms the list as a 'whole' compared to the singular parts of a non-isolated list. Findings and reasoning by Osgood(1953) point at how perceptual salience is necessary but not a sufficient condition. The isolate could be unique/distinctive as a unit, but if the non-isolated items do not operate to form a unique whole by agglutinating the effect is not as strong. Hence even when the researchers are assessing the retention of one isolated unit in the isolated list vis-à-vis the same unit in the non-isolated list, what actually facilitates retention is the relationship of the isolate to the remaining indiscriminable non-isolates which are encoded together as a whole. Hunt and Lamb (2001) attribute the effect to the balance of similarity and difference among the elements in a list, hence creating an advantage for the isolated list as a whole unit which gets encoded and organized differently than its non-isolated counterpart. According to Hunt and Lamb (2001) this is due to organizational and distinctive processing. Organizational processes result from encoding similarities among the different items in a list, while distinctive processes result from encoding similarities and differences among these elements. Isolated lists are encoded as different, distinct 'whole' units and hence retained better.

Problem: To study the Isolation effect on the serial learning of lists

Hypotheses:

- **Null:** There would be no difference in serial learning across the presence or absence of isolation conditions (i.e. There would be no difference in the total number of nonsense syllables correctly placed in the appropriate serial position on the reconstruction sheet across both conditions)
- **Alternate:** serial learning would be better in the presence of isolation condition as opposed to the absence of isolation condition (i.e. the total number of nonsense syllables correctly placed in the appropriate serial position on the reconstruction sheet would be higher in the isolation condition as compared to the absence of isolation condition)

Design: Repeated measures design with single IV having two levels

Independent variable: Isolation of items on list – Present/Absent

Dependent variable: performance on serial learning task

Operational definition of variables

- **Independent variable:** Isolation achieved by changing the font, case, colour and size (bigger than the rest of the items) of the third and sixth item on an eight-item list
- **Dependent variable:** Total number of nonsense syllables correctly placed in the appropriate serial position on the reconstruction sheet

Control variables:

1. The total number of items on both lists was eight
2. The two items used for the isolation effect were also be present in the non-isolated list in a different position. However, their font, case, colour and size were the same as the rest of the items on the non-isolated list
3. The exposure time of each item was be 3 seconds
4. Half the experimenters presented the Presence of Isolation condition followed by the Absence of Isolation condition and vice versa.
5. The participants read aloud each item on the list
6. A maximum of three minutes was given to finish the reconstruction task

Materials:

- The materials for the experiment were prepared in a hard-copy format, in the form of cards or the in the soft copy format in the form of slides on a PowerPoint Presentation.
- In either case there were cards/slides, eight cards/slides per condition. Each word appeared in the middle of the card slide in small case, black ink, Calibri font, size 24(except the two isolated items on the isolated list). The two isolated words were in all capital, blue ink, Times New Roman font, size 36 only in one list (isolated list)
- In case the material was in soft copy (slides on a PPT presentation) each slide with a word followed by a blank slide
- A demonstration sheet with three nonsense syllables apart from the ones on the 2 lists.
- Two separate lists/slides for each condition consisting of the eight words presented before, however in a scrambled order (different from the order in which they were presented to the participant)

- Stopwatch/metronome for manual presentation. Each slide with a word auto-timed for a three second display
- A reconstruction sheet with a series of seven empty boxes for the participant to fill appropriate words in the correct serial order
- Screen, Record sheets and Stationery

Procedure:

The participants of half the experimenters were administered the Isolation condition followed by the absence of isolation condition and vice versa. After the P was ushered in to the laboratory, made to sit comfortably and rapport was established, the cards/slides of the first condition were presented. First, each word was exposed individually over the screen. Each trial began with asking if the P is READY accompanied by the participant indicating their readiness. This was followed by the presentation of an eight-item list, one item shown at a time. Each list item was presented for 3 seconds with a blank slide & ready signal separating the offset of one item from the onset of the next. Participant were instructed to say each item aloud as it appeared on the screen. Immediately after the last item, the participant is given a reconstruction test. The eight items in the list were re- presented on the screen/ or handed out on a sheet, in a new random order. A series of eight empty boxes, representing all possible list positions, was handed out along with the reordered list. The task was be to reconstruct the original order of presentation by placing the items into their appropriate serial positions (boxes). Everyone was given as much time as they needed to complete the reconstruction task. Thereafter the P was given a two-minute unfilled interval and the next condition wasstarted in a similar manner.

