PREFACE

In the curricular structure introduced by the University for students of Bachelor Degree Programme, the opportunity to pursue Graduate course in subjects introduced by this University is equally available to all learners. Instead of being guided by any presumption about ability level, it would perhaps stand to reason if receptivity of a learner is judged in the course of the learning process. That would be entirely in keeping with the objectives of open education which does not believe in contrived differentiation.

Keeping this in view, study materials of the Graduate level in different subjects are being prepared on the basis of a well laid-out syllabus. The course structure combines the best elements in the approved syllabi of Central and State Universities in respective subjects. It has been so designed as to be upgradable with the addition of new information as well as results of fresh thinking and analysis with the changing time.

The accepted methodology of open and distance education has been followed in the preparation of these study materials. Co-operation in every form of experienced scholars is indispensable for a work of this kind. We, therefore, owe an enormous debt of gratitude to everyone whose tireless efforts went into the writing, editing and devising of a proper lay-out of the materials. Practically speaking, their role amounts to an involvement in invisible teaching. For, whoever makes use of these study materials would virtually derive the benefit of learning under their collective care and wisdom without each being seen by the other.

The more learners would seriously pursue these study materials the easier it will be for him/her to reach out to the wider horizons of a subject. Care has also been taken to make the language lucid and presentation attractive so that may be rated as quality self-learning materials. If anything remains still esoteric or difficult to follow, arrangements are there to come to terms with them through the counseling sessions regularly available at the network of study centres set up by the University.

Needless to add, a great part of these efforts is still experimental-in fact, pioneering in certain areas. Naturally, there is every possibility of some omission or inadequacy here and there. However, these do admit of restitution and furtherance in due course. On the whole, therefore, these study materials are expected to evoke wider appreciation the more they receive serious attention of all stakeholders.

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BACHELOR DEGREE PROGRAMME IN EDUCATION (EED)

PAPER-VIII
EDUCATIONAL RESEARCH AND ICT IN EDUCATION

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EDUCATIONAL RESEARCH AND ICT IN EDUCATION
EED
PAPER-VIII (GROUP - A & B)

Group-A : Educational Research

Group-B : Information and Communication Technology in Education

Group—A

Educational Research

UNIT I ❑ Research — Meaning and Nature

Structure

1.1 Introduction

Man is always engaged in the search of new knowledge. There are many sources of knowledge like authority, tradition, experience, deductive reasoning, inductive reasoning, and scientific approach, etc. Research is a systematic process and it follows a scientific approach. Research in the field of education is found demand of the day. Progress ion in any field is directly linked with research in that field, and Education is of no exception. Research in education is a search that provides knowledge for the solution of problems in the field of education. In this unit, concept and definition of research, nature of research, sources of knowledge and need of research in education will be discussed.

1.2 Objectives

After completion the unit, the learners will be able to -

- Explain the meaning and nature of research;
- Explain different sources of knowledge;
- Discuss the need of research in education.

1.3 Meaning and Nature of Research

1.3.1 Meaning of Research

Research is a quest for knowledge and search for truth and this search is unending. Research focuses on new knowledge or makes corrections of the previous errors and misconceptions. It is such a vast concept that ordinary definitions cannot project its meaning completely. Various definitions given by different experts are given below. From these definitions we can understand the meaning of research clearly.

According to J.W. Best, "Research is considered to be more formal, systematic, intensive process of carrying on the scientific method of analysis. It involves a more systematic structure of investigation usually resulting in some sort of formal record of procedures and a report of results or conclusions".

P.M. Cook gave the definition of research as, "Research is an honest, exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem. It is the process of arriving at dependable solutions to problems through the planned and systematic collection, analysis and interpretation of data. The best research is that which is reliable, verifiable and exhaustive so that it provides information in which we have confidence."

According to C.C. Crawford, "Research is a systematic and refined technique of thinking, employing specialised tools, instruments and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means. It starts with a problem, collects data or facts, analyses them critically and reaches decisions based on the actual evidence."

Rusk has defined research very precisely as, "Research is a point of view, an attitude of inquiry or a frame of mind. It asks questions which have hitherto not been asked and it seeks to answer them by following a fairly definite procedure. It is not a mere theorising,

but rather an attempt to elicit facts and to face them once they have assembled. Research is likewise not an attempt to bolster up preconceived opinions, and it implies a readiness to accept the conclusions to which an inquiry leads, no matter how unwelcome they may prove, when successful, research adds to the scientific knowledge of the subject."

According to J Francis Rummel, "Research is an endeavour to discover, develop and verify knowledge. It is an intellectual process that has developed over hundreds of years, ever changing in purpose and form, and always searching for truth."

According to W.S. Monroe, "Research may be defined as a method of studying problems whose solutions are to be desired partly or wholly from facts. The facts dealt with in research may be statements of opinions, historical facts, those contained in records and reports, the results of tests, answers to questionnaires, experimental data of any sort, and so forth. The final purpose of educational research is to ascertain principles and develop procedures for use in the field of education; therefore, it should conclude by formulating principles or procedures. The mere collection and tabulation of facts is not enough, though it may be preliminary to it or even a part thereof'.

Clifford Woody has defined research as, "Research is a careful inquiry or examination in seeking facts or principles, a diligent investigation to ascertain something."

From the above definitions of research given by different educationists, we may summarise the meaning of research. Research is a systematic attempt to obtain answers to meaningful questions about phenomena or events through the application of scientific procedures. It is an objective, impartial, empirical and logical analysis and recording or controlled observations that may lead to the development of generalizations, principles or theories, resulting, to some extent in prediction and control of events that may be consequences or causes of specific phenomena. Research is scientific and such, is not, satisfied with isolated facts, but seeks to integrate and systematize its finding. It is concerned with the objective verification of generalizations. Such verification requires logical analysis of problems and devising of appropriate methodologies for obtaining evidence.

1.3.2 Nature of Research

Research is the application of the scientific methods in the study of problems. It is also defined as scientific thinking. When we are able to describe the nature of scientific thinking, we shall be in a better position to visualise as to how research and scientific thinking are alike. It is man's unending search for truth which has brought him to stage of the scientific thinking as the main source of evidence.

Research is rightly considered as a science because it makes use of methods and systems for delivering objective truth. To secure better conception of the scientific method of investigation, we will discuss some of the distinguishing criteria of beliefs and assumptions on which science is based.

These are briefly described as under:

a) All events in nature are, at least to a degree, lawful or ordered, predictable and regular. This order, predictability and regularity of nature can be discovered through the activities of the scientific method.

b) Truth can ultimately be derived only from observations. Scientist does not depend upon authority as a source of truth, but relies upon empirical observations. Thus, the phenomena that can actually be observed to exist are within the domain of scientific method.

c) A scientist maintains a doubtful attitude towards the data. He/She regards findings as tentative, unless they are verified. Verification of the finding requires that offer scientists must be able to repeat the observations and get the same results.

d) The scientist is objective, impartial and local in collecting and interpreting data or making observations. His/Her personal bias does not in any way influence the truth and facts even when they are not in conformity with his own opinions.

e) A scientist does not bother about the moral implications of his findings. He/She generally deals with facts and does not consider what finding is good or what is bad for us.

f) The ultimate goal of science is to integrate and systematize finding into a meaningful pattern or theory. The theory, however, is regarded as tentative and not the ultimate truth. It is subject to revision or modification as new evidence is found.

Now let us see how a problem is solved through scientific method. The scientific method consists of five definite steps:

1. *Identification and definition of the problem:* A scientific inquiry starts with the identification of a problem that is in need of solution. The problem identified must be defined in such a manner that observation or experimentation in the natural world can provide a solution.

2. *Formulation of hypothesis:* Once the problem is defined, the next step is to

formulate the hypothesis, which provides an intelligent guess for the solution of the problem. It also requires a critical review of the knowledge or information related to the problem.

3. *Implication of hypothesis through deductive reasoning:* The next step after the formulation of a hypothesis is to deduce the implication of the suggested hypothesis that is what would be observed if the hypothesis is true.
4. *Collection and analysis of evidence:* The deduced implications of the hypothesis are tested by collecting relevant evidence related to them through observation, testing and experimentation.
5. *Verification, rejection, or modification of hypothesis:* Once the evidence has been collected and analyzed, the results are analyzed in order to verify whether the evidence support the hypothesis. It may be noted that the characteristic of scientific method is not to prove the hypothesis in terms of absolute truth but to conclude that the evidence does or does not support the hypothesis.

We have already said that research is the application of scientific method. So the steps of research will be similar to that of scientific method as discussed above.

Best and Kahn (1992, pp. 18-20) have summarized the main nature and characteristics of research as under:

a) Research is directed towards the solution of a problem. It may attempt to answer a question or to determine the relation between two or more variables.

b) Research emphasizes the development of generalizations, principles, or theories that will be helpful in predicting future occurrences. Research usually goes beyond the specific objects, groups or situations investigates and infers characteristics of a target population from the sample observed. Research is more than information retrieval, the simple gathering of information. Although many school research departments gather and tabulate statistical information that may be useful in decision making, these activities are not properly termed as research.

c) Research is based upon observable experiences or empirical evidences. Certain interesting questions do not lend to themselves to research procedures because they cannot be observed. Research rejects revelation and dogma as methods of establishing knowledge and accepts only what can be verified by observation.

d) Research demands accurate observation and description. The researcher uses

quantitative, numerical measuring devices, the most precise means of description. The researcher selects or devises valid data gathering instruments or procedures and employs appropriate mechanical, electronic, or psychometric devices to refine human observation, recording, computation, and analysis of data.

e) Research involves gathering new data from primary or first-hand sources or using existing data for a new purpose. Teachers frequently assign a so-called research project that involves writing a paper dealing with the life of a prominent person. The students are expected to read a number of encyclopaedia, books, or periodical references, and synthesize the information in a written report. This is not research, as the data are not new. Merely reorganizing or restating what is already known and has already been written, valuable as it may be as a learning experience, is not research. It adds nothing to what is known.

f) Although research activity may at times be somewhat random and unsystematic, it is more often characterized by carefully designed procedures, always applying rigorous analysis. Although trial and error are often involved, research is rarely a blind, shotgun investigation - trying something to see what happens.

g) Research requires expertise. The researcher knows what is already known about the problem and how others have investigated it. He has searched the related literature carefully. He is also thoroughly grounded in the terminology, the concepts, and the technical skills necessary to understand and analyse the data that he/she has gathered.

h) Research strives to be objective and logical, applying every possible test to validate the procedure employed, the data collected, and the conclusions reached. The researcher attempts to eliminate personal bias. There is no attempt to persuade or to prove an emotionally held conviction. The emphasis is no testing rather than on proving the hypothesis. Although absolute objectivity is as illusive as pure righteousness, the researcher tries to suppress bias and emotion in his or her analysis.

i) Research involves the quest for answers to unsolved problems. Pushing back the frontiers of ignorance is its goal, and originality is frequently the quality of a good research project. However, previous important studies are deliberately repeated, using identical or similar procedures, with different subjects, different settings and at a different time. This process is replication, a fusion of the words repetition and

duplication. Replication is always desirable to confirm or to raise questions about the conclusions of a previous study.

j) Research is characterised by patience and unhurried activity. It is rarely spectacular and the researcher must accept disappointment and discouragement as he/she pursues the answers to difficult questions.

k) Research is carefully recorded and reported. Each important term is defined, limiting factors are recognized, procedures are described in detail, references are carefully documented, results are objectively recorded, and conclusions are presented with scholarly cautions and restraints. The written report and accompanying data are made available to the scrutiny of associates or other scholars. Any competent scholar will have the information necessary to analyse, evaluate, and even replicate the study.

1) Research sometimes requires courage. The history of science reveals that many important discoveries were made in spite of the opposition of political and religious authorities. The Polish scientist Copernicus (1473-1543) was condemned by church authorities when he announced his conclusion concerning the nature of the solar system. His theory that the sun, not the earth was centre of the solar system in direct conflict with the older Ptolemaic theory, angered supporters of prevailing religious dogma, who viewed his theory as denial of the story of creation as described in the book of Genesis. Modem researchers in such fields as genetics, sexual behaviour, and even business practices have aroused violent criticism from those whose personal convictions, experiences, or observations were in conflict with some of the research conclusions.

1.4 Sources of Knowledge

Man has been engaging himself in the search of truth since early stage of civilisation. The sources of knowledge by which man from earlier times seeks answers to his/her problems, can be classified under, in general, six categories:

1. Authority
2. Tradition
3. Personal Experience
4. Deductive Reasoning

5. Inductive Reasoning
6. Scientific Approach

1.4.1 Authority

From very ancient time, authority is regarded as the source of knowledge. Historically, authority figures a primary means of information. For example, the tribal chief remained the supreme authority for many centuries and his subjects considered him as an all-knowing and all-competent superman. They looked to him for guidance and advice in their social, religious, economic, political and even private affairs. In some time periods and cultures, the church and its leaders were responsible for providing much of the knowledge that individuals gained throughout the course of their lives. Then the king came to the picture to share this authority. The citizens referred their problems to the king for obtaining a solution.

When democracy became stronger then the authority of the king has been taken over by the parliament and legislatures. In modern society the real authority lies with the constitution of the state. When a man accepts what a respected or famous person tells us, then he is gaining knowledge via authority. The children may gain much of their own knowledge through authority figures like their parents. When a child grows up, his/her parents provide him/her information and the child accepts that information without any question. He/She believes that parents know what they talk about, and thus, he/she accepts the answers they give.

Children may have also gained knowledge from their teachers whom they viewed as authority figures, at times blindly accepting what they said as truth. Most people tend to accept information imparted by those they view as authority figures. This may not be a problem if the perceived authority figure truly is an authority on the subject. However, problems may arise in situations where the perceived authority figures is not really knowledgeable about the material he or she is imparting. For example, if a patient goes to a physician for health problem then it is good because a physician has an authority to help a patient for his/her recovery. But, if he/she goes to the member of his Gram Panchayat who is a farmer, then problem arises. Accepting the word of an authority figure may be a reliable and valid means of gaining knowledge, but only if the individual is truly an authority on the subject. Although authority is a very useful source of knowledge, we must always ask. How does authority know? We need to question "authoritative" sources of knowledge and develop an attitude of skepticism so that we do not blindly accept whatever is presented

to us as a source of knowledge because authority has some disadvantages. First, a person often claim to be an expert in a field when not really have the knowledge in that field. Second, it is also found that authorities may differ on a particular issue which indicates that their authoritative statements are more personal opinion than the fact.

1.4.2 Tradition

Tradition is another source of knowledge and is closely related to authority. It is transmitted from one generation to another, from individual to individual. It is rooted in the spiritual health, culture and language of the people. Tradition is practical common sense based on experiences passed on from generation to generation.

A man depends on traditions for solutions to many daily life problems. One accepts traditions and customs from the forefathers and culture. Tradition and customs determines mode of living, mode of thinking, mode of facing problems and situations, and mode of adjustment. The Director General of United Nations Educational, Scientific and Cultural Organization (Mayor, 1994) had defined traditional knowledge:

"The indigenous people of the world possess an immense knowledge of their environments, based on centuries of living close to nature. Living in and from the richness and variety of complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them that is particular and often detailed. In rural communities in developing countries, locally occurring species are relied on for many - sometimes all - foods, medicines, fuel, building materials and other products. Equally, people's knowledge and perceptions of the environment, and their relationships with it, are often important elements of cultural identity".

In many activities and situations, we refer to tradition and custom and this ready-reckoner serves the purpose very well. But, if we follow tradition and custom almost blindly then an intellectual stagnation arises. We find that many theories based on tradition which prevails for years were later found erroneous and ultimately the theories were rejected. Although customs and traditions still remain in our society and is guiding us to tackle many situations and problems but we should evaluate them carefully before taking them as truth.

1.4.3 Personal Experience

Personal experience is another well-used source of knowledge. Experience is a collection of situations or events gained over the course of many years. These events can have

positive outcomes and negative outcomes. Experience is not taught, it is learned through trial and error. Even the most highly educated or decorated can't succeed without experience. By personal experience, one can find the answers to many of the questions he/she faces. Much wisdom passed from generation to generation is the result of experience. If people were not able to profit from experience, progress would be severely retarded. In fact, this ability to learn from experience is a prime characteristic of intelligent behaviour. When confronted with a difficult situation, one usually turns first to his own experiences. If one's experience is inadequate, he/she may turn to those of friends and others.

There is a clear connection between personal experience and science. This connection is very important because science itself is an appeal to experience. Experience is so powerful source of knowledge that Albert Einstein has also quoted, "The only source of knowledge is experience". Science begins with the distinctions, tentative generalisations, and the suppositions found in ordinary experience and extend these by making them more definite and consistent.

The appeal to personal experience is no doubt very important but it may have some inaccuracies. The sources of inaccuracies are generalisations from insufficient evidence, dependence of subjective judgement, preconceived ideas, prejudice etc. Thus, uncritical use of experience may lead to incorrect conclusions. According to Van Dalen (1973, p. 5)—

"A person may make errors when observing or when reporting what he has seen or done. He may (1) omit evidence that does not agree with his opinion, (2) use measuring instruments that require many subjective estimates, (3) establish a belief on insufficient evidence, (4) fail to observe significant factors relating to a specific situation, or (5) draw improper conclusions or inferences owing to personal prejudice."

So, from the above remarks we must learn that we should be very cautious and careful to use experience as a reliable source of knowledge. Personal experience should not be the final source of evidence. A man should move to the next step of his thinking.

1.4.4 Deductive Reasoning

We have discussed different sources of knowledge like authority, tradition and personal experience. But these methods are not systematic. Ancient Greek philosophers made perhaps the first significant contribution to the development of a systematic approach for gaining knowledge. Aristotle and his followers introduced syllogism, which can be described as a thinking process in which one proceeds from general to specific knowledge through logical argument. This type of logical argument is called deductive reasoning, which provides

a means of testing the validity of any given conclusion or idea by proceeding from the known to the unknown. The main instrument of deduction is syllogism. It is composed of a major premise, a minor premise, and a conclusion. Major premise is based on a self-evident truth or previously established fact or relationship. Minor premise is concerned with a particular case to which the truth, fact, or relationship invariably applies. Given the logical relationship of these premises, the conclusion is inescapable. For example,

"All men are mortal" (Major Premise)

"Rabindranath is a man" (Minor Premise)

"Rabindranath is mortal" (Conclusion)

In deductive reasoning, if the premises are true, the conclusion is necessarily true. Deductive reasoning makes an important contribution to the development of modern problem solving. But it is not fruitful in arriving at new truths. Besides this deductive reasoning have other limitations. To arrive at true conclusions, one must begin with true premises. The conclusion of a syllogism can never exceed the content of the premises. Deductive conclusions are necessarily elaborations on previously existing knowledge and for this reason one cannot conduct scientific inquiry through deductive reasoning alone because it is difficult to establish the universal truth of many statements dealing with scientific phenomena.

1.4.5 Inductive Reasoning

The conclusions of deductive reasoning are true, only if the premises on which they are based are true. But how can we know whether the premises are true? To determine whether premises are true, Francis Bacon stressed the need for basing general conclusions upon specific facts gathered through direct observations. This is known as inductive reasoning. In inductive reasoning, one goes from particular to general. We can find the difference between deductive and inductive reasoning in the following examples:

Deductive: Every animal is mortal.

All cows are animals.

Therefore, every cow is mortal.

Inductive: Every cow that has ever been observed is mortal.

Therefore, every cow is mortal.

It is to be noted here that in deductive reasoning, we must know the premises before

we can reach a conclusion, but in inductive reasoning we reach a conclusion by observing examples and generalizing from the examples to the whole class or category. To be absolutely certain of an inductive conclusion, the investigator must observe all examples. This is known as perfect induction under the Baconian system; it requires that the investigator examine every example of a phenomenon. But practically it is not possible to examine every instance of a phenomenon to which generalisation refers. In this situation one may arrive at a generalisation by observing only some instances that make up the phenomenon. This is known as imperfect induction. Imperfect induction does not help a person to arrive at infallible conclusion, it provides reliable knowledge.

1.4.6 Scientific approach

Exclusive use of Bacon's induction method often resulted in the accumulation of isolated knowledge and information that made little contribution to the advancement of knowledge.

Inductive method alone did not provide a completely satisfactory system for the solution of problems. Random collection of individual observations without a unifying concept or focus often obscured investigations and therefore, led to a generalization or theory. In the 19th century, the deductive method of Aristotle and the inductive method of Bacon were fully integrated in the work of Charles Darwin. Darwin's procedure, involving only observation, was unproductive until reading and further thought led him to formulate a tentative hypothesis to explain the facts that he had gathered through observations. He then proceeded to test this hypothesis by making deductions from it and gathering additional data to determine whether these data would support the hypothesis. From this method of inquiry, Darwin was able to develop his theory of evolution. This new technique or method is called the inductive - deductive method, or the “scientific approach”. This use of both inductive and deductive reasoning is characteristic of modern scientific inquiry. So, we can say that scientific approach is a back-and-forth movement of thoughts in which man first operates inductively from partially known or sometimes confused information learned from experiences, previous knowledge, reflective thinking, observations and so on, towards a meaningful whole or hypothesis, and then deductively, from suggested whole or hypothesis to the particular parts in order to connect these with one another in a meaningful pattern to find relationships.

Dewey (1933, p.87) has described inductive-deductive method very nicely— *"While induction moves from fragmentary details (or particulars) to a connected view of situation (universal), deduction begins with the latter and works back again to*

particulars, connecting them and binding them together."

So, in conclusion, we can say that the scientific approach is generally described as a method of acquiring knowledge in which researcher moves inductively from his/her observations to hypotheses and then deductively from the hypotheses to the logical implications of the hypotheses. He/She deduces the consequences that would follow if a hypothesized relationship is valid and if the deduced implications are compatible with the organized body of accepted knowledge, investigator then further test them by gathering empirical data. On the basis of the evidences, he/she accepts or rejects the hypotheses.

1.5 Need of Research in Education

Research in any field is needed for its development. Education is of no exception. Research in education, as in the other fields, is essential for providing useful and dependable knowledge through which the process of education can be made more effective. There are various considerations, which emphasize need for research in education.

According to F.L. Whitney, " The unsolved problems of education are so numerous and so varied that it is necessary to simplify a survey of them by using some rather arbitrary classification".

Educational research refers to a systematic attempt to gain a better understanding of the educational process, generally with a view to improving its efficiency. It is an application of scientific method to the study of educational problems. Travers (1958) states: *educational research represents an activity directed towards the development of an organized body of scientific knowledge about the events with which educators are concerned*.

According to the Report of the First International Conference on Educational research, "Research is literally speaking a kind of human behaviour, an activity in which people engage".

In education, teachers, administrators, scholars or others engage in educational research, when they systematically assemble information about schools, school children and the social matrix in which a school system is determined, the characteristics of the learner or the interaction or the interaction between the school and the pupils.

Now we can summarise the need of research in education:

a) The vast area of education can be subdivided into various fields. They may be classified under various stages of education - infant education, primary education,

secondary education, college education and University education; or under various kinds of education general education, technical education, vocational education, teacher education, special education, physical education etc. The problems in education can be classified in different aspects like curriculum, syllabus, administration, organisation, policies, planning, decision-making, teaching and learning, methods of teaching, media of instruction, examination, guidance, evaluation etc. Research in education is very urgent in every field, every aspect and every level.

b) Education is a behavioural science and thus the major concern of educational research is to understand, explain and to some degree predict and control human behaviour. It is an activity directed towards the development of organized and useful body of scientific knowledge about the events with which educators are concerned.

c) A scientific body of knowledge about education should enable the educators to determine just what teaching and other learning conditions to provide in order to produce desired aspects of learned behaviour among young people who attended school.

d) Education has strong roots in the fields like philosophy, history, economics, psychology and sociology. It is however based on conceptual frame of theory. Research through an intensive process of scientific enquiry about the philosophical, historical, economic, psychological and sociological impact on various aspects of education should be done so that sound theories in these fields can be established.

e) Research in education is required for better understanding of different cultures and impact of culture on values, attitudes, ideals, personality development, and human behaviour.

f) Education is a science. So research in education add scientific knowledge to the fields concerning nature of human mind, its growth and development; theories of administration and supervision; educational programmes and practices prevalent in different countries for enrichment and improvement.

g) The uses of action research have shown great interest in the field of education. Because it focused on immediate application, not on the development of theory or on generalization of applications. It has placed its emphasis on a problem here and now in a local setting.

h) Research in education is needed because of the changing face or conception of education. The International Commission on the development of Education in its report "Learning to Be" (Unesco, 1972, p.43) emphasizes:

"Education from now on can no longer be defined in relation to fixed content which has to be assimilated, but must be conceived of as a process in the human being, who thereby learns to express himself, to communicate and to question the world, through his various experiences, and increasingly - all the time - to fulfil himself. It has strong roots, not only in economics and sociology, but also in findings from psychological research which indicate that man is an unfinished being and can only fulfil himself through constant learning. If this is so, then education takes place at all ages of life, in all situations and circumstances of existence. It returns to its true nature, which is to be total and life long, and transcend the limits of institutions, programmes and methods imposed on it down the centuries"

From the above discussion, it is clear that the area of educational research should not be limited within the formal and conventional models, rather, it has to be extended to non-formal and innovative systems based on ecological and cybernetics models.

i) Due to rapid scientific and technological development, a great change has been taken place in the field of education. Research in education should be progressed in that direction so that necessary improvements in curriculum, text books, evaluation, teaching learning process etc. be done so that we can accept the changes in a smooth way.

1.6 Let us sum up

There are many sources of knowledge which includes authority, tradition, personal experience, deductive reasoning, inductive reasoning and scientific approach. Research is scientific in nature and thus follows scientific approach, which is the combination of deductive and inductive reasoning. For conducting any research, the knowledge of the scientific methods is very essential. It helps researcher to conduct his/her research in a systematic manner. The meaning and nature of research have been discussed in this unit. The field of education is changing its nature constantly due to the rapid development of science and technology. Thus, like other fields, research in education is indispensable to bring necessary improvements in the area of curriculum, teaching methods, text books, evaluation system, learner attitude, value system etc.

1.7 Unit End Exercises

1. Define research.
2. What is the nature of research?
3. What is meant by scientific method of research?
4. Mention different sources of knowledge.
5. Define Authority.
6. What is meant by deductive reasoning?
7. What is inductive reasoning?.
8. What is meant by scientific approach?
9. What is the difference between deductive reasoning and inductive reasoning?
10. Why research in education is needed?

