
Topic 1 ► The Educational Research Process

LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Identify the different methods of acquiring knowledge;
2. Define what is educational research;
3. Discuss the importance of educational research and its characteristics;
4. Identify the criteria of research;
5. Describe the steps involved in the research process;
6. Identify a research problem; and
7. List the criteria of a good research problem.

► INTRODUCTION

The word research has been used in many different ways and sometimes rather loosely giving rise to confusion and sometimes with the intention to deceive. The claim that the majority of dentists used the particular brand of toothpaste is misleading as there is not mention as to how many dentists were interviewed and whether they are representative of all dentists in the country. With regards to the advertisement on slimming pills, research on the use of various types of medicine and supplements by humans tend to be inconclusive. It would be difficult to make a claim that it will reduce weight as there are many other contributory factors such as gender, level of health, weight and so forth. In the strictest sense of the term what Azlan and Kong Beng are doing is not research.

Looking up facts and writing them down is nothing more than fact finding and fact transcribing (Leedy, 1974). There is even the tendency to call the written work a "research report" which is not accurate. It may be a report but not a research report. There needs to be a distinction between true research and the accumulation of facts. Research is a way of thinking; it involves thinking what we want to study, how we go about collecting data, analysing the data and deriving conclusions.

"Research has shown that 4 out of 5 dentists interviewed used Plantoid Herbal Toothpaste"

"Years of research has shown that SlimTex Capsules will reduce your weight in a matter of weeks"

"Azlan is doing research browsing through consumer reports, catalogues, brochures and market surveys before deciding what car

"Kong Beng is surfing the internet doing research on the symptoms of HIV AIDS"



ACTIVITY 1.1

Identify the different ways in which the word 'research' has been used in the statements above.

1.1 METHODS OF ACQUIRING KNOWLEDGE

Over the centuries, humans have accumulated vast amount of knowledge and the amount of knowledge produced is doubling every two years. There are many ways in which we obtain knowledge about a given phenomenon, event or situation. There are six ways in acquiring knowledge and they are; through our beliefs, intuition, authority, empiricism, rationalism and science (see Figure 4.1).

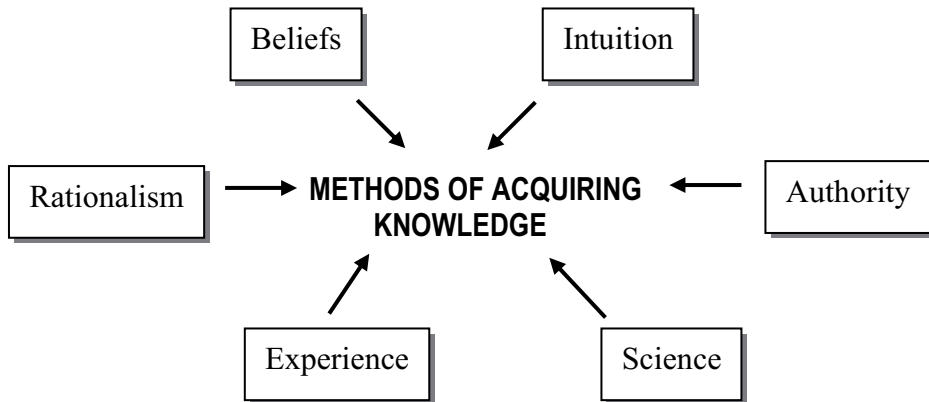


Figure 1.1: Methods of acquiring knowledge

Source: adaptation of G.C. Helmstadter, *Research concepts in human behaviour*.
New York: Appleton-Century-Crofts

- **Beliefs:** These are all superstitious beliefs people hold on to as though they are fact. For example, wear your lucky shirt when making deals which you strongly believe will bring you good fortune.
- **Intuition:** An approach in acquiring knowledge that is not based on reasoning or inferring. Intuitive knowledge is not scientific but is knowledge that originates from gut feeling or predictions by soothsayers, astrologers and fortune-tellers.
- **Authority:** Knowledge that originates from persons or sources that are highly respected. For example, various religions have a sacred text that represents the facts, which are considered indisputable, final and cannot be challenged.
- **Experience:** This approach of acquiring knowledge is based on the statement which says, “If I have experienced it, then it is valid and true”. In other words, only facts that are in agreement with experience are accepted, and those that do not are rejected. However, reliance on experience has its shortcomings because our perceptions of people, events and objects are affected by many factors. For example, we constantly add, delete and reconstruct our experiences.
- **Rationalism:** This approach uses reasoning to arrive at knowledge and assumes that valid knowledge is acquired through correct reasoning.