Instructions:

"Please be comfortable. This is a simple experiment which has two parts. In the first part, I would be showing you few nonsense syllables…one at a time…over this screen. A non-sense syllable is a combination of three letters without any dictionary meaning. I want you to look at these syllables carefully and spell them out loudly(demonstration). Before the presentation of every nonsense syllable…I will give you a ready signal. After I finish showing you the syllables on by one, I will show you all of them together in a list where the syllables would be in a random order. Alongside, I will give you a sheet with a few blank boxes one below the other. Your task would be to arrange the syllables in the boxes, in the same order as they were presented to you. For example, if in the original order of presentation XYZ was followed by PTQ and VBN…then in the boxes too, you would be expected to write XYZ first, PTQ second and VBN third. In case you do not remember the word for a particular position, move to the next. In all, you would be given a total of three minutes to finish this task. When you finish this procedure once, we will have a short break and then start part 2. In the second part of the experiment, we would see another list where you will have to do the same

task once again. Have you understood…? Could you explain what we would be doing…? Shall we begin?

Post task questions:

- How do you feel about the task we just did…
- What do you think the experiment was about…
- Did you find any of the two lists easier to learn in the given order …If yes, why…..
- Do you think any of the words that were differently coloured helped you in remembering that list better …. Tell me more about it…? What if those words were like the others in the list?

Analysis of data:

Tables & Graphs

Table 1: Participant's responses in the absence of isolation condition

Serial Position	**Correct word shown in the respective position**	**Participants response on reconstruction sheet**	**Correct / Incorrect**
1.			
2			
3.			
….			
8			
Total number of non-sense syllables correctly placed in serial positions (serial learning score)			

Table 2: Participant's responses in the presence of isolation condition

Serial Position	**Correct word shown in the respective position**	**Participants response on reconstruction sheet**	**Correct / Incorrect**
1.			
2			
3.			
…			
8			
Total number of non-sense syllables correctly placed in serial positions (serial learning score)			

Table 3: Participant's serial learning score across both conditions

Condition	Participant's serial recall score
Presence of Isolation	
Absence of Isolation	

Table 4: Serial learning score of 20 participants across both conditions

Participant number	Serial learning score in Presence of Isolation Condition	Serial learning score in Absence of Isolation Condition
1		
2		
….		
20		
Total		
Mean		

Graph1: Bar graph representing the participant's serial learning score across both conditions

Graph2: Bar graph representing the mean serial learning score of 20 participants across both conditions

Statistical treatment:

The mean of the serial learning score for both conditions is computed. Thereafter the difference between the mean scores is tested for significance using the t test as an inferential statistic.

Results and discussion:

The current experiment was conducted to study the effect brought about by isolation on serial learning. The experiment utilised a repeated measure design with one IV having two levels. Isolation was manipulated in the experimental group by utilising a list with 2 items in different size, case and colour than the rest of the items. A reconstruction task sheet was used to assess serial learning in both the conditions.

Individual data:

In the current experiment it was hypothesized that_____(write the hypothesis). Hence it was expected that the serial recall score of the participant would be higher in the presence of Isolation condition as opposed to the control condition.

Table 1 is a record sheet of the participants' performance on the serial recall task in the absence of isolation condition. No words were isolated in the list by changing the colour, font or size. As can be seen, the participant accurately placed _____words in their appropriate serial

position. The E observed that_____(please write your observations of the participants' performance on the task)

Table 2 is a record sheet of the participants' performance on the serial recall task in the presence of isolation condition. Two words were isolated in the list by changing the colour, font case and size of the words. As can be seen, the participant accurately placed _____words in their appropriate serial position. The E observed that_____ (please write your observations of the participants' performance on the task)

Table 3 is a summary table which compares the total number of words serially placed by the participant across the two conditions. As can be seen from the table the participant's reconstruction score was _____in the control condition, while it was _____ in the presence of isolation condition. Thus, serial learning in the isolation condition is more/less than that in the control condition and the data is as/not as expected.