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Unit 2 ❑ Educational Research — Meaning, Nature and Types

Structure

2.1 Introduction

Research and innovation in any field of study is necessary for its knowledge expansion, progression and development. Education is of no exception. To address the problems in the field of educational studies it requires a purposeful research effort. Educational research is also an application of scientific method to the study of educational problems. The areas of educational research are quit vast. The process of research in education basically includes purposes, approaches, techniques and methods. Moreover, methods of educational research are of different types. It depends upon the nature of problem. In this unit, concept and definition of educational research, its nature, scope and types including the importance will be discussed.

2.2 Objectives

After completion of the unit, the learner will be able to -

- Enumerate the meaning and nature of educational research;
- Elucidate the scope of educational research;
- Explain different types of research;
- Discuss the importance of educational research.

2.3 Meaning, Nature and Scope of Educational Research

2.3.1 Meaning of Educational Research

Educational research is a systematic attempt to gain a better understanding of the educational process with an aim to improve it. The main objective of educational research is to understand, explain, and to extent predict and control of human behaviour in educational settings. Educational research tries to develop new knowledge about the nature of children, how they learn, how they grow and how their personality develop. It also attempts to gather facts about teaching-learning process, the factors influencing it and to find out better process of it. Educational research also tries to analyse emotional development of child, social adjustment and skills etc,

According to George G. Mouly (ref), "The systematic and scholarly application of the scientific method, interpreted in its broadest sense, to the solution of educational problems; conversely, any systematic study designed to promote the development of education as science can be considered educational research."

According to Travers (ref), "Educational research is that activity which is directed towards development of a science of behaviour in educational institutions. The ultimate aim of such a science is to provide knowledge that will permit the educator to achieve his goals by the most effective methods."

P.M. Cook (ref) has described, that, "Educational research aims to make contribution towards the solution of problems in the field of education by use of the scientific - philosophical method, the method of critical reflective thinking. On the level of science, this operates in terms of specifies of experience which are organised and evaluated which result in hypotheses and theories each successively subject to deductive testing. The method of philosophical uses arrived at larger and longer generalisation constantly approaches the truth in the field investigated."

2.3.2 Nature of Educational Research

We have discussed in Unit-1 that research is a scientific thinking. It is the application of the scientific methods in the study of problems. Educational research is also scientific in nature. Scientific method of educational research is the combination of inductive and deductive methods which involve a double movement of thoughts, first, a movement from the partially known and sometimes confused data or experience, from all available sources towards the universal relationships expressed as hypotheses, propositions or laws, that is from the

particular to the general; and a second movement from these general propositions or laws to the particular facts or data or experience, that is from the general to the particular. So, scientific thinking starts with facts and continually returns to facts to test and verify its hypotheses, propositions or laws.

According to Travers (1958, p.5), "Educational research represents an activity directed towards the development of an organized body of scientific knowledge about the events with which educators are concerned. A scientific body of knowledge about education should enable the educators to determine just what teaching and other learning conditions to provide in order to produce desired aspects of learned behaviour among young people who attend school".

In Unit-I, we have discussed the characteristics of a scientific research. These characteristics can be summarised as follows:

i) Research gathers new knowledge from primary sources.

ii) Research is expert, systematic and accurate investigation.

iii) Research is logical and objective.

iv) Research endeavours to organise data in quantitative terms.

v) Research requires patience and appropriate period of time.

vi) Research requires courage.

vii) Research is highly purposive.

viii) Research places emphasis upon the discovery of general principles and scientific generalisations.

ix) Research usually involves hypothesis.

x) Research maintains rigorous standard.

xi) Research is carefully recorded and reported.

The above characteristics are also applicable to educational research. But educational research has some special characteristics because it is not as inductive and as exact as the research done in physical sciences. The nature of the educational research and the tools used are not similar to those of pure science. That's why educational research has some specific features and characteristics which can be stated below:

i) Educational research is based on sound philosophy of education, which guides us

for evaluation of principles and activities in research. The values in life and in education form the basis of the solution of problem in educational research. In this context we can mention the words of Robert R Rusk, *"In the application of scientific procedure to education, a sound philosophy - as well as a sound common sense must be invoked to save the scientific procedure from itself."*

ii) Educational research requires scientific attitude of mind, imagination and insight of the researcher. The nature of educational problems is such that the researcher must have capability to look beyond the present.

iii) The problems of educational research are not so simple. They are complex and interdisciplinary in nature. Educational research is linked with several disciplines like Philosophy, Psychology, Sociology, Economics, History, Anthropology, Political science, Technology etc.

iv) Educational research does not demand the accuracy as observed in the research of physical sciences. Education is a social science. The social problems are very complex in nature. There are many types of variables linked with the social problems and it is very difficult to manipulate and control all the variables which puts limit on the precision and exactness of the results arrived from the experimentations in education.

v) Educational research is not the field of specialists only. Any competent teacher who has a desire to do things better and has insight can undertake research in education.

vi) Educational research, generally, does not require expensive materials because in most of the cases it deals with the school problems.

vii) Educational research is based on interdependence of 'cause and effect'. In social phenomena cause and effect are interdependent and sometimes confusion arises to find out as to what the cause is and what the effect is.

Differences between Research in Education and Research in Sciences

i) Variables and other experimental conditions cannot be controlled totally in educational research. But in the research of sciences, the experimental conditions are controlled rigidly.

ii) The reliability and validity of the tools used for data collection in educational research are usually not high, but those for research in sciences have high values.

iii) Replication is difficult in educational research, but the researches of sciences can easily be replicated by another experiment.

iv) Research in education cannot attain the fullest perfection, whereas research in science can attain the fullest perfection.

2.3.3 Scope of Educational Research

Educational research is the scientific study of educational processes. The area of educational research is increasing day by day with the gradual development of knowledge and technology. Educational process involves individuals (i.e., students, teachers, parents, administrators etc) and institutions (i.e., schools, colleges, universities, research institutes etc.) and the educational research discovers facts and relationship in order to make educational process more effective. Educational process includes investigation, planning, collecting data, processing of data, their analyses, interpretation and drawing inferences.

The major fields of educational research can be classified in terms of the different content areas as follows:

i) Psychology of Education

ii) Philosophy of Education

iii) Sociology of Education

iv) Economics of Education

v) Educational Management

vi) Educational Measurement

vii) Curriculum, Textbooks and Methods

viii) Teacher Education

ix) Guidance and Counselling

x) Comparative Education

xi) Adult Education

xii) Special Education

xiii) Women Education

xiv) Educational Technology etc.

There may be many other fields of research in education. We have mentioned some of the major fields in the above list.

Similarly, the area of educational research may be classified in terms of different stages and sectors of education as given below:

i) Pre-primary Education

ii) Primary Education

iii) Secondary Education

iv) Higher Education

v) Vocational and Technical Education

vi) Non-formal Education

vii) Open and Distance Education

Besides these, there are many other areas of educational research. For example, Language Education, Science Education, Mathematics Education etc.

So, it is clear that area of educational research is very vast and has many dimensions. That means a researcher in the field of education may conduct his/her research in a particular content area and at a particular stage. For example, research can be performed, say, in mathematics education in the area of curriculum and at the secondary level. With the changing need of the society, different new areas of education is evolving and much importance is given on the research of those areas. As for example, Educational technology is becoming popular day by day and it is now used in almost every sphere of education. Similarly, Open and Distance Learning has become one area in educational research. It will be interesting to note that the different areas within Open and Distance Education have attracted the attention of researchers nowadays.

2.4 Types of Research

We have already discussed that research is conducted at different stages for different purposes. On the basis of purpose, research may be categorised in three forms:

i) Basic or Fundamental research,

ii) Applied research, and

iii) Action research.

If we classify the methods of research then we have mainly three broad categories:

i) Historical research,

ii) Descriptive research, and

iii) Experimental research.

Now, Let us discuss different types of research in the following sections:

2.4.1 Basic or Fundamental Research

Basic or fundamental research is concerned mainly with generalisations and with the formulation of a theory. The purpose of this type of research is to find out the new knowledge in the form of new theory, facts and truth. Basic or fundamental research is also called pure research.

According to Travers (1948, p.4): "Basic (or pure or fundamental) research is designed to add an organised body of scientific knowledge and does not necessarily produce results of immediate practical value."

In the words of Pauline V. Young (ref), "Gathering knowledge for knowledge's sake is termed pure or basic research." That is in another words we can say that the main purpose of basic research is the discovery of knowledge solely for the sake of knowledge development. Basic research is not concerned for the application of the new findings or social usefulness of the results. Basic research draws its pattern and spirit from physical sciences. It generates new ideas, principles, and theories, which may not be immediately utilized but nonetheless, form the basis of progress and development in different fields. Today's computers which we use in every sphere of our life could not exist without research in pure mathematics conducted over a century ago, for which there was no known practical application at the time. Basic research rarely helps practitioners directly with their everyday concerns; nevertheless, it stimulates new ways of thinking that have the potential to revolutionize and dramatically improve how practitioners deal with a problem in the future.

We can summarise the characteristics of basic research as:

i) Fundamental or Basic research is basic and original.

ii) New theories are discovered from basic research.

iii) It can result in the development or refinement of a theory that already exists.

iv) Main aim of basic research is to get new knowledge without thinking formally of implementing it in practice.

v) It is based on the honesty, love and integrity of the researcher for discovering the truth.

In the field of education, basic research attempts at the development and testing of the theories of the behaviour of learners and teachers in educational and/or classroom settings.

Thorndike's theory of leaming, Skinner's operant conditioning, Guilford's structure of intellect etc. are the products of some basic research in education.

2.4.2 Applied Research

Applied research is directed towards the solution of specific and practical problems. This research is also called field research. A fundamental research develops theories, laws etc., but applied research is concerned primarily with the testing of such theories or laws in the actual field. The applied research also takes into consideration the scientific method of inquiry but its methodology is not as rigorous as that of fundamental/ basic research.

We can summarise the main characteristics of applied research as follows:

i) It is based on the concept of the basic research. But it is problem oriented.

ii) It helps in finding solutions for real life problems. That's why it is useful to society.

iii) Applied research helps in testing empirical content of a theory.

iv) It helps in developing the techniques that can be used for basic research.

v) Applied research is used in testing the validity of a theory in actual field.

In the field of education, applied research is mainly intended to improve school practices and add to greater teacher effectiveness in a practical manner. Most of the problems faced by teachers, policy planners, and administrators are solved through applied researches.

2.4.3 Action Research

2.4.3.1 Meaning of Action Research: In 1926, Buckingham used the concept of action research in education for the first time, in his book 'Research for Teachers'. But later on Stephen M. Corey (1953) has applied the concept of action research for the first time in studying and solving educational problems. Corey has defined action research as, "The process by which practitioners attempt to study their problems scientifically in order to guide, correct and evaluate their decisions and actions are, what a number of people have

called, action research". Action research is done to solve a specific problem felt by a person working in the field. It is undertaken by educational practitioners (teachers, supervisors and administrators) to take decisions scientifically for improving their current practices. So, in other words we can say that the process by which practitioners attempt to study their problems scientifically in order to guide, correct and evaluate their decisions and actions are, called action research. Action research is based on immediate application, but not on the development of theory or on generalization of applications. It focuses on the immediate problem in a local setting. For example, a teacher carries out action research for the improvement of his/her own teaching and a school administrator carries out action research for the improvement of his/her administrative behaviour. So, we can say that action research is the research by the practitioner (teacher/administrator/examiner etc.)

Action research is similar to applied research. But there are some differences between them as given below:

a) Applied research is carried out on a larger sample and the findings coming out from the applied research are applicable universally; but action research is conducted on the immediately available small sample to find out the solution of the immediate problem.

b) Another difference between applied research and action research is that applied research is conducted by experts, but no such expertise is necessary in action research. Action research is the concern of the field workers.

2.4.3.2 Definition of Action Research: According to Sara Blackwell, "Research concerned with school problems carried on by school personnel to improve school practices is action research".

In the words of Goode (1959), "Action research is research used by teachers, supervisors or administrators to improve the quality of their decisions and action."

Corey has defined action research: "Action research is a process for studying problems by practitioners scientifically to take decision for improving their current practices".

According to McThrete- "Action research is organised, investigative activity, aimed towards study and constructive change of given endeavour by individual or group concerned with change and improvement".

Definition of action research as given by Hammerseley (1993), "Action researches are small scale and narrowly focused researches undertaken by teachers in a given context. It

has also been referred to as research into practice by practitioners and for practitioners."

2.4.3.3 Characteristics of Action Research: The main characteristics of action research may be described in the words of Best and Kahn (1986) as follows: "This action research movement in education has its goal of involving classroom teachers in the study and application of research to the educational problems in educational setting. Action research focuses on immediate application and not on the development of theory or on general application. Its findings are to be evaluated in terms of local applicability and not universal validity. The main purpose in this kind of research is to improve school practices and to improve those who try to improve the practices."

L.Cohen and L. Manion have highlighted the features of Action research as given below:

"In Action research, teachers, the classroom practitioners, feel and solve the problem. A practitioner undertakes both the functions of diagnosis and therapeutic treatment—

i) to find out remedy of problems diagnosed in specific situations;

ii) to heighten the self awareness, self-critical and analytical abilities of teachers and teacher educators; and

iii) to inject innovative approaches of teaching."

We can summarise the characteristics of action research as follows:

1. Action research is a scientific process for studying the current practical problems of education.
2. The practitioner can study only his/her own problem.
3. Action research is a personal research carried out for clinical utility.
4. The focus of action research is to improve and modify the current practices.
5. Action research does not contribute to the gamut of theoretical knowledge. It studies the current educational problems to find out immediate solution in terms of the local applicability in a local setting.

Differences between Action research and Fundamental research:

The main differences between fundamental research and action research are given below:

i) The purpose of fundamental research is to evolve and test educational theories and

to obtain principles which are applicable universally. But the purpose of action research is to solve a specific problem felt by a person working in the field and this solution has no general acceptance, it is applicable to a particular situation.

ii) In fundamental research, the researcher may not be personally involved in the research problem whereas in action research, the researcher is invariably involved in the research problem.

iii) The researcher must have expertise to conduct a fundamental research whereas an ordinary teacher taking an ordinary training can conduct action research.

iv) The sample size of fundamental research is large, whereas in action research the students in a particular class taught by the teacher act as sample and obviously the sample size is small.

v) Very rigid research design is followed in fundamental research, whereas in action research, the research design is very simple.

vi) In fundamental research the analysis of data is generally complex and much stress is given on statistical treatment. But in action research the analysis of data is very simple and no stress is given on statistical treatment.

2.4.3.4 Steps of Action Research: Following are the main steps of an action research:

i) **Identification of Problem :** Like other type of research, action research starts with the identification of a research problem. A teacher should be sensitive towards job activities. The problem is isolated from the broad field. The investigation must realize the seriousness of the problem.

ii) **Defining and Delimiting the Problem:** After identifying the problem, it should be defined so that action and goal may be specified. The delimitation means to localize the problem in terms of class subject, group and period in which a teacher perceives the problem.

iii) **Analyzing Causes of the Problem :** The causes of the problem are analyzed with the help of some evidences. The nature of the causes is also analyzed whether it is under the control or beyond the control of the investigator. This helps in formulating the action hypothesis.

iv) **Formulating the Action Hypotheses:** The bases for the formulation action hypotheses are the causes of the problem which are broadly under the approaches

of the investigator. The statement of action or hypothesis consists of two aspects—action and goal. It indicates that fhe action should be taken for achieving the goal.

v) **Design for Testing the Action Hypothesis:** A design is developed for testing the most important action-hypothesis. Some actions may be taken and their results are observed. If the hypothesis is not accepted, second design is developed for testing another hypothesis. In action research, one hypothesis is tested at a time. The design of action research is flexible and can be changed at any time according to the convenience of the researcher.

vi) **Conclusion of Action Research Project:** The accepting or rejecting the action hypothesis leads to draw some conclusions. The statement of conclusion indicates some prescription for the practical problem of school or classroom. The conclusions are useful in modifying and improving the current practices of school and classroom teaching.

2.4.4 Historical Research

2.4.4.1 Meaning of Historical Research : History is a branch of learning that studies the record of past events. It is a meaningful record of human development. History is not merely a list of chronological events but a truthful integrated account of the relationships between persons, events, times and places. History is used to understand the past and try to understand the present in the light of past events.

Historical research refers to the application of scientific method to the description and analysis of past events. It demands standards of careful methodology and spirit comparable to those which characterise other types of research. Historical research deals with the past experiences. The aim of historical research is to apply the method of reflective thinking of social problems, still unsolved, by means of discovery of past trends of event, fact and attitude. It traces lines of developments in human thought and action in order to reach some basis for social activity. Historical studies in education provide important information concerning the effects of certain past educational practices and may suggest programmes for future action, based upon the evaluation of past experiences.

2.4.4.2 Steps in Historical Research: Historical research involves the following steps:

i) Selection of the problem

ii) Formulation of hypotheses

iii) Collection of data

iv) Criticism of data

v) Interpretation of data

vi) Report writing

Selection of the problem:

Like other types of research, the first step of historical research is the selection of a problem. The problems in historical research have some special characteristics. All problems are not suitable for historical research. Only those problems are selected for study which need scanning of historical records and have some social utility.

Fromulation of hypotheses:

The second step is formulation of hypotheses. While formulating hypotheses, the researcher may formulate questions that are most appropriate for the past events he/she is investing and then direct their research towards seeking answers to these questions with the help of evidences. Hypotheses for historical research may not be formal hypotheses to be tested. Rather, they are written as explicit statements that tentatively explain the occurrence of events and conditions.

Collection of Data:

Like all other types of research, it is a necessary condition that the researcher must collect relevant and accurate data so that the hypotheses may correctly be verified. Data collection in historical research is a very time consuming and tedious job. Enough skill of the researcher is necessary for the collection of data from relevant and appropriate sources. In historical research, there are two types of sources of data. One type is called Primary sources of data and the other is called Secondary sources of data.

a) Primary sources of data : These data provide first hand information from direct measurement, eyewitness accounts or observations. Goode, Barr and Scates (1941) have called them as the 'first witnesses of a fact'. The original documents come under the category of primary sources. They are available in written, pictorial and mechanical forms such as Personal records, Official records, Oral testimony of traditions and events, Pictorial records, Mechanical records, Remains or relics.

b) Secondary Sources of data : Secondary data refer to 'second hand' data. Secondary sources are the accounts of an event provided by a person who did not directly observe

the event, object or condition. The person might have directly contacted an actual observer and talk with him/her or read an account by an observer. That's why secondary sources are subject to an inherent danger of inaccuracy and distortion. For this reason the researcher should rely much on primary sources. But it is not always possible to obtain primary data and in this situation the researcher may have to rely on secondary sources. However, in most cases it is advisable that the secondary sources should be used to bridge the gaps between the various pieces of primary data.

Criticism of data:

After the identification of data, the researcher must evaluate them rigorously because the truthfulness of the data is questionable. This process is known as 'criticism of data'. Here, the researcher seeks the authenticity of the source and also the validity of the data.

There are two types of criticism:

a) External Criticism: The process of establishing the genuineness and authenticity of the data is known as external criticism. It is also called lower criticism. According to Moulay (1963), the purpose of external criticism is not so much 'negative', that is the detection of fraud as it is the 'establishment of historical truth'.

b) Internal Criticism: It is also called higher criticism. Internal criticism is concerned with validity, creditability or worth of the content of the document. It also involves factors such as competence, good faith, bias and general reputation of the author.

Interpretation of data

After the collection and criticism of data, the researcher analyses the data. The analysis of data in historical research does not require statistical treatment. The data are then interpreted in the light of the research problem. The interpretation of data in historical research is complicated because the nature of historical data is unique. The researcher must be cautious while dealing with cause and effect relationships, because historical causes are invariably complex. In historical research, the cause-effect relationship is not clear-cut as seen in physical sciences. The researcher must also be very cautious in his/her use of analogy in the interpretation of data. While drawing comparisons between one historical event and any number of others, he/she must carefully make use of similarities as well as of differences.

Report Writing

It is the last but important step of historical research. This part of historical research

needs the highest level of scholarship on the part of the researcher. This is a matter of expositional strategy, which calls for creativity in addition to the qualities of imagination and ingenuity. The presentation of the report should be objective and systematic and should not hide or distort the truth. The historical research report must be presented in the logical, chronological and topical order. The research report should not be unattractive and also not too much ornamental. The researcher must follow precision, continuity and clarity in his/ her writing.

2.4.4.3 Importance of Historical Research in Education: Historical research is very much important in the field of education. This research helps to know and understand educational achievements and trends of the past in order to gain perspective on present and future directions.

Knight (1934) has analysed the value of historical research and Good, Barr and Scates (1941, p.243) have discussed this in their writing as follows:

i) A knowledge of the history of schools and other educational agencies is an important part of the professional training of the teacher or the school administrator.

ii) Much of the works of the school are traditional. The nature of the work of the teacher and the school administrator is restrictive and tends to foster prejudice in favour of familiar methods. The history of education is the "sovereign solvent" of educational prejudices.

iii) The history of education enables the educational worker to detect fads and frills in whatever form they may appear, and it serves as a necessary preliminary to educational reform.

iv) Only in the light of their origin and" growth can be numerous educational problems of the present be viewed sympathetically and without bias by the teacher, the school administrator, or the public.

v) The history of education shows how the functions of social institutions shift and how the support and control of education have changed from very simple and local arrangements to those that are now somewhat centralised and complex.

vi) The history of education is an ally in the scientific study of education rather than a competition. It serves to present the educational ideals and standards of other times, and it enables social workers to avoid mistakes of the past.

vii) It inspires respect for sound scholarship and reverence for great teachers.

2.4.5 Descriptive Research

2.4.5.1 Meaning of Descriptive Research: Descriptive research is concerned with current phenomena and its status. This type of research is designed to obtain precise information of the current phenomena and to draw general conclusions from the facts discovered. It studies the relationships among non-manipulated variables only. The researcher selects the relevant variables from the events or conditions that have already occurred or exist at present, and analyses their relationships without introducing any manipulations to the variables.

The meaning of descriptive research will be understood clearly from the following definitions:

According to Best (1983): "A descriptive study describes and interprets what exists. It is concerned with the conditions or relationships that exist, opinion that are held, processes that are going on, effects that are evident or trends that are developing. It is primarily concerned with the present, although it often considers past events and influences as they relate to current conditions."

In the words of Good (1963) : "Descriptive studies may include present facts or current conditions concerning the hature of a group of persons, a number of objects, or a class of events and may involve the procedures of induction, analysis, classification, enumeration, or measurement."

Gephart and Ingle (1969) have defined descriptive research as— "The ultimate aim of descriptive research is to classify events, so that later research can employ an unequivocal terminology and to lessen the confusion coming from ad hoc definitions. But purpose of descriptive research is to establish a clear description of materials and phenomena under investigation."

According to Lovell and Lawon (1970) : "Descriptive research does not involve the experiments per se. It seeks to discover the nature of the factors involved in a given situation, it seeks to determine the degree in which they exist, and it attempts to discover the links or relationship which exist between the factors."

International Encyclopaedia of Psychology (1996) has given the definition of descriptive research as follows: "Descriptive research is nearly self-explanatory; it occurs when the researcher wants merely to characterize the behaviours of an individual or a group. For example, survey of the students of a high school to ascertain the level of ICT use."

2.4.5.2 Steps in Descriptive Research: The steps followed in descriptive research is almost similar to other types of research. Descriptive studies describe and interpret present conditions or relationships. So, the researcher may follow the following steps for his/her study:

i) Selection of the problem: As in descriptive research, the researcher studies the present status of the phenomena, determining the nature of prevailing conditions, practices and attitudes he/she may select the problem accordingly from the area of his/her interest.

ii) Statement and definition of the problem: The research problem must be stated clearly and precisely by the researcher. The variables involved in the study must be reflected in the statement of the research problem and all terms must be defined in operational forms.

iii) Formulation of hypotheses: The researcher formulates hypotheses on the basis of the existing theories and facts. These hypotheses guide the researcher throughout the research process in solving his/her research problem.

iv) Identification of data: The next step is to list the necessary data to be collected for the study. The data for the descriptive research are of two types— Qualitative and Quantitative. The researcher must identify the nature of the data i.e. qualitative or quantitative for his/her study so that he/she can test the hypotheses properly.

v) Selection or development of tools: After identification of the nature of data (qualitative or quantitative) to be collected for the study, the next step is to select appropriate tool for the collection of data. If standardised tool is not available, then the researcher has to develop tool of his/her own purpose. In that case, he/she must evaluate the reliability and validity of the tool. The most frequent tools used for descriptive research are questionnaire, schedules, rating scales, interviews, psychological tests, attitude scales etc.

vi) Selection of the sample: Sample should be selected from the population with appropriate sampling techniques so that the sample represents the population adequately and serves the purpose of the study.

vii) Collection of data: After selection of appropriate tools and the sample, data are collected from the sample with due care.

viii) Analysis and interpretation of data: Data so collected by the researcher are then tabulated properly and quantified, if necessary. The data are then analysed and interpreted with the help of appropriate statistical techniques. On the basis of the results, the hypotheses are then either retained or rejected.

ix) Writing of Research Report: It is the last but most important step of any research. The researcher writes an appropriate and clear report of what he/she has done and found; and generalize the conclusions very cautiously. He/she should mention the limitations of his/her study in the report. Proper reporting of any study guides other people or researcher for further research.,

2.4.5.3 Types of Descriptive Research: Descriptive studies may be classified into three broad categories— i) Survey Studies, ii) Interrelationship studies and iii) Developmental studies. These three categories have also sub-categorised as listed in the following table:

Descriptive Studies

Survey Studies	**Interrelationship Studies**	**Developmental Studies**
Descriptive Research	a) Case Studies b) Causal-Comparative Studies c) Co-relational Studies	a) Growth Studies i) Longitudinal Studies ii) Cross Sectional Studies b) Follow- up Studies c) Trend Studies

2.4.5.4 Importance of Descriptive Research in Education: Descriptive research method is most popular in the field of education. Among all research methods descriptive method is used widely in educational research because it has some advantages and importance in the field of education. These are as follows:

i) Descriptive research method is very easy and direct in use.

ii) Descriptive research is used in solving problems about children, school organisation, supervision and administration, curriculum, teaching methods and evaluation.

iii) This method is used to describe the current and present educational phenomena, problems and opinions possessed by the teachers, students, administrators etc. about their educational environment.

iv) Descriptive method is used to study the existing relationship between or among variables without any manipulation. Many times, it is found that manipulation of the variables is very tough job; then descriptive method is the only means to conduct the research.

v) Although descriptive research is mainly concerned about the status of current educational problems, but many times this type of research suggests many valuable solutions to the educational problems.

vi) This type of research is also useful in the development of many data collecting tools like questionnaire, schedule, checklist etc. in the field of education.

vii) Descriptive research is also very helpful in developing new generalisations, principles or theories in the field of education which possess universal validity and utility.