Ancient philosophers believed that knowledge derived from reasoning was just as valid as knowledge gained from observation. Reasoning is regarded as the beginning of the scientific process where hypotheses are proposed.

- **Science:** It is a process that is followed in generating knowledge and has been accepted as the best method of acquiring knowledge. It lists a series of steps to be followed when acquiring knowledge using the scientific method.

However, it has been argued that strictly following the scientific method prevents us from studying in depth human behaviour [We will discuss this issue in Chapter 7-9 under qualitative research].



ACTIVITY 1.2

1. Identify the different methods by which we acquire knowledge. Give specific examples for each method.
2. Which method has contributed most towards our understanding of how children learn? Give specific examples.

1.2 RESEARCH DEFINED

According to the Webster's dictionary, research is diligent scientific search or inquiry to discover facts. The Wikipedia encyclopaedia describes research as an active, diligent and systematic process of inquiry in order to discover, interpret or revise facts, events, behaviours or theories. Kerlinger defines research as "the systematic, controlled, empirical and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among the phenomena" (p.10). You will notice certain key words in these definitions of research:

- | | |
|----------------------------|----------------------|
| • Scientific | • Controlled |
| • Systematic process | • Theory, hypotheses |
| • Inquiry or Investigation | • Presumed relations |
| • Discover | • Natural phenomena |

It is a scientific (or systematic) process of gathering information about the hypothesised relations between phenomena. For example, to investigate if there is a relationship between a student's attitude towards mathematics and his or her performance in mathematics. The scientific method was popularised by John Dewey in 1933 and lists the following steps:

1. Formulation of a hypothesis (a tentative statement about the relation between two or more theoretical constructs. e.g. attitude and mathematic performance).

2. Test the hypothesis (design a study to establish whether the relationship between the constructs are as hypothesised).
3. Collect data (e.g. collect data on attitude towards mathematics and mathematics performance).
4. Decide to accept or reject the hypothesis (e.g. correlation between attitudes towards mathematics and mathematics performance).

The purpose of using the scientific method is to enable the researcher to describe (the relations between factors); to predict (given what is known we can we predict what might happen); to control (when certain variables are manipulated, does it lead to a particular condition), and to explain (can a theory be formulated to explain the phenomena being investigated).

1.3 CHARACTERISTICS OF RESEARCH

Research is a way of thinking and to qualify as a research it needs to have certain characteristics such as follows (adaptation of Leedy, 1993, Borg & Borg, 1983, Mitchell & Jolley, 1988).

- (a) **Research begins with a question in the mind of the researcher.**
You need only to look around and everywhere you see phenomena which will arouse your curiosity. For example, why are children in this school unable to read? Why are girls performing better than boys? These are situations in which the meaning of which you do not comprehend. By asking relevant questions we create an inquisitive environment which is the prerequisite for research. Research arises from a question that is intelligently asked with regards to a phenomenon that the researcher observes and is puzzling him or her.
- (b) **Research requires a plan.**
One does not discover the truth or explanations about a phenomenon without serious and meticulous planning. Research is not looking-up something in the hope of coming across the solution to your problem. Rather it entails a definite plan, direction and design.
- (c) **Research demands a clear statement of the problem.**
Successful research begins with a clear, simple statement of the problem. The statement of the problem should be stated precisely and grammatically complete, must set forth what it seeks to discover and enables one to see what one is attempting to research.
- (d) **Research deals with the main problem through subproblems.**
Divide the main problem into appropriate subproblems, all of which when resolved will result in the solution of the main research problem.

(e) **Research seeks direction through appropriate hypotheses.**

Having stated the problem and the related subproblems, the subproblems are then each viewed through logical constructs called hypotheses. A hypothesis is a logical supposition, a reasonable guess, an educated conjecture which may give direction to thinking with respect to the problem, and thus, aid in solving it.

(f) **Research deals with facts and their meaning.**

Having defined the problem, the subproblems and hypothesis, the next step is to collect whatever facts pertinent to the problem. Organise the data collected into a form that is potentially meaningful.



