Module: TTU **Level: Second Year**

Semester: 2 **Groups: 1 &2**

I. RESEARCH METHODS IN EDUCATION

1. EXPERIMENTAL STUDIES

Experimental studies are done in carefully controlled and structured environments and enable the causal relationships of phenomena to be identified and analysed. The variables can be manipulated or controlled to observe the effects on the subjects studied. Studies done in laboratories tend to offer the best opportunities for controlling the variables in a rigorous way, although field studies can be done in a more 'real world' environment.

An experimental design gives the most reliable **proof for causation**. In an **experimental study,** individuals are randomly allocated to at least two groups. One group is subject to an intervention, or experiment, while the other group(s) is not. The outcome of the intervention (effect of the intervention on the dependent variable/problem) is obtained by comparing the two groups.

❖ Quasi-experimental studies

In a **quasi-experimental study**, one characteristic of a true experiment is missing, either randomisation or the use of a separate control group. A quasi-experimental study, however, always includes the manipulation of an independent variable which is the intervention. One of the most common quasi-experimental designs uses two (or more) groups, one of which serves as a control group in which no intervention takes place. Both groups are observed before as well as after the intervention, to test if the intervention has made any difference. (This quasi-experimental design is called the 'non-equivalent control group design' because the subjects in the two groups (study and control groups) **have not been randomly assigned.)**

Another type of design that is often chosen because it is quite easy to set up uses only **one group** in which an intervention is carried out. The situation is analysed before and after the intervention to test if there is any difference in the observed problem. This is called a 'BEFORE-

AFTER' study. This design is considered a 'pre-experimental' design rather than a 'quasi-experimental' design because it involves neither randomisation nor the use of a control group.

2. CORRELATIONAL STUDIES

A correlation study aims at determining the degree of relationship between two or more quantifiable variables. Some authors consider this research as a type of **descriptive research**, since it describes the current conditions in a situation. A correlational study describes in quantitative terms the degree to which the variables are related.

3. EX-POST FACTO STUDIES

There is some research where both the effect and the alleged cause have already occurred and are studied by the researcher in retrospect. Such research is referred to as EX-POST FACTO (after the fact). Kerlinger (1973) defines Ex-post Facto research as : "Systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable".

Thus, in ex-post facto research or causal-comparative research the researcher has no control on the variables or he cannot manipulate the variables (independent variables) which cause a certain effect (dependent variables) being measured. Since this type of a study lacks manipulation of variables, the cause-effect relationship measured are only tentative. Some authors categorize Ex-post facto studies into the category of descriptive research. Though it too describes conditions that exist in a situation, it attempts to determine reasons or causes for the current status of the phenomena under study.

Both ex post facto and correlational research investigate relationships between variables. The major distinction between the two is that in ex post facto research one categorizes the participants into at least two groups on one variable and then compares them on the other variable. In correlational research, a researcher deals with one group of individuals measured on at least two continuous variables.

4. LONGITUDINAL STUDIES

These are studies over an extended period to observe the effect that time has on the situation under observation and to collect primary data (data collected at first hand) of these changes. Longitudinal studies are often conducted over several years, which make them unsuitable for most relatively short taught post-graduate courses. However, it is possible to base short time scale research on primary data collected in longitudinal studies.

5. CROSS-SECTIONAL STUDIES

This is a study involving different organisations or groups of people to look at similarities or differences between them at any one particular time, e.g. a survey of the IT skills of managers in one or a number of organisations at any particular time. Cross-sectional studies are done when time or resources for more extended research. It involves a close analysis of a situation at one particular point in time to give a ‘snap-shot’ result.

II. VARIABLES IN RESEARCH

There are five types of variables. These are: (1) Independent Variables, (2) Dependent Variables, (3) Moderator Variables, (4) Control Variables, (5) Intervening Variables.

1. The Independent Variable: It is a stimulus variable. It is an input which operates either within a person or within environment to affect his/her behaviour. It is that factor which is measured, manipulated, or selected by the researcher to determine its relationship to an observed phenomenon.

2. The Dependent Variable: It is a response variable or output. It is an observed aspect of the behaviour of an organism that has been stimulated. The dependent variable is that factor which is observed and measured to determine the effect of the independent variable. It is the variable that will change as a result of variation in the independent variable. It is considered dependent because its value depends upon the value of the independent variable. It represents the consequence of change in the person or situation studied.

3. The Moderator Variable: It is defined as that factor which is measured, manipulated, or selected by the researcher to discover whether it modifies the relationship of independent variable to an observed phenomenon. The sex generally functions as a moderator variable.

4. The Control Variable: It is defined as that variable whose effect must be mentalised or cancelled by the researcher. In general, while the effects of the control variables are neutralized, the effects of the moderator variables are studied. Examples of control variables are: sex, intelligence, and socio-economic status.

5. The Intervening Variable: Each independent variable, moderator and control variables can be manipulated by the researcher and each variation can be observed by him/her as it affects the dependent variable. An intervening variable is that factor which affects the observed phenomenon, but cannot be seen and measured or manipulated. Examples of intervening variables are: the attitude, learning process, habit, and interest.

III. A RESEARCH HYPOTHESIS

After stating the research question and examining the literature, the quantitative researcher is ready to state a **hypothesis** based on the question. This should be done before beginning the research project. Recall that the quantitative problem asks about the relationship between two (or more) variables. The hypothesis presents the researcher's expectations about the relationship between variables within the question. Hence, it is put forth as a suggested answer to the question, with the understanding that the ensuing investigation may lead to either support for the hypothesis or lack of support for it.