2.4.6 Longitudinal Research

Developmental studies is one of the broad categories of descriptive research. Developmental studies is also called Genetic studies. Developmental studies may be undertaken in three forms - Growth studies, Follow-up studies and Trend studies.

Growth studies is concerned with the understanding of the interrelated factors that affect the growth of children at various stages of development and how the duration, intensity and timing of such factors in the developmental period affect the growth.

Growth studies have two types : Longitudinal and Cross-sectional.

Longitudinal Studies follow the same subject, a group of subject or an institution over a long period of time. For example, if a researcher wants to know the change in personality with time, he can choose a student of 10 years. The researcher then test and measure the personality of the same student whenever his/her age is 10,11,12,13,14 years. By plotting the growth pattern of personality of the same student the researcher can assess the change in the trait over a period of time. It is longitudinal studies. Here, it is to be noted that the same student is studied over a long period of time and "thus some extraneous variables like family background, social status etc. are controlled. So, the change in personality of the student can be considered due to change in age of the student only.

Longitudinal studies can be considered as a kind of extended Case Study as it involves a long life-span of the same subject, group or institution. This type of research is mostly common in clinics and laboratories. However, this type of research is not uncommon in the field of education. We can cite some examples of longitudinal studies in education. Terman and his co-workers (1925, 1947) made a longitudinal investigation of gifted children and their studies have made a significant contribution to the understanding of the gifted children. The longitudinal studies of Gesell (1928, 1940, 1946) has contributed greatly in the understanding of the child and his/her development. He studied mental and physical growth

and the development of emotional expression, philosophic outlook, adaptive behaviour, language, interpersonal relationships, and personal-social behaviour of children from infancy to age 16. Another good example of longitudinal studies is the works of Honzik, Macfarland, and Allen (1949). They studied the fluctuation of IQ scores of children from age two to age eighteen.

Advantages:

Longitudinal studies have many advantages. Individual variability of growth and development is revealed better in longitudinal studies. According to Dalen and Meyer (1966), longitudinal technique is the most satisfactory method of studying human development.

Disadvantages

In spite of some advantages of the longitudinal studies it suffers from some limitations. The limitations are:

i) Longitudinal studies have ample weaknesses as the data is obtained from single subject or limited number of subjects. The results of longitudinal studies obtained from a single subject may not be applicable to all others because that subject may not be the representative of the population. Another problem is that in some cases it is difficult to track the same subject over a long period of time, especially for a subject belonging to mobile community.

ii) In longitudinal studies, the researcher usually can not make improvements in his measuring tools as his/her studies develop without disrupting the continuity of the procedures. This is another problem of the longitudinal studies. Because at the later stage of study, if the researcher finds better tools and uses them for data collection, the data he/she collects with the new tools are not likely to be comparable.

iii) Longitudinal research requires extensive facilities, maximum perseverance on the part of the researcher over a number of years, and considerable amount of money. That's why this type of research is not suitable for individual researcher, it may be taken as projects by research organisations.

2.4.7 Cross-sectional Research

We have already mentioned that there are two types of Growth Studies. One is Longitudinal Studies and another is Cross-sectional Studies. We have also discussed about longitudinal studies. Now let us discuss about cross-sectional studies.

Cross-sectional studies overcome many of the limitations of longitudinal studies. The cross-sectional research measures several different groups of children of different ages simultaneously on certain variables of interest and compares the groups among themselves to find out how they differ and what dominant characteristics are shown at different age levels. Such studies are completed within a short period of time. For example, simultaneously at one point of time, the researcher administers his/her tools for measuring few variables of 4,5,6,7,8 year old children. Data are collected from all age groups on each variable. The researcher calculates the mean scores of all age group of children on each variable and then compares them. On the basis of this analysis, the researcher can describe which traits are dominant at which age level or which dominant characteristics define a particular age group.

Advantages

Cross-sectional studies have many advantages like:

i) It can be completed within a short duration.

ii) It is handy and easily manageable.

iii) A cross-sectional design is simpler.

iv) It is less expensive.

v) It fits to most of the research studies.

Disadvantages

Cross-sectional studies are very popular because, it has many advantages as mentioned above. But it has some limitations also. These are as follows:

i) Extraneous variables have considerable effects on the results. In this type of research extraneous variables are not controlled properly.

ii) In cross-sectional studies, the measurements taken of individuals at each age level may not be comparable, because the groups may differ on variables other than age.

iii) Chance differences between samples may seriously bias the results. It is a very serious limitation of cross-sectional research.

2.4.8 Experimental Research

2.4.8.1 Meaning of experimental research: We have already discussed two methods of research, Descriptive and Historical. Another method of research is experimental. According to John W. Best, “Experimental research is the description of what will be or what will occur, under the carefully controlled conditions. In this type of research, the researchers have some degree of control over the variables involved and the conditions under the variables are observed. Experimental research is the most reliable and dependable type of research and it involves 'experimentation', or what we conduct 'experiments' to explore the true causal relationships.” The procedure of experimental research is the deliberate manipulation of some aspects of the experiment (i.e., causes) in which the researcher is interested and to observe how the condition is changed (i.e., effect) due to the manipulation. Different researchers have defined 'experiment' as follows:

In the words of F.S. Chapin : " An experiment is an observation under controlled conditions"

According to W.S. Monro and M.D. Engelhart, "Experimentation is the name given to the type of educational research in which the investigator controls the educative factors to which a child or group of children is subjected during the period of inquiry and observes the resulting achievement."

Definition given by E.B. Wilson: "An experiment is a question framed on the basis of what is known and addressed to nature to elicit further knowledge. It thus, transcends the mere observations or collection of materials; it is consciously directed, purposeful observation"

According to Festinger, "The essence of an experiment may be described as observing the effect on a dependent variable of the manipulation of an independent variable".

In the words of Ernest Greenwood: "Experiment is the proof of a hypothesis which seeks to make up two factors into a causal relationships through the study of contracting situations which have been controlled on all factors the one of interest, the latter being either the hypothetical cause or the hypothetical effect"

2.4.8.2 Nature of experimental research: The experimental method in educational research is the application and adaptation of the classical method of the science laboratory. This method provides much control and establishes a systematic and logical association between manipulated factors and observed effects.

The basic assumption of experimental method rests on "Law of Single variable" given

by J.S.Mill. This law states that if two situations are similar in every aspect, and one element is added to or subtracted from one, but not from the other, and difference that develops is the result of the operation of that element added or subtracted. Experimentation, therefore, involves an attempt to control all essential factors save a single variable which is manipulated with a view to determining and measuring the effect of its operation. This procedure is distinctly different from historical and normative survey methods.

There are Four essential characteristics of experimental research are:

i) Control,

ii) Manipulation,

iii) Observation, and

iv) Replication.

i) Control: It is the essential factor in experimental research. The main purpose of control in experimental research is to create an environment so that the effects of the desired variables can be measured objectively. We know that, in experimental research the independent variable is manipulated and the dependent variable shows the effect of manipulating the independent variable. Besides these, there are variables which are not manipulated by the experimenter but have significant influence on the results of a study. These variables are called extraneous variables. By control, effort is made to reduce the effect of extraneous variables to the minimum. There are many methods for controlling extraneous variables such as Randomisation, Matching cases, Group matching, Analysis of Covariance (ANCOVA) etc. Since in the field of education, complex human beings are the subjects, some variables are extremely difficult or even impossible to control

ii) Manipulation: Another essential characteristic of experimental research is manipulation. Manipulation refers to the deliberate operation of the conditions by the experimenter. In the process of manipulation, a pre-determined set of varied conditions are imposed on the subjects selected for the experiment. The set of varied conditions is referred to as the independent variable, the experimental variable, or the treatment variable. In experimental research, we deliberately manipulate the independent variable, or the experimental variable, or the treatment variable and study what changes occur in the dependent variables for this manipulation.

iii) Observation: In experimental method, the researcher intelligently manipulates the independent variables and observe carefully and record the effect of this manipulation on the dependent variables.

iv) Replication: In experimental research, to draw better conclusion we try to remove the effect of extraneous variables on the dependent variables by the method of control. But no matter how a researcher carefully and objectively perform this control, still some discrepancies remain and influence the experimented outcome. These discrepancies can be taken care of through logical replication of the experiment. Replication is a matter of conducting a number of sub-experiments within the framework of an overall experimental design.

2.4.8.3 Steps in Experimental Research: We have discussed the steps of scientific method in Unit I. The major steps in experimental research are almost similar to those of the scientific method. These steps are discussed in brief as follows:

i) **Survey of the related literature:** It is the first step of experimental research where the researcher studies the latest literature related to his/her problem area for updating the knowledge. Through the study of related literature he/she is acquainted with what has been done till now in the problem area and what is to be done further.

ii) **Selecting and defining the problem:** After surveying the literature, experimental research starts with the selection of the problem which is amenable to experimentation. It needs a rigorous logical analysis and definition of the problem in precise terms. Also, the researcher should define the variables (independent variable, dependent variable, extraneous variable etc) in operational terms which will help him/her to convert the problem precisely into hypotheses that can be verified or refuted by the experimental data.

iii) **Stating the hypotheses:** The next step is to state the hypotheses. The hypotheses suggest that an antecedent condition or phenomenon (independent variable) is related to the occurrence of another phenomenon, condition, 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 the researcher observes the effect on the dependent variable presumably because of the exposure to the independent variable. Therefore, the researcher should not only be concerned primarily with experimental plans and statistical procedures, but also should give sufficient attention and care to the formulation of hypotheses.

iv) **Constructing the experimental plan:** Experimental plan refers to the conceptual framework within which the experiment is conducted. According to Van Dalen (1973) experimental plan represents all elements, conditions or phenomena, and

relations of consequences so as to:

- Identify all non-experimental variables that might contaminate the experiment and determine how to control them;
- Select a research design;
- Select a sample of subjects to represent a given population, assign subjects to groups, and assign experimental treatments to groups;
- Select or construct and validate instruments to measure the outcomes of the experiment;
- Outline procedures for collecting data and possibly conduct a pilot or 'trial run test' to perfect the instruments or design; and'
- State the statistical or null hypothesis.

Here, it is to be noted that in order to select a suitable research design for conducting the experiment and assign subjects to different experimental treatments to measure the results of experiment, the researcher must be well acquainted with different types of experimental designs (discussion of different experimental designs is out of scope of the syllabus).

v) **Data Collection:** After finalising the research plan and design, the researcher will conduct the experiment according to the experimental design and then measure the results of the experiment.

vi) **Data Analysis and Interpretation:** After collection of data the researcher will classify them and then tabulate them properly. The data are then analysed with the help of appropriate statistical techniques. On the basis of the results, the hypotheses are then either retained or rejected.

vii) **Conclusions:** The findings are then interpreted leading to the conclusions of the research study.

viii) **Research report writing:** Lastly the researcher reports the study i.e. what he/she has obtained in details so that the readers can make judgement of his/her research.

2.4.8.4 Importance of Experimental Research in Education: We can also conduct experimental research in education for determination and evaluation of the accuracy, adequacy and effectiveness of various educational programmes, strategies, classroom practices, teaching

methods, evaluation techniques, educational and instructional objectives etc. The outcomes of experimental research in the mentioned fields lead to conduct further experimental research for improvement and modification, if necessary. In this connection we can mention the words of Campbell and Stanley (1963), "the experiment is the only means for setting disputes regarding educational practice, the only way to verify educational improvements, and the only way of establishing a cumulative tradition in which improvements can be introduced without the danger of a faddish discard of old wisdom in favour of inferior novelties."

2.5 Importance of Educational Research

Educational research is essential for the betterment of system of education, for society and in large sense, for the country and the world. Educational research has some important factors which increases its demand and more focus on it. These are:

i) **Objectivity:** Educational research brings objectivity which has much importance, otherwise only few educators' opinion or view would control the system.

ii) **Sense of awareness:** Educational research brings sense of awareness. According to Everett Walters, "The teacher who carries on an active research programme has at his/her command a sense of awareness and of deep understanding. He/She has at his fingertips illuminating examples and searching questions which can give his lectures or discussions that vibrancy and sparkle which make for real teaching."

iii) **Promoting educational reforms:** Research promotes educational reforms. Walter R. Brog has said, "Although research is still in its infancy, it has in its short span already produced much useful knowledge and has brought about great changes in educational practices and in the thinking of educators."

iv) **Leading to refinement :** Educational research refines our knowledge, discovers new truth and develops culture. In the words of J.W. Best, "The secret of our cultural development has been researched pushing back the areas of ignorance by discovering new truth, which in turn, lead to better ways of doing things and better products."

v) **Better understanding of teaching-learning process :** Educational research brings better understanding of the teaching-learning process. John Best has rightly said, "In the field of education, we identify research with a better understanding of the teaching-learning process, and the condition under which it is most successfully carried on."

vi) **Controlling factor of social behaviour :** Educational research acts as a controlling factor of social behaviour. In the words of P.V. Young, "The primary goal of research, immediate or distant, is to understand social life and thereby gain a greater measure of control over social behaviour."

vii) **Economizing effort and increasing efficiency :** Educational research economizes effort and increases efficiency of a teacher. According to Rusk, "Research should accordingly, by putting more scientific weapons at the disposal of teacher, economize effort and increase efficiency. It is in fact likely to lead to what Ballard has termed 'leisurely methods'. The leisurely methods of today are just as effective as the strenuous method of the past."

viii) **Dignifies the work of the teacher :** Educational research dignifies the work of the teachers. In the words of Buckingham, "Research will not only powerfully and rapidly develop the technique of teaching, but will also react to vitalize and dignify the work of the individual teacher. It is our firm belief that the emancipation and professionalizing of the teacher's calling rests for upon any consideration having to do with salary, tenure or legal status. Society to be respectable. If, as has often been observed there is no such general belief in the public is right about it - whether the teacher readily has, to the extent that the professional or craft worker has, a special competency peculiar to his/her calling. In my judgement nothing would so effectively obtain for a teaching body the professional expertness and the reputation for having it as the open eyed, open minded and scientific spirit of inquiry."

ix) **Brings confidence to the teacher :** Educational research brings confidence to the teachers. According to Rusk, "When the teacher's technique is based on research, teaching will no longer be regarded as one of the black arts, but will assume the status not a dismal science, but of a progressive and enlightened procedure. The more highly skilled and better informed teacher will find new interest in his/her work and a new confidence in own abilities."

x) **Needed selection for new methods :** Educational research is needed for the selection of new methods. Kothari Commission (1964-66) has pointed out the necessity of educational research as, "Much of the opposition of a policy of selective admission would disappear if good methods of selection were evolved. What is needed is a reliable method of selection, which will take account of past

performance, native talent and the principles of social justice? Educational research will have to develop vigorously to discover such methods."

xi) **Identification of talent :** Educational research is needed for the identification of talents spread over the country. We must search intelligent citizens in different areas and subjects through research for the development of the country. Then our large population will be an asset.

xii) **For studying the child:** Educational research is needed for studying the child. In the words of 'The Organisation of Educational Research' [UNESCO, 1966], "In many of its recommendations, the International Conference on Public Education has stressed the need for psycho-educational knowledge of the child as the starting point for any educational activity. It has also shown that research forms as indispensible basis for any national organization of education, especially as regards to curricula, syllabuses and methods as well as financing education for its planning and for the building of the schools".

2.6 Let us sum up

The field of education is changing its nature constantly due to the rapid development of science and technology. Thus, like other fields, research in education is indispensable to bring necessary improvements in the educational process. Educational research is the application of the scientific method in the field of educational process. But what type of educational research will be conducted depends on the nature of the problem. There are mainly three types of educational research— Historical, Descriptive and Experimental. Historical research describes what was; Descriptive research describes what is and Experimental research describes what will be when certain variables are manipulated. Besides these, action research may be undertaken by the teachers for the solutions of their own immediate professional problems in local settings. Action research is one type of applied research. Fundamental research in education is conducted to develop new theories, laws, principles etc. which have universal acceptability.

2.7 Unit End Exercises

1. Define educational research.
2. What is the nature of educational research?
3. Mention different areas of educational research.

4. Define action research.
5. What are the differences between fundamental research and applied research?
6. What is historical research?
7. Mention different steps of descriptive research.
8. What is meant by criticism of data in historical research?
9. What is meant by manipulation and control in experimental research?
10. Why educational research is so important?

2.8 References

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Unit 3 ❑ Basic Ideas of Research

Structure

3.1 Introduction

Research is a systematic, scientific and careful investigation to discover or unfold new ideas, concepts and processes of some observations based on facts and phenomena. Research is also a process to find out the solution of unsolved problem or to establish cause-effect relationship of different variables. According to Best, "Research may be defined as objective analysis and recording of controlled observations that may lead to the development of generalizations, principles, or theories, resulting in predictions and possibly ultimate control of events."

To develop a good idea of research a researcher should be acquainted with the characteristics of a good research problem which in turn may help the researcher to make the research more meaningful. To design a good research problem researcher must have to read, understand and apply the knowledge of previous research work which is called review of related literature for the research. This related research helps to understand research variables among which a researcher has to find out the relation and have to justify the pre-assumed or hypothecated result of the research. These variables may be of different kind, independent, dependent, intervening, attribute, extraneous etc. The research hypothesis or hypotheses may also be designed depending on the characteristics or nature of the problems and also basic observations by the researcher. Depending on the crises or demand of the problem, researcher must design the population and subsequently require feasible sample to study. A good sampling helps to solve the research problem with precision. Therefore, basic ideas of research helps a lot to researchers to solve the problem that peeps in his or her research mind.

3.2 Objectives

After completion of this unit the learners will be able to—

1. Define and understand what a research is,

2. Understand and explain the characteristics of a good research problem,
3. Understand and explain the purpose of review of related literature,
4. Define, understand, identify, distinguish and explain research variables with its kind,
5. Define, frame the research hypothesis/es with its nature and types,
6. Define, choose and frame population and sample with its nature and uses.

3.3 Characteristics of a Good Research Problem

3.3.1 Main characteristics of a good research problem:

1. A good research problem must be related with new questions or problems.
2. The good research problem must have a clear and concise statement of objectives of the problem.
3. The problem should be grounded with the theory, so that objectives may be achieveable.
4. The problem may be corelated with a single or multiple field of study.
5. The problem must be based on some research literature,
6. A good research problem must have a design with proper tools to standerdise.
7. A good research problem must have possible hypotheses.
8. A good research problem must have proper methodology of analysis.
9. A good research problem must have a potential imprtance and significance.
10. A good research problem may have an extention of further studies.

3.3.2 Conditions of a good research problem:

i) Related with new question or problem: A good research problem must have one or more than one new question/s or problem/s that have to be solved .The problem should generate a number of more specific research questions. These convert the problem into a question format and represent various aspects of the problem. The research questions make the more general statement easier to address and also provide a framework for the research. Convertion of these questions can be a challenge.

ii) Clear and concise statement of objectives: A research problem is a good problem if the objectives of the problem can be stated clearly and concisely, otherwise it is probably a poor problem or a non-problem. The best way to test the problem statement is to write it into a concise sentence or paragraph and to share it with others. If the problem can be stated in a clear paragraph, it overcomes the difficulties then that will be considered as a suitable problem.

iii) Grounded with theory so that objectives may be achieveable: A good research problem has theoretical and/or conceptual frameworks for their analyses. They relate the specific objectives of what are being investigated to a more general background of theory which helps to interpret the results and to make a link it with the field.

iv) Correlated with a single or multiple field of study: A good research problem must relate to the academic fields which have a connection and limitations. Research problems which do not have clear links to one or more than one such fields of study are generally in trouble. Without such a field it becomes impossible to determine where the problem lies in the universe of knowledge.

v) Based on some research literature: To select a good research problem a number of previous related literature or published research works must have to be studied and correlated. Related to the former points, a well-stated problem will have to frame. If it is framed in such a way that drawbacks of the previous literature may be searched with a newer way it may be called as good research problem.

vi) Have a design with proper tools to be standerdised: A research problem will be called as good, if it is designed scientifically with proper questions or questionnaire as tool and to be standerdised it for the precision of the result of the research.

vii)Have a possible hypotheses: Assumptions towards the solution of the problem or possible answers of the research problem i.e. framing hypotheses indicates healthy characteristic of a good research problem.

viii) Have proper methodology of analysis: Choice of methodology for analysing the results or data of the research towards a solution must indicates the characteristics of a good resarch problem.

ix) Have a potential imprtance and significance: The sollution of the good research problem must have some utilities in future either in acdemic or social or any other field.

x) Have a scope of further studies: A good research problem may not end itself

after completion of work. It must have some extension of further research by researcher or any other person.

3.4 Review of Related Literature-purpose

3.4.1 Meaning of related literature

A researcher must have a clear concept on the previous research works before entering into the research. There are huge research publications on different journals of different fields. But all these publications may or may not be relevant to the problem of the researcher. Researcher must choose those studies which are related any way with the problem of study.

3.4.2 Meaning of review of related literature

Review or study means careful investigation for acquiring knowledge through scrutiny. It may also be said view again of the past events or the progress made so far. Thus, studies on related literature and review of related papers are basically same. An effective or successful research is based upon careful and intrinsic review of the approved or authentic research journals, books, dissertations, theses, official records or minutes, documentary materials, charts, court decisions, declarations, affidavits, letters, diaries, maps, films, pictures etc. After such a review researcher will be able to find out any relation with the problem of study and progress accordingly to frame the research problem judiciously.

3.4.3 Purpose of review of Related Literature

i) Effective research is based upon past experiences. Review of related literatures helps the researcher to eliminate the duplication or repetition of what has been done earlier. It also helps the researcher to avoid the unfruitful problem areas.

ii) Review of related literature help the researchers to get information regarding the recommendations of previous researches which helps to avoid the faults.

iii) Review of related research helps the researcher to make an outline of the research which helps to define the problem to be investigated.

iv) Review of related research helps a researcher to delimit the boundary of the research that means which areas will not be considered for study though it may have some relation with the problem. But due to lack of some feasibility scope of research may be shorten.

v) Review of related research helps a researcher to identify the required variables by which the study could be done. The variables could be well defined to solve the problem by the review.

vi) Review of related research will help a researcher to write the objectives specifically which are achievable within the stipulated research framework.

vii) Review of related research helps a researcher to be well aware about the population, sample, sampling techniques, and data collecting tools or instrument, research design, statistical or non- statistical method of analysis.

3.5 Variables—dependent and independent

3.5.1 Meaning of Variable

It is well known that everything is changing in the world with respect to time and other different factors. So, everything is varied with time except few unchangeable constants. The factors for which a subject, fact and phenomenon is changed are called variables and the subject of study is also called variables. Research must study such both types of changes with each other. It may be discussed with an easy example of daily life. Water is warmed with the increase of heat. Therefore, temperature is varied with variation of applying heat. In this example, both temperature and heat are variables and changing of temperature depends on the changing of Heat. The same pattern is also observed in human behavior and also in educational field. Researcher searches or observes for such type of variation and collect data to get results of the problem studied. Therefore, subjects and factors for which the changes of subject occurred both are called variables. There are different kind of variables viz., dependent, independent, intervening, attribute and extraneous variables.

3.5.2 Dependent and Independent Variables in Educational :

In case of the above example of changing temperature with changes of heat; it may be said temperature depends on apply of heat. Therefore, 'Temperature' is dependent variable here and heat may be changed as according to desire or wish of the researcher which is independent of all other factors of study, so heat is independent variable here for this phenomenon.

It is observed that students learning is controlled by several direct or indirect factors. The personality of an individual is also controlled by several direct or indirect factors. Here, Learning and Personality these two factors or traits are called dependent variables. Therefore,

the factor which is changeable with others is called dependent variables, the direct or indirect factors in both cases are called independent variables. So, we can say, the factors on which dependent variables varied are independent variable. It may also be illustrated with another example given below :

Illustration with Example:

Example-1 : In education, due to change of teaching method or teaching learning material. Students' achievement level is changed. Here, Teaching methods and teaching-learning materials are considered as independent variables which may be manipulated by the researcher. Student achievement level is dependent variable in both cases.

Example-2 : 'Development of Environmental Awareness' of the school students generally depends on the 'Concepts in Science'. Those who are better in science their environmental awareness should be better. With this prediction a researcher must test this with two tools— one is measuring the Concepts in Science and other is measuring the Environmental Awareness level of the same students. Here, whether the Environmental Awareness depends on the concepts in science or not could be studied precisely by the tools. So, Environmental Awareness is the dependent variable and Concepts in science is independent variable in this research study.

Definition of Dependent and Independent Variables:

Dependent Variable: The dependent variable is the condition, that changes as the researcher changes or manipulates the independent variables.

Independent Variable: The independent variables are the conditions that the researcher manipulates or changes to ascertain their relationship to the observed phenomenon.

3.6 Research Hypothesis - meaning, nature amd uses

3.6.1 Meaning

A supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation.

Hypothesis means - A supposition or explanation (theory) that is provisionally accepted in order to interpret certain events or phenomena to provide guidance for further investigation. If it specifies values for every parameter of a population, it is called a simple hypothesis.

In science, a hypothesis is an idea or explanation that the researcher then tests through

study and experimentation. Outside science, a theory or guess can also be called a hypothesis. A hypothesis is something more than a wild guess but less than a well-established theory.

The word Hypothesis consists of two parts - 'Hypo' means less than and 'Thesis' means a theory. So, hypothesis means less than a thesis. It is a tentative working proposition drawn from a knowledge base. It provides direction to the researcher and act as a guide to the researcher for executing the research. It serves as a framework for drawing conclusion. So, Hypothesis is logically framed assumptions, which must be testable.

It is generally assumed that hypothesis is nothing but a guessing, but it is not right. All guessing could not be experimentally verified but hypothesis must be experimentally verified.