The participants responses in the PTQs also reveal that_____(quote relevant responses to indicate support to the hypothesis or vice-versa)

Graph 1 is a graphical representation of the participants' performance on both the conditions. Through the two bars, the graph indicates the number of words correctly placed by the participant, in the appropriate serial position, in both the conditions. As ca be seen the bar in the _____condition is taller than the bar in the _____condition which clearly denotes_____ (the way isolation impacts learning of verbal material).

Overall, the individual data is in / not in line with the hypothesis.

Group Data:

In a similar vein as above, discuss Table 4 which indicates the performance of 20 participants across both conditions. What are the total scores? What are the mean scores? In which condition have participants performed better? Are the group data results as expected?

Thereafter discuss the trends seen in the Group data graph. Which of the two bars is taller…? What does that indicate?

Finally, using the findings from both individual and group data, comment on whether the hypothesis is supported or not.

Conclusion: using the data in the discussion conclude if the hypothesis is validated or not.

Application value:

The isolation effect would be useful in designing material in any domain where distinctiveness and perceptual salience of the material would be of importance. It can be used in designing learning material with special emphasis on key points to be attended to / remembered. It could be of use

in designing presentations wherein the attention of the audience is to be manoeuvred towards specific points. The learning could also come handy while designing websites and advertisements.

8.2 QUESTIONS

1. What is the Isolation effect?
2. Who pioneered the isolation effect?
3. Why does the isolation effect occur?
4. What are the various ways in which isolation can be manipulated?
5. What is set size?
6. What explains the improved memory of isolated lists as opposed to non-isolated lists ?
7. What is the retrieval measure used in this experiment? Do you know any other methods of measuring retention/memory?
8. What is the IV and DV of the Experiment?
9. What are the CVs of the Experiment?
10. What is the design of the experiment?
11. What Inferential Statistical method is used in the experiment and Why?

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8.4 APPENDIX

1. List of nonsense Syllables

Non Isolated items	Isolated Items
qed	bjx
gok	dzp
zec	YUL
vum	naq
yul	kiy
wdk	XTJ
njl	gox
xtj	fiw

2. Reconstruction task sheet

Serial number	Nonsense syllable in appropriate order
1	

2	
3	
4	
5	
6	
7	
8	

*****

9

PSYCHOLOGICAL TEST

Unit Structure

9.0 OBJECTIVES

1. The learner will be able to administer, score and interpret the Warwick Edinburgh Mental Well Being Scale (WEMWB) and Satisfaction with Life Scale.
2. The learner will be able to communicate the test interpretation to the test taker
3. The learner will be able to calculate and interpret reliability of a test
4. The learner will be able to calculate and interpret validity of a test

9.1 INTRODUCTION

A Psychological test is a standardized and objective measure of a sample of behaviour. It also including scales and self-report inventories to measure of an individual's mental and/or behavioural characteristics. The primary characteristics of a good psychological test are reliability, validity and standardization.

Standardization refers to the uniformity of procedure in the administering and scoring of the test

Reliability refers to consistency of test scores. According to Anastasi reliability refers to the consistency of scores obtained by the same individuals when re-examined with the same test on different occasion, or with different sets of equivalent times, or under other variable examining condition.

Test-retest reliability, alternate-forms reliability, split-half reliability are different types in which reliability coefficient can be estimated.

Spearman-Brown, Kuder-Richardson formula and Cronbach are methods used to estimate the internal consistency of the test.

Cronbach's alpha is computed by correlating the score for each scale item with the total score for each observation and then comparing that to the variance for all individual item scores.

Following are the steps used to estimate the internal consistency of the test:

Step 1: Total of variances of scores on each item of the test to be calculated

$$\sigma i^2 = \sigma_1^2 + \sigma_2^2 \ldots\ldots + \sigma_2^n$$

Step 2: For estimating the internal consistency of the test Cronbach's

$$\left[\frac{k}{k-1}\right]\left[1 - \frac{\Sigma\sigma_i^2}{\sigma t^2}\right]$$

Alpha can be used

Cronbach's alpha =

Where ,

k= number of items in WEMWBS (14)

$\Sigma\sigma i^2$ = Total of variances of scores on each item of WEMWBS

$\Sigma\sigma t^2$= Variance of total scores on WEMWBS on 30 Test-takers (* square the σt value)

Another important aspect of a good psychological test is the estimation of validity.