SELF-CHECK 1.1

1. Define research in your own words.
2. Identify the steps that are followed in gaining knowledge through the use of the scientific method.
3. What are the four objectives of science attempting to accomplish?
4. What are some characteristics of research?

1.4 WHAT IS EDUCATIONAL RESEARCH?

What is educational research? Generally, educational research is defined as research that investigates the behaviour of students, teachers, administrators, parents and other members of the community who interact with educational institutions. The word behaviour is taken broadly to mean such phenomena as learning, attitudes, aptitudes, abilities, interests, practices, processes, emotions and so forth.

What is the purpose of educational research? Since education is fundamentally the development of individuals then the central purpose of educational research is to find ways to improve student learning. It has been argued that educational research that does not have this as its ultimate motivation and objective is not educational research. Anyone who is engaged in a systematic search of ways to improve student learning is doing educational research. For example, a classroom teacher experimenting with alternative ways of explaining laws of physics and a full-time researcher comparing the effectiveness of different reading methods in early literacy programmes are both engaged in a search for ways to improve student learning, and, in this sense, are both engaged in educational research. The leadership styles of the school principal will influence teacher morale and job satisfaction which will translate to how teachers behave in

the classroom. So, the behaviour of school principals and headmasters can influence student learning and attitudes.



ACTIVITY 1.3

1. Do you agree with statement "...the central purpose of educational research is to find ways improve student learning"?
2. Give some examples of findings from educational research in your area of interest.

1.5 THE RESEARCH PROCESS

As discussed earlier, research is a systematic process which means there are definite steps involved. Figure 1.2 lists the seven steps involved in the research process.

1.5.1 Generating Research Ideas

For many beginning researchers and graduate students "the problem of finding a problem" can be difficult. There are cases of graduate students who have completed all coursework requirements and "get stuck" at the thesis stage and some never graduate. Hence, it is advisable that students search for a suitable problem early which they can explore throughout their coursework. The word 'problem' means there is dispute, controversy, debate or disagreement that needs to be addressed, solved or answered. For example, why do young learners have difficulty with multiplication and division operations compared to addition and subtraction operations in mathematics.

Where does one find research problems in education? They are all around you! There are abundant research problems or unresolved issues everywhere. Look at the 14 year old who says, "I hate history". Do you know why? Do you want to know why? In fact, whatever that arouses your interest for which there are as yet no answers or are inconclusive have the potential of being a research problem. Often one starts with a rather general, diffuse and even confused notion of the problem. Do not worry, this is the nature and complexity of research process. It is the first step towards becoming a mature researcher. The following steps are to help you get a research problem (see Figure 1.2).

