UNIT 4 DESCRIPTIVE, EXPERIMENTAL AND ACTION RESEARCH

Structure

4.0 INTRODUCTION

As you studied in the previous Units, a 'research method' is a particular way of studying a problem. The 'method' is determined by the features of the research problem and also the field of inquiry. Units 2 and 3 dealt with 'Historical Method', 'Philosophical Method', 'Naturalistic Method' and "Case Study". This Unit is a continuation of the previous Unit. Here, we shall discuss three more important research methods, viz., Descriptive Method, the Experimental Method and Action Research.

4.1 OBJECTIVES

After the completion of this Unit you should be able to

- Describe the steps involved in descriptive research,
- Explain the characteristics and features of a few types of descriptive research such as survey research, documentary analysis, correlational studies and causal-comparative studies,
- Describe the steps involved in experimental research,
- Identify and explain a few designs for experimental studies,

- Describe Action Research and its various stages, and
- Compare Action Research with Applied Research.

4.2 DESCRIPTIVE RESEARCH

Descriptive research studies are designed to obtain information concerning the current status of a given phenomenon. They are concerned with the existing conditions or relationships, prevailing practices, current beliefs, points of view or attitudes, processes that are going on and their effects and the developing trends. In short, it determines the nature of a situation as it exists at the time of study. The aim of descriptive research is to describe "what exists" with respect to variables or conditions in a situation.

The descriptive research method is appropriate in behavioural sciences. Many types of behaviour that interest the researcher cannot be arranged in a realistic setting. For example, it would be unthinkable to prescribe cigarette smoking for the purpose of studying its possible relationship to throat or lung cancer, or deliberately arrange accidents, in order to evaluate the effectiveness of seat-belts or helmets in preventing serious injuries.

Although some experimental studies of human behaviour can be appropriately carried out both, in the laboratory and in the field, the prevailing method used in social sciences is descriptive. Under the conditions that naturally occur at home, inside the classroom, on the playground or within the community, human behaviour can be systematically examined and analysed. This analysis may lead to the modification of factors or influences that determine the nature of human interaction. It is through this modification of factors that social institutions may become more effective influences in promoting human welfare.

4.2.1 Descriptive Research: Main Steps

In descriptive studies, we do not present private convictions and data based on casual or cursory observations. In a descriptive study, we

i) examine the problematic situation,
ii) define our problem and state our hypothesis,
iii) list the assumptions upon which our hypothesis and procedures are based,
iv) select appropriate subjects and source material,
v) select or construct techniques for collecting data,
vi) validate the data gathering techniques,
vii) make objective and discriminating observations,
viii) describe, analyse and interpret our data in clear, precise terms.

We, as researchers, collect evidence on the basis of some hypothesis, tabulate and summarize the data carefully, and then analyse the results thoroughly in an endeavor to draw meaningful generalizations that will advance knowledge.

Collection of data

When presenting a descriptive research report, one must identify not only the kind of data obtained but also the exact nature of its population. The units that constitute a population may be people, items, events or objects. After identifying the population, one must decide whether to collect data from (a) the total population or (b) a representative sample of the population.

a) **Total population:** Obtaining information from every unit of a small population is not difficult in most instances, but the findings are not applicable to any population other than the group studied. After collecting information from every student in one particular study center, you may, draw generalizations about the average age or the kind of profession of students in the center; but, you cannot claim that these generalizations will hold true for students in any other study center. Similarly, after studying the attitude of teachers of the School of Education in IGNOU towards the Distance Education Programme, a researcher cannot claim that the findings will hold true for teachers in other schools of IGNOU.

b) **Sample population:** Obtaining information from a large population, such as all teachers in the state, is often impractical, impossible or exorbitantly costly. Contacting, observing, measuring or interviewing every unit in the group may absorb so much time that the data becomes obsolete before the study is complete. To overcome these difficulties, investigators often collect information from a few carefully selected units drawn from a population.While carrying out the research on Study Habits of undergraduate students of IGNOU, the researcher cannot collect data from all the 50,000 undergraduate learners. He/she will have to select a representative sample of the population. However, the sample will have to be selected from different categories of the population, viz. male/female, employed/unemployed etc. If these sample units represent accurately the characteristics of the population, generalisations based on the data obtained from them may be applied to the entire group. But selecting a representative sample is a difficult task. How to select a proper sample is the topic of discussion in Unit 1, Block 3.

Descriptive data may be expressed qualitatively (in verbal symbols) as well as quantitatively in mathematical symbols. A study may consist almost exclusively of one form or may contain both forms. If an investigator is comparing the undergraduate programmes of selected open universities, he/she may present qualitative data, i.e., word descriptions concerning the organisation of the programmes, the duties of the counsellors, the decisions of the board of education regarding the programme etc. But he/she may also include considerable quantitative data, such as, the amount of money spent on the printed material, the number of students served by each counsellor and the amount of specialised training which the counsellors have received.

Qualitative data - word description - may predominate in studies that examine the general nature of a phenomena. Qualitative studies give social scientists useful information, but verbal symbols lack precision as words do

not hold the same meaning for all people, at all times, and in all contexts. However, qualitative studies need not be looked down upon; for, they help workers identify the significant factors to measure. Until these general explorations are made, measurement cannot be utilised fruitfully.

4.2.2 Types of Descriptive Research

In this sub-section, we are going to discuss various types of descriptive research. There is nothing sacrosanct about such a categorisation, but it helps us understand the phenomenon (research) more clearly.

i) **Survey studies:** Quite often, descriptive research itself is termed survey research, but it is better to think of it as a **category** under descriptive research.

'Survey' is probably the most widely used method for obtaining descriptive and evaluative information in education. When trying to solve problems, educational, governmental, industrial and political, organisations often conduct surveys. Detailed descriptions of existing phenomena are collected with the aim of employing the data to justify current conditions or practices or to make more intelligent plans for improving them. The objective may not only be to ascertain status, but also to determine the adequacy of status by comparing it with selected or established standards. Educators who wish to improve existing status of a unit may survey how others have solved similar problems. At times, we need to collect all three types of information:

- data concerning existing status, e.g., to find out the study habits of undergraduate students of IGNOU,
- comparison of status and standards, e.g., to compare the achievement level of distance education students and conventional education students, and
- means of improving status e.g., to find out measures to improve student support services in distance education programmes.

On the other hand, we can also limit our studies to one or two of these types.