3.6.2 Place of hypothesis in Educational Research

Hypothesis is a powerful tool in any research as :

i) It provides direction to the research and act as guide to the researcher.

ii) It helps to make predictions about some outcome

iii) It directs researcher to delimit the study

iv) It helps the researcher to relate theory to observation and observation to theory

v) It enables the researcher to establish the relationship of the variables involved in the study and gives suggestion to use the proper method.

vi) It provides the basis for reporting the conclusions of the study.

3.6.3 Nature of the hypothesis

i) The language of hypothesis or hypotheses must be easy, clear and precise.

ii) It must be stated in simple form.

iii) It must be testable or verifiable.

iv) It should clearly state the relationship between the variables.

v) It should be consistent with the established facts.

vi) It should be amenable for testing within a reasonable specified time.

3.6.4 Types of hypothesis

Hypothesis may be of three types:

i) Null hypothesis,

ii) Positive or declarative or alternative form of Hypothesis, and

iii) Question form of hypothesis.

i) Null Hypothesis: It asserts that no significant difference is there between the observed value and expected value of a statistic. It is also termed as statistical hypothesis. Example of null hypothesis - "There is no significant difference between the achievement of boys and girls in secondary examination". Or "There is no significant difference in mean performance between urban boys and urban girls".

ii) Positive or declarative or alternative form of Hypothesis : In this case the positive statement of the expected outcome of research is mentioned. As for example, "Micro-teaching is effective in developing skills among the trainee teachers".

iii) Question form of Hypothesis : The hypotheses could also be expressed in question form.

Example: "Is ICT teaching more effective than demonstration method?"

3.7 Population, Sample sampling - Meaning, Nature and Uses

To perform a research work, authentic data, information and experiences are to be collected from different resources, may be primary and secondary. To precise and generalise the result of the research, information is to be collected from all the resources or subjects which may be called population. But, due to lack of time, financial support and humane support, data is to be collected from delimited population, which may be called as sample.

3.7.1 Meaning of Population

To do a research work, data or information has to collect from different sources. It may be very big number of persons, schools, students or any subjects which may be called as population as a whole. This huge number makes a herculean task to the researcher and also very it is expensive.

Therefore, it must have to make scientific and justified representation of the whole population which is called 'sample'.

Population: It means the aggregate or totality of objectives or individuals regarding which inferences are to be made in a study. It refers to any collection of specified group. Population may also be called as universe.

A research population is also known as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain

population usually have a common, binding characteristic or trait.

Definition: To perform the research in time with requisite amount of available funding sampling for representative population is essential.

Sample is defined as a complete set of elements (persons or objects) that possess some common characteristic defined by the sampling criteria established by the researcher. Population Composed of two groups - target population and accessible population.

Sample: In research, sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalize the findings from the research sample to the population as a whole.

In statistics, a sample is the subset of a population that is used to represent the entire group as a whole. When doing research, it is often impractical to survey every member of a particular population because the sheer number of people is simply too large.

Definition: Sample may be defined as a smaller representative proportion, the selected characteristics of which represent those of the population. A good sample must be representative of the population as nearly as possible. It must provide whole of information about population from which the sample has been drawn.

Need for sampling: In many cases the researcher is to study the eharacteristics of certain population. But, it is neither feasible nor practicable to approach each and every elements of the population.

Advantages of sampling:

Sampling is used in practice for the following reasons:

i) It saves time and reduces cost.

ii) It may enable more accurate measurement due to its limited area.

iii) It usually enables to estimate sampling error.

iv) When data is unlimited, sampling is useful.

3.7.2 Nature

Population:

i) Population must be related with the objectives of the research for which specific kind of data are needed.

ii) Population must bear the same traits.

iii) Population depends on the criteria of research.

Sample:

i) It is nearly representative of the population as possible.

ii) It should be free from error due to bias.

iii) It should be free from sampling error.

iv) It should be adequate in size to be reliable.

3.7.3 Uses of Sample

i) Sampling minimizes the time and expenditure of research study.

ii) Proper sampling helps to actualize the results obtained from study.

iii) Representative sampling always justify taking the measure of the problem properly from the research result.

iv) Sample and sampling make statistical analysis very easy.

3.7.4 Types of Sampling

In educational, psychological and other types of social researches, experimenters typically rely on specific type of a few different sampling methods. Types of sampling are:

3.7.4.1 Probability Sampling: Probability sampling means that every individual in a population stands and equal chance of being selected. Because probability sampling involves random selection and it assures that different subsets of the population have an equal chance of being represented in the sample. This makes probability samples more representatives, and researchers are better able to generalize their results to the group as a whole.

Different types of probability sampling:

- *Simple random sampling* is, as the name suggests, the simplest type of probability sampling. Researchers take every individual in a population and randomly select the sample, often using some type of computer program or random number generator.
- *Stratified random sampling* involves separating the population into subgroups and then taking a simple random sample from each of these subgroups. For

example, a research may divide the population into subgroups based on race, gender, locality or age and then take a simple random sample of each of these groups. Stratified random sampling often provides greater statistical accuracy than simple random sampling and helps to ensure that certain groups are accurately represented in the sample.

- *Cluster sampling* involves dividing a population into smaller clusters, often based upon geographic location or boundaries. A random sample of these clusters is then selected and all of the subjects within cluster are measured. For example, imagine that you are trying to do a study on school principals in your state. Collecting data from every single school principle would be cost-prohibitive and time-consuming. Using a cluster sampling method, you randomly select five countries from your population states and then collect data from every subject in each of those five counties.

3.7.4.2 Non-probability Sampling: Non-probability sampling, on the other hand, involves selecting participants using methods that do not give every individual in a population an equal chance of being chosen. One problem with this type of sample is that volunteers might be different on certain variables than non-volunteers, which might make it difficult to generalize the results to the entire population.

There are also a couple of different types of non-probability sampling:

- *Convenience sampling* involves using participants in a study because they are convenient and available. If you have every volunteered for a psychology study conducted through your university's psychology department, then you have participated in a study that relied on a convenience sample. Studies that rely on asking for volunteers or by using clinical samples that are available to the researcher are also examples of convenience samples.
- *Purposive sampling* involves seeking out individuals that meet certain criteria. For example, marketers might be interested in learning how their products are perceived by women between the ages of 18 and 35. They might hire a market research firm to conduct telephone interviews that intentionally seek out and interview women that meet their age criteria.
- *Quota sampling* involves intentionally sampling a specific proportion of a subgroup within a population. For example, political pollsters might be interested in researching the opinions of a population on a certain political issue. If they use simple random

sampling, they might miss certain subsets of the population by chance. Instead, they establish criteria that a certain percentage of the sample must include these sub-groups. While the resulting sample may not actually be representative of the actual proportions that exist in the population, having a quota ensures that these smaller subgroups are represented.

3.7.4.3 Sampling Errors: Since sampling naturally cannot include every single individual in a population, errors may occur. Differences between the characteristics of a population and characteristics of a sample drawn are known as sampling error.

While it is impossible to know exactly how great the difference between the population and sample may be, researchers are able to statistically estimate the size of the sampling errors. In political polls, for example, you might often hear of the margin of errors expressed by certain confidence levels.

In general, the larger the sample sizes the smaller the level of error. This is simply because as the sample becomes closer to reaching the size of the total population, the more likely it is to accurately capture all of the characteristics of'the population. The only way to completely eliminate sampling error is to collect data from the entire population, which is often simply too cost-prohibitive and time-consuming. Sampling errors can be minimized, however, by using randomized probability testing and a large sample size.

3.8 Let us sum up

This unit described the various aspects and elements of research and its methodology. The basic ideas of 'Research Methodology' are the complete plan of attack on the central research problem. It provides the overall structure for the procedures that the researcher follows, the data that the researcher collects, and the data analyses that the researcher conducts, thus involves planning. It is a plan with the central goal of solving the research problem in mind. Research methodology describing how the study was conducted. It includes; research design, Study population, sample and sample size, methods of data collection, methods of data analysis and anticipation of the study. Research methodology refers to a philosophy of research process. It includes the assumptions and values that serve a rationale for research and the standards or criteria the researcher uses for collecting and interpreting data and reaching at conclusions (Martin and Amin, 2005:63).

The various sections of the units and sub units prescribed ideas on selection of good research problem, review of related literature, variables, hypotheses and sampling. The sub units progressed with a good deal of explanation on the basic elements of research in education.

Some people consider research as a movement, a movement from the known to the unknown. It is actually a voyage of discovery. In fact, research is an art of scientific investigation.

3.9 Unit End Exercises

1. What are the requisites of a good research problem?
2. List the significance of review of related literature in educational research.
3. Name and explain the different variables in research.
4. Mention the uses of research hypothesis.
5. Define population, sample and sampling

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UNIT 4 ❑ Research Data

4.1. Introduction

It is well known that to solve any problem, relevant information or data is essential. This information may also be called as Data for a particular research study. Sometimes

information collected from different sources may be qualitative and sometime it may be quantitative. But, for each research, researcher must have to search data from different primary sources or secondary sources. Data is very essential, from where researcher or investigator may find different required observation after some inferential analysis and come to different generalization about the result of the research.

To collect relevant data researcher must search for different tools or instruments either self-made or borrowed from other related research. These tools may be of different types, viz. Different type of Questions, Achievement test, Questionnaire both close or open ended, Interview schedule may be closed or open ended etc. But for a good and scientific research, each and every tool must be standardized with its validity, reliability, objectivity and ease of administration.

After the collection of data or information researcher should arrange and tabulate these data scientifically for statistical analysis so that conclusion or inferences may be drawn from those for the study of research. These statistical analyses need descriptions of the data with its nature and derived inferences. Therefore, descriptive statistics like mean, median, mode, SD, bar diagram, pie chart etc. and inferential statistics, like correlation, t-test, F-ratio test etc. must have to use for analysis. These analyses will help the researcher to verify whether hypotheses taken initially will retain or rejected and thus conclusion of the study may be drawn simultaneously.

4.2 Objectives

After completion of this unit the learners will be able to —

1. Identify the nature of qualitative and quantitative data properly,
2. Analyze the qualitative and quantitative data,
3. Acquaint with tools of data collection,
4. Prepare questionnaire or interview schedule,
5. Understand the meaning of descriptive and inferential statistics,
6. Apply relevant statistical techniques to analyze data,
7. Test the acceptation or rejection of hypotheses.

4.3 Qualitative and Quantitative data

4.3.1 Data: Meaning and definition

The word data is the plural form of datum. The datum means score, report, record or any kind of information. Therefore, data may refer to numerical or non-numerical information, scores, and records, reports documents for some event or phenomenon or subject to be studied. It may be qualitative and quantitative. As for example, the colour of hair of a man may be black, brown, gray, white etc. Which is qualitative data but height and weight of a man must be numerical in nature in centimeter or kilogram respectively is quantitative data.

Definition of data:

1. Facts about something that can be used in calculating, reasoning, or planning.
2. Information expressed as numbers for use especially in a computer.
3. Information in raw or unorganized forms (such as alphabets, numbers, or symbols) that refers to, or represent, conditions, ideas, or objects. Data is limitless and present everywhere in the universe.

4.3.2 Qualitative data

Qualitative data is information about qualities; information that can't actually be measured. Some examples of qualitative data are the softness of your skin, the grace with which you run, and the color of your eyes.

Qualitative data is extremely varied in nature. It includes virtually any information that can be captured that is not numerical in nature.

Qualitative data is a categorical measurement expressed not in terms of numbers, but rather by means of a natural language description. In statistics, it is often used interchangeably with "categorical" data. For example: favorite color = "blue", height = "tall" etc.

4.3.3 Quantitative data

Quantitative data is information about quantities; that is, information that can be measured and written down with numbers. Some examples of quantitative data are your height, your weight, and the length of your finger nails etc.

Quantitative data are anything that can be expressed as a number, or quantified.

Examples of quantitative data are scores on achievement tests, number of hours of study, or weight of a subject. These data may be represented by ordinal, interval or ratio scales and lends themselves to most statistical manipulation.

In statistics, quantitative data is numerical and acquired through counting or measuring and contrasted with qualitative data sets, which describe attributes of objects but do not contain numbers.

Qualitative data consist of words and narratives. The analysis of qualitative data can come in many forms including highlighting key words, extracting themes, and elaborating on concepts. Quantitative data are numerical information, the analysis of which involves statistical techniques.

4.4 Tools of Data Collection—Characteristics, merits and demerits of Questionnaire and Interview:

4.4.1. Tools of data Collection

Tool is a device or instrument, especially prepared by individual or group to keep in one held in the hand and used to carry out a particular function. In natural sciences like physics and chemistry, physical and chemical properties are measured by the instruments precisely prepared by scientists. Generally, research in behaevioural sciences or in social sciences, information may be collected in different ways like observation, questioning with questionnaire directly or indirectly at instant or prepared or may be with interview, either by open-ended or close-ended questions.

Research tools enable researchers to construct theories and systems models. They typically support capturing hypotheses, inferring mechanisms, and formulating experimental results within the same framework.

4.4.1.1 Tools used for data collection: To collect data, researchers should use appropriate tools or instruments. The different tools used in research for data collection are:

1. Observation, 2. Interview, 3. Questionnaire, 4. Check list, 5. Rating scale,

6. Schedule, 7.Tests etc.

4.4.1.2 What are the tools or instruments used for data collection in research?

They are the tools for data collection. They include Questionnaire, Interview, Observation and Reading. Essentially the researcher must ensure that the instrument chosen is valid and

reliable. The validity and reliability of any research project depends to a large extent on the appropriateness of the instruments. .

Data Collection Tools

- Case Studies. A case study is usually an in-depth description of a process, experience, or structure at a single institution
- Checklists
- Interviews,
- Observation Sometimes, the best way to collect data through observation,
- Surveys or Questionnaires.
- The Nature of Qualitative Research.
- Methods of collecting qualitative data.
- Interviews.
- Focus group discussions.
- Observation.
- Self- Study.
- Ethnography.
- Action Research.

4.4.2. Characteristics, merits and demerits of Questionnaire and Interview:

4.4.2.1 Questionnaire: A questionnaire consists of series of questions through which information about certain conditions and practice is collected. It is administered either personally to an individual or to a group.

A questionnaire is a research instrument consisting of a series of questions (or other types of prompts) for the purpose of gathering information from respondents. Although questionnaires are often designed for statistical analysis of the responses, this is not always the case.

4.4.2.1.1 Characteristics of questionnaire: The following are the characteristics of a questionnaire. A questionnaire must—

1. Need to know what needs to be measured - Having a clear picture and understanding of what data needs to be collected contributes to the quality of data collection.
2. Should know how to word/frame question and words should be neutral and should not be leading - Whatever your opinion may be, own opinion should never be reflected in the questions. This is done both intentionally and unintentionally but should be taken care of.
3. Emphasis on right word/phrase should be kept in mind - The language should be clear so that the required data can be received. This also makes the question and the requirement of survey easy to understand and thus help in getting a better response and answer.
4. Define and qualify terms — This is most essential when a technical survey or a field specific survey is being done. If you think that the audience being surveyed might not know about some terms than they must be defined to get any proper response. This will increase the quality and decrease the bounce rate or number of questions which were left unanswered.
5. Avoid double negatives or more than one negative word in question-
   Use of negative word has a psychological effect and can influence the answer.
6. Sufficient or adequate alternatives should be provided - Available options should have the most expected answers
7. Multiple questions in a question should be avoided - One question should have one answer. If more than one questions need to be asked, than it should be made a separate question to improve clarity of questions.
8. Word requiring emphasis should be emphasized - It helps in making a point and question clear.
9. Options like good/bad/fair/average should be quantified through photographs or other mean - these are very vague terms and interpretations of these varies from person to person
10. Unwanted assumptions should be avoided - A survey is about getting factual data and assumptions should be avoided.

4.4.2.1.2. Merits of questionnaire: Questionnaires have advantages over some other types of instruments or tools in that they are cheap, do not require as much effort from the

questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. However, such standardized answers may frustrate the users. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and responds to them.

The merits of questionnaire are:

i) Questionnaire is real and practical

ii) By a questionnaire, in a short period of time large amounts of information can be collected from a large number of people and also in a relatively cost-effective way.

iii) It can be carried out by the researcher or by any number of people with limited affect to its validity and reliability.

iv) The results of the questionnaires can usually be quickly and easily quantified either by a researcher or through the use of a software package.

v) It can be analyzed more 'scientifically' and objectively than other forms of research tools.

vi) When data collected by using questionnaire are quantified, it can be used to compare and contrast other researches and may be used to measure change.

vii) The quantitative data from this tool can be used to create new theories and / or test existing hypotheses.

While questionnaires are inexpensive, quick, and easy to analyze, often the questionnaire can have more problems than benefits. For example, unlike interviews, the people conducting the research may never know, if the respondent understood the question that was being asked. Also, because the questions are so specific to what the researchers are asking, the information gained can be minimal. Questionnaires also produce very low return rates, whether they are mail or online questionnaires. The other problem associated with return rates is that often the people who do return the questionnaire are those who have a really positive or a really negative viewpoint and want their opinion heard. The people who are most likely unbiased either way typically don't respond because it is not worth their time.

4.4.2.1.3. The disadvantages of questionnaires:

i) About questionnaire, it is argued to be inadequate to understand some forms of information - i.e., changes of emotions, behaeviour, feelings etc.

ii) By questionnaire quantitative research is simply an artificial creation by the researcher, as it is asking only a limited amount of information without explanation.

iii) Questionnaire itself has low validity.

iv) In using questionnaire there is no way to tell how truthful a respondent is being.

v) In case of questionnaire there is no way of telling how much thought a respondent has put in.

vi) The respondent may be forgetful or not thinking within the full context of the situation.

vii) There is a level of subjectivity that is not acknowledged.

viii) In questionnaire, there may be missing something that is of importance.

4.4.2.1.4 Type of Questionnaire:

Usually, a questionnaire consists of a number of questions that the respondent has to answer in a set format. A distinction is made between open-ended and close-ended questions. An open-ended question asks the respondent to formulate his/her own answer, whereas, a close-ended question has the respondent pick an answer from a given number of options. The response options for a close-ended question should be exhaustive and mutually exclusive. Four types of response scales for close-ended questions are distinguished:

- *Dichotomous,* where the respondent has two options,
- *Nominal-polytomous,* where the respondent has more than two unordered options,
- *Ordinal-polytomous,* where the respondent has more than two ordered options,
- *Continuous* (Bounded), where the respondent is presented with a continuous scale.

A respondent's answer to an open-ended question is coded into a response scale afterwards. An example of an open-ended question is a question where the test has to complete a sentence (sentence completion item).

Question sequence in questionnaire

In general, questions should flow logically from one to the next. To achieve the best answer/s questions should flow from the least sensitive to the most sensitive, from the factual and behavioural to the attitudinal, and from the more general to the more specific.

There typically is a flow that should be followed when constructing a questionnaire in regards to the order that the questions are asked. The order is as follows:

1. Screens,
2. Warm-ups,

3. Transitions,
4. Skips,
5. Difficult,
6. Classification.

Screens are used as a screening method to find out early, whether or not someone should complete the questionnaire. Warm-ups are simple to answer, help capture interest in the survey, and may not even pertain to research objectives. Transition questions are used to make different areas to flow well together. Skip to include questions similar to "If yes, then answer question 3. If no, then continue to question 5." Difficult questions are towards the end because the respondent is in "response mode.'1 Also, when completing an online questionnaire, the progress bars lets the respondent know that they are almost done so they are more willing to answer more difficult question. Classification or demographic question should be at the end because typically they can feel like personal questions which will make respondents uncomfortable and not willing to finish survey.

Basic rules for questionnaire item construction

- Use statements which are interpreted in the same way by members of different subpopulations of the population of interest.
- Use statements where persons that have different opinions or traits will give different answers.
- Think of having an "open" answer category after a list of possible answers.
- Use only one aspect of the construct you are interested in per item.
- Use positive statements and avoid negatives or double negatives.
- Do not make assumptions about the respondent.
- Use clear and comprehensible wording, easily understandable for all educational levels
- Use correct spelling, grammar and punctuation.
- Avoid items that contain more than one question per item (e.g. Do you like strawberries and potatoes?).
- Question should not be biased or even leading the participant towards an answer.

Mode of questionnaire

- Face-to-face questionnaire administration, where an interviewer presents the items orally.
- Paper-and-pencil questionnaire administration, where the items are presented on paper.
- Computerized questionnaire administration, where the items are presented on the computer.
- Adaptive computerized questionnaire administration, where a selection of items is presented on the computer, and based on the answers on those items, the computer selects following items optimized for the estimated ability or trait.

4.4.3. Interview

Interview means a meeting of people face to face, especially for consultation. In an interview oral question is asked, whereby the subject supplies the essential information at the time of face-to-face relationship.

An interview is a conversation where questions are asked and answers are given. In common parlance, the word "interview" refers to a one-on-one conversation with one person acting in the role of the interviewer and the other in the role of the interviewee.

A formal meeting in which one or more persons question, consult, or evaluate another person: a job interview is a meeting or conversation in which a writer or reporter asks questions of one or more persons from whom material is sought for a newspaper story, television broadcast, etc.

The definition of an interview is a conversation in which someone is questioned about their background, lifestyle or experience.

Importance of interview:

i) It probes into the problem;

ii) It provides opportunities to cross questioning;

iii) It helps to gain impression of the interviewee;

iv) It is helpful in diagnosis crises;

v) It is suitable for exploratory studies;

vi) It is also suitable for non-literate persons.

Characteristics of a good Interview

i) Proper planning,

ii) Skillful execution,

iii) Proper recording,

iv) Interpretation.

Execution of a good Interview

i) Come to the interview well prepared with background knowledge of the subject, familiarity with your recording equipment, a consent form that the interviewee will sign giving you permission to use the tape recorded interview for research purposes.

ii) Make the narrator as comfortable as possible; polite, friendly behavior will put your interviewee at ease. Interviews should not begin abruptly. Take the time to introduce yourself and to talk about your project. Let's find a quiet place where we can sit down and talk. Where would you like to sit to do the interview? How would you like to proceed with the interview?

iii) Take time to find a quiet spot in which to conduct the interview. Remember that even the sound of clocks, pets, chatter, add distracting noises to the recordings and may also distract you and the interviewer, affecting the overall quality of the interview and recording. Set up the recorder between yourself and the interviewee. Before you turn on the recorder, ask if the narrator is ready to begin.

iv) Begin the interview with a few simple questions that the interviewee can answer easily and comfortably.

v) Ask questions one at a time and do not rush the interviewee to respond. Allow the interviewee time to think and respond. Do not become anxious by silence. Silences will make for a better interview, pause at least ten seconds before asking a new question.

vi) Speak clearly so that the interviewee can easily understand and hear you. Keep the questions as brief as possible so that what you are asking will be clear to the interviewee. Repeat the question, if you need to.

vii) Ask as many open ended questions as possible. These questions encourage the interviewee to tell stories rather than providing yes/no responses.

viii) When constructing your questions, write them in clear, plain language. Remember that your interviewees are not academics.

For example, do not ask: "How has gender impacted your migration experience." Rather, ask, "What was your experience like as woman crossing the border?" "How did being a woman affect your decision to migrate?" "How was your experience as a woman different than that of other migrants you know?" "Tell me about what your experiences as a single man were like immigrating to the United States."

Another example. Do not ask: "Did you access social networks?" or "what social networks, if any did you access?" Instead, consider: "Were there people (family members, friends, or co-workers, for example) that you depended on to help you with your trip?" Or "Were there family members or friends that you were able to depend on when you first came to the United States?" Then you can ask to follow up questions if they answer yes...For example: "Who were they? And, in what ways (or how) did they help you? Was that common practice?"

ix) Listen actively to the interviewee's answers and then ask the follow up questions like, "how did you feel about that?" or "what happened next?" to bring out more details before you go on to the next question on your page. Respond appropriately to the interviewee. Pause or say something like "that must have been difficult" if the interviewee describes a painful memory. Also, if the interviewee is clearly overcome by emotion, ask if they would like to take a break and/or stop the interview and return to it later.

x) Do not contradict or correct your interviewee and keep your personal opinions to yourself as much as possible. Do not ask leading questions like: "Tell me about that winter, you must have had a miserable time."

xi) Do not rush the end of the interview. Have a good closing question that helps the interviewee summarize or come to a conclusion. You might consider asking them if there is anything they wish to say that they may not have already told you, before pausing the recorder.

Always thank your interviewee for the time and generosity in helping with your project. Remember to have the interviewee sign the release form.

Merits of Interview as a tool of research:

i) Easy correction speech - Any misunderstanding and mistake can be rectified easily in interview.

ii) In interview method a development of relationship helps to collect authentic data.

iii) Interview helps to collect sufficient fresh, new and primary data.

iv) Interview is time saving

v) Interview is of very low-cost tool

vi) Interview helps in-depth study

vii) Interview is a flexible tool

Demerits of Interview:

i) Interview may be an incomplete process.

ii) In interview there may be no record.

iii) At the time of Interview there may be possibility of lack of attention.

iv) Sometimes interview may be time consuming

v) Inefficiency of the interviewer may distort the research result

vi) Personal matter of the interviewee may not be expressed.

4.5 Descriptive and Inferential statistics (Meaning only)

4.5.1 Descriptive statistics

First of all, the meaning of Statistics is that an important field of mathematics which is used to analyze, interpret, and predict outcomes from data. Descriptive statistics will teach the basic concepts used to describe data. This is a great beginner course for those interested in Data Science, Economics, Psychology, Machine Learning, and Sports analytics.

Statistics is the study of numerical data. It deals with the gathering, presentation, management, organization, calculation and analysis of usually vast numerical data. There are primarily, two kinds of divisions of statistics. Descriptive Statistics and Inferential statistics. The statistical analysis enables us to draw conclusions about the study.

Descriptive statistics are used to describe the basic features of the data in a study of research. They provide simple summaries about the sample and the subject to measures. It also considers together with the simple graphics analysis to which they form the basis of virtually quantitative analysis of the data obtained.

Descriptive statistics are also meaning the brief descriptive coefficients that summarize a given data set, which can either be a representation of the entire population or a sample of it. Descriptive statistics are broken down into measures of central tendency and measures

of variability, or spread. Measures of central tendency include the mean, median, mode and variability including the standard deviation.

What Are Descriptive Statistics? Imagine that you are interested in measuring the level of anxiety of college students during final week in one of your courses. You have 11 study participants rate their level of anxiety on a scale from 1 to 10, with 1 being 'no anxiety' and 10 being 'extremely anxious.' You collect the ratings of anxiety of different students.