Test validity refers to the degree to which the test actually measures what it claims to measure. Any psychometric test which fulfils the purpose for which it is developed can be called a valid measuring test.

The different methods to establish validity of the test are content, criterion, construct.

Criterion Related Validity:

This is a validation procedure which indicates the effectiveness of a test in predicting an individual's performance against a criterion. A criterion is a standard against which the test score is evaluated. There are two types criterion related validity, concurrent and predictive validity. To obtain the criterion- related validity the test developer must set a relevant and appropriate criterion. Thus, the criterion chosen for estimating the validity must be valid, relevant and uncontaminated.

Concurrent validity is obtained by calculating the relationship degree between the score on the new test are related to the scores of already established criterion test , which is administered at the same time.

Step 1 : A relevant criterion measure is selected to establish the validity of the test under consideration.Both the tests are administered concurrently, that is at the same time.

Step 2: Validity is calculated by using the Pearson's Product moment formula:

$$r = \frac{N(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[N.\Sigma X^2 - (\Sigma X)^2]\ [N.\Sigma Y^2 - (\Sigma Y)^2]}}$$

9.2 ADMINISTRATION, SCORING & INTERPRETATION OF WARWICK-EDINBURGH MENTAL WELL-BEING SCALE (WEMWBS) & SATISFACTION WITH LIFE SCALE (SWLS) AND CALCULATION OF RELIABILITY, VALIDITY OF WEMWBS.

The purpose of the present practical is to administer, score and interpret the Warwick-Edinburgh Mental Well-Being Scale (WEMBS) and Satisfaction With Life Scale (SWLS). And to estimate the internal reliability coefficient using Cronbach's alpha. The criterion test used to estimate the validity of WEMWBS will be SWLS.

The concept of mental wellbeing is described as a state of positive being, thinking, behaving and feeling. Mental wellbeing and mental health are different terms as 'mental health' is a term often used to incorporate a range of states from excellent mental health to severe mental health problems.

The World Health organization states that mental wellbeing involves a state of well-being in which people are able to cope with the normal stresses they face in daily life.

In general, wellbeing is considered global dimension of psychological wellbeing, emotional wellbeing and social wellbeing. The component of emotional wellbeing comprises three components, positive affect, negative affect, life satisfaction and happiness. The psychological wellbeing consisting of self-acceptance, personal growth, purpose of life, environmental master, autonomy and positive relations with others. The elements of social wellbeing associated with social actualization, social contribution, social coherence, social integration.

There are two approaches to study mental wellbeing, the hedonic approach and eudaemonic approach. The hedonic approach includes the states of happiness and life satisfaction. The eudemonic approach includes the positive psychological functioning, good relationships with others and self-acceptance.

The Warwick-Edinburgh Mental Well-Being Scale (WEMWBS). The scale includes affective-emotional aspects, cognitive-evaluative dimensions and psychological functioning capturing the global aspect of the concept of wellbeing.

The life satisfaction component is a cognitive component of the broader concept subjective wellbeing. Global life satisfaction is a broad concept of an individual's comprehensive judgment of life. The SWLS items are global rather than specific in nature, allowing respondents to weigh domains of their lives in terms of their own values, in arriving at a global judgment of life satisfaction (Pavot, 1993).

Purpose:

1. To administer, score and interpret the Warwick Edinburgh Mental Well Being Scale (WEMWB)
2. To administer, score and interpret Satisfaction with Life Scale
3. To calculate reliability coefficient of Warwick Edinburgh Mental Well Being Scale using Cronbach's alpha
4. To calculate concurrent validity of WEMWB using Satisfaction with Life Scale

Method:

Description of the scale:

Warwick Edinburgh Mental Well Being Scale (WEMWBS)

The WEMWBSe covers eudemonic-hedonic wellbeing and psychological, subjective wellbeing.

The development of Warwick Edinburgh Mental Well Being Scale (WEMWS,2007) was led by Professor Sarah Stewart-Brown and supported by Professor Stephen Platt et al.

The scale consists of 14 items covering both hedonic and eudaemonic aspects of mental health

Test-retest reliability at one week in the student sample was 0.83. Scales measuring components of affect or well-being all showed significant high correlations with WEMWBS, PANAS-PA r = 0.71 and WHO-5 r = 0.77.