Surveys may be broad or narrow in scope. They may be confined to a small geographical area or a whole state or even the country. Survey data may be gathered from every member of a population or from a carefully selected sample. For instance, in order to find out the study habits of undergraduate students of IGNOU, a survey may be made of all the undergraduate students of IGNOU with respect to their age group, employment status, socio-economic status, etc. Alternatively, it can also be a survey of a sample of students belonging to one particular course. The scope and the depth of the study depend primarily on the nature of the problem.

The steps involved in survey research are, in general, similar to what we stated for descriptive research. However, the steps taken particularly in the case of surveys are presented as follows:

a) **Planning** involves the determination of what topic is to be investigated and what population is to be studied. At this stage, one also decides the methods and procedures that will be used to gather the data.

b) **Sampling** involves decision making about which people from the population are to be included in the survey. If one is to generalise from the sample to the population, it is essential that the sample selected be representative.

c) **Construction of data-gathering instruments** involves writing the questions and planning the format of the instrument to be used. Among the data-gathering techniques used in surveys are personal interviews, questionnaires, rating scales, etc.

d) **Carrying out the survey** includes pre-testing the instrument to determine whether it will obtain the desired data, interviewing subjects or distributing questionnaires to them, and verifying the accuracy of the data gathered.

e) **Processing the data** includes tabulating the data, computer processing of the data (if necessary), interpreting the results, and reporting the findings.

The information sought in most surveys of educational institutions falls broadly into the following categories:

- the setting for learning,
- the characteristics of educational personnel,
- the nature of learners,
- the nature of educational process, and
- the relationship between various sets of variables.

Studies may explore extensively one or more of these areas or they may examine intensively specific aspects of just one area.

ii) **Analysis of documents:** From documents and records, we can unearth pertinent data. Documentary analysis, which is sometimes referred to as 'content', 'activity', or 'informational' analysis is very much like historical research. Both methods of investigation require that researchers examine existing records : historical research is primarily concerned with the more distant past, but descriptive research is concerned chiefly with the present.

A wide variety of documentary surveys are made. Some scholars analyse judicial decisions, state laws on education or rulings of a university boards. Researchers may also gather data describing existing educational practices in schools and colleges, processes and conditions from administrative records, forms and reports, committee reports and minutes of meetings, budget and financial records, etc.

University catalogues or bulletins may provide information about curriculum offerings, content of particular courses, entrance or graduate requirements. Syllabi, courses of study, reading lists, text books and such

other documents may help investigators in determining what is taught. To determine what content should be included in the curriculum, investigators have also analysed the types of errors made by learners in oral and written communication, arithmetic and other subjects. To determine what facts, topics, issues and generalisations are most frequently used in adult life, social scientists have tabulated the frequency of their mention in newspapers, periodicals, motion pictures, cartoons and other sources. Studies such as these have led to important curricular revisions.

Thus, amongst the advantages and purposes that may be served through documentary analysis, we include the following:

a) to describe the prevailing practices or conditions in the educational field (e.g., entrance requirements at any open university),
b) to discover the relative importance of, or interest in certain problems or topics, i.e., to spot trends (e.g., public information on education as measured by newspaper coverage in a particular month),
c) to discover the level of difficulty of presentations available in text books or in other publications (e.g., vocational level of intermediate science text books; abstract concepts found in the first grade text books),
d) to evaluate bias, prejudices or propaganda in text book presentation (e.g. Soviet Union as it was represented in school text books in America, racial, religious or sex stereotypes),
e) to analyse the types of errors and weaknesses in students' performance, e.g., typing errors, errors in English usage,
f) to evaluate the relationships of stated objectives and what is being taught, and
g) to identify the literary style, concepts or beliefs of a writer.

Documentary research produces valuable information, but the method has certain limitations, and investigators may draw faulty conclusions from the data. An analysis of errors made on test papers, for example, may reveal what difficulties pupils encounter, but this information is of limited use, for it does not reveal why they made the errors. Similarly, counting the frequency of occurrence of particular contents or activities, and measuring the amount of time and space devoted to them may not reveal the importance of the item being analysed. It has been noticed that the position of content in a record or document and the emotional terms with which it is described are factors that must also be considered, and that it is quite a complex objective to achieve.

Some documentary research findings are of little value because the investigators fail to analyse the representative sample of source materials. Many studies do not provide information concerning the adequacy of the sample size or the conformity of the sample to the universe. If an analysis is made of newspaper editorials concerning the various types of schools, or university teachers' unions, for example, the reader must judge for himself/herself whether the newspapers selected represent the opinion of the different social, religious, economic or political groups from all the parts of the country. Very often, the write-ups are not representative in nature.

Documentary research is not without other pitfalls as well. Data do not become true reflections of reality through the magic of publication. In using documentary sources, one must bear in mind the fact that data appearing in print are not necessarily trustworthy. One must subject each documentary source material to the same rigorous external and internal criticism that a historian does. Moreover, the categories used in the available statistical material do not always coincide precisely with the variables which the educator wants to investigate. Sometimes the definitions of categories are ambiguous, and they may change from year to year. The boundaries of some units of analysis, e.g., school districts, age cohort, etc. can also change; different agencies collecting similar data do not always use exactly the same classificatory system. The data collected always reflect the orientation, concerns, self-interests, and the levels of accuracy preferred by of the producers of the records, which may not be an accurate reflection of reality or behaviour.

Check Your Progress 1

List the steps involved in survey studies. Describe briefly in about 30 words the objectives of documentary analysis.

Notes: (a) Space is given below for your answer.
(b) Compare your answer with the one given at the end of this unit.

.....
.....
.....
.....
.....
.....
.....
.....

iii) **Correlational studies:** Human behaviour at both, the individual and the social levels is characterised by great complexity. However, given the present state of social research, we understand too little of this complexity. One approach to a fuller understanding of human behaviour is to begin by testing out simple relationships between those factors and elements which are supposed to have some bearing on the phenomenon in question. The value of correlational research is that it is able to achieve this end. We know that one of the primary purposes of science, as conceived traditionally, is to discover relationships among phenomena with a view ultimately to predicting and, in some situations, controlling their occurrence.

Much of social sciences research in general, and educational research in particular, is concerned at our present stage of development with the first step in this sequence, i.e., establishing interrelationships among variables. Correlational studies are concerned with determining the extent of relationship existing between variables. They enable us to measure the

extent to which variations in one variable are associated with variations in another. We may wish to know, for example, how delinquency is related to social and class background, or whether a relationship exists between the number of years spent in full-time education and subsequent annual income, or whether there is a link between personality and achievement.