Descriptive statistics are ways of summarizing large sets of quantitative (numerical) information. If you have a large number of measurement, the best thing you can do is to make a graph with all the possible scores along the bottom (x-axis), and the number of times you came across that score recorded vertically (y-axis).

Descriptive statistics implies a simple quantitative summary of a data set that has been collected. It helps us understand the experiment or data set in detail and tells us everything we need to put the data in perspective.

It can also be mentioned that descriptive statistical measures are generally used to describe the characteristics of the population and sample. These statistics limit to the generalization of the nature of a particular group that are studied. Descriptive statistics mostly used in educational research in measurement of central tendency (namely mean, median and mode) spread or variability or dispersion (namely range, the quartile deviation, the variance or the standard deviation) relative position and relationship, Tabulation, bar graph, pie diagram, frequency polygon etc.

4.5.2 Inferential statistics

Descriptive statistics used describe the properties of sample. Inferential statistics are used to enable the researcher to make generalization or inferences about the populations from the observations of the characteristics of samples. Generally in Education, mean, percentage, correlation coefficient, t-test, F-test etc. are used as inferential statistics.

Descriptive statistics is distinguished from inferential statistics (or inductive statistics), in that descriptive statistics aim to summarize a sample, rather than use the data to learn about the population that the sample of data is thought to represent.

Do we accept or reject the null hypothesis? What ‘p’ value should we use as a cut-off? In the behavioral and social sciences, a general pattern is to use either .05 or .01 as the cut-off. The one chosen is called the level of significance. If the probability associated with an inferential statistic is equal to or less than .05, then the

Distinction between descriptive statistics and inferential statistics. Descriptive statistics are numbers that are used to summarize and describe data. The word "data" refers to the information that has been collected from an experiment, a survey, a historical record, etc. (By the way, "data" is plural. Descriptive statistics uses the data to provide descriptions of the population, either through numerical calculations or graphs or tables whereas inferential statistics make inferences and predictions about a population based on a sample of data taken from the population in question.

This guide explains the properties and differences between descriptive and inferential statistics.

With inferential statistics, we may try to reach conclusions that extend beyond the immediate data alone. For instance, we use inferential statistics may try to infer from the sample data, what the population might think. Or, we use inferential statistics to make judgments of the probability that an observed difference between.

Definition of inferential statistics: Mathematical methods that employ probability theory for deducing (inferring) the properties of a population from the analysis of the properties of a data sample drawn from it.

Statistical inference is the process of deducing properties of an underlying probability distribution by analysis of data. Inferential statistical analysis infers properties about a population; this includes testing hypotheses and deriving estimates.

Definition of Inferential Statistics - Inferential Statistics is all about generalizing from the sample to the population, i.e., the results of analyses of the sample can be deduced to the larger population, from which the sample is taken.

4.6 Steps of Testing Hypothesis

It is well known that hypothesis or hypotheses is / are presumed solution/s or trend of solution/s of a study. The research solutions sometimes may be same to the assumptions or may differ from those. Therefore, it needs the testing of those hypotheses for complete verification whether null or positive hypotheses may sometime be accepted or may be rejected. So, testing of hypotheses is essential.

To test the hypotheses some mathematical and statistical procedures or steps are to be followed. The steps are as followed:

Step-1.

State or frame the null or alternative hypotheses for the study based on objectives of the study.

As for example: There is no significant difference between boys and girls in science knowledge. Alternative hypotheses may be written as Boys are better in science than girls.

Step-2.

In this step, Collection of data and tabulation of data with applications of different descriptive and inferential statistical analyses are done to get the result by which prediction in hypotheses are to be judged.

Step-3.

After using inferential statistics, like t-test, F-test, ANOVA, ANCOVA etc. the experimental result is compared with expected table value at a particular degree of freedom at 0.05 or 0.01 level, i.e., at 95% level of accuracy or 99% level of accuracy.

Step-4.

At conclusion, on the basis of comparison of table value with experimental value, hypotheses may be accepted or rejected.

4.7 Let us sum up

Research data is any information that has been collected, observed, generated or created to validate original research findings. In the present unit the concepts on the nature of qualitative and quantitative data properly are laid down. The instruments for collection of data like different forms of tools are discussed vividly with examples. After collection of data, the next step is analysis. The subunits also depicted a clear understanding of the qualitative and quantitative data analyses. In order to analyse quantitative data, the meaning of descriptive and inferential statistics is dealt with every necessary conceptual details. Application of relevant statistical techniques to analyse data and test the acceptance or rejection of hypotheses are also reflected in the last sub unit. Thus, "Research data, unlike other types of information, is collected, observed, or created, for purposes of analysis to produce original research results. Data might be used to prove or disprove a theory, bolster claims made in research, or to further the knowledge around a specific topic or problem.

4.8 Unit End Exercises

1. What is meant by research data?
2. Distinguish between qualitative and quantitative analyses of data.
3. What are tools? Give few examples.
4. What is the significance of statistical analysis in research?
5. Explain descriptive statistics and inferential statistics with examples.

4.9 References

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Group—B

Information and Communication Technology (ICT) in Education

Unit 1 ❑ ICT in Education

Structure

1.1 Introduction

Information and Communication Technology connects each nooks and corners of the world in general and stakeholders in particular. Education system is not an exception one. This quantum jump of technology towards academia has its history by the invention of Gutenberg's printing machine, which was the greatest revolutionary event. Still this technological development is taking place after the invention of computers and associated technologies. With the advent of computer and associated technology, accessibility and usability of resources have undergone through a vital change, which is rather a positive sign for the society. In view of foregoing, this unit will focus on implementation of different embedded tools and techniques of information and communication technologies for the quality education system and for its continuous development.

1.2 Objectives

After completion of the Unit, the learners will be able to-

- understand the concept of ICT in Education
- gain knowledge on Web 1.0 and Web 2.0

- comprehend and categorize Free and Open Source Software
- know and identify Open Educational Resources

1.3 ICT in Education: Meaning, nature and scope

Technology is a combination of tools and techniques; it is not a new thing. If we look back into the ancient world, when wheel was invented, that was also a technological invention of a society. So far, from that time to the present age time has gifted a lot of contrivances to carry forward our life in a changing environment. With the “advent of technology and web, the entire education system is gearing up from its static point to a dynamic state. The future of education system in the last century is not simply about reaching more people, but about improving the quality, sustainability, granularity and diversity of educational opportunities. Let’s start with few formal definitions of Information and Communication Technology.

Basically, Information and communication technology is combination of three words, viz., Information, Communication and Technology. However, the term Information Technology (IT) is generally about practices of computers with its peripheral devices like printers, scanners, floppy disk etc. And after intervention of Internet along with its peripheral provisions like computer network, world wide web, email etc. Term Information Communication Technology (ICT) has come into the practices (Anderson, 2010). So, we may say world wide web connects the dots between people and computers. Gradually, it increases use and access of resources worldwide, communicated by others. In this context a statistic given by IBM is worth- mentioning that "Our current output of data is roughly 2.5 quintillion bytes a day" (IBM, 2016). Therefore, in a nutshell information communication Technology is a flow/process to identification, collection, organisation and dissemination of intellectual thoughts (information) by using computer/Internet and peripheral devices (Technology) in a communicative, participative and collaborative way to all (Communication). It is veiy much clear that like other equipment, computer is also a tool for us to promote educational system. And provision of World Wide Web (WWW) enhance this process by connecting each and every nooks of the world. Even better to say, this digital inclusion emerges the scope and coverage of SDG4, "Quality Education" (for further reading see: <https:// www.un.org/sustainabledevelopment/education/7utm source= hootsuite>). ICT tools are proving indispensable supports to every level of education especially higher education. Components of ICT are stated below through a figure as depicted by UNESCO (Figure

1) for understand-ability of the ICT. Until and unless we are not aware of these components, we might not be able to explore/ use different provisions of technologies in education sector.

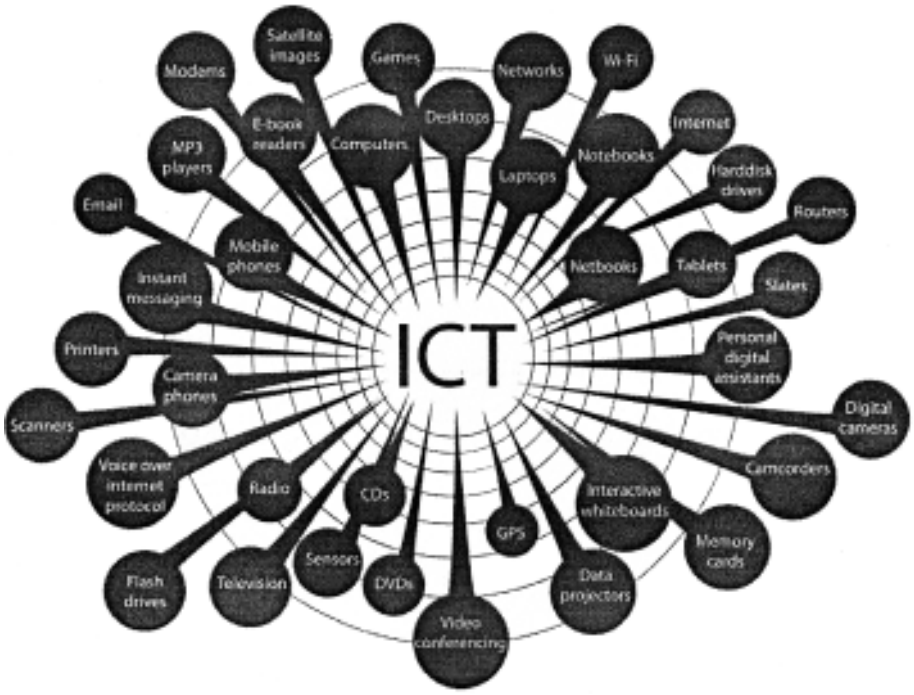

Figure l: Components of ICT (Anderson, 2010)

ICT environment is changing rapidly. Whether its tools or about its techniques or by it variety of contents. Computers are connected worldwide through Internet in general and world wide web in particular. Web is a platform of interlinked hypertext pages containing data (text/numerical) accessed over the internet.

1.4 Web

From the inception of the Web by Tim Berners Lee (1989) there were immense progress had been made. As a result, there are now of six versions already been developed as Web 1.0, Web 2.0, Web 3.0, Web 4.0, Web 5.0. Next section is going to focus on this issue relating to web. Journey of the web was started as a system of interlinked pages made of html language. Basically, that system was static by its nature. Now we are towards the mechanism of Internet Information Services Manager (ISM) in Internet Information Services (IIS) 6.0 (Satff@Mircosoft.com, 2014) which is actually considered as a web

6.0. Table 1 will give you an idea on varieties of different web versions.

Table l: Differences between Web 1.0-4.0

Web 1.0	**Web 2.0**	**Web 3.0**	**Web 4.0**
First generation of web	second generation of web	Third generation of web	Fourth generation of web
Static	Dynamic	Personalised	Ubiquitous web
Read-only	Read-Write	Sharable web	Read-write-execution-concurrency web (Aghaei, Nematbakhsh & Farsani, 2012).
Directories	Tagging	Semantic Web	Open, Linked and Intelligent web
Client to Server	Peer to Peer	Peer to Peer	Peer to any other
HTML	XHTML	XML	RDF
Navigate the web	Content creation	Semantic mark-up and web services	Web application

From the above table it is very much clear that Tim Berners Lee started the journey from few interlinked pages which is now triggering the web with its advance technology based on semantic mark-up services. As a result, with the advent of upgraded software, low cost hardware and interventions of web technologies strengthening entire educational system as a whole. Fig 2 also is an instancte, which shows different features and characteristics of different flavours of web technologies.

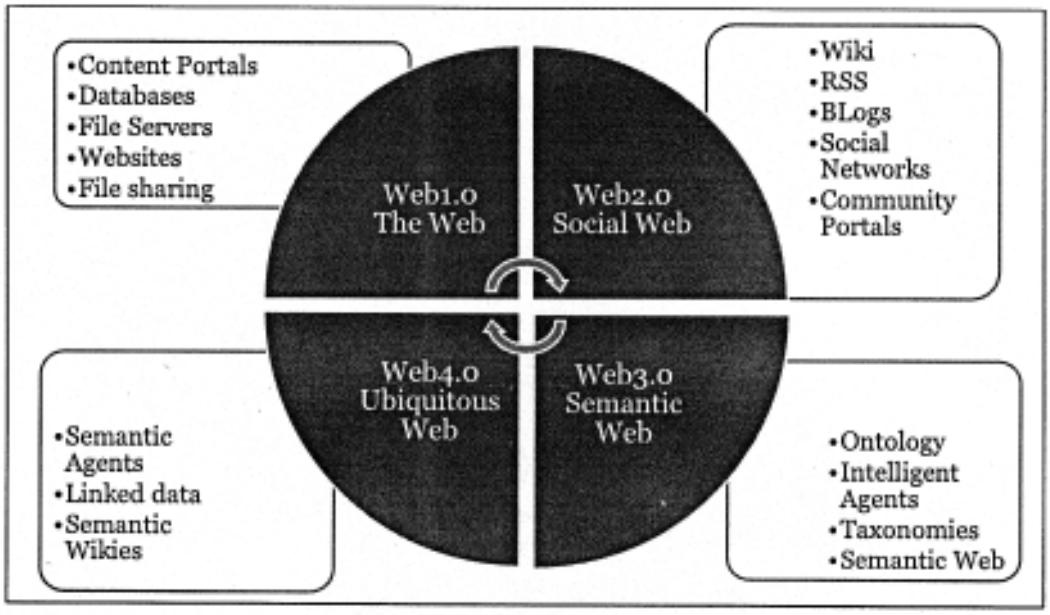

Figure 2: Differences between Web versions Source: (Abarca, 2016)

This section already shows different aspects of ICT which are as product and as services may affect the attire of teaching-learning process. Generally, as an end-user, in current situation we are enjoying products and services of web 2.0 technologies. Therefore, implication of web 2.0 in educational sector makes a unique term that is Education 2.0. Education 2.0 is application of Web 2.0 tools and technologies to education.

1.5 Free and Open Source Software (FOSS)

Free and Open Source Software (FOSS) is a brunch of software distribution where source code and binary code of a software is freely available without free cost. According to OSI (Open Source Initiatives)—

"Open source promotes software reliability and quality by supporting independent peer review and rapid evaluation of source code. To be certified as open source, the license of a program must guarantee the right to read, redistribute, modify and use it freely". Linux operating system, Mozilla, web browser MySQL (RDBMS) are some example of open source software.

Open source platform or in broader sense principle of open practice strictly follows open license for its each and every products whether its a text document or its a software. So before approaching next section lets have a clear idea about open license. License is

a documentation which specifies do's and don’ts of a particular piece of work. It generally gives you permission up to which extends a work maybe used by the users. Simultaneously it also restrict you for forbidden works. Open license is such kind of documentation which gives priof permission to reuse, remix, revise, redistribute actual works of a creator and after reuse remix and revise user can retains right for further distribution. But user have to acknowledge actual author for actual work.

Table 3: OER Distribution terms

Reuse	Use the content in its unaltered form
Revise	Adapt, adjust, modify, improve, or alter the content
Remix	Combine the original or revised content with other OER to create something new
Redistribute	Share copies of the original content, revisions or remixes with others
Retain	Keep access to the materials after the learning event

There are varieties of open license. All among Creative Commons license is quite popular as it has six provision of licensing. Make easily sharable materials with the provisions of open licensing systems like creative commons; updated materials which can be edited, augmented, customized, combined and reformatted by anyone; amplify access of learning resources; assist with both teaching and learning Protect intellectual works from plagiarism.

In nutshell, we need open license to protect content contributors right in such tech-sawy world where content can so easily be copied and shared.

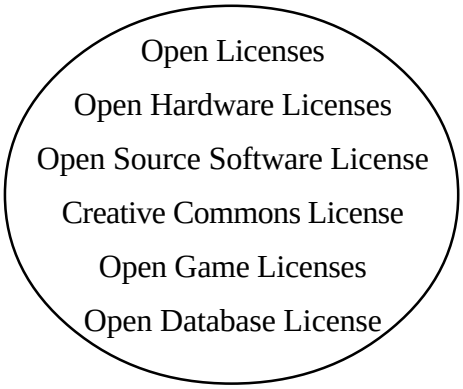

Figure 4: Open Licenses Diagram

The concept of open licensing was first admired by Richard Stallman with General Public License (GNU PL). Which gives permission to free use, study, modification and sharing of computer software code as a licensed public good. "FreeBSD" license, MIT

license, Mozilla Public License 2.0 are of same kind for software distributions. Open Access initiative is legally free in all sense which incorporates provision of open license. In case of open access publishing Creative Commons (CC) license is broadly used. Creative commons is a non-profit organisation. It allows six types of licenses to content contributors for offering permission to use as follows:

Product(s)	**Use**
 CC-o	Free contents without any restrictions
 Attribution CC BY	Copy, Adapt or modify, Distribute (publish, display, publicly perform or communicate the work), and License to others.
 Attribution-ShareAlilce CC BY-SA	Copy, Adapt or modify, Distribute, and License to others on the same terms as the original work
 Attribution-NoDerivs CC BY-ND	Copy, Distribute verbatim copies only, and License to others
 Attribution-Noncommercial CC BY-NC	Copy, Adapt or modify, Distribute, and License to others
 Attribution-Non Commer-cial-ShareAlike CC BY-NC-S	Copy, Adapt or modify, Distribute, and License to others on the same terms as the original work.
 Attribution-NonCommercial-NoDerivs CC BY-NC-ND	Copy, Distribute verbatim copies only, and License to others.

Contents with such licenses are free to reuse, remix, revise, redistribute and to retain. Contributors already given permission to users for repurposing in terms of acknowledging their contributions towards academic society. This is the main flavour of open license. For democratisation of knowledge, accessibility of educational resources without any barrier is very much required. Open license is supporting strongly to achieve this goal. In next section we will discuss about the educational resources published and available in open platform which is widely known as Open Educational Resources (OER).

1.6 Open Educational Resources (OER)

The term Open Educational Resources (OER) is educational resources to reuse, remix, revise, re-distribute and retain without any legal, technical, economic and social barrier. Education is a matter of transmission and sharing. OER is a small part of open Education Practices which includes open access journals, open data, open thesis and dissertations, open books, open source software etc. Main motto of openness to achieve democratization of knowledge. Educational system includes pedagogy, instructional system design and technology to students without barrier of person, time, place, and pace. OER promotes flexible learning to achieve equitable quality education, they even could be flexible in accessing higher education without/less entry requirement rigidities and most importantly without time and pace constrains. '

Usually in present practices, some printed Text/ Self-Learning Materials, audio/video files are received by the learners and within a time span they have to submit their assignments and finally they could appear in final examination (Abeywardena, 2012). But the time has changed towards interactive and collaborative environment where students could choose educational resources as per their level of cognition, age and facilities they have. Even assessment procedure is a very important issue to rectify from current practice to evidence-based technology to assess their level of achievements.

Technology is at our door-step. Teaching-learning technology is under-going through a paradigm shift from program-based learning to Self-Learning and presently to Meta-learning/ resource based learning. In such system Open Educational Resources have tremendous potentiality to improve the quality, efficacy and efficiency of education with its quality of free availability and adaptability. "OER describes any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or license fees." Several OER initiatives were there for education, institutions where open licensed content can be produced in various medium. WOU OER Repository; OER Asia; OER Commons; OER Online Archive; Open

Educational Resources (OER) Africa; GLOBE; Creative Commons; Copyright Licenses; Oasis: COL Open Access Institutional Repository; The Orange Grove; RRU Open Educational Resource. Figure 5 is an instance of institutional OER repository through which learners can browse, search and retrieve required documents (Institutional/university publications like SLMs, A/V lecture, previous years question answers etc.) without any technical, legal and economical barrier. This repository basically follows CC- BY-NC-SA open license to promotes its resources.

Figure 5: NSOU-OER Repository

In this digital era, Massive Open Online Course (MOOC) can achieve principles of economy of scale to a large number of students across the world. OER is a cost effective provision for education systems to reduce cost of materials and time of courses.

1.7 Let us sum up

The Information and Communication technology to be precise has become a driving force behind economic growth and a developmental tool as well. ICT is an extended term for Information technology which is a technological source to make information available at the right time, right place in the right form to the right user. Earlier, one had to wait for the newspapers to get the information across the world. Now with the smarter technology, information can be accessed from anywhere using smartphones and gadgets. All this is made possible with the help of Information and Communication Technology. Information technology has been influencing our lives in the recent years in the fields of education too.

ICT has opened more accesses, shortened a long distance and made everything became closer as well as it has benefited us with more effective and useful time. Skill and competence to the ICT tools like Web 1.0 and web 2.0, FOSS could eventually provide all stakeholders of education sector with simpler and easier and quality life. The Open Educational Resources (OER) are teaching, learning and research materials in any medium - digital or otherwise - that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.

1.8 Unit End Exercises

1. Define ICT
2. Explain Web 1.0 and Web 2.0
3. What is FOSS ? Give examples.
4. Mention the features of OER.
5. Delineate the significance of ICT in education system.

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Unit 2 ❑ Approaches, Stages and Competencies

Structure

2.1 Introduction

Now the main issue is how to adopt/adapt such circumstances-to carryout-1 teaching-learning process as a whole. This issue is pertinent for learners as well as for teachers also. Because entire education community may not be fully aware of the technological needs, implementation and usefulness. We have to set our mind to integrate such technological interventions in our educational system. Cause being, the exponential growth of communication channels and computer systems, ease of use, and diversity of information transfer allow teachers and students to have access to a world beyond the classroom. Let us see what are the approaches and competencies of ICT in educational sector penetrating the entire system.

2.2 Objectives

After completion of the Unit, the learners will be able to-

- outline the approaches in application of ICT in education
- enumerate the various stages of ICT usage
- delineate the pedagogical usages of different aspects of ICT
- integrate teacher competencies in the domain of ICT in education

2.3 Approaches in adoption and use of ICT in Education

Emerging, Applying, Infusing and Transforming

Requirements may vary from institutions to institutions based on situation, culture, course and infrastructure. There are different approaches in ICT development as identified involves integrating ICT across the curriculum.

They are as follows:

Emerging: It is the beginning stages of ICT development. In this stage of exploration, the administrators and teachers try to evaluate the possibilities and consequences of using ICT in the teaching-learning process. This stage begins with few initiatives like opt computer equipment/software. The focus is on understanding the technical importance of ICT like the use of word processing, locating information on CD-ROMs etc.

Applying: It comes after understanding of the influence of ICT to the curriculum and the teaching-learning processes. In this secondary phase/ at the applying approach phase, administrators and teachers use ICT for tasks already carried out in curriculum. Teachers largely dominate the learning Emerging Applying Infusing Transforming Technology Pedagogy - 3- environment. Schools at the applying approach phase adapt the curriculum in order to increase the use of ICT in various subject areas with specific tools and software such as drawing, designing, modelling and application specific tools., adapt the curriculum in order to increase the use of ICT in ICT - Use and Abuse various subject areas. At this stage, teachers use ICT for professional purposes; focusing on improving their subject teaching through ICT applications.

Infusing Approach: This approach involves integrating ICT across the curriculum. In this approach, it is seen that academicians are engaging their self to employ a range of computer-based technologies in laboratories, classrooms, and administrative offices to improve their own learning and the learning of their learners.

Transforming Approach: In this final stage, ICT becomes an integrated part of all school activities. The focus of the curriculum is learner-cantered and is now thoroughly integrated with all subjects. ICT is also taught as separate subject at the professional level and incorporated into all vocational areas. This is the phase of specialization where teachers specialize in the skills of using the ICT tools. This helps in making the process of teaching more learner centric and thus the school becomes a centre of learning for the community.

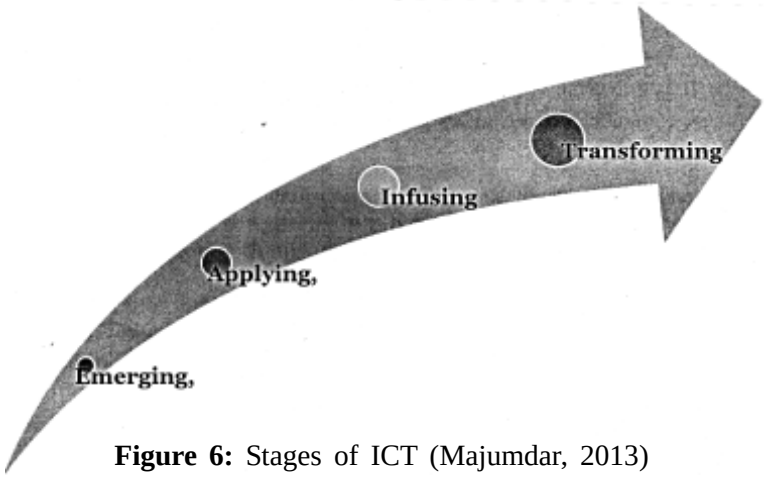

Figure 6: Stages of ICT (Majumdar, 2013)

In continuation to this, you can consult table below for a comparative discussion on different approaches of ICT implementation.