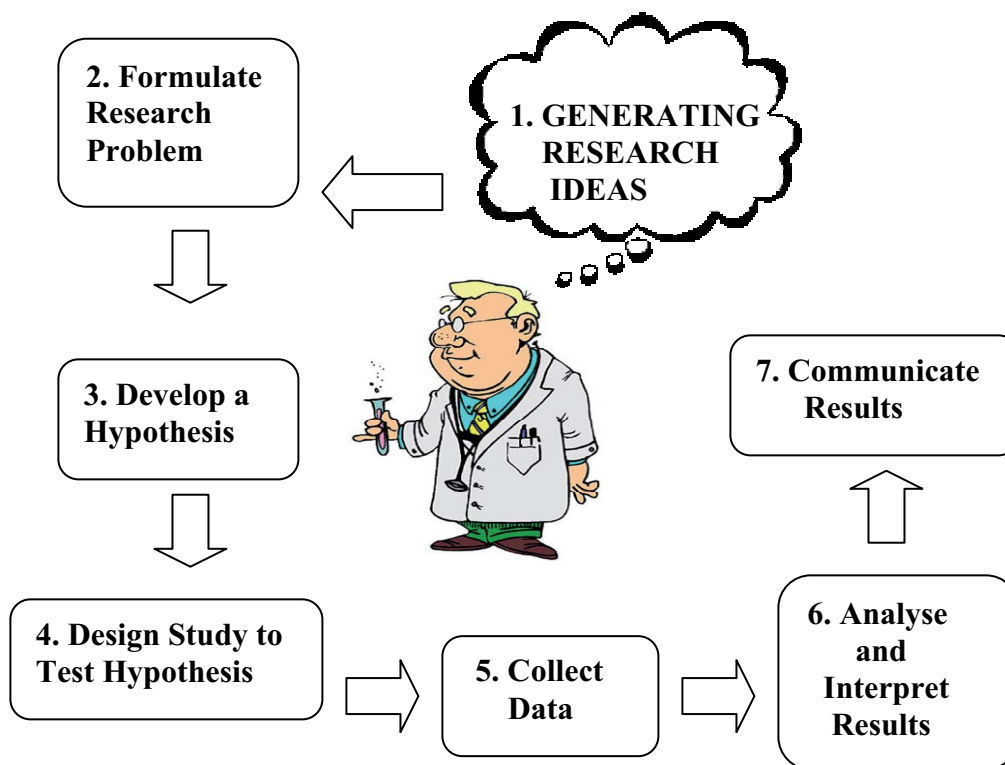


Figure 1.2: The seven steps of the research process

- **Step 1: Identify a Broad Problem in Your Area** that is of interest to you and related to your professional goals. You should build a sizable knowledge in your area of interest that is for the long term. For example, you may be interested in how young children learn mathematics, how to get teenagers interested in science, how to enhance the teaching of moral education, how to improve training in the corporate sector using e-Learning, the relationship between headmasters' leadership style and teacher morale, and so forth.
- **Step 2: Systematic Programme of Reading** within your broad area of study. For example if you are interested in why children have difficulty in learning mathematics, you could start with textbooks in the area or chapters of textbooks. Textbooks explain the basic concepts and facts related to the issue and may cite research in the area which will be listed in the 'references' which you could further explore. Journals such as the *Review of Research in Education* and *Review of Educational Research* provide valuable information about a particular field as they review related literature. Next is to read articles in the relevant journals in the field. For example if you are interested in reading research then you should read "Journal of Reading" and the

"Reading Research Quarterly". You should look through the catalogue both in the library and on-line and identify the journals in your field.

Students do not adequately refer to journals in the field but instead tend to cite from popular sources such as newspapers, magazines and speeches. Journals report empirical evidence about the field you are interested in and they indicate the current thinking about research and the trend of research efforts in the field. This will give you a grasp of leading edge research in the United States, Britain, Europe and Australia and how you might do the same in Malaysia.

- **Step 3: Relate Your Research Problem to a Theory** in the field. A theory is an explanation of events or phenomena or behaviour. For example, if you are interested in finding out whether providing children with multimedia presentations explaining science concepts will enhance understanding, you may want to explore the underlying theories of visual learning. Many phenomena in education are explained drawing upon theories from cognitive psychology, sociology, psycholinguistics, management, computer science and so forth. It should be remembered that theory provides the direction of the research [we will discuss in more detail the role of theory in Chapter 2].



SELF-CHECK 1.2

1. How do you go about finding a research problem in education?
2. What other sources provide research problems in education?

1.5.2 Formulate The Research Problem

Upon having a broad idea of what you want to investigate, the next step is to formulate the problem simply, clearly and completely. This is what we mean by '*statement of the problem*'. An adequate statement of the research problem is an important step in the research process. Obviously, if you want to solve a problem, you must know what is the problem. What is a good problem statement? Although research problems differ greatly, and although there is no one "right" way to state one, certain characteristics of problems and problem statements can be learned and used to good advantage.

Example: The relationship between self-esteem, attitudes toward science and academic performance in science.

This is an example of a research problem stating the relation between three factors or variables (self-esteem, attitudes and academic performance). A problem is an interrogative sentence or statement that asks: What relation exists between the variables? The answer to this question will be sought by conducting the research.

Three Criteria of Good Problem Statements

1. The problem should **express a relation between two or more variables**
 - Is A related to B?
 - How are A and B related?
 - How is A related to B under condition C?
 - Is there a difference between A and B in terms of C?
2. The problem should be **stated clearly and unambiguously** preferably in question form. Instead of saying, "The problem is", or "The purpose of this study is...."; ask a question. Questions have the advantage of posing problems directly. The purpose of a study is not necessarily the same as the problem of the study. For example, the purpose of the study was to throw light on the relationship between academic performance and self-esteem. The problem stated as a question: Is self-esteem related to academic performance?.
3. The problem should be such as to **imply possibilities of empirical testing**. A problem that does not contain implications for testing its relationship or relations is not a scientific problem. So, if you can measure the constructs self-esteem and academic performance, then the problem is considered a good problem.