Satisfaction With Life Scale (SWLS):

The Satisfaction with Life Scale (SWLS) was developed by Ed Diener, Robert A. Emmons, Randy J. Larsen and Sharon Griffin (1985). The SWLS is a short 5-item instrument designed to measure global cognitive judgments of satisfaction with one's life. The scale is scored by summing responses to each item answered on a 1 to 5 Likert scale.

The internal reliability coefficient is .87, 2 months test-retest reliability is .82 (Diener et al, 1985). The SWLS also has been examined for its relation to an array of both self- report and external criteria in an effort to establish its validity as a measure of life satisfaction. The correlation between Fordyce Global Scale & SWLS was found 0.82 (Tennat et al, 2007).

Materials:

1. Warwick Edinburgh Mental Well Being Scale (WEMWS)
2. Satisfaction with Life Scale (SWLS)
3. Stationery
4. Screen

Procedure:

The test administrator ensured that all the arrangements for administering the test were made. The test taker was then ushered into the laboratory and was asked to sit comfortably.

Before giving the instructions for the scale, establish rapport with the test taker by asking few general questions.

Instructions:

"Be comfortable, today I will be giving you two psychological scales, which will help you to understand some aspect of yourself. The first scale consists of a few statements about your thoughts and feelings. Besides each statement there are options that range from none of the time to All the time. Please tick the option that best describe your experience over last two weeks. (The test administrator reads aloud the instructions printed on the test.)

There are no 'right' or 'wrong' answers, as each one of us differs in the manner we think and feel. The accuracy of the test result depends on how honestly you respond to these tests.

Please note that your responses will be kept confidential and only total score will be used for the purpose of further calculations. There is no time limit for the test but do not spend too much time on one statement. Have you understood? Shall we proceed"

After the instructions, the test administrator ensured that the test takers filled the demographic details on the scale and was asked to begin. After the test taker finished answering the scale, the test administrator ensured that all the test taker had answered all the questions. And after a gap of few minutes the next scale was given to the participant.

'Here is another scale which I will be giving you. This scale is developed to assess satisfaction people feel towards their lives. Below are five statements that you may agree or disagree with. Using the 1 - 7 scale

below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding. Do you have any questions? Shall we proceed?"

The test-taker is then asked the following PTQs:

Post-Task Questions:

1. What are your feelings while responding to the statements of the scale?
2. Did you face any difficulty responding to the statements of the scale?
3. Has any particular event/ incident have taken place in your life over in the recent past, which you think might have influence the way you answered the questions in the scale?

After taking the PTQs, a date and time when the results of the test would be shared with the test taker. The test taker is thanked and ushered out of the laboratory.

The two scales were scored using the instructions given in the Appendix A &B

Data of 30 students was collected for both the scales. A 'Z' test was calculated for the WEMWBS, the Z table was used to interpret the data

Debriefing:

[Note for the Test Administrator: It is very important the manner in which test results are communicated to the test taker. Before debriefing the test taker, you need to be well versed with the nature of the test and the way test results are interpreted. The test results must be communicated in a very sensitive manner, especially if the test scores are low or below average. The test administrator must ensure that strengths of the test taker are to be emphasized rather than weakness]

"The scales you took earlier were Warwick Edinburg Mental Wellbeing Scale and Life satisfaction scale. These tests help us to understand how people feel and how they function both on a personal and social level.

Your total score on Mental Wellbeing Scale was _____. When data from 30 adults was collected and analyzed, the average score on the Mental Wellbeing Scale was _____. Your score was higher than /lower than/close to average score.

Further, to interpret the results we calculated the z score, which helps us to know where your test score lies when compared to the population.

It was found that Z score for your score on Warwick Edinburg Mental Wellbeing Scale was _____. This Z score implies that _____ (interpret the Z score with reference to Z score table and communicate the interpretation)

The second scale you completed was the Satisfaction with Life Scale. Your is score on the test _____. The score indicates that _____
(Please refer to the Appendix to interpret the score on the test)

Analysis of Data:

1) Table I: Total score for WEMWBS and SWLS for 30 test takers

Test Taker	Total Score on WEMWBS	Total Score on SWLS
1		
2		
….		
30		
Total		
Average		
σ_t *(SD)		