Correlational studies are generally intended to answer three questions. They are:

a) Is there a relationship between two variables (or two sets of data)? If the answer to this question is 'yes', then two other questions follow:
b) What is the direction of the relationship? and
c) What is the magnitude of the relationship? The magnitude of the relationship is determined by the coefficient of correlation.

For instance, on the basis of his/her experience, a researcher may hypothesize that there is a relationship between performance in an intelligence test and a test of achievement in arithmetic. The correlational technique will help him test his/her hypothesis about the relationship between these two variables and assess the magnitude of the relationship. Pearson's product moment, one of the best known measures of association, is a statistical value of the coefficient of correlation ranging from -1.0 to +1.0, through zero and expresses a relationship in quantitative form. Where the two variables fluctuate in the same direction, i.e., as one increases so does the other, a **positive** relationship is said to exist. A **negative** correlation or relationship, on the other hand, is to be found when an increase in one variable is accompanied by a decrease in the other variable. The values near zero indicate a weak relationship between the variables, whereas values closer to either +1.0 or -1.0 indicate a stronger relationship in either of the directions. Thus, the coefficient of correlation, tells us something about the relationship between **two variables**. However, other measures exist which allow us to specify relationships when more than two variables are involved. These are known as measures of **multiple correlation and partial correlation**. (We will not go into details about these measures over here).

One danger in interpreting correlations is to assume that because two variables are related in a predictable fashion to one another with a high degree of probability, they are also in a causal relationship. This is not necessarily the case. For one thing, there is never more than a probable relationship between variables in any case. For another, it is quite possible for two variables to be related to one another with a high degree of probability but with a third variable accounting for the nature of relationship. Correlation must not be interpreted to mean that one variable is causing the scores in the other variable to be what they are. For example, it may be found that there is a negative correlation between measures of anxiety and measures of intelligence. It should not be interpreted that there is a causative relationship between anxiety and intelligence, that is, that pupils are anxious because they are unintelligent or that pupils appear unintelligent because they are anxious. It might be that there are other underlying characteristics of individuals that tend to make some appear

unintelligent and anxious, and others, intelligent and not anxious. Interpretation of such a correlation is difficult without experimental confirmation. For example, the relationship between anxiety measures and intelligence measures could be investigated experimentally by deliberately inducting anxiety in a testing situation and determining the effect on intelligence test scores.

Characteristics of correlational studies

Correlational studies can be broadly classified either as **relational studies** or as **prediction studies**. As a method, the former is particularly useful in exploratory studies in fields where little or no previous research has been undertaken. It is often a shot in the dark aimed at verifying hunches which a researcher has about a presumed relationship between some characteristics or variables. Take a complex notion like **teacher effectiveness** for example. This is dependent on a number of complex factors operating singly or in combination. Factors such as intelligence, motivation, person, perception, verbal skills, etc., come to mind as possibly having an effect on teacher outcomes. A review of the literature of research will confirm or reject these possibilities. Once an appropriate number of such possibilities has been identified in this way, suitable measures may then be chosen or developed to assess them. They are then given to a representative sample, and the scores obtained are then correlated with the complex factor that is being investigated, namely, teacher effectiveness. As it is an exploratory undertaking, the analysis will consist of correlation coefficients only. The investigation and its outcomes may then be used as a basis for further research or as sources of additional hypotheses.

In contrast to exploratory research studies, prediction studies are usually undertaken in an area having a firmer and securer knowledge base. Prediction through the use of correlational technique is based on the assumption that at least some of the factors that will lead to the behaviour to be predicted are present and measurable at the time the prediction is made. For example, since we know that IQ and General Achievement (GA) are positively correlated, we can predict with some degree of accuracy that an individual with a high IQ will probably have a high GA. To be valuable for prediction, the extent of correlation between two variables must be substantial and, of course, the higher the correlation, the more accurate the prediction.

iv) **Causal-comparative studies**: There is, at times the need to discover **how** and **why** a particular phenomenon occurs, and not confine our investigation to **what** a phenomenon is like. In this instance, the investigator tries to compare the similarities and differences among phenomena to find out what factors or circumstances seem to accompany or contribute to the occurrence of certain events, conditions or practices.

Unlike a scientist working in a laboratory, an educator cannot always select, control and manipulate factors that are necessary to study cause-effect relations. An investigator cannot, for example, manipulate domestic background, social class, intelligence, etc. In situations that do not allow

researchers manipulate the independent variable and establish the controls that are required in "true experiments", they may conduct a causal-comparative study.

In a causal-comparative investigation, a researcher studies a real life situation in which subjects have experienced what he/she wants to investigate. For example, if an investigator wants to study emotional instability, he/she does not place children in a situation where all factors are kept constant except one variable which is manipulated to determine what causes a particular type of emotional disturbance. Rather, he/she chooses children who according to a selected criterion, are 'disturbed' and compares them with emotionally stable children. After searching for factors or conditions which seem to be associated with one group and not the other, he/she may present a possible explanation of the underlying causes of the emotional problem.

Limitations of causal-comparative method

i) Lack of control is a serious limitation and weakness of this method of research.

ii) It is usually difficult to identify the relevant factors causing a particular condition or phenomenon. For instance, students' liking for a teacher depends on a number of factors and a researcher may not be able to identify all the factors. He/she may only be able to identify good teaching and mastery of subject matter as some of the factors effecting students' liking for a teacher.

iii) The joint method of agreement and disagreement requires that a single factor must be the cause for the occurrence or non-occurrence of the phenomenon. But in the case of social phenomena, with which an educational researcher is usually concerned, this condition does not come invariably. In fact, in these situations events usually have multiple rather than single causes. Furthermore, a phenomenon may result not only from multiple causes but also from one cause in one instance and from another cause in another instance.

iv) When a relationship between variables is established, it is difficult to distinguish between the cause and the effect.

v) The classification of subjects into dichotomous groups for the purpose of comparison also presents problems.

vi) In comparative studies of natural situations, the researcher does not have the same control over the selection of subjects as he/she has in experimental studies. It is difficult to identify existing groups of subjects who are alike in all respects except for their exposure to one variable.

Though causal-comparative studies have many limitations, and they do not often produce precise and reliable knowledge that can be gained through rigorous experimental studies, they provide the means of tackling problems that cannot be probed in laboratory situations. Furthermore, they yield valuable information and clues concerning the nature of phenomena and are well suited to many types of field studies seeking to establish causal relationships.

Check Your Progress 2

Explain briefly the purpose of correlational studies. List the weaknesses of causal-comparative studies.