SELF-CHECK 1.3

1. What is a good problem statement?
2. Why do graduate students have difficulty in stating research problems?

1.5.3 Develop Hypotheses or Research Questions

Your car will not start. You put forward the hypothesis that "the car that does not start because there is no petrol". You check the fuel gauge to either reject or accept the hypothesis. If you find there is petrol, you reject the hypothesis.

Next, you hypothesise that "the car did not start because the spark plugs are dirty". You check the spark plugs to determine if they are dirty and accept or reject the hypothesis accordingly.

Similarly, in educational research you have to put forward hypotheses or research questions that state a relationship between the variables or constructs you are studying. After having established the research problem or area that you plan to investigate, the next step is to breakdown the problem into subproblems called hypotheses or research questions. A hypothesis or research question is an "educated guess" or a hunch about possible relationships or differences. The hypothesis or research question guides the selection of appropriate research method, data collection techniques, data analysis techniques (e.g. the statistical analysis to be used) and so forth.

Hence, hypotheses or research questions have to be clearly stated and you should be prepared to defend or support your choice of hypotheses or research questions. For example, you hypothesise that "Students taught science using a problem-based approach will more creative". You are seeking to confirm empirically that the problem-based approach in science teaching will enhance creativity of learners.

1.5.4 Design Study to Test Hypotheses or Research Questions

Having determined the hypotheses or research questions, the next step is to design the study. We often hear of graduate students saying they want to do an 'experiment' or a 'survey'. But, they are unable to state with clarity and precision the hypotheses or research questions they intend to answer. It is like 'putting the cart before the horse'. The hypotheses or research questions determines the design of the study. If you intend to test the effectiveness of an educational phenomenon such as a teaching method or a counselling technique, the logical choice would be to design an experiment. If you intend to find out whether teachers are satisfied with their profession or how they perceive their principals, than the survey would be the appropriate research design. If your intention is to

study inter-racial mixing among students in the school canteen, than a qualitative approach using the observation technique might be more appropriate.



ACTIVITY 1.4

The following are research problems taken from the research literature. Study them carefully and construct one or two hypotheses or research questions based on them.

- How do self-esteem and level of aspiration influence academic achievement?
- Does providing learners with graphic organisers enhance their understanding of science text material?
- How does the organisational climate in schools affect teacher satisfaction and morale?

Hence, the decision on which methodology to use will depend on the research problem and the research questions or hypotheses. It is not good practice to decide on a methodology and then work on the research questions. You have to be able to state clearly what you intend to study and then decide on an appropriate methodology. If you are clear about your research problem and research questions, you will find it easy get assistance from your supervisor and other students in designing a study to find answers to your research questions.

1.5.5 Collect Data

The research question determines the design of the study and method of data collection to answer the question. Say for example, one of your research questions is determine whether there are differences in self-esteem between male and female 16 year old students in secondary school. To answer this question you have to collect data on the self-esteem of students. This may be done by developing a self-esteem instrument (or using an available instrument) and administering it to a sample of secondary school students. The sample will have to be representative of 16 year old students in secondary school to allow you to generalise the results obtained to the population. Here you are using quantitative data collection methods [*We will discuss in detail quantitative data collection methods in Chapters 3-5*].

**ACTIVITY 1.5**

You have stopped at a junction because the lights had just turned red. But, on your left a motorcyclist and a car beat the lights. You are most annoyed. Being a good social scientist, you ask yourself why people beat traffic lights. If you were to convert the problem into a hypothesis, which of the following would be the best hypothesis? Explain your answer.

- (a) Some people beat traffic lights more frequently than others.
- (b) People who beat traffic lights are a danger to themselves and other road users.
- (c) Beating traffic lights is common in crowded cities.
- (d) Road users are more likely to beat traffic lights when traffic is light than if traffic is heavy

On the other hand, if you are interested in studying student-teacher interaction, you may have to spend time in classrooms. You can use a structured observation checklist or leave it open-ended and record all the processes that occur in the classroom. Here you are using qualitative data collection methods [*We will discuss in detail qualitative data collection method in Chapters 7-9*].