2) Calculation of Z score for WEMWBS using the formula:

$$Z = \frac{\text{Test taker Score on WEMBS - Mean of WEMBS}}{\text{SD of WEMBS}}$$

(Note: For interpretation of the z score refer to the z table)

3) Table II: Item wise score of 30 Test takers on WEMWBS

Test Taker/ Item No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1														
2														
….														
30														
Mean														
σ^2	σ^2_1	σ^2_2	σ^2_3	..									…	σ^2_{14}

4. With the help of data from table 2 reliability coefficient was calculated using Cronbach's Alpha (α)

Step 1: Total of variances of scores on each item of WEMWBS (Add all the σ2 of the Items)

$$\sigma i^2 = \sigma_{1^2} + \sigma_{2^2} \ldots\ldots + \sigma_{2^{14}}$$

Step 2: Use the following formula to calculate the Cronbach's Alpha

$$\left[\frac{k}{k-1}\right]\left[1 - \frac{\Sigma\sigma_i^2}{\sigma t^2}\right]$$

Cronbach's Alpha (α) =

Cronbach's Alpa = _____

Where ,

k= number of items in WEMWBS (14)

$\Sigma\sigma i^2$ = Total of variances of scores on each item of WEMWBS

$\Sigma\sigma t^2$= Variance of total scores on WEMWBS on 30 Test-takers (* square the σt value)

5) Table III: Calculation of Pearson's Product Moment Correlation between WEMWBS & SWLS

Test Taker	Total Score on WEMWS	Total Score on SWLS	X^2	Y^2	XY
1					
2					
…					
30					
	∑ X	∑ Y	∑ X^2	∑ Y^2	∑ XY

$$r = \frac{N(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[N.\Sigma X^2 - (\Sigma X)^2]\ [N.\Sigma Y^2 - (\Sigma Y)^2]}}$$

Pearson r Calculation:

Interpretation:

Test Score Interpretation:

1) Mention the total score of the test taker on WEMWS. Discuss the score comparing with the mean score of the group in terms of whether the score is higher/lower/close to the mean group score.

2) Mention the test taker's z score and interpret the z score referring to the z table.

3) Mention the total score of the test taker on SWLS. Interpret the score referring to the interpretation given in Appendix B.

4) Discuss the interpretation in terms of the PTQs and the discussion with the test taker during the debriefing session.

Interpretation of Reliability & Validity Coefficient:

5) Discuss the mean, standard deviation values of WEMWBS

6) Mention the internal consistency reliability estimate with the help Cronbach's Alpha coefficient. Is the reliability of WEMWBS is high/moderate/low? Discuss the reliability of the scale in terms of research findings.

7) Mention the r value. Interpret the r- value and the validity of WEMWBS. With the help of research findings, justify the use of Satisfaction with Life scale to establish validity of WEMWBS.

Conclusion:

Mention the test taker score and interpretation (in brief) on WEMBWS and Satisfaction with life Scale.

Mention the internal consistency reliability estimate along with the interpretation.

Mention the validity of the scale by stating the r value along with the interpretation

9.3 QUESTIONS

1. Elaborate the nature, scope of psychological test
2. What are the characteristics of a good psychological test
3. Explain the concept of reliability and the types of reliability
4. Mention the steps to calculate reliability using Cronbach's Alpha
5. Explain the concept of validity and the types of validity
6. Mention the steps to calculate the concurrent validity

7. What is z score?
8. Explain the concept of correlation. And types of correlation
9. Explain the term mental health.
10. Explain the nature of WEMBWS.
11. Explain the concept of Life satisfaction
12. Enumerate the nature Satisfaction with Life scale

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9.5 APPENDIX

Appendix A

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS)

……
…….

WEMWBS

Name: …… Age: …….

Below are some statements about feelings and thoughts.

Please tick the box that best describes your experience of each over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5

I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

Warwick–Edinburgh Mental Well-being Scale (WEMWBS)

Soring & Interpretation (WEMWBS):

The total score on WEMWBS is scored by summing the responses to each of the 14 test items on a 1 to 5 likert scale (1 = None of the time to 5 = All of the time). All questions are equally weighted. Scores can range from a minimum of 14 to a maximum of 70 points. Higher scores are associated with higher levels of mental wellbeing

Appendix B:

The Satisfaction with Life Scale
By Ed Diener, Ph.D.