Notes: (a) Space is given below for your answer.
(b) Compare your answer with the one given at the end of this Unit.

.....
.....
.....
.....
.....

4.3 EXPERIMENTAL RESEARCH

Experimental research studies are designed for establishing causal relationships. This method begins with a question concerning the relationship between two or more variables. At the same time, the researcher advances one or more hypotheses stating the nature of the expected relationship. The experiment is the event planned and carried out by the researcher to gather evidence relevant to the hypotheses.

The application of experimental method yielded better results in physical sciences; therefore, this method was soon applied to other sciences like biological sciences and medicine. Towards the end of the 19th century, scholars began to apply the same methods to psychological problems, thus beginning experimental psychology. Joseph M. Rice and Thorndike were the early investigators who extended the experimental method to education (Ary ct.al. 1972).

In its simplest form an experiment has three characteristics:

i) an independent variable is manipulated,
ii) all other variables except the independent variable are held constant, and
iii) the effect of the manipulation of the independent variable on the dependent variable is observed.

The independent variable and the dependent variable(s) are important in an experiment. The independent variable is manipulated or changed by the experimenter. The variable upon which the effects of changes are observed is called the dependent variable, which is observed but not manipulated by the experimenter. The dependent variable is so named because its value is hypothesised to depend upon, and vary with, the value of the independent variable. For example, to examine the effect of different teaching methods

upon achievement in reading, an investigator would manipulate method, the independent variable, by using different teaching methods in order to ascertain their effect upon achievement, the dependent variable.

4.3.1 Three Characteristics of Experimental Research

There are three essential ingredients in the conduct of an experiment: control, manipulation and observation. We shall discuss each of them as follows:

i) **Control**: Control is the first essential ingredient of experimental method. Without control, it is impossible to evaluate unambiguously the effects of an independent variable. Basically, the experimental method rests upon two assumptions regarding variables. These are:

a) If two situations are equal in every respect except for a variable that is added to or deleted from one of the situations, any difference appearing between the two situations can be attributed to that variable. This statement is called the **law of the single variable.**

b) If two situations are not equal, and it can be demonstrated that none of the variables is significant in producing the phenomenon under investigation, or if significant variables are made equal, then any difference occurring between the two situations after the introduction of a new variable to one of them can be attributed to the new variable. This statement is called **the law of the only significant variable.**

The main purpose of 'control' in an experiment is to arrange a situation in which the effect of variables can be measured. The conditions to be fulfilled under the first law can be obtained more easily in physical sciences. A high degree of control is much easier to achieve in a laboratory setting than in situations outside the laboratory. In the laboratory, there is only a limited number of variables which can be manipulated easily. However, as educational research is concerned with human beings, there are always many variables present in a situation. To attempt to reduce educational problems to the operation of a single variable, is not only unrealistic but perhaps impossible as well. Fortunately, we do not require such rigorous control to be introduced in educational settings, for many factors involved in such a setting may be quite insignificant and irrelevant for our study. To this extent, in educational research, the *law of the single significant* variable is more appropriate. For example, if we were to study the effect of two methods of teaching arithmetic to two groups of children, we are likely to select the two groups which are identical in every respect except in the way they are taught arithmetic. But it is impossible to have two groups that are identical in every respect. So, the endeavour of the researcher should be towards obtaining two groups that are as similar as possible, at least in those factors that are thought to have an effect on achievement in arithmetic. These could be, general intelligence, motivation, reading ability, etc. Other variables that are not likely to affect achievement in arithmetic can be ignored. For example, height and weight of children need not have any

relation with achievement in arithmetic. So, these variables can be safely ignored while establishing the similarity of the two groups. Thus, in experimental studies in education we need procedures that permit us to compare groups on the basis of significant variables. 'Control' is the term used to indicate an experimenter's 'procedures' for eliminating the differential effects of all variables extraneous to the purpose of the study. (An extraneous variable is a variable that is not related to the purpose of the study but may affect the dependent variable). The experimenter exercises controls, for instance, when the groups are made comparable on extraneous variables that are related to the dependent variable. If a variable is known to be unrelated to the dependent variable, it cannot influence the dependent variable and we do not need to control it for its effects.

ii) **Manipulation** : Manipulation of a variable is another distinguishing characteristic of experimental research. It refers to a deliberate operation performed by the researcher. In contrast to the descriptive research, in which the researcher simply observes conditions as they occur naturally, the researcher in the experimental research actually sets the stage for the occurrence of the factors whose performance is to be studied under conditions where all other factors are controlled or eliminated. In educational research and other behavioural sciences, the manipulation of a variable takes a characteristic form in which the experimenter imposes a predetermined set of varied conditions on the subjects. This set of varied conditions is referred to as the independent variable, the experimental variable, or the treatment variable. Then, different conditions are designed to represent two or more values of the independent variable; these may be differences in degree or differences in kind. That is, the independent variable may assure two or more values and the difference in the values may be of quantitative or qualitative nature. Methods of teaching, attitudes, socio-economic status, personality characteristics, types of motivation, etc. are some common examples of the independent variable in educational research. For example, if the researcher compares two methods of teaching, then method of teaching is the independent variable and can be manipulated by the teacher. We may manipulate a single variable or a number of variables simultaneously.

iii) **Observation:** In experimentation, we are interested in the effect of the manipulation of the independent variable on a dependent variable. Observations are made with respect to some characteristics of the behaviour of the subjects employed in the research. These observations, which are quantitative in nature, may constitute the dependent variable. This needs some explanation.

The dependent variable in educational research is often achievement of some type, such as learning. We are often interested in explaining or predicting achievement. Since learning cannot be measured directly, we can only estimate it through measures like scores in a test. Therefore, strictly speaking, the dependent variable is scores or observations rather than achievement.

Check Your Progress 3

Explain briefly the significance of control, manipulation, and observation in an experimental study.

Notes: (a) Space is given below for your answer.
(b) Compare your answer with the one given at the end of this Unit.

.....
.....
.....
.....
.....
.....