There are two reasons for stating a hypothesis before the data-gathering phase of a quantitative study:

- A well-grounded hypothesis indicates that the researcher has sufficient knowledge in the area to undertake the investigation.
- The hypothesis gives direction to the collection and interpretation of the data; it tells the researcher what procedure to follow and what type of data to gather and thus may prevent a great deal of wasted time and effort on the part of the researcher.

1. Meaning of Hypothesis

The word hypothesis consists of two words: *Hypo+ thesis = hypothesis*

- 'Hypo' means tentative or subject to the verification or means composition of two/ it means more variables which is to be verified.
- 'Thesis' means statement about the solution of a problem / it means position of these variables in the specific frame of reference.

As such, **a hypothesis is a tentative statement about the solution of the problem. It offers a solution of the problem that is to be verified.**

2. Definitions of Hypothesis

The term hypothesis has been defined in several ways. Some important definitions have been given in the following:

• **According to J. E. Greigton**

"A hypothesis is a tentative supposition or provisional guess which seems to explain the situation under observation".

• **According to B. W. Tuckman**

"A hypothesis is defined as an expectation about events based on generalisation of the assumed relationship between variables".

• **According to M. Verna**

"A hypothesis is a theory when stated as a testable proposition formally and clearly and subjected to empirical or experimental verification"

Some Examples of Hypotheses

- ✓ "Students who eat breakfast will perform better on a math exam than students who do not eat breakfast."
- ✓ "Students who experience test anxiety prior to an English exam will get higher scores than students who do not experience test anxiety.

3. Types of Hypothesis

A hypothesis may be classified in either of these two major types null or the alternative form.

The null hypothesis is denial of an existence, an attribute, a relationship, a difference or an effect. As such, it is stated in the negative form of the statement.

In contrast, **the alternative hypothesis** states the very opposite of what the null hypothesis predicts. Tentatively, it affirms the existence of a phenomenon.

4. Variables in Hypotheses

Hypotheses propose a relationship between two or more variables. An independent variable is something the researcher changes or controls. A dependent variable is something the researcher observes and measures.

Daily apple consumption leads to fewer doctor's visits.

In this example, the independent variable is apple consumption — the assumed cause. The dependent variable is the frequency of doctor's visits — the assumed effect.

5. **Elements of a Good Hypothesis**

When trying to come up with a good hypothesis for your own research or experiments, ask yourself the following questions:

- Is your hypothesis based on your research on a topic?
- Can your hypothesis be tested?
- Does your hypothesis include independent and dependent variables?

Before you come up with a specific hypothesis, spend some time doing **background research**. Once you have completed a literature review, start thinking about potential questions you still have. Pay attention to the discussion section in the journal articles you read. Many authors will suggest questions that still need to be explored.

In order to form a hypothesis, you should take these steps:

- Collect as many observations about a topic or problem as you can.
- Evaluate these observations and look for possible causes of the problem.
- Create a list of possible explanations that you might want to explore.
- After you have developed some possible hypotheses, think of ways that you could confirm or disprove each hypothesis through experimentation. This is known as falsifiability.

6. **Developing a Hypothesis**

a. Ask a question

Writing a hypothesis begins with a research question that you want to answer. The question should be focused, specific, and researchable within the constraints of your project.

Do students who attend more lectures get better exam results?

b. Do some preliminary research

Your initial answer to the question should be based on what is already known about the topic. Look for theories and previous studies to help you form educated assumptions about what your research will find. At this stage, you might construct a conceptual framework to identify which variables you will study and what you think the relationships are between them.

c. Formulate your hypothesis

Now you should have some idea of what you expect to find. Write your initial answer to the question in a clear, concise sentence.

Attending more lectures leads to better exam results.

d. Refine your hypothesis

You need to make sure your hypothesis is specific and testable. There are various ways of phrasing a hypothesis, but all the terms you use should have clear definitions, and the hypothesis should contain:

- The relevant variables.
- The specific group being studied.
- The predicted outcome of the experiment or analysis.

e. Phrase your hypothesis in three ways

A hypothesis often follows a basic format of "If {this happens} then {this will happen}." One way to structure your hypothesis is to describe what will happen to the **dependent variable** if you make changes to the **independent variable**. The basic format might be: "If {these changes are made to a certain independent variable}, then we will observe {a change in a specific dependent variable}."

If a first-year student starts attending more lectures, then their exam scores will improve.

In academic research, hypotheses are more commonly phrased in terms of correlations or effects, where you directly state the predicted relationship between variables.

The number of lectures attended by first-year students has a positive effect on their exam scores.

If you are comparing two groups, the hypothesis can state what difference you expect to find between them.

First-year students who attended most lectures will have better exam scores than those who attended few lectures.

f. Write a null hypothesis

If your research involves statistical hypothesis testing, you will also have to write a null hypothesis. The null hypothesis is the default position that there is no association between the variables. The null hypothesis is written as H_0, while the alternative hypothesis is H_1 or H_a.

H_0: The number of lectures attended by first-year students has no effect on their final exam scores.
H_1: The number of lectures attended by first-year students has a positive effect on their final exam scores.

Examples of Hypthesis in Education: The following are additional examples of hypotheses in educational research:

- Boys in elementary school achieve at a higher level in single-sex classes than in mixed classes.
- Students who complete a unit on problem-solving strategies will score higher on a standardized mathematics test than those who have completed a control unit.
- Middle school students who have previously taken music lessons will have higher math aptitude scores.

- Students who do warm-up exercises before an examination will score higher on that examination than those who do not.
- Elementary school children who do not get adequate sleep will perform at a lower level academically than will their peers who have adequate sleep.

7. Characteristics of a Good a Hypothesis

- A hypothesis must be **testable**.
- A hypothesis should be **consistent with the existing body of knowledge**.
- A hypothesis should be stated as **simply and concisely** as possible.

Once a researcher has formed a testable hypothesis, the next step is to select a research design and start collecting data.