1.5.6 Analyse and Interpret Data

The data collected from subjects (e.g. students, teachers, school administrators and others) will have to be analysed. If your study involves quantitative data then statistical procedures will be used to analyse the data. The analysed data is usually presented as tables and graphs. Based on the statistical analysis, the researcher interprets the data in relation to the research questions or hypotheses. In the case of qualitative data, information is coded and presented anecdotally. Instead of numbers, data is presented in the form of words and sentences. Similarly, the data is interpreted in relation to the research questions or objectives of the study [*We will discuss how to analyse and interpret qualitative data in Chapter 8*].

1.5.7 Communicate Results

Data that has been analysed and interpreted will have to be communicated to the community of fellow researchers and practitioners. The results of a study are most commonly communicated to interested parties through journals. There are numerous journals in education reporting the findings of studies in the many fields of education (e.g. early childhood, reading, second language learning, educational psychology, adolescents, mathematics teaching and so forth). If you are a graduate student, you will most probably be communicating the results of your study in the form of a thesis or dissertation or even a research practicum. There is an established format of presenting the findings of your study which will be discussed in detail in Chapter 10.



ACTIVITY 1.16

1. Identify a research problem that you are interested in investigating.
2. Formulate TWO research questions or hypotheses based on the research problem.

1.6 CONSTRUCTS AND VARIABLES

A **construct** is deliberately and consciously invented or adopted for a special scientific purpose. "Intelligence" is constructed based on observation of presumably intelligent and less intelligent behaviours or having a value of more or less. Constructs are used in theoretical schemes and are related in various ways to other constructs. E.g. school achievement is in part a function of intelligence. Intelligence is so defined and specified that it can be observed and measured. E.g. administering intelligence tests, interview teachers about their students.

Researchers somewhat loosely call constructs or properties they study as 'variables'. E.g. gender, social class. A **variable** is something that varies. A variable is a symbol to which numerals or values are assigned. For example, the symbol "intelligence" is assigned a set of numerical values which may be IQ scores ranging from 50 to 150. In the case of the variable "gender" there are only 2 values and they are called **dichotomous variables**, i.e. male (1) and female (0). Other examples of two-value variables are: graduate-nongraduate, low income-high income, citizen-noncitizen. Besides dichotomous variables, some variables are polytomies, e.g. religion - Islam, Christianity, Buddhism, Hinduism, etc.

1.7 TYPES OF VARIABLES

There are many ways of classifying variables but in educational research, the two most common methods of classification are as follows:

- Independent and Dependent Variables
- Continuous and Categorical Variables

(a) Independent and Dependent Variables

An independent variable (IV) is the variable that is presumed cause a change in the dependent variable (DV). The independent variable is the antecedent while the dependent variable is the consequent. See Figure 1.3 which describes a study to determine which teaching method (independent variable) is effective in enhancing the academic performance (dependent variable) of students.

- The **independent variable** (teaching method) can be manipulated 'Manipulated' means the variable can manoeuvred, and in this case it is divided into 'discussion method and 'lecture method'. Other examples of independent variables are gender (male-female), race (Malay, Chinese, Indian), socioeconomic status (high, middle, low). Other names for the independent variable are treatment, factor and predictor variable.
- The **dependent variable** in this study is academic performance which cannot be manipulated by the researcher. Academic performance is a score and other examples of dependent variables IQ (score from IQ tests), attitude (score on an attitude scale), self-esteem (score from a self-esteem test) and so forth. Other names for the dependent variable are outcome variable, results variable and criterion variable.

Put it another way, the DV is the variable predicted to, whereas the independent variable is predicted *from*. The DV is the presumed effect, which varies with changes or variation in the independent variable.