4.3.2 Steps Involved in Experimental Research

A number of steps are involved in experimental research. Here, we shall talk about four steps to reach the stage of the 'actual experiment'. Brief explanations are needed for steps 3 and 4 only. The steps are

i) Surveying the literature related to the problem,
ii) Identifying and defining the problem,
iii) Formulating a problem hypothesis, and defining basic terms and variables. Stating of hypotheses is an important step in experimental research. They suggest that an antecedent condition or phenomenon (independent variable) is related to the occurrence of another condition, phenomenon, event, or effect (dependent variable). To test a hypothesis, the experimenter attempts to control all the conditions except the independent variable which he/she manipulates. Then he/she observes the effect on the dependent variable presumably because of the exposure to the independent variable,
iv) Constructing an experimental plan is the next step in experimental research. This refers to the conceptual framework within which the experiment is conducted. This would involve –

- identifying all the non-experimental variables that might contaminate the experiment and determine how to control them. If the researcher is interested in finding out the effect of two particular teaching methodologies on achievement in arithmetic, the pure effect of teaching methodology may get contaminated if the student gets extra coaching in arithmetic at home or some competition is held in the school,
- select a research design,
- select a sample of subjects to represent a given population, assign subjects to groups, and assign experimental treatments

to the groups. (Subject implies the respondent or living organism that is studied),
- select or construct and validate instruments to measure the outcomes of the experiment,
- outline procedures for collecting the data and possibly conduct a pilot or "trial run" test to perfect the instruments or design, and
- state the statistical or null hypothesis.

The above steps bring the researcher to the stage when he/she actually conducts the experiment, applies statistical measures to the data obtained, and then tests the significance of the results.

In the next sub-section, we shall take up the various designs involved in experimental method.

4.3.3 Designs of Experimental Study

A research design is very important for the researcher. A well developed design provides the structure and strategy to control the investigation and extract dependable answers to the questions raised by the problem or hypothesis. It is the nature of the problem that determines the appropriateness of the design.

Before we discuss the experimental designs, it will be relevant to look into the terms and symbols which we shall make use of.

i) X represents the *independent var*iable, which is manipulated by the researcher; it is also referred to as the experimental variable or the treatment variable.

ii) Y represents the measure of the *dependent variable*. Y_1 represents the dependent variable before the manipulation of the independent variable X; it is usually a pre-test of some type administered before the experimental treatment. Y_2 represents the dependent variable after the manipulation of the independent variable X; it is usually a post-test administered to subjects after the experimental treatment.

iii) S represents the *subject* or *respondent* used in the experiment.

iv) E group refers to the *experimental group* -- the group that is given the independent variable treatment.

v) C group refers to the *control group* -- the group that does not receive the experimental treatment.

vi) R indicates *random assignment* of subjects to the experimental groups and the random assignment of treatments to the groups.

There is a large number of experimental designs. Various authors have classified experimental designs into certain categories. Most common categorization comprises:

- Pre-experimental Design
- True Experimental Design
- Quasi Experimental Design

Some authors like Donald Ary and others (1985) add two more categories namely

- Factorial Design
- Time Series

Various designs under the above mentioned categories are given in the table below:

Pre-experimental	True Experimental	Quasi Experimental	Factorial Design	Time Series
• *One Group Pre-test Post-test Design* • *Static Group Comparison*	• *Randomized Subjects' Post-test only Control Group Design* • *Randomized Matched Subjects, Post-test only Control Group Design* • *Randomized subjects Pre-test Post-test control Group Design* • *Solomon Three Group Design* • *Solomon Four Group Design*	• *Nonrandomized Control Group, Pre-test Post-test Design* • *Counter Balanced Design*	• *Simple Factorial Design*	• *One Group Time Series Design* • *Control Group Time Series Design*

However, in this section, we will bring before you only a few most frequently used designs, from each of the five categories.

4.3.3.1 Pre-experimental Design

The two designs classified as pre-experimental designs offer minimal control of extraneous variables. Still they are used quite often for educational research. These designs help to illustrate the advantages of more rigorously controlled designs that are presented later.

Design 1. One Group Pre-test Post-test Design

When this design is employed, the dependent variable is measured before the independent variable or treatment is applied or withdrawn, and then measured yet again. The one group design usually involves three steps:

a) administering a pre-test measuring the dependent variable,

b) applying the experimental treatment X to the subjects, and
c) administering a post-test again measuring the dependent variable.

Differences attributed to application of experimental treatment are then determined by comparing the pre-test and post-test scores.

Pre-test	*Independent variable*	*Post-test*
Y_1	X	Y_2

Design 1. One Group Pre-test Post-test Design

To illustrate the use of this design, let us as distance teachers assume that we want to evaluate the effectiveness of a particular self-instructional material in Physics for undergraduate university students. How may we go about this task?

At the beginning of the academic year, the students are given a standardized test that measures the objectives of undergraduate Physics quite satisfactorily, following which the distance teacher then introduces the self-instructional material. At the end of the year, the students are administered the standardized test a second time. Comparing the scores of the two tests would reveal what difference the exposure to the SIM has made.

However, using only one group, as in Design 1, gives us superficial control. The major limitation of the one-group design is that, since no control group is used, the experimenter cannot assume that the change between the pre-test and the post-test scores is brought about by the experimental treatment alone. It is quite possible that some extraneous variables account for all or part of the change. For example, students experience changes with the passage of time; they grow mentally as well as physically, or they may acquire additional learning experiences that would affect the dependent variable. This extraneous variable can be thought of as **maturation** i.e. with the passage of time students get maturity and this in turn may effect achievement level. Another type of extraneous variable that can operate between the pre-test and the post-test scores and which cannot be controlled is **history**. History as a source of extraneous variance refers to the specific events that can occur between the pre-test and the post-test other than the experimental treatment. In the example cited above, not receiving material regularly or illness just before the test.could decrease achievement scores. Similarly, a crucial discovery in physics could increase widespread interest and hence affect the test scores. In fact, history and maturation become increasingly influential sources of extraneous variance when the time interval between Y_1 and Y_2 is long.

Another short coming of Design 1 is that it offers no way of assessing the effect of the pre-test Y_1 itself. We know that "practice effect" exists when subjects take a test a second time or take an alternate form of the test. In other words, subjects do better the second time even without any instruction or relevant discussion during the interval. This is true not only for achievement

and intelligence tests but also for personality tests. In the case of personality tests, a tendency towards better adjustment is generally observed.

To sum up, Design 1 has little to recommend it; without a control group to make a comparison possible, the results obtained in a one group design are basically uninterpretable. The results of the experiment would have been dependable if there could be a comparable group i.e. control group to which SIM had not been given.

Design 2. Static Group Comparison

Design 2 utilizes two or more groups, only one of which is exposed to experimental treatment. The groups are assumed to be equivalent in all relevant aspects, they differ only in their exposure to X.

This design is often used in educational research. For example the achievement of students taught by a new method is compared with that of a similar class taught by a traditional method.