……

SWLS

DIRECTIONS: Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding**.**

1 = Strongly Disagree

2 = Disagree

3 = Slightly Disagree

4 = Neither Agree or Disagree

5 = Slightly Agree

6 = Agree

7 = Strongly Agree

1. In most ways my life is close to my ideal.
2. The conditions of my life are excellent.
3. I am satisfied with life.
4. So far I have gotten the important things I want in life

5. If I could live my life over, I would change almost nothing.

Soring and interpretation:

The SWLS is a 7-point Likert style response scale. The total score is obtained by summing the responses to each item. The possible range of scores is 5-35. Scores between 5-9 indicate the respondent is extremely dissatisfied with life, whereas scores between 31-35 indicate the respondent is extremely satisfied.

30 – 35 Very high score; highly satisfied Respondents who score in this range love their lives and feel that things are going very well. Their lives are not perfect, but they feel that things are about as good as lives get. Furthermore, just because the person is satisfied does not mean she or he is complacent. In fact, growth and challenge might be part of the reason the respondent is satisfied. For most people in this high-scoring range, life is enjoyable, and the major domains of life are going well – work or school, family, friends, leisure, and personal development. 25- 29 High score Individuals who score in this range like their lives and feel that things are going well. Of course their lives are not perfect, but they feel that things are mostly good. Furthermore, just because the person is satisfied does not mean she or he is complacent. In fact, growth and challenge might be part of the reason the respondent is satisfied. For most people in this high-scoring range, life is enjoyable, and the major domains of life are going well – work or school, family, friends, leisure, and personal development. The person may draw motivation from the areas of dissatisfaction.

20 – 24 Average score The average of life satisfaction in economically developed nations is in this range – the majority of people are generally satisfied, but have some areas where they very much would like some improvement. Some individuals score in this range because they are mostly satisfied with most areas of their lives but see the need for some improvement in each area. Other respondents score in this range because they are satisfied with most domains of their lives, but have one or two areas where they would like to see large improvements. A person scoring in this range is normal in that they have areas of their lives that need improvement. However, an individual in this range would usually like to move to a higher level by making some life changes.

15 – 19 Slightly below average in life satisfaction People who score in this range usually have small but significant problems in several areas of their lives, or have many areas that are doing fine but one area that represents a substantial problem for them. If a person has moved temporarily into this level of life satisfaction from a higher level because of some recent event, things will usually improve over time and satisfaction will generally move back up. On the other hand, if a person is chronically slightly dissatisfied with many areas of life, some changes might be in order. Sometimes the person is simply expecting too much, and sometimes life changes are needed. Thus, although temporary dissatisfaction is common and normal, a chronic level of dissatisfaction across a number of areas of life calls for

reflection. Some people can gain motivation from a small level of dissatisfaction, but often dissatisfaction across a number of life domains is a distraction, and unpleasant as well.

10 – 14 Dissatisfied People who score in this range are substantially dissatisfied with their lives. People in this range may have a number of domains that are not going well, or one or two domains that are going very badly. If life dissatisfaction is a response to a recent event such as bereavement, divorce, or a significant problem at work, the person will probably return over time to his or her former level of higher satisfaction. However, if low levels of life satisfaction have been chronic for the person, some changes are in order – both in attitudes and patterns of thinking, and probably in life activities as well. Low levels of life satisfaction in this range, if they persist, can indicate that things are going badly and life alterations are needed. Furthermore, a person with low life satisfaction in this range is sometimes not functioning well because their unhappiness serves as a distraction. Talking to a friend, member of the clergy, counselor, or other specialist can often help the person get moving in the right direction, although positive change will be up the person.

5 – 9 Extremely Dissatisfied Individuals who score in this range are usually extremely unhappy with their current life. In some cases, this is in reaction to some recent bad event such as widowhood or unemployment. In other cases, it is a response to a chronic problem such as alcoholism or addiction. In yet other cases the extreme dissatisfaction is a reaction due to something bad in life such as recently having lost a loved one. However, dissatisfaction at this level is often due to dissatisfaction in multiple areas of life. Whatever the reason for the low level of life satisfaction, it may be that the help of others are needed – a friend or family member, counseling with a member of the clergy, or help from a psychologist or other counselor. If the dissatisfaction is chronic, the person needs to change, and often others can help.

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