Authors, years	Stages of ICT implementation				
	I.	II.	III.		IV.
Petrauskas (1990)	Early/elementary	Experimental	Planned	Widespread	Harmonious application
Fullan (1996)	Material, media	Change of behaviour, methods			Change of content
Fullan (1996)	Initiative	Implementation			Institutionalisation
Coughlin (1999)	Entry	Adaptation			Transformation
Urbonaite (2000)	There are no computers or at least 5?6, or not a powerful class, informatics is taught	Have 6?12 more powerful computers with multimedia equipment, informatics is taught	Have 10?20 computers with the possibility to use the Internet, profiled teaching of separate subjects		
Strategy of ICT implementation in education (2000)	Readiness	Modernisation of libraries	ICT integration into curriculum		Development of education networks
McCormick, Scrimshaw (2001)	More effective us of ICT	Extension of activity by new methods			Activity transformation
StaR Chart project (2001)	Early	Developing		Advanced	Target

Andresen (and Brink (2002)	Scenario 1. Presentation of curriculum /content by linear multimedia	Scenario 2. Presentation of curriculum/content by non-linear multimedia (e.g., hypertext)	Scenario 3. Presentation of curriculum/content by teaching ?oriented target programs	Scenario 4. Training of a pupil to create one?s product of multimedia
Anderson and Weert. (2003)	Introduction/discovery of ICT media	Application/Learning how to use media	Involvement/Understanding how and when to use media	Transformation Specialisation for professional activity
Juceviciene (2002)	Access of teachers and pupils to computers.	Diversification and efficiency increase of traditional educational process	Expansion of learning/teaching possibilities using websites, the Internet, intranet	Transformation of learning/ teaching
Strategy of ICT implementation of vocational education (2004)	Emerging	Applying	Infusing	Transformation
EnGauge project (2004)	Awareness	Adoption	Exploration	Transformation
UNESCO (2005)	Emerging	Applying	Integration	Transformation

Adopted from Stages of ICT implementation (Chreptaviciene, Virginija; Kondratas, 2005)

2.4 Stages of ICT Usage

Information and Communication Technology (ICT) is considered as a permeating tool that will strengthen the socio-economic development of a community as well as of the country. Awareness on ICT application in educational sector may improve implementation as well as quality. To enhance awareness on ICT application first step may start with

learning how to use, how to imply and what to do with ICT applications in educational sector. It is necessary for teachers and learners both. ICT skilled teacher are able to develop a high quality skills and knowledge based society (Anderson, 2010). By following Mazumder's model we can say

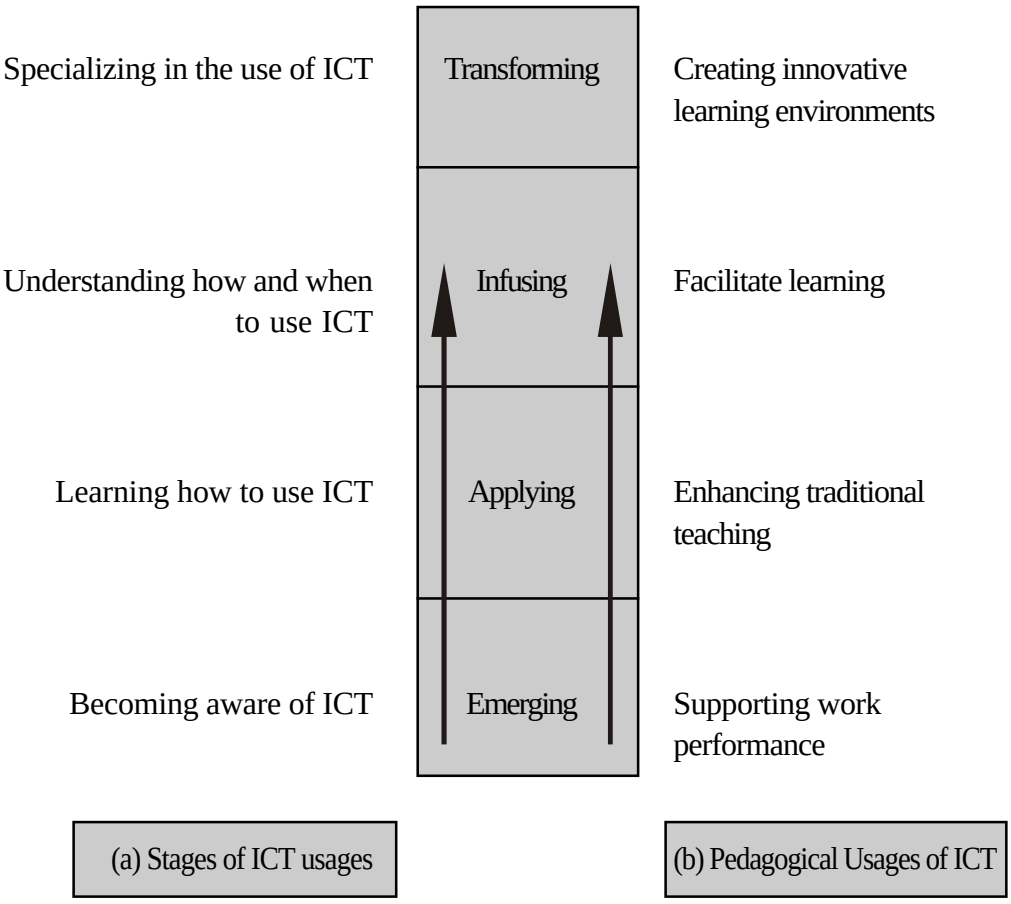

Figure 7: Majumdar's model of ICT mapping

In conclusion, we may recite following lines for better understanding of teaching-learning process with the help of ICT. Learning and teaching for a new generation of young people who are growing up in a digital world, are comfortable with technology, and need their schools to reflect these realities. It envisions a journey that takes us through learning about ICT, learning with ICT, and learning through ICT (cited in Ledesma, 2005, p. 3)".

2.5 Pedagogical Usages of ICT

Supporting Work Performance:

Appropriate use of ICT can transform the whole teaching-learning processes leading to paradigm shift in both content and teaching methodology. ICT has the potential to transcend the barrier and space. ICT integration in the field of education has impacted hugely in improving the quality of education. It is widely believed that ICT integration will help us in making education more accessible and affordable. Increasing role of ICT will make education more democratic thereby improving the quality education services available to even students sitting in far- flung remotest corners of the country.

Enhancing Traditional Teaching:

The new environment of interactive learner-centered approach of ICT has completely meta-morphosised the process of education i.e., delivery and dissemination. The technological creativity of learner will help generate sharing of knowledge to perform tasks in a better way and to develop their capacity and skills to keep pace with the rapid changes.

Significance of ICT pedagogy:

We must not allow the ICT related opportunities to slip out of our hands. We must empower our youth with the latest technology to tap the latest skills and hidden potential of our youth population. There is considerable hope that technology can expand and improve education in all levels with special reference to design and content of instructional materials, delivery, and assessment and feedback.

In technology enhanced learning (TEL) teacher's role will be more challenging and definitely different from what is presently the traditional class room teaching. In the new role he will be more a director/coach or a facilitator, because the Educational Technology enhances the quality of teaching and learning by arousing inquiry, curiosity and exploration. ICT will afford opportunity to the individual for self-paced learning, which caters to learners' abilities & aptitudes.

learner's abilities and aptitude.

Innovative learning environments:

Innovative Learning Environments (ILEs), which combine flexible use of spaces, furniture and technology with greater collaboration and flexibility in relation to teaching and the curriculum, are becoming more common.

The attributes of technology rich learning environments that support innovation and collaboration are- strong, engaging and motivating storyline, teachers have been able to construct robust interdisciplinary modules where students are gaining digital literacies, collaborative problem-solving, creativity and many other skills, while interacting with the latest technologies.

An Effective Learning Environment:

- Today's learners seek a learning environment that is not as obsolete as traditional classrooms but that is specifically engineered to support thinking.
- They prefer the learning environment that pushes their learning capacity with altering strategies and teaching practices.
- They want to be a part of an impactful learning setting that provides a sense of achievement while they can be adaptive and interactive with fellow learners as well as instructors.
- In brief, they want to be active and engaged players throughout the learning course.

Source: https://raccoongang.com/blog/what-makes-good-learning-environment/

Engaging in Interactive Games and Activities:

An effective online learning platform is the one that establishes strong interactions and promotes collaborative learning culture. This means that it is imperative for instructors to maintain positive relationships with the learners while also ensuring healthy association among the learners. This can be done by using the best way of encouraging group activities. Introduction of non-competitive games and activities break down the cliques within a learning environment. This also assists the new and shy students to have a sense of belonging.

Such activities promote communication and collaborative working environment and establish cooperative learning structures.

Using technology to innovate learning environments:

Technology can be an enabler in the strategic design of environments to produce desired changes in pedagogy and learning. However, it is essential to remember that it is how the technology is used rather than the technology itself that impacts learning. Rather than the mere integration of technology into existing teaching practices, technology use within the context of ILE supports attempts to reframe the nature of education in profound ways.

Technology has several important roles to play in supporting innovation. It provides tools and infrastructure as well as access to ideas and opportunities. It has been shown to motivate students and build their capacity and capability to make changes. It is also useful for organising, analysing and presenting large quantities of assessment and evaluative information to inform pedagogical development.

In order to ensure an innovative and learning-centred approach to technology, it is important to reflect on and inquire into the potentialities of technology to support visions of pedagogy and learning. Opportunities to develop teacher capacity are crucial, as are opportunities and inspiration for innovation, the reorganisation and creation of new learning materials and activities, and the redesign of curricula models.

Source: https://theeducationhub.org.nz/ile-and-technology/

2.6 Teacher Competencies: Integration of Content, Pedagogy and Technology

We have so far discussed a lot of ways to use technology in the classroom. As teachers, we feel a push to incorporate technology into our classrooms because of the new outcomes that demand it. The TPACK model gives us a new framework for the integration of technology in education and how we can structure our classrooms to provide the best educational experience for students while incorporating technology.

TPACK is essential to enabling teachers to implement ICT in their teaching, as it enables teachers to select and use hardware and software, identify the affordances (or lack thereof) of specific features and use the tools in pedagogically appropriate and effective ways.

The TPACK Framework:

TPACK stands for Technological Pedagogical Content Knowledge. It is a theory that was developed to explain the set of knowledge that teachers need to teach their students a subject, teach effectively, and use technology. We'll get into more details in just a minute, but let's look at where this started.

Use of TPACK in the Classroom:

Keeping technology as a separate knowledge set causes problems, but when we understand the framework of TPACK, we can integrate technology into the content and pedagogy of our classrooms. The integration will help our students learn more effectively.

Mishra and Koehler suggest that TPACK should guide curriculum development and teacher education. They explain how TPACK should change the way we plan our daily

lessons. They describe a planning process where—

- We first choose the learning outcomes that we will be working on that day or during that class session. The learning outcomes are the content.
- The second step they propose is choosing an activity type. The activity type is the pedagogy or how are the students going to learn the content.
- Finally, we can choose technologies that will support the activity type and aid the students in learning.

The simplest idea at play in TPACK is that a person who is a world-renowned expert in a subject might not be a great teacher because they lack the pedagogical knowledge to make the subject accessible and understandable. To be a great teacher, we have to combine our knowledge of the subject with our knowledge of how to teach. With the increasing focus on technology, we need to also learn how to combine technology with our content and pedagogy to create an effective learning environment.

TPACK Framework:

- The Technological Pedagogical Content Knowledge (TPACK) framework describes the kinds of knowledge required by teachers for the successful integration of technology in teaching.
- It suggests that teachers need to know about the intersections of technology, pedagogy, and content. Specifically, how these areas of knowledge interact and influence one another in unique and specific contexts.
- In terms of teaching with technology, it suggests that it impacts not only what we teach but how we teach.

Descriptors of TPACK:

The TPACK framework looks at content knowledge (CK) as the "what" that is the subject matter (arts, English, mathematics, science, etc.) teachers teach, pedagogical knowledge (PK) is the "how" that tells how the teacher will make the content more accessible (via direct instruction, inquiry, group discussion, debate, modelling, etc.). Then, technological knowledge (TK) as the "partner" answering the question of what tools (laptops, projects, smart boards, multimedia, simulations, etc.) will be selected to make the content more accessible to the students.

The TPACK framework goes beyond seeing these three knowledge bases in isolation and goes further by emphasizing the kinds of knowledge that lie at the intersections between three primary forms:

- Pedagogical Content Knowledge (PCK),
- Technological Content Knowledge (TCK),
- Technological Pedagogical Knowledge (TPK), and
- Technological Pedagogical Content Knowledge (TPACK).

TPACK-Outcomes:

Researchers argue that pedagogical use of technology and effective technology integration using pedagogies for specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts. Individual teachers, grade-level, school-specific factors, demographics, culture, and other factors ensure that every situation is unique, and no single combination of content, technology, and pedagogy will apply to every teacher, every course, or every view of teaching. From the figure below, the outer dotted circle of the framework is thus renamed as the "Contextual Knowledge" (i.e., the teacher's knowledge of the context) and define it as everything from a teacher's awareness of available technologies, to the teacher's knowledge of the school, district, state, or national policies they operate within. This also makes the outer circle another knowledge domain that teachers must possess to integrate technology in teaching. This, in turn, implies that contextual knowledge is something that we (as teacher educators) can act on, change, and help teachers develop. Since CK is taken (for Content Knowledge) and another CK would be confusing; therefore, the outer dotted circle is named as XK for "contextual Knowledge" distinguishing it from CK.

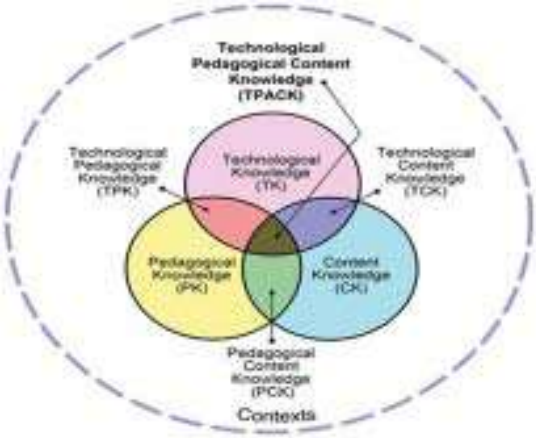

Fig: TPACK-Illustration

Source: https://en.wikipedia.org/wiki/Technological_pedagogical_content_knowledge

Domains of TPACK:

TPACK domains and related subdomains address the complex nature of teaching effectively with appropriate technologies. While the different domains and subdomains can be explored as separate skill concepts, domains and subdomains were conceptualized to work in synergistic reciprocity meaning that the knowledge is not entirely separate indicating the intersectionality of each area.

Accordingly, the TPACK model consists of three (3) main domains, each containing one (1) subdomain. The purpose of the subdomains is to unpack the broader domain concept by understanding intersections among the three primary knowledge anchors for the overall framework. The main domains are-

1. Technological Content Knowledge (TCK);
2. Pedagogical Content Knowledge (PCK), and
3. Technological Pedagogical Knowledge (TPK).

The three subdomains are—

1. Technological Knowledge (TK);
2. Content Knowledge (CK); and
3. Pedagogical Knowledge (PK).

In 2019, Mishra proposed a revised TPACK diagram to emphasize the context in which technology integration occurs by retitling the outer circle as Contextual Knowledge or XK.

Technological Knowledge (TK) addresses how teachers demonstrate professional knowledge of technology. TK considers what is required for teachers to integrate technology tools and resources into their course content and instructional practice. The technology component of TPACK in Technology is most beneficial for learning when it brings a change in professional teaching practice and in designs for learning. For teachers, TK not only addresses knowledge about technology but also knowledge of the skills needed to use technology to effectively plan instruction, including with science teachers.

TK involves understanding cross-platform applications and capabilities as well as how to configure those applications to realize instructional objectives and student learning outcomes. Content Knowledge (CK) is situated within the following definitional parameters of a teacher's knowledge about a particular subject matter and how it is taught and learned.

TPACK and the teaching-learning climate:

For educators, effective content instruction that engages students in higher-order activities using authentic, real-world examples facilitated through technology is the cornerstone of teaching and learning in the 21st century.

Thus, educators must not only be thoughtful in the instructional techniques they use to present content but also strategic in the technology selected to teach the subject matter as it may result in positive or negative results in long-term learning and knowledge retention. Pedagogical Knowledge (PK) addresses how teachers demonstrate professional knowledge of pedagogy. PK refers to the specific knowledge about teaching such as approaches or methods of how teachers teach a particular topic or how to scaffold a concept to the diverse interests and abilities of learners. For teachers and educators, an effective teaching method that engages students in higher-order activities using real-world examples facilitated through different learning styles is the cornerstone of teaching and learning in the current era.

Accordingly, educators must be thoughtful in the instructional techniques to teach the subject matter as it may have a great impact on long-term learning and knowledge acquisition. Choosing the right technology to enable higher-order thinking within the content, long-term knowledge retention, and facilitate student learning outcomes are paramount within the CK construct. Finally, Context Knowledge (XK) is the umbrella domain that refers to how teachers contextualize implementation based on the overall teaching and learning context.

TPACK, or Technological Pedagogical Content Knowledge, is a model that helps teachers consider how their knowledge domains intersect in order to effectively teach and engage students with technology.

2.7 Let us sum up

This unit reflects on the various approaches of ICT in education. The integration of ICT and its various facets is the prominent part of success of ICT in the teaching learning process of any educational institution. Taking the aspects of resources, competencies etc. ICT integration is planned and developed in any Institution. The unit highlights on some such approaches of integration. Followed by this, comes the stages of adoption of ICT in education, i.e., emerging, applying, infusing and transforming. The basics of understanding the stages in the use of ICT is dealt with clear objectives. The last but not the least, teacher competencies is central to adoption of the ICT tools and its application for a quality output in teaching-learning-evaluation climate of an education system.

2.8 Unit End Exercises

1. Describe any one approaches in application of ICT in education.
2. What are the different stages of ICT usage in education system?
3. Enumerate the teacher competencies required for ICT usage.

4. Outline the pedagogical significance in the different aspects of ICT in education.
5. Mention the stages of adoption of ICT.

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https://theeducationhub.org.nz/ile-and-technology/

Source: https://raccoongang.com/blog/what-makes-good-learning-environment/

Declaration: Contents taken from OERs are mentioned within the text as 'Source'. The write up is mostly taken from Wikipedia. The references are drawn as attributed there.

Unit 3 ❑ ICT Tools

Structure

3.1 Introduction

Organizing and managing time in and out of the classroom is essential for teachers to perform all their necessary tasks, prepare their lessons well in advance, and create truly effective classes.For this reason, ICT tools help you to create presentations quickly, prepare classes, and organize your material in a virtual space, among others. With these ICT tools, teachers can:

- Create online presentations.
- Concept maps and collaborative learning
- Make collaborative documents.
- Organize tasks.
- Propose activities that encourage student participation.
- Even evaluate them in an original and fun way.

With this backdrop, you will be introduced with various ICT tools in this unit. The subsequent sections will deal with relevant computer software used in educational settings. Web 2.0 tools forms a pivotal tool in this contemporary times, also known as social digital technology. You will be introduced with interesting assessment tools that can be efficiently used by the teachers for effective outcome. This unit will not only increase your awareness on the in-vogue ICT Tools but also develop interest to gain confidence in using them. The understanding, identification and basic use of various ICT tools in the teaching learning assessment system forms the crux of this unit.

3.2 Objectives

After completion of the Unit, the learners will be able to-

- describe various computer software related to education
- gain an understanding of the available Web 2.0 Tools and their uses in education
- comprehend assessment tools and their uses in education

3.3 Computer software

Software is a set of integrated program as a set of instruction. There are different kinds of software available in the market on the basis of availability, license and cost.

Parameter	Restricted	Open
Proprietary Software	Cost, Availability, License, Source Code	Use without modification and Binary code
Open Source Software	Not restricted	Cost, Availability, License, Source code, Customisation, Augmentation and Repurposing

By following this table, different kinds of word processing software are available in open source and proprietary domain. Few examples are as follows:

Word software like Microsoft Word, WordPerfect, Lotus Word Pro, iWork Pages are available in proprietary software and OpenOffice, WPS Office Free, LibreOffice, Apache OpenOffice, SoftMaker, FreeOffice, Google Docs. Focus Writer, KOffice: The Integrated Office Suite etc.

Application of word processing software:

Spreadsheets and word processors, these two software come under the application software which are widely used in the computer program. Word processing software is generally dealing with the textual interpretation and design of the thought contents. Whereas, spreadsheet application is processing different kinds of number crunching and data analysis. Now next section will carry forward about two widely used word processors, among which one is of proprietary software that is Microsoft word processor and another is from open source software, Open Office.org. But before that let us start with the intrinsic features and purpose of the word processor software.

Word processor:

Word processor software are used to articulate thoughts of content(s) as a text document in different forms like articles, reports, or any other literary work and in different formats like .doc/docx, .pdf, .ppt/.pptx etc.

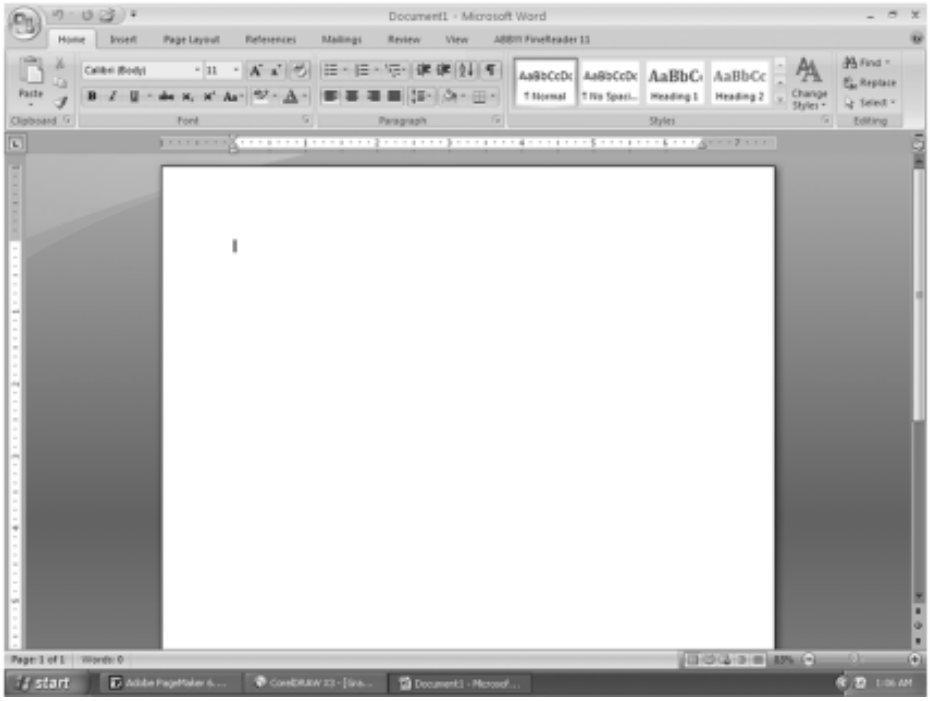


Figure 8: MS Word

These word documents slightly have embedded with the powerful application enabling users to pick out controls over headings and sub-headings of huge content. Users might be able to control/navigate MS word for text alignment and page margins, font size, style, and typeface etc. (See figure 4).

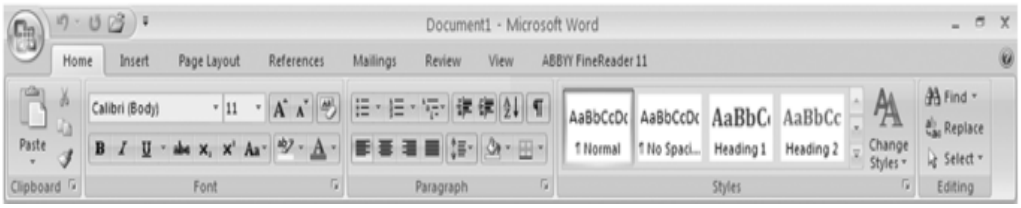


Figure 9: MS word features

Tools of benefit to writers, including word count, header and footer, page number,

insertion of pictures tables, shapes, smart art, charts, equation, symbols so on and so forth to sharpen text contents (See figure 5).

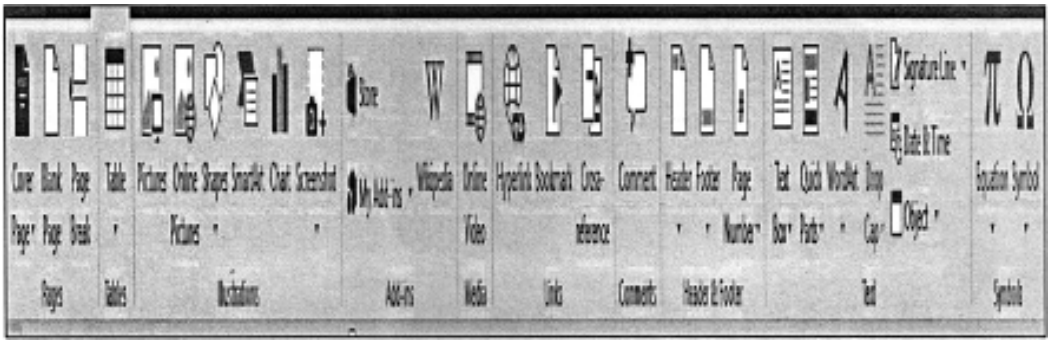


Figure 10: MS word Tools

Even new versions of MS word are able to manage references as embedded text by following specific reference style manual (See figure 6). Integration between reference management software and word processor is also possible.

Figure 11: MS word Reference integration

Now we will concentrate on the use of Excel application in next section. We know that word, excel and PowerPoint presentation are three essential flavor of MS Office and open office which are widely used in educational sector to do scholarly communication.

Same types of actions and executions possible through using Openoffice.org or Libreoffice. Here are some snaps of open Libreoffice as an example to be looked into in figure 10.

Figure 12: Libreoffice interface

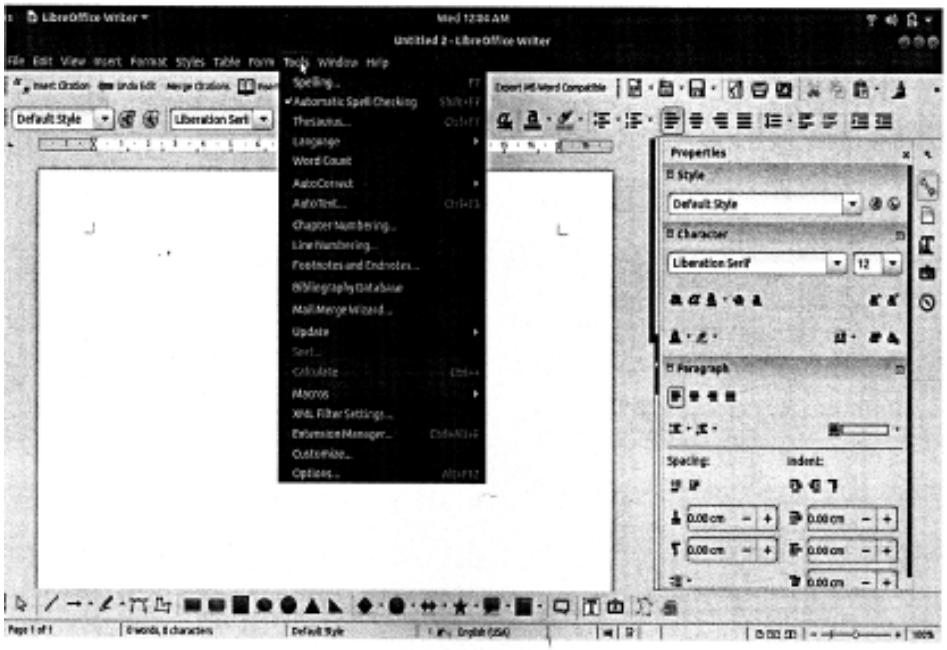


Figure 13: Tools of Libreoffice Interface

Spreadsheets

A spreadsheet program a dedicated tool to manage numbers in different aspects viz.

entering, editing, and exporting with intervention of mathematical formulas.