Design 2 has a control group or groups, which permit(s) the comparison that is required for scientific respectability. If the experimental group is superior on the Y_2 measure, the researcher then has more confidence in his/her conclusion that the difference is due to experimental treatment.

However, there is a basic flaw in this design. Since neither **randomization** nor even **matching** is used to assign subjects to the experimental and control groups, we cannot be sure that the groups are equivalent prior to the experimental treatment. They may differ on certain relevant variables, and it may be these differences rather than X that are responsible for the observed change. Because we cannot be sure that the groups are equal with regard to all the factors that may influence the dependent variable, this design is considered to be lacking in the necessary control and must be classified as pre-experimental.

Group	*Independent Variable*	*Post-test*
E	X	Y_2
C	-	Y_2

Design 2: Static Group Comparison

4.3.3.2 True Experimental Designs

The following two designs, belong to the 'true experimental' design, because of the control that they provide. i.e.

(i) Random assignment of subjects to the groups.
(ii) Random assignment of treatment to the groups.
(iii) Post-testing all the groups.

Design 3. Randomized subjects, Post-test only Control Group Design

This particular design requires two groups to which subjects are randomly assigned and each group is assigned to a different condition. No pretest is used; randomization controls all the possible extraneous variables. This does not mean that randomization procedures (like drawing names out of a hat, or flipping a coin) remove the extraneous variables, such as the IQ or age, which may affect the dependent variable, or control their presence. These extraneous variables still affect the inquiry; but, now, it is the laws of chance rather than the personal features of E that operate. In fact, the larger the number of subjects used, the more equivalent or similar the groups will tend to be. Suppose a researcher wants to study the effect of instructional material on achievement in a course during a contact programme. He/she may randomly assign the students to the groups and provide treatment to one of the groups. The assigning of the treatment will be random. At the end of the contact programme he/she may test both the groups.

After the subjects are assigned to the groups, only the experimental group is exposed to the experimental treatment. Otherwise, in all other respects, the two groups remain similar. Members of both groups are then measured on dependent variable Y_2. Scores are then compared to determine the effect of X.

Group	*Independent Variable*	*Post-test*
(R)E	X	Y_2
(R)C	-	Y_2

Design 3: Randomized subjects, Post-test only Control Group Design

The main advantage of Design 3 is randomization, which assures statistical equivalence of the groups prior to the introduction of independent variable. Design 3 provides controls for the main effects of history, maturation and pretesting; because no pretest is used, there can be no interactional effect of pretest and X (treatment).

Design 4. Randomized Matched Subjects, Post-test only Control Group Design

This design is similar to Design 3 except that it uses a matching technique, rather than random assignment, to obtain equivalent groups. Subjects are matched on one or more variables that can be measured conveniently, such

as IQ or reading scores. The matching variables used are generally those that have a significant correlation with the dependent variable. On the basis of these variables, subjects are paired so that opposite members'/'scores' are as close as possible; and then, one member of each pair is randomly assigned to one treatment and the other to the second treatment.

Group	*Independent Variable*	*Post-test*
(Mr) E	X	Y_2
(Mr) C	-	Y_2

Design 4. Randomized matched subjects, Post-test only Control Group Design

Matching is most useful in studies where small samples are to be used and where Design 3 is not appropriate. Also, the matched subjects' design serves to reduce the extent to which experimental differences can be accounted for by initial differences between groups. However, for matching to really become a means of control, the matching of all the potential subjects must be complete, and the assignment of the members of each pair to the groups must be determined randomly. If one or more subjects should be excluded because an appropriate match could not be found, this would bias the sample. When using Design 4, it is essential to match every subject, even if only approximately, before random assignment is effected.

4.3.3.3 Quasi Experimental Design

One of the Quasi Experimental Designs is Non-randomized Control Group, Pre-test Post-test Design. You would notice that randomized control group pre-test post-test design is a true experimental design which we have presented before. The only difference in the quasi experimental design is that the groups are not randomized. Hence they are unlikely to be comparable. In fact, it is on this ground that the design becomes quasi experimental and not true experimental. Since the rest of the design related characteristics remain common with the randomized control group pre-test post-test design of the true experimental design category, we do not need to provide any further details on this design.

Group	*Pretest*	*Independent Variable*	*Post-test*
E	Y_1	X	Y_2
C	Y_1	-	Y_2

4.3.3.4 Factorial Designs

A factorial design is one where two or more variables are manipulated simultaneously in order to study the independent effect of each variable on the dependent variable as well as the effects due to interactions among the several variables. Factorial designs are of two types. In the first type, one of the independent variables may be experimentally manipulated. The

researcher is primarily interested in the effect of a single independent variable but he/she must take other variables into consideration which may influence the dependent variables. In the second type of design, all the independent variables may be experimentally manipulated. Factorial designs have been developed at varying levels of complexity. The simplest factorial design is the 2 by 2 (2 X 2) Design. The two independent variables have two values.

Level 1 subjects receive Treatment A and others Treatment B. Some level 2 subjects receive Treatment A and other Treatment B.

Attribute variable X_2	***Experimental Variable*** X_1	
	Treatment A	Treatment B
Level 1	Cell 1	Cell 3
Level 2	Cell 2	Cell 4

The strength of the factorial design is that it can achieve in one experiment what might otherwise require two or more separate studies.

4.3.3.5 Time Series Design

We have already discussed pre-test post-test designs. They generate one time data on the dependent variable before and after the experimental treatment. There are instances in educational systems where it becomes necessary to compare change in the trend of a particular phenomenon or process or product. For example, let us assume that learners behaviour – attitudes, achievements etc. changes over a period of time. If a specific treatment is introduced in an institution to study the change in attitude or achievement it is useful to study the trend through measurement at certain intervals before the introduction of the treatment. Instead of one time pre-test, the test is repeated three or four times before the treatment is administered. This generates data on the trend of behaviour. Similarly after the treatment is administered instead of one time post-test, the post-test is administered several times at intervals. This provides data to derive the trend in the change in behaviour. Since both, pre-tests and post-tests are used over a time, it is called Time Series Design. In a time series design the effect of the treatment on the dependent variable is tested by comparing the trends. This can be represented in the following form :

Y_1	Y_2	Y_3	Y_4	X	Y_5	Y_6	Y_7	Y_8

What we have described above is one group time series design. If you add a control group and repeat the same time series measurement without the treatment of the control group it becomes control group time series design. Similarly control group time series design is represented as.