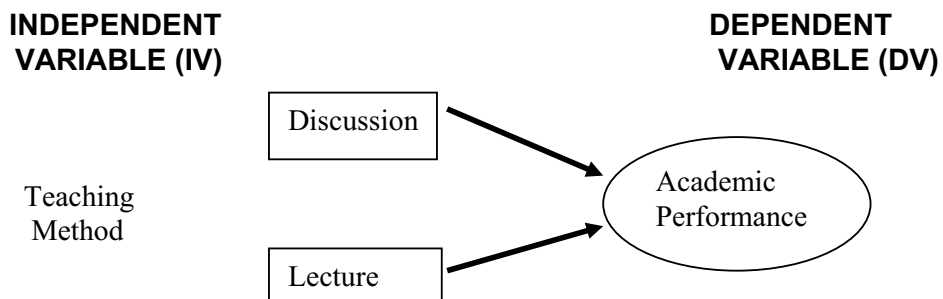


Figure 1.3: Independent and dependent variable

(b) **Continuous and Categorical Variables**

A **continuous variable** (also called ordinal variable) is capable of taking on an ordered set of values within a certain range. For example, an attitude scale towards smoking may have values ranging from 5 to 20 which expresses differing amounts of attitude towards smoking. A **categorical variable** (also called nominal variables) may be made up of two or more subsets or categories. Each subset or category possesses certain characteristics and individuals are categorised by their possession of those characteristics that defines a subset. For example, the variable socio-economic class (SES) may consist of 3 values such as high SES, middle SES and low SES.

(c) **Operational Definition of Variables**

“If you lead a good life, you will not suffer”. This is a specific prediction of the future, but it cannot be scientifically tested. Such a prediction is not scientifically tested because we cannot define it operationally. How do you define ‘good life’ and how do you define ‘suffer’. According to Bridgman, 1927, **operational definition** means that variables used in the study must be defined as it is used in the context of the study and publicly observable. This is done to facilitate measurement and to eliminate confusion. For example, when you state in your study that you are studying ‘excellent principals, you should be able to explain what ‘excellent’ means. Once the behaviours of an excellent principal have been identified the operational definition will be unique to your study (see Figure 1.4).

However, it should be borne in mind that in education not all variables are directly observable. For example, we cannot really observe learning, memory, reasoning, and so forth. Though they cannot be observed they can be measured to see their traces. With enough indirect evidence, researchers can make a convincing case for the existence of these invisible variables (Mitchell & Jolley, 1988). For example, though we cannot observe learning directly, we can see its effect on performance, i.e. we can operationally define learning as an increase in performance. Thus, if we see students improve their performance after practicing a task, we conclude that learning has occurred.

Similarly, we can provide operational definitions for such intangible variables such as self-esteem, racial stereotype, attitudes and so forth.

Operational Definition

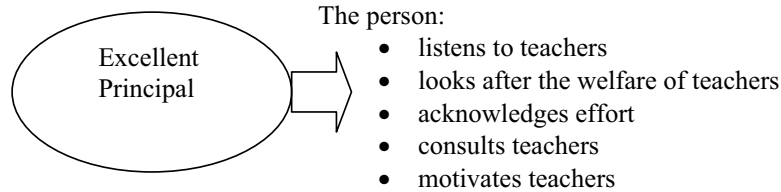


Figure 1.4: Example of an operational definition of an excellent principal



SELF-CHECK 1.4

1. What is a variable?
2. What is the difference between an Independent Variable and Dependent Variable? Give specific examples.
3. Why do you need to define variables operationally?

SUMMARY

- The word research has been used in many different ways and sometimes rather loosely giving rise to confusion and sometimes with the intention to deceive.
- There are six ways in acquiring knowledge and they are; through our beliefs, intuition, authority, empiricism, rationalism and science.
- Research is defined as the systematic, controlled, empirical and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among the phenomena.
- The purpose of the scientific method is to describe, explain, control and predict phenomena.
- Educational research is defined as research that investigates the behaviour of students, teachers, administrators, parents and so forth.
- The seven steps of the educational research process is a useful guide for beginning researchers to follow.
- A good research problem is stated clearly, expresses a relationship between variables and can be tested empirically.

- An independent variable can be manipulated to see its effect on a dependent variable.
- Operational definition of variables is necessary to allow measurement and elimination of confusion.

KEY TERMS

Educational Research

Operational Definition

Research

Scientific Method

The Research Process

- Research question
- Hypothesis
- Research questions

Variables

- dependent variable
- independent variable
- categorical variable
- continuous variable



DISCUSSION

1. Write down your definition of research.
2. Suggest how you will go about finding a research problem that you propose to investigate.
3. Discuss some educational research you have read?
[Go to OUM's Digital Library and click on 'ProQuest' which has a good collection of journals in education]
4. List the current thinking on research in your area of interest.
5. Make up operational definition for the following variables:
 - Underachievement
 - Parental bonding
 - Aspirations [of teenagers]
 - Autocratic Leader [principal or headmaster]
 - Teacher Burnout
 - Socioeconomic status
 - Leadership
 - Reading ability
 - Delinquency



READINGS

OUM Digital Library

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