Spreadsheets are designed to automate the management of large amounts of numerical data and to apply calculations as required. They are used for everything from account and sales reports to sports leagues. The strength of a spreadsheet application lies in the ease with which it can hold and manage rows and columns of figures, and the speed with which it can calculate formulas, produce charts, and filter out particular values.

Spreadsheet programs are built around a grid of cells that typically hold numerical data but which can also contain text, dates, and other content.

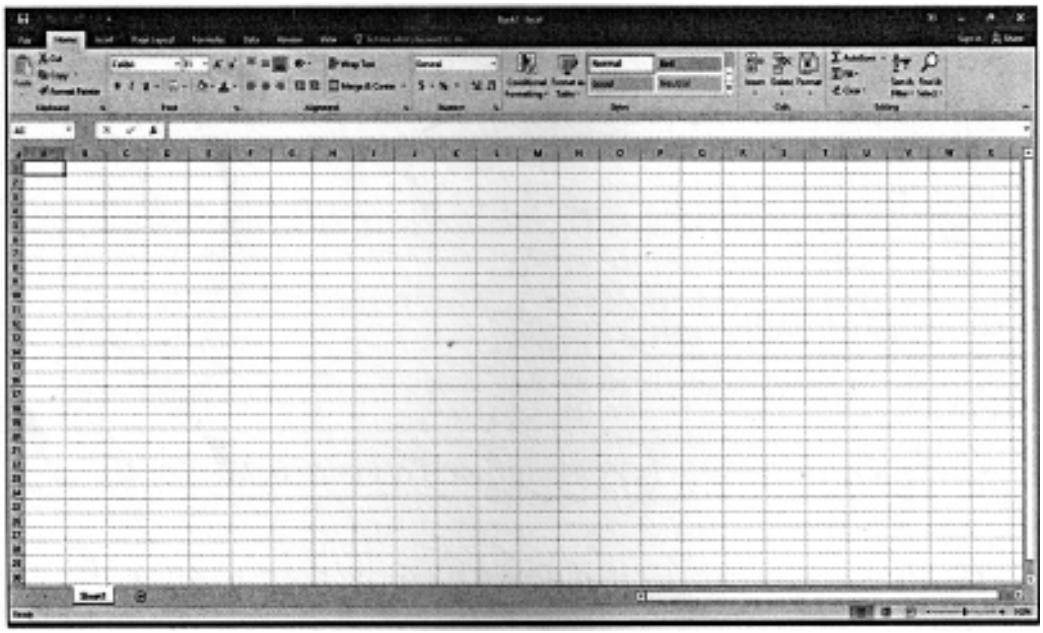


Figure 14: MS Excel interface

Generally, spreadsheet application is incorporated with few tools for filtering and sorting data, executing calculations to group of cells, and producing charts as a result. Data representation is enriched with Column or Bar Chart, Line or Area Chart, Pie or Doughnut chart, Hierarchy chart, Statistic chart, Scatter (x,y) or Bubble chart, Waterfall or Stock Chart, Combo Chart. Surface or Rader Chart, Pivot Chart including few Sparkline which are especially mini charts to be placed in a single cell, each representing a row of data in one's selection (See figure 8).

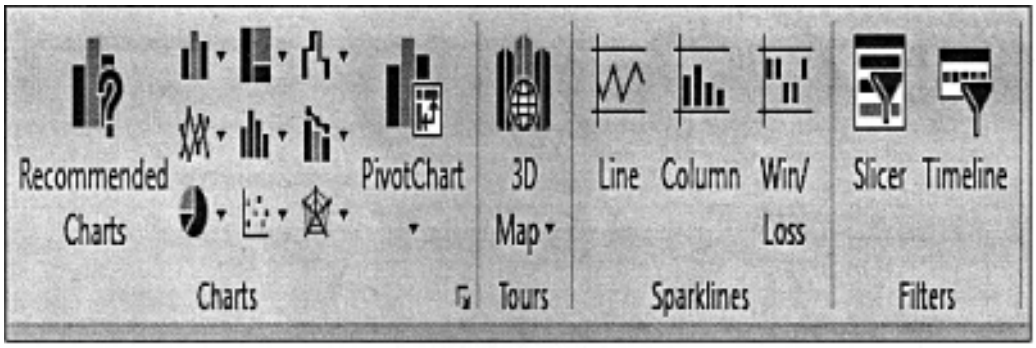


Figure 15: Data representation through chart

Formatting options are usually limited. But ability to format numerical data as currency, fractions, and percentages is possible. Numeric navigation with the help of different formulas are possible in MS Excel.

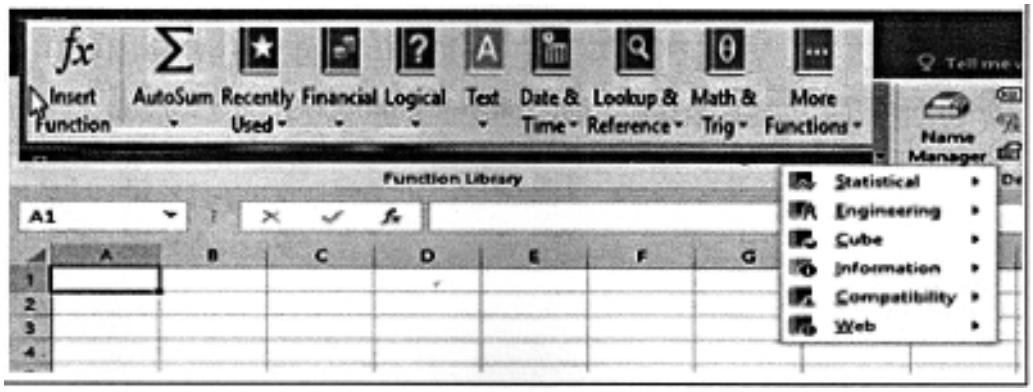


Figure 16: Data Representation: Formulas in MS Excel

These results are executable in different file formats are as follows:

- Open and edit Excel and PowerPoint binary files (.xls, .ppt) as Microsoft OOXML files (.xlsx, .pptx).
- Open and edit OpenDocument Format files (.odt, .ods, .odp) as Microsoft OOXML files (.docx, .xlsx, .pptx).
- Open and edit Comma Separated Value (.csv) files in Excel as Microsoft OOXML files (.xlsx).
- Open PowerPoint OOXML files (.pptx) that have legacy objects, no longer supported in this version of Office.

- Open and edit Rich Text Format files (.rtf) as Microsoft OOXML files (.docx).
- Print Excel and PowerPoint files.
- Export Word, Excel, and PowerPoint files as Open Document Format files (.odt, .ods, .odp)
- Export Word files as tagged PDF (.pdf)

Example of as follows from LibreOffice calc (excel) in figure 10.

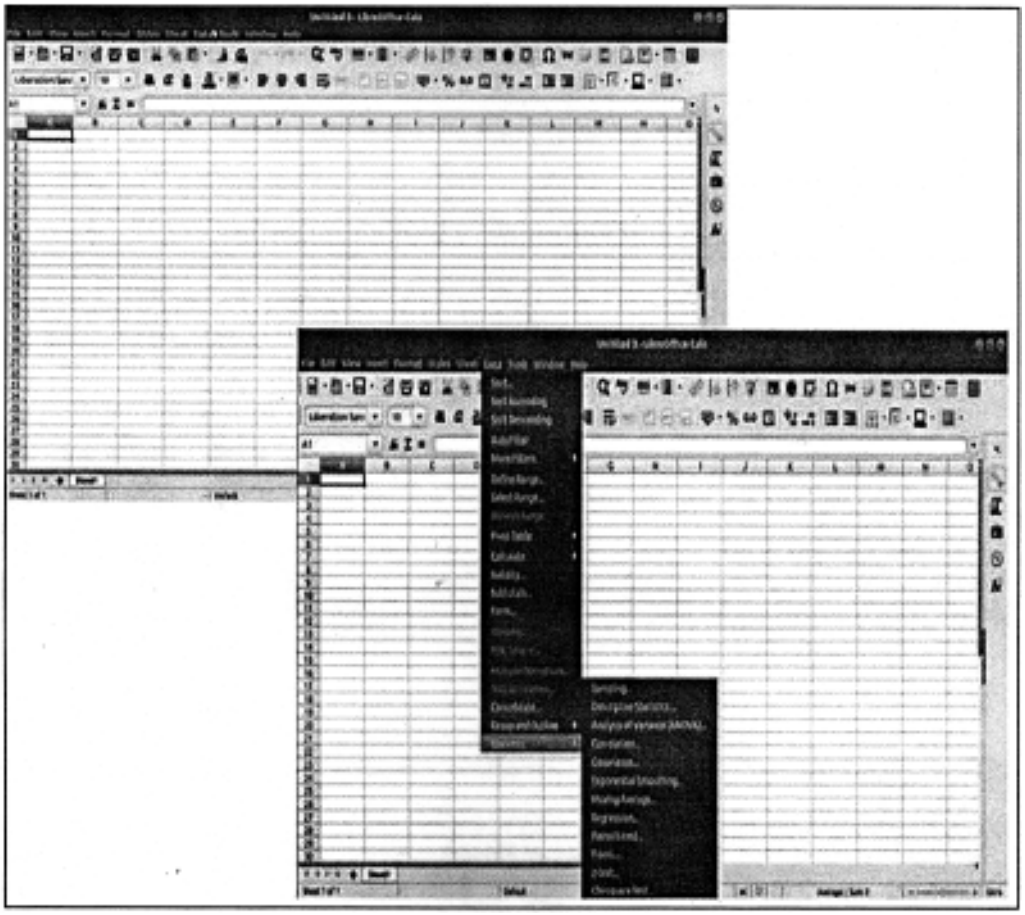


Figure 17: Libreoffice Calc

Excel sheet is mostly used in data representation to conduct scholarly communications. It is a logical application to curation and representation of data.

3.4 Web 2.0 tools

Technology is being used to motivate learners to extend their learning beyond classes. Aforesaid services, tools will help us to achieve technology- enabled learning.

After gone through section 1.2 you are now well acquainted with world wide web and different versions of Web. In academia there are lots of scopes to use maximum number of services to enrich the entire educational system

for further development of the pedagogy. Perhaps result of such web 2.0 implementation in education sector called as Education 2.0. This section is going to focus on different services and tools of Web 2.0 technology which are involved to strengthen the pedagogy. In education we can use such web 2.0 technology in various aspects. To create content in a collaborative platform, to deliver those contents, to communicate learners in face to face mode as well as in distance mode in a participative way. Here, broadly we can segregate web 2.0 tools in two parts viz. content Development platform, Content delivery platform and Communication, collaboration and social networking tools. We are starting with tools and technologies.

Tools and Technologies for Connecting with learners:

E-mail: Learners can generate and send their personal communication with the faculty to keep themselves up to date by e-mail. They can send mail by attaching document (which is limited size of 2MB). Individual teachers can send e-mails when there are trying to interact with learners immediately. E-mails can be sent individually or in group. It is very easy to make groups of addresses in the most common e-mail programs. Now-a- days LMS are incorporated with the automatic e-mail so that learners' get informed about contributions, forum postings or administrative news by the system automatically.

Website or Blog: Blog or Weblog is a user-generated website, or web page on hired web space or can use free hosting web sites to generate and distribute information which are selected by users in reverse chronological order. It is a mechanism to share knowledge, understanding and opinions with other people of a domain expert. Generally, dealing with the current events or general views of authors own. It is a type of website also. Most popular free blogging services are from Google and wordpress to provide information.

Figure 18: Screenshot of edublog

RSS Really simple syndication, a way of aggregating web content in one place. Users have to subscribe to sites with RSS feeds and the aggregators collects new content and sends it directly to desktop. So the content of many sites is visible in one place, usually a personalised service to keep update by accessing specific pages in a single click. Atom, Feed reader are some of example of RSS feed reader.

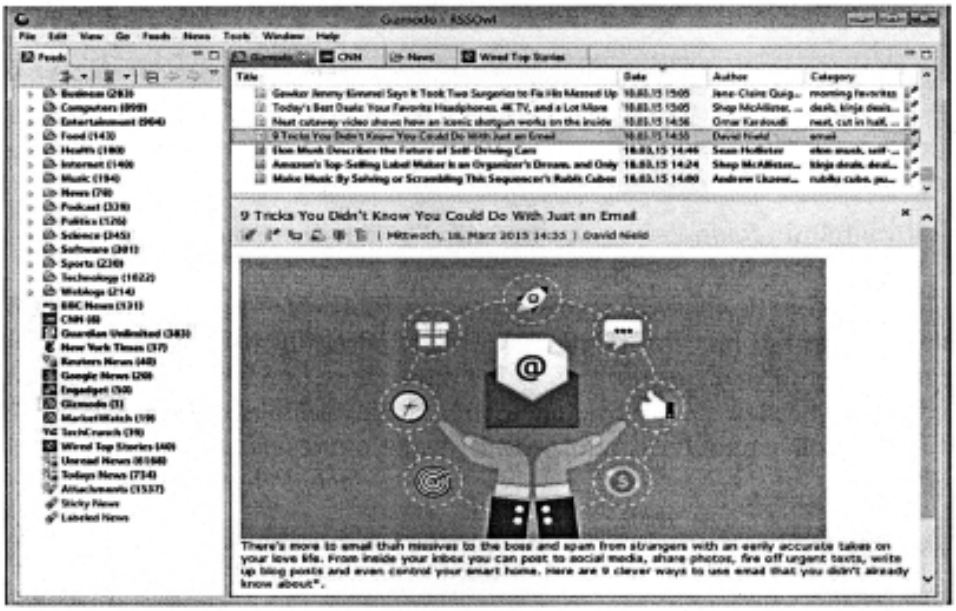


Figure 19: RSS feed

RSS can have made you able to instantaneously see/access when new posts are added to pre-installed RSS and Atom feeds by clicking the browser icon. One can manage his/

her own feeds, reload feeds, and export feeds so that s(he) can import t and save them for future.

Online Survey: online survey is a wonderful platform to get quick feedback from learners. Google form and survey monkey are few applications through which we can prepare a set up to get the information from learners, teachers and persons are associated with subject domain/ academia. Even scholars can also use such tools to collect required data for their research work. These tools are enough efficient to analyse data automatically to provide outputs on the basis of collected data.

Figure 20: Survey Tool

Online Bookmarks: It is a Web based service, allows user to locate, classify, rank, and share Internet resources by tagging sites. It can organise Webpages with tags. It also facilitates others to access one's personal collection if the actual user permits that particular user. Personal account generation is also mandatory here.

Virtual Learning Environments: A virtual learning environment (VLE) is a system, customised to support teaching and learning environment.

This system is incorporated with entire educational system including lecture deliberation through audio/video platform, wikis, presentation, text based Self-Learning Study materials

(SWLMs) in pdf or doc file, Self-assessment through multiple questions, self-evaluation, peer assessment, tracking tools, communication/update news from the administration through automatic email, instant messaging, blogs, RSS, discussion boards, etc. Each and every Learner Management Systems (LMS) has its own inbuilt communicative, participative and collaborative platform to interact with the learners. MOODLE is an example of successful and popular open source Learning Management Software.

Social Networks: Social networking tool is a Collaborative, Communicative and interactive platform that organise social interaction between community member where members can share their knowledge easily. Few applications like Facebook, Twitter or MSN Instagram may be used to communicate with learners, so that teachers get connected with the learners who are sporadic by their nature. It is possible to make groups in Facebook and share information with the learners. They can share pictures, important information, etc. User authentication & Personalization is main strength of these services.

Figure 21: Social Network

Online Groups and Forums: Communication platform to get connected in a broader approach. This platform made easy to communicate with a large number of learners in a single click, using forum and e-mail groups like Google groups and Yahoo groups teacher/ learners can create specific group of domain specific/institution specific services to communicate each other.

SMS and Instant Messaging: This tool is made for sending information in one-to-one basis or one-to-any basis. Instant messaging service like whatsup, messenger, viber is few very popular service through which learner can take help in distance mode. Even they can share file too by using such IM tools.

In spite of such services there are a bunch of web-extension service for Education. Reference management software is an important tool for higher education to communicate research outputs. Mendeley and Zoteroare two free and Open source reference management software through which scholars can easily handle and manage a huge number of references. Not only that, these two software has provision to be incorporated with MS word, open office, Libre office etc.

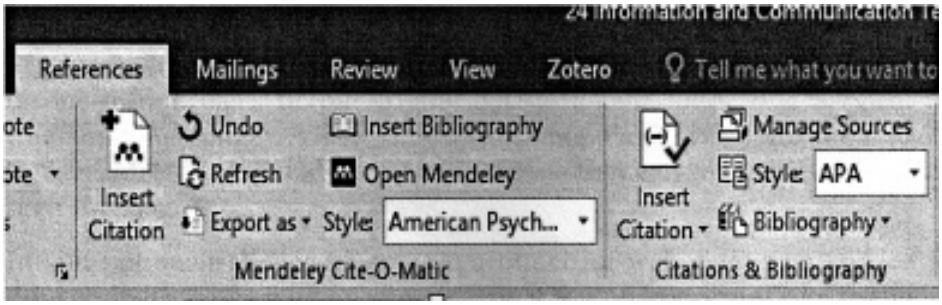


Figure 22: Managing References through MS word

These web 2.o compliant applications made education quite easy to handle and flexible. Thus, such platform naturally saves teachers as well as learner's time, and help teachers find the best facilities to offer. In an educational system teachers are acting as a bridge between resources and learners. In addition to this, technology and application of web 2.0 boosted up existing situation only. Education with such tools and technology along with internet, can provide ready-references to the learners. As a results learner will not remain just only consumer of the pedagogy they will become producer of the pedagogy.

Photograph Sharing Utility are able to organise and publish a bunch of photographs online. Photograph can be described and commented upon by generating and using personal account. Instagram, Flicker are two most popular example of photo sharing utility.

Web Aggregators: Web Aggregating services is a service which facilitates users, accessibility and use of more than one web2.o compliant service in one web page. Its enabling maximum benefits to user as well as to service provides. User are able to combine two or more than two services by selecting them as per requirements. For example, AddThis, Add To Any. Main specification of this aggregator is anyone can use all services either provided by same provider or by different provider by creating one free account only. User have to choose and pick services first. Then, it will provide a code to use such services through your web page, operator can perform a single authentication gateway for all provided services. Such service also facilitates Share Buttons, Follow Buttons, List building etc. for robust performance.

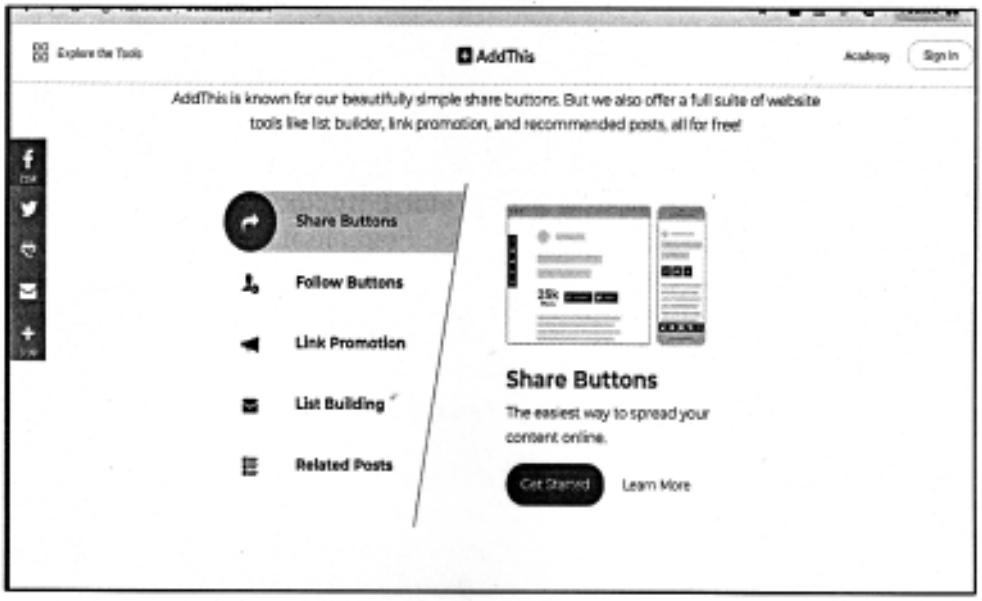


Figure 23: Web Aggregator

Apart from such general tools, entire web2.o service is segreted in three layers for educational purpose, Content Development Tools, Content Delivery tools, Assessment Tools and Content Communication Tools. Content Development tools help teachers to develop their thought content for the transmission to their learners. Content Delivery tools are those through which teachers are able to deliver their contents to the learners. And after that, through assessment tools teachers are able to measure learners progress. Communication tools are helping teachers and learnbers to communicate, interact with each other. These are as follows:

Content Development	
Services	Tools
Concept Mapping	MindMap, SimpleMind, MindNode
Read/Write web	Blogs, Wikies
Blogging Platform	Aol Lifestream, Blogger, Live Journal
Image development/Editing	Canva

Animated Presentations	Adobe spark
Interactive video/Audio	Wirewax, Audacity
Presentation	PowerPoint
Screen Capture/recording	Green shot, Cam studio
Online Survey	Google Survey

Content Delivery	
Services	Tools
Lectures	Audio/Video lecture,
Virtual Learning Environments	Edmodo, Schoology, Educlipper, Google Classroom, Google Communities, Edublogs, Kidblog, Moodle, PBWorks, and Wikispaces.
Document Sharing	Dropbox, We Transfer
Question-Answer system	AnswerBase, Quandora
Gamification	MamboJo, Growth Engineeering
Live Broadcasting	Periscope, Google duo, Facebook chat
Webinar	WebinarsOnAir, Livestorm, Webinato, GoToWebinar, Zoom

Tools

Categories	Services
Instant Text messaging	Emails, AOL Mail, Bentio, Messenger, Email App

Social Bookmarking sites	Bobrdobr, BonzoBox, Bookmerken, Cite U Like, Connotea, cootopia, Delicious,
Social Networking	Facebook, Flaker, Formspring, Friend Feed, Hedgehogs
Mashup	Podcasting, Vodcasting
Social News	DigaCultura, Digg, Digo, Dig This Webhost, Gabbr, Hacker News, Hotklix
Photograph Sharing Utility	Flicker, Instagram

Communicative Collaborative and participative services	
Categories	Services
Discussion Forum	Blackboard discussion, PhpBB
Messaging Tools	Skype, Messenger, Flock
Team Communication	Slack, Facebook, Workplace
Video Discussion	Voice Thread, Flipgrid, Recap, Vialogues, Flipgrid
Virtual meeting	G0T0 Meeting, Meeting Burner, Meetin.gs, Yugma ZOHO meeting, Skype, Facebook

3.5 Assessment tools: Rubistar

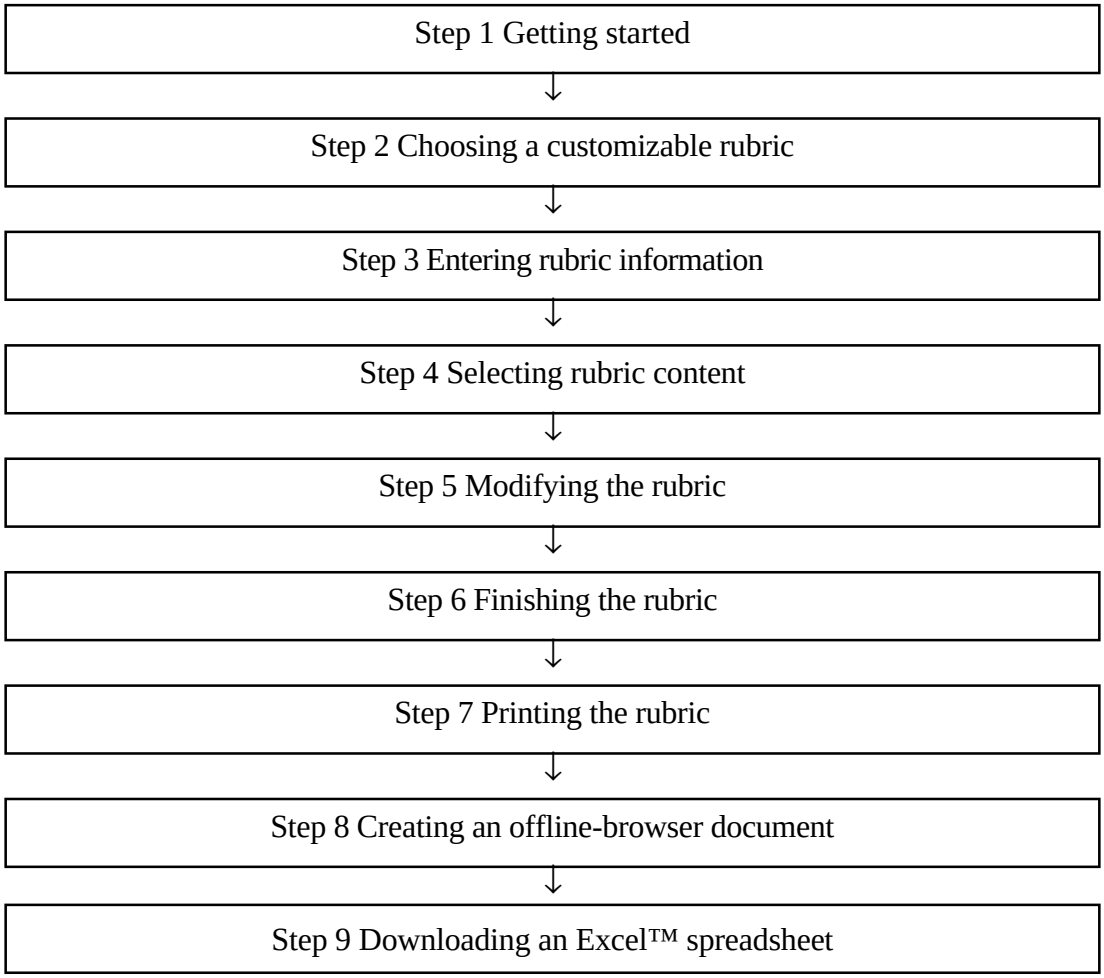
In ICT-enabled educational tools, Rubistar is the most powerful tool which is easy to use also. It was developed and hosted by ALTEC, a non-profit organisation, run out by the University of Kansas, USA.