Group									
E	Y_1	Y_2	Y_3	Y_4	X	Y_5	Y_6	Y_7	Y_8
C	Y_1	Y_2	Y_3	Y_4	-	Y_5	Y_6	Y_7	Y_8

Check Your Progress 4

Draw and compare the figures representing pre-test post-test experimental design and one group time series design.

Notes: (a) Space is given below for your answer.
(b) Compare your answer with the one given at the end of this unit.

4.4 ACTION RESEARCH

Many authors have pointed out the contradiction between the words and implied meanings of 'action' and 'research'. Action is a here and now activity whereas research is a planned, future-oriented activity. Research is preceded by careful planning for application of sophisticated methodology for generating knowledge that can be generalized. Action is temporal and intended to achieve immediate results without any agenda of generating generalizable knowledge. Whatever the strength of this argument, this contradiction is only apparent. Action research is a well developed research technique; it is also widely used in various sectors including education.

There is the other end of misunderstanding about action research. Some enthusiastic writers bring all types of research under action research as long as the researcher is a practitioner himself or herself. Action research has a definite meaning and practice distinctly different from other research methods.

It is difficult to define action research; indeed, the meaning is implied in the two words. Super-imposing relevant research methods and processes over action that is here and now is the main intention of action research as a means of solving problems. In other words, *Action Research is research intended to solve practical problems of an individual or a group or an institution through planned intervention in the day-to-day working. Here, the emphasis lies on solving problems through adoption of alternative practices.* Cohen and Manion described action research as, "a small-scale intervention in the functioning of the real world and a close examination of the effects of such intervention". On the basis of analyses of a number of action research cases, it becomes evident that it is

- Situational – it emerges out of situational needs and a solution is also designed with respect to the situation,
- Collaborative and Participatory – although individuals can carry out action research individually, it is increasingly becoming a team game where practitioners collaborate and participate with other colleagues in the organization and with the researchers, and
- Self-evaluative – just as action research is self-initiated since it evolves out of the perception of problems by the practicing individual or group, it becomes self-evaluative where the action research team evaluates the outcome of the exercise..

4.4.1 Action Research Contrasted with Applied Research

The emphasis of action research on problem solving has often been questioned as a topic of research itself. Nevertheless, almost all textbooks on research methodology provide separate treatment to action research, which indicates its acceptability and relevance. However, it is important to differentiate it with respect to other research methods and designs, particularly applied research. Obviously, if action research intends to solve problems through adoption of alternative practice and assessing its impact, it is not historical, philosophical or even survey type of research. It comes closer to experimental research, particularly, certain types of pre-experimental designs. The major departure from applied research is on the very intent of the two types of research studies. Let us see the differences between applied research and action research against a few issues of research methodology (see the table below).

Table 1. Comparison of Applied and Action Research on Methodological Components

Research Methods	Applied Research	Action Research
Goals	Creation of new knowledge through generalization	Locale specific problem solving
Hypothesis	Often formulated on the basis of previous research and theoretical knowledge	Not necessary; can be formulated by informed guess of the practitioners
Research design	Sophisticated	Crude
Treatment	Usually, decided and designed well in advance and not changed during the experiment	Interim review of the effect of treatment leads to modification of the treatment since emphasis is on problem solving
Sample	Randomised or representative	Whatever is available – sampling is not an issue
Variables	Carefully chosen and classified under categories like criterion, independent and intervening	Not an issue – whatever be the variables they are there in the problem situation
Tests and measurements	Necessary to check validity, reliability and objectivity; also relevance of norms where normative sampling is	Tests, questionnaires, etc, designed by practitioners can be adequate; however, instruments with tested

	necessary	properties like validity, reliability etc. provide better information and feedback
Statistical analysis of data	Sophisticated techniques are used not only to assess the impact of the independent variables on the treatment but also to assess the impact of intervening variables	Crude analysis that provides adequate feedback to the problem solving efforts is adequate

4.4.2 Partners in Action Research

There are at least three possible partners in action research. First, an individual teacher or an administrator may undertake action research to solve his/her problems in a work situation. The second important possibility is that, a group of teachers can undertake action research together where they have a common problem, like indiscipline, lack of motivation, etc. It is also possible that a group of administrators across educational institutions can undertake action research where they face a common problem. The third possibility is collaboration among practitioners – individual(s) or group(s). This collaborative action research brings the strength of the two or more types of professionals to bear upon the quality of research and also on the quality of the solution arrived at. In this case, research may take a more sophisticated form than normally it does in action research.

This partnership issue in action research brings us to another dimension. How large an operation can action research be? Well, it depends upon the partners. If it is one individual carrying out a problem solving exercise, obviously, the campus of the action research will be small. When several teachers join on one problem, the research may cover an entire institution. Extending it further, when several teachers or educational administrators across institutions in a district or a state join hands to solve a problem, the research may cover several institutions.

4.4.3 Areas of Action Research

Action research can cover almost every area of activity of an educational institution. Let us see a sample list.

1. Teaching methods – classroom instruction, laboratory practices, field trips, etc.
2. Learning strategies – individual study skills, study habits, group assignments, projects, cooperative learning, etc.
3. Evaluation procedures – evaluation of cognitive and non-cognitive skills, use of various techniques and tools of assessment, etc.
4. Staff development – in-service staff development programmes, trainings, work groups, workshop designing, etc.
5. Management and Administration – personnel management, information systems management, management of academic activities including evaluation, participatory management and team building, motivation, etc.

6. Behavioural changes – attitudes and values through specific scholastic and non-scholastic interventions, etc.

Thus, almost all areas have the potentiality of using action research for solving problems and for improvement of practices.

4.4.4 Stages of Action Research

There are four major stages in the conduct of action research. These stages are clearly demarcated. It can be a linear or spiraling process. Stage one comprises actual diagnosis of the problem. Often, the perceived problem is only symptomatic and not the real one. It becomes necessary to go deep into the problem through the symptoms to diagnose it clearly. Stage two is the planning stage where the treatment is designed and methods of assessing the impact are defined. Stage three is the actual implementation, collection and analysis of data to assess the change in the magnitude of the problem stage four is Reflection. These three stages can be broken down into eight stages as shown below:

Stage One – Diagnosis

1. Identification, evaluation and formulation of problems – diagnosing the problem on the basis of symptoms.
2. Preliminary discussions and negotiations among interested parties – specially important if the project is to be undertaken by more than one individual and in partnership with professional researchers.
3. Review of literature – though not in all cases, certain types of problem may call for reviewing research literature before articulating the problem.
4. Modification and redefinition of initial statement of problems – the discussion and negotiation of the stage two and review of related literature may warrant redefinition or refining the problem statement for the action research.

Stage Two – Planning the Intervention

5. Selection of research procedure – designing the intervention, sampling, administration, choice of material, and methods of evaluation.

Stage Three – Intervention and Impact Assessment

6. Implementation of the project – actually, carrying out the treatment designed on the sample as per the specifications arrived at stage 5 above. This will also include collection of relevant data. In some cases action research may also call for base line information, e.g. students' performance in a particualr subject; such information is collected before the treatment is administered to the sample.
7. Interpretation of data – the data collected needs to be interpreted through minimal statistical or qualitative analysis so that the impact of the treatment on the alleviation of the problem can be assessed.

Stage Four – Reflection

8. Beyond the factual data base results is the role of reflection with the main purpose of interpreting the results – the why's and how's of the findings and reflecting on the onward destination.

Although these stages are clearly demarcated, it is possible to interpret them in a linear sequence as well as in spiraling process. Wherever. Wherever the purpose of a piece of action research is limited to solving 'a unique problem' that is not typical, it can afford a linear sequencing and research is over here and now. However, wherever action research is taken up on a typical area of education, e.g. classroom instruction, it is pregnant with unlimited possibility. Each action research can lead to another level of excellence and performance in the selected area of education. In such areas, action research needs to be seen as a spiraling process.

4.4.5 Action Research in DE: A Case

There is a tremendous scope for action research in open and distance education. It can be taken up in formulating the design of self-instructional material. For example, will the learning improve if self-instructional materials include advance organizers or if it is written in deductive format. Action research can be carried out in personal contact programs, evaluation of distance learners, management of student support services or administration and management of distance learning institutions. Let us conclude with a brief case of an action research in open and distance education carried out in the National Open School of India.

With regard to Personal Contact Programmes (PCP), there were two different trends. One, large numbers of students do not attend Personal Contact Programmes. Two, there does not appear to be any difference in the performance of those students who attend and those who do not attend Personal Contact Programmes. So the questions were:

- Is PCP irrelevant for distance learners?
- Is there something wrong with the way PCPs are conducted?

A researcher decided to confront the second question and find a method so that those who attend PCP perform better. As a teacher of Physics, he designed a specific instructional approach for the PCPs and administered the usual weekends on selected topics of Physics for two full months. Students appeared for the final examination and the teacher waited for their results. As soon as the results were declared, he reviewed the results of those who attended the special PCP. He found that all of them had performed better than their counterparts who either attended the normal PCPs or those who did not.

Firstly, the performance in Physics improved by finding an adequate solution to the problem. Secondly, it was evident that there is nothing wrong with PCPs; they are relevant, but impact depends upon how they are designed and implemented.

Check Your Progress 5

Compare the goals of applied and action research.

Notes: (a) Space is given below for your answer
(b) Compare your answer with the one given at the end of this unit.

4.5 LET US SUM UP

In this Unit, we studied three important research methods, viz., Descriptive Method, Experimental Method and Action Research. Descriptive research describes what is and involves the description, recording, analysis and interpretation of conditions that exist. Experimental research describes what will be when certain variables are carefully controlled or manipulated. We also studied various types of descriptive research, like survey, documentary analysis, correlational and causal comparative studies. And lastly we discussed action research in detail.

4.6 CHECK YOUR PROGRESS: THE KEY

1) The steps involved in survey studies in education are: planning, sampling, construction of data gathering instruments, carrying out the survey and processing of the data.

Documentary analysis can show us the existing conditions and practices of an institution, the relative importance of problems in an institution and the difficulty level of learning materials. It also helps us to (i) evaluate the bias or propaganda found in textbooks and the relationships between objectives and the ways of achieving them, (ii) analyse the weaknesses of students and the errors made by them and (iii) identify the styles, concepts and beliefs of textbook/course writers.

2) Correlational studies are useful to:

- determine the relationship between variables and
- measure the extent to which variations in one variable are associated with the variations in another variable.

The weaknesses of causal comparative studies are: lack of control, difficulty in identifying the relevant causal factors, determining their number in a given phenomenon, classifying subjects into dichotomous groups for the purpose of comparison, lack of control over the selection of subjects.

3) Control is crucial to (i) evaluate unambiguously the effects of an independent variable and (ii) arrange a situation in which the effect of variables can be measured.

Manipulation controls or eliminates the irrelevant factors and arranges a situation in which only relevant factors can be studied.

Observations are made to study specific characteristics in the behaviour of the subjects employed in experimental research.

4) Pre-test Post-test Experimental Design

Group	***Pre-test***	***Treatment***	***Post-test***
E	Y_1	X	Y_2

One Group Time Series Design

Y_1	Y_2	Y_3	Y_4	X	Y_5	Y_6	Y_7	Y_8

Compared to one test each before and after the treatment in pre-test post-test experimental group design, tests are repeated at specified intervals in one group time series design. Whereas time series designs compares the trends of change in the dependent variable, the pre-test post-test experimental design tests one time gain or change in the dependent variable

5) Goals in applied research are creation of new knowledge through generalization whereas in action research the goals are local specific problem solving.

References

Ary, D., Lucy, C. Jacobs and Razavich, A., *Introduction to Research in Education,* Third Edition, New York: Holt, Rinehart and Winston Inc., 1972.

Cohen, L. and Manion, L. *Research Methods in Education* (Third Edition), London: Routledge, 1989.

Dear Student,

While studying the units of this block, you may have found certain portions of the text difficult to comprehend. We wish to know your difficulties and suggestions, in order to improve the course. Therefore, we request you to fill out and send us the following questionnaire, which pertains to this block. If you find the space provided insufficient, kindly use a separate sheet.

Questionnaire

Enrolment No | | | | | | | | | |

1.How many hours did you need for studying the units?

Unit no.	**1**	**2**	**3**	**4**	**5**
No. of hours					

2. Please give your reactions to the following items based on your reading of the block:

Items	**Excellent**	**Very Good**	**Good**	**Poor**	*Give specific examples, if poor*
Presentation Quality					
Language and Style					
Illustrations Used (diagrams, tables, etc.)					
Conceptual Clarity					
Check Your Progress Questions					
Feedback to CYP Questions					

3. Any other comments:

Mail to:
Course Coordinator (ES-315)
STRIDE, IGNOU, Maidan Garhi
New Delhi – 110068, India.