"RubiStar is a tool to help the teacher who wants to use rubrics but does not have the time to develop them from scratch. While many teachers want to use rubrics or are experimenting with writing rubrics, they can be quite time-consuming to develop."

Rubistar is an online tool for teachers through which teacher can use existing rubrics for use in math, writing, reading, science, music etc. Even they can customise those rubrics

for their dedicated purpose. Teachers can modify such rubrics at any level. It facilitates scoring guide with preseted criteria for students'/learners performance and able to evaluate the level of their performance on the basis of pre-sated criteria. For such output, Rubistar has its own mechanism to define level of the students' performance with incorporated numerical scores.

To avail this service, we need to create an account for personal use at Rubistar website (see webpage). Main steps to create a rubrics are depicted as follows:



By clicking on the option in Create account, after filling all fields it will automatically show a notification that you are in the system and your account has already been created.

Figure 24: Rubistar

Start New Rubric with green button.

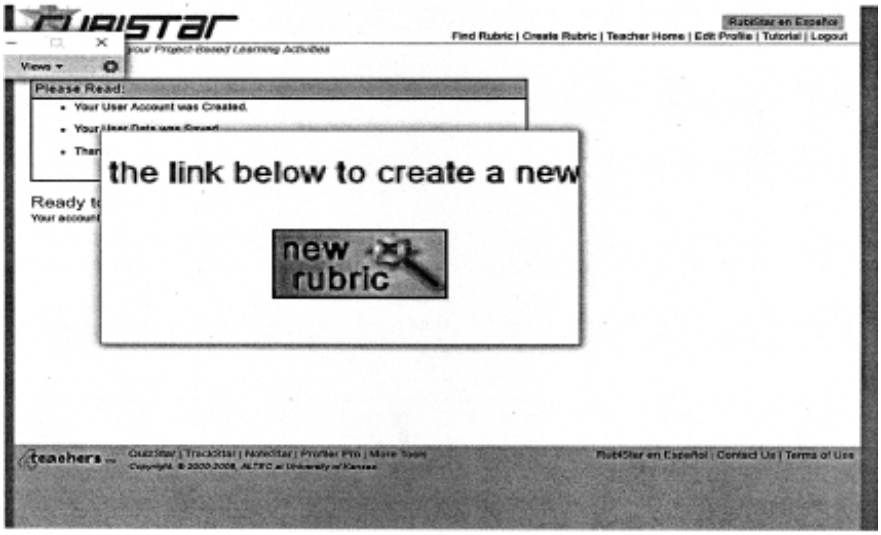


Figure 25: Rubistar: create Rubric

Then choose required rubrics like 'Oral Projects', 'Products', 'Science', 'Research & Writing' etc. (see figure).

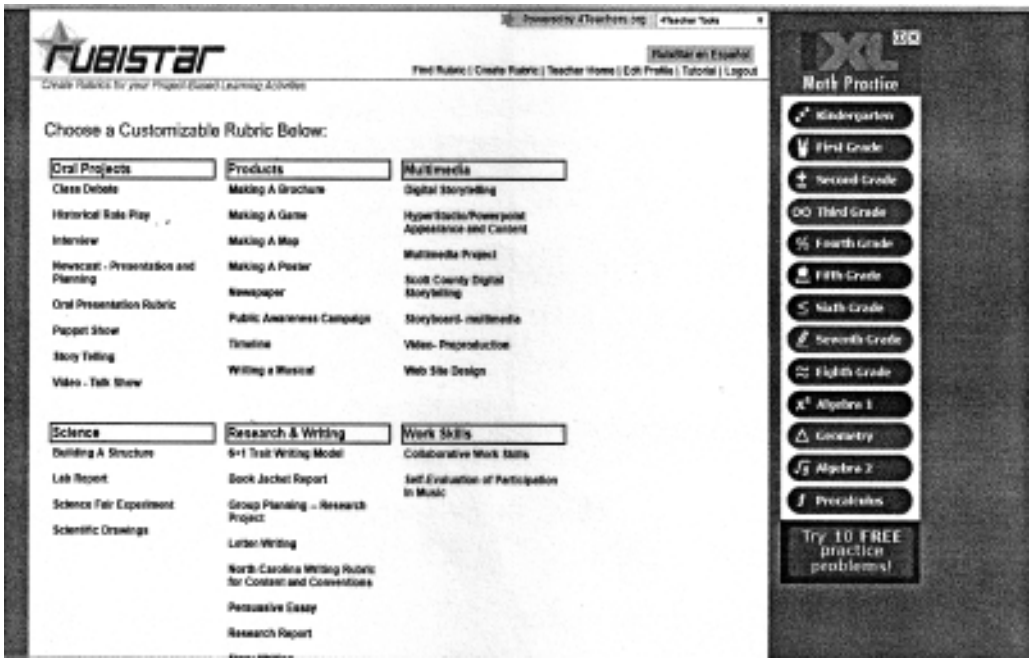


Figure 26: Rubistar: create Rubric on Research Topic

For example, we want to create a rubric on research report.

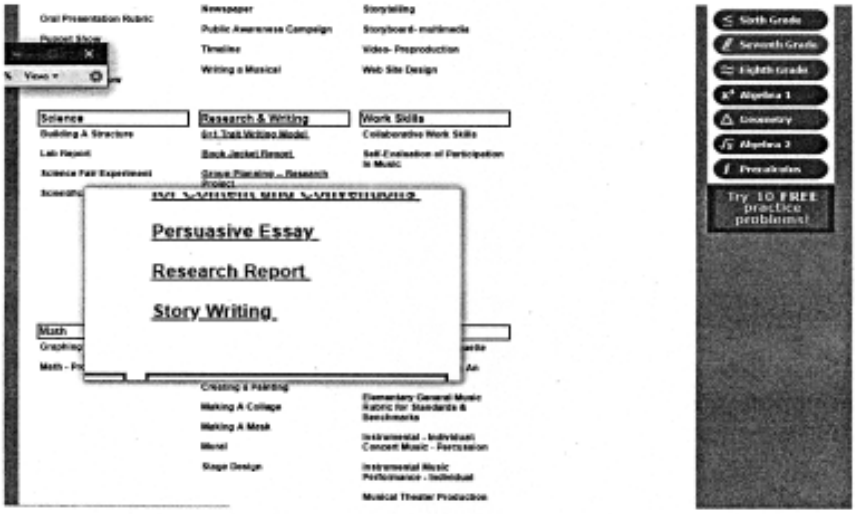


Figure 27: Rubistar: Choose Rubric template

Then fill up entire rubrics with proper descriptions (Figure 28)

Figure 29: Rubistar: Rubric Description

Once description is ready then website will auto-generate boxes with dropdown list at level of 1,2,3,4 rating. See figure 27

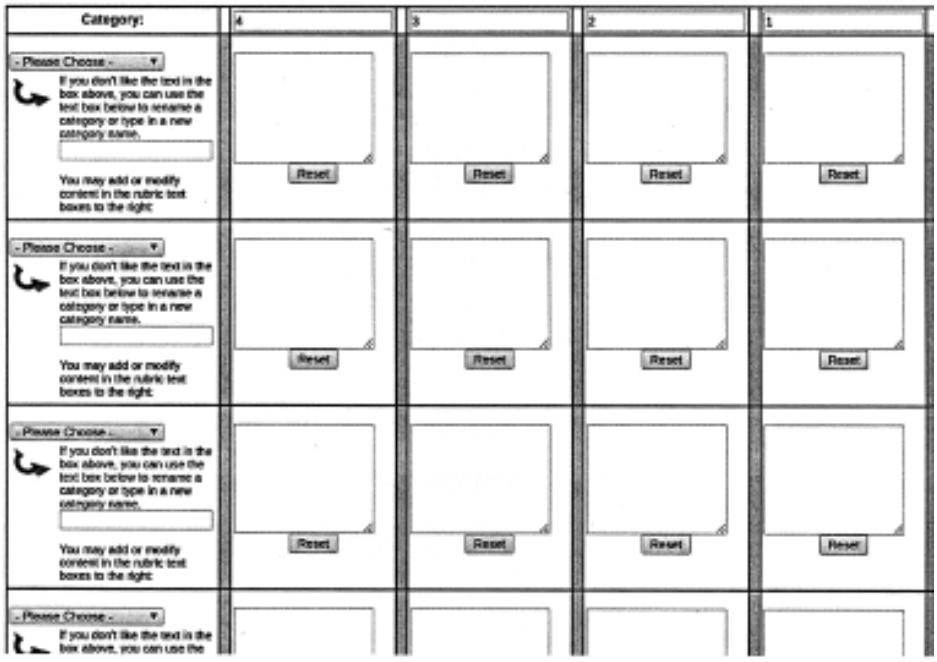


Figure 30: Rubrics

After choosing and modifying rubrics, finally click on the submit button and it will offer ready for download or printing. Results will be as shown in Table:

Figure 31: Ready to print Rubric interface

CATEGORY	4	3	2	1
Required Elements	The project was done by the student. Pertains to the time frame studied. Requirments are exceeded.	Required elements are met.	Some of the required elements are not included on the poster.	Several required elements were missing.
Use of Time	Good use of time. Could tell student took time to ensure project was professional and attractive.	Used time ok. Focused on getting the project done and not especially concerned about attractiveness of project.	Could tell time was not used well. Project either looks hurried and unfinished or student claimed minimal time used.	Did not take time to do the project with thought and concern.
Content - Accuracy	many details and facts are accurate and displayed on/ in the project.	accurate facts are displayed on/in project.	Some facts are accurate others are not.	Facts are not accurately displayed on/in the project.
Mechanics/neatness	The project is exceptionally neat Capitalization and punctuation are correct throughout.	There are 1-2 errors in capitalization or punctuation. Project could use some cleaning up.	There are several errors in capitalization or punctuation. Project needs to be neater.	There are more than 5 errors in capitalization or punctuation. Project was thrown together.
Graphics - Originality	Several of the graphics used on the project reflect an exceptional degree of student creativity in their creation and/or display.	One or two of the graphics used on the poster reflect student creativity in their creation and/or display.	The graphics are made by the student, but are based on the designs or ideas of others.	No graphics made by the student are included.

So in nutshell, rubrics is a tool to assess learner's development with the assignment given and it is also a tool to assess learners progress with the subject.

Hot Potatoes

Hot Potatoes is a Web authoring tool suite which enabling you to create interactive

multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the World Wide Web by using which includes six applications viz. Jcloze, Jcross, Jmatch, Jmix, Jquize and Masher. The last application, i.e., Masher collaborate all exercise in one unit. Hot Potatoes is generally fit for any project for which you are seeking for. It is not open-source. It is only a freeware. That means this software is not released under any open license platform even you are not entitled to modify this software as per your requirements. You can only download, install and use this software at free of cost. Hot Potato was created by the "Research and Development team at the University of Victoria, Humanities Computing and Media Centre". Commercial aspects of the software are handled by Half-Baked Software Inc. Hot Potato was first released in version 2.0 in September 1998, at the EuroCALL conference in Leuven, Belgium. Hot Potatoes has been freeware since October 2009.

Main task is to do in hotpotatoes is to enter your data, may be texts, questions or answers, the programs will automatically create the Web pages for teachers. Then they can post them to the Web site, every aspect of the pages can be customized. Creators name will be shown into exercises to identify as the author of the exercises. Hot Potato is downloadable from Hot Potatoes 6.3 installer (Hot Potatoes for Windows 98/ME/NT4/ 2000/XP/Vista/7/8/8.i/i0, version 6.3).

Interface of Hot Potato installer will appear as shown in figure

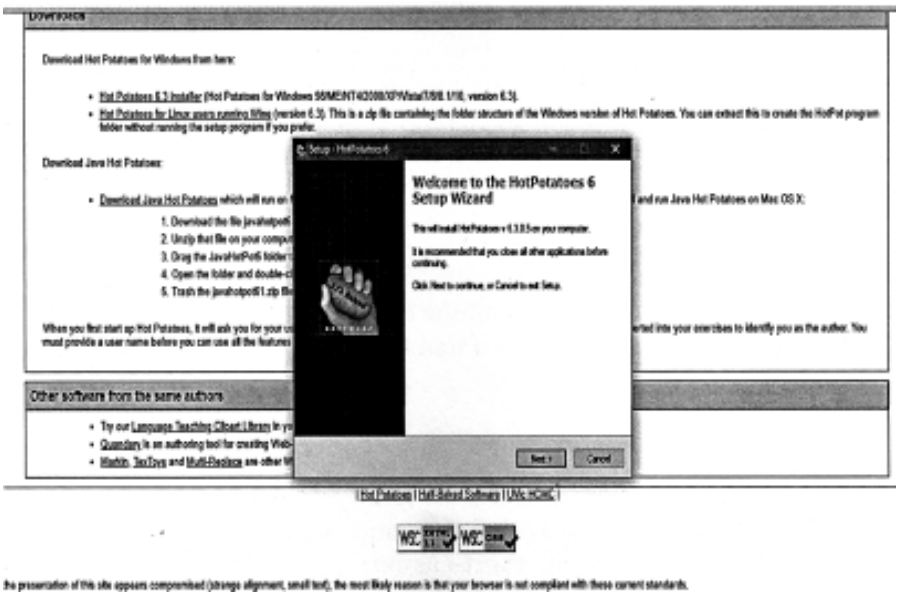


Figure 32: Hot Potato Homepage

Click on the Install Button to 'Install' it properly.

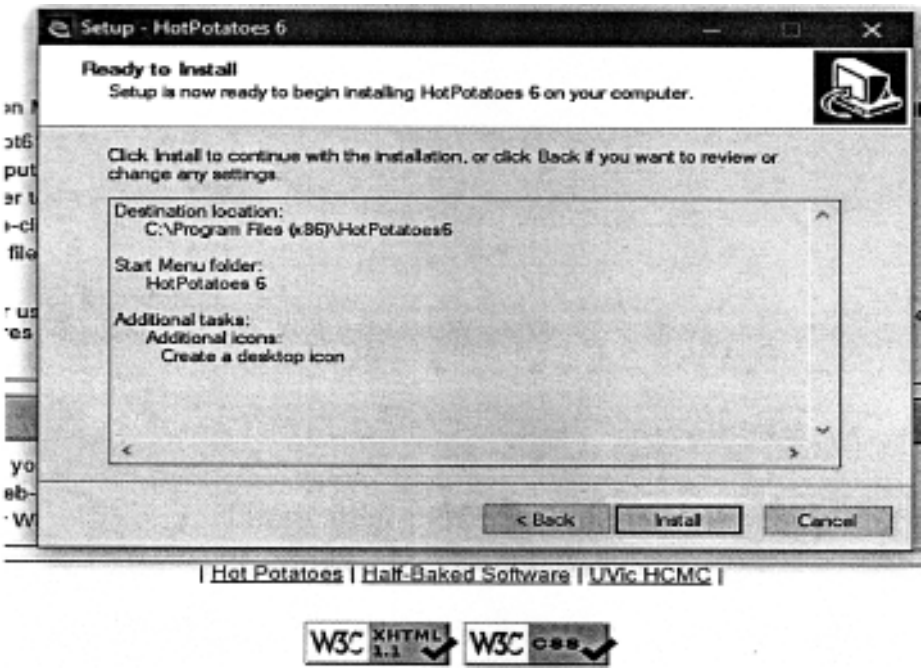


Figure 33: Hot Potato Installation

Contributors name is mandatory for completion of Hot Potato installation (Figure 32).

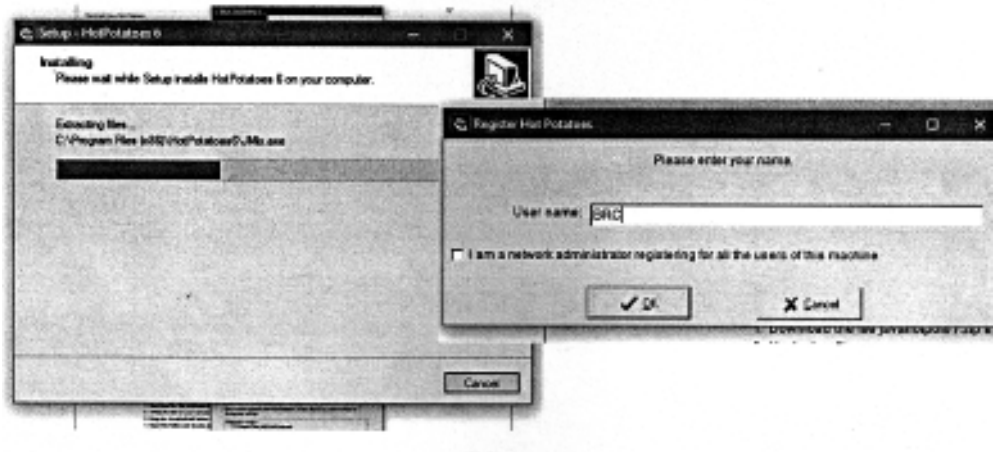


Figure 34: Register in Hotpotato

Hot Potato is ready to use. In this stage choose option as per the requirement. Five applications are there to create content as follows:

Application(s)	Function(s)
JMix	Multiple choice
JQuize	Short-answer Quiz
JCross	Crosswords
JMatch	Matching
JCloze	Cloze texts can be used for any type of fill in exercises, with or without wordlist at the top and with or without extra clues given. Learners are trained in understanding as well as spelling.
JMasher	jumbled sentence to order something

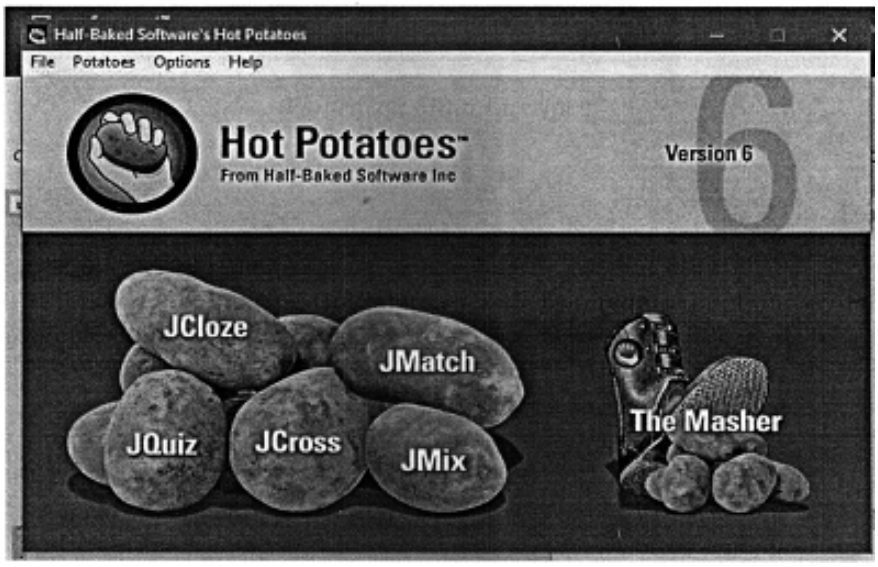


Figure 35: Main Interface

To start a program using Hot Potato click first on required option, say for example- Jquiz

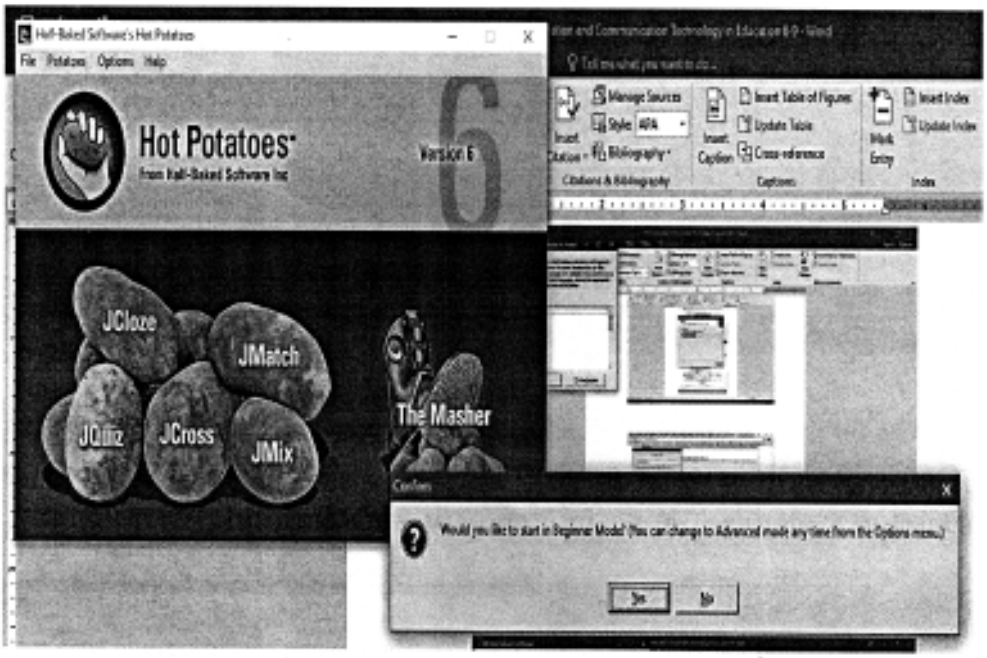


Figure 36: Choose option to work upon

First, create ‘data file’ which has a Hot Potato XML extensin (like, jew or, jel).

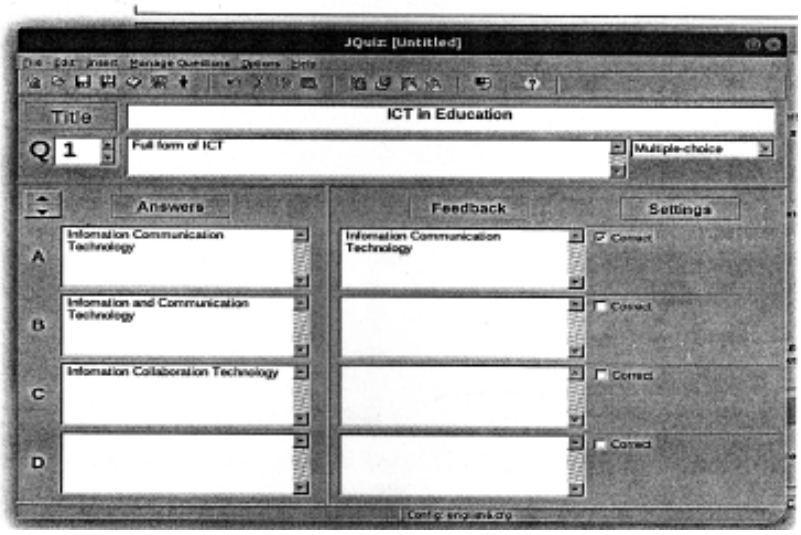


Figure 37: Hot Potato Quize

This file is only usable in Hot Potatoes program. If one has knowledge of html and java programmings(he) can modify it later. At final stage this file is ready to be exported to web-based exercises (.htm file) which can be displayed anywhere on the Web.

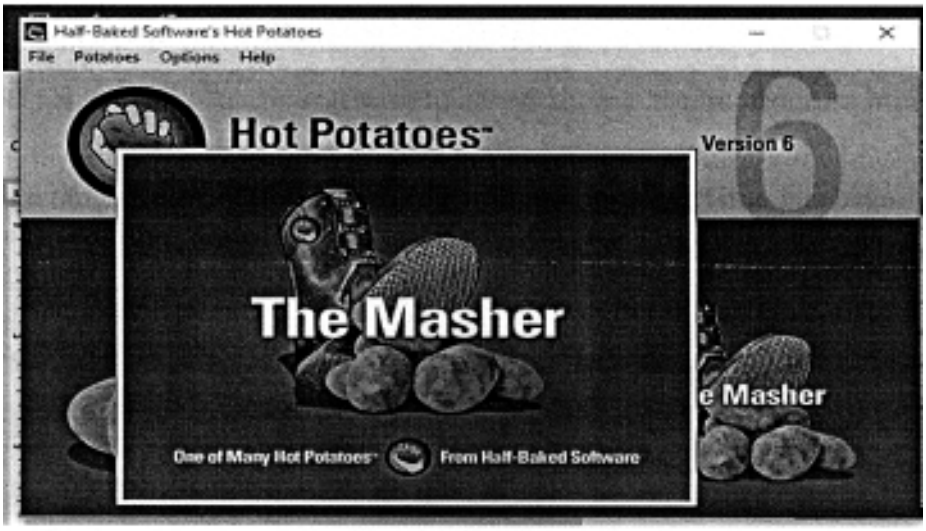


Figure 38: The Masher

Masher is a place to collaborate different works in one place.

Teachers can use this software to assess their learners progress minutely.

Education is representing a robust platform to acquire knowldge with the advent of Information communication technology. Time has began to start with online education like MOOCs which are basically using Open Educational Resources for its sustainable development. In thus a way, learners will be producer of the learning system rather than consumer of the system.

3.6 Let us sum up

Information Communication Technology (ICT) tools contribute to high quality lessons since they have potential to increase students' motivation, connect students to many information sources, support active in-class and out-class learning environments, and let instructors to allocate more time for facilitation. This unit focuses on some pertinent ICT tools and software that has truly contributed to the enhancement of quality in teaching learning and assessment milieu. Today, the use of ICT tools such as laptop computers, electronic pads, smart phones, along with the broadband internet, interactive Web 2.0 technologies and cloud applications have enhanced both, teaching and learning in the different stages of education.

3.7 Unit End Exercises

1. Name the computer software required to use ICT in teaching-learning evaluation system.
2. Reflect on some notable Web 2.0 tools in education.
3. What is the importance of social technological tools in present day education system?
4. Give few examples of widely used ICT tools in education.
5. Identify the various ICT assessment tools and their application in educational institutions.

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