APPLYING RESEARCH TO SCHOOL EDUCATION

A Training Package for SSA and DIET functionaries

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PREFACE

School Education in all its frontiers aims at quality improvement. There has been a tremendous upsurge in the recent years at the national front which include eminent educational personnel, curriculum planners, educational practitioners, teachers etc, towards improving the learning of children, teachers' competence, infra structure, curricular and textbooks renewal and so on. There are newly introduced innovative schemes in schools at the state and at the National level to improve the quality of learning and teaching. Efforts have been made in different states to train teachers in action research programmes in order to empower them with the skills of researching and solving the actual classroom problems and be the reflective classroom practitioners and researchers.

The entire gamut of school education which is in the transit of change towards excellence requires systematic endeavours to probe into the changes introduced. It is necessary to take stock of the situation, evaluate the effects of the implementation of new programmes, decide empirically and rationally in light of the evidences and the experiences acquired to aid in examining the existing and in revision of policies in the area of school education. This demands a need for the knowledge and training in research methods, which would empower the educational practitioners with required skills and abilities to operate as researchers in the field conditions.

This training material is designed to provide an understanding of the research methods and its applicability in real field conditions. The modules are developed keeping in mind the present context of school education, which is reflected in the examples, and the activities provided. The material addresses the educational practitioners such as the SSA functionaries, and other state and district level educational practitioners who are entrusted with responsibilities like, training of teachers, supervising and monitoring the learning achievement in schools. It addresses, in particular, those under the initiatives of the state, work in the realistic field conditions and provide the state of affairs related to school education in the state, through surveying, evaluating and reporting. The material aims to develop an insight into the kinds of research techniques that one can adopt, use of different types of tools, rational selection of sample and tools, and systematic ways of analyzing and

reporting the research. While it is recommended for the field researchers, it is also suggested to use the material to train the educational practitioners and others who are concerned with research in school education.

This training material, which is an approved PAC programme evolved based on the need requirements of the State Tamil Nadu. The programme was initiated by holding a meeting with the Joint Director of SSA unit in Chennai to know the status of research in school education in Tamil Nadu. Consequently, two workshops were organized involving the resource persons from universities to develop the training materials. The workshop also included SSA functionaries from Chennai to identify the research requirements of the educational personnel in the field.

I immensely thank Dr. Kashinath from Dharwad University, Karnataka and Dr. Sumangala from Calicut University for their valuable contribution to the training package. I also thank the resource persons Dr. Vijayalakshmi from Padmavathi Women's University, Tirupathi, Dr. Eknath Ekbote from Gulbarga University and the SSA members for participating in the planning phase of the workshop. I am also thankful and appreciative of my junior research fellow, Ms. Jubilee Padmanabhan for her assistance and help in bringing out this training package.

It is hoped that this material would be of great help and assistance to the Education functionaries and other stakeholders in the Education sector in their training programmes on research methods and also in their research endeavour.

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Module One

WHAT IS RESEARCH AND RESEARCH IN EDUCATION?

Getting started

At the end of this module, you will be able to

- Understand the meaning of research.
- Understand the need for research in education.
- Identify various potential areas of education and the scope for research in those areas.
- Explore the areas of education in which research is carried out to a great extent.
- Explore the areas of education in which research is carried out minimally.
- View educational research as a scientific inquiry embedded in social and cultural settings.

What is research?

Research is a search or inquiry or investigation or examinination aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws. It is collecting of information about a particular subject.

Research is an examination of a subject from different points of view. It's not just a trip to the library to pick up a stack of materials, or picking the first five hits from a computer search. Research is a hunt for the truth. It is getting to know a subject by reading up on it, reflecting, playing with the ideas, choosing the areas that interest you and following up on them. Research is the way you educate yourself.

Research is defined as human activity based on intellectual application in the investigation of matter. The primary aim for applied research is discovering, interpreting, and the development of methods and systems for the advancement of human knowledge on a wide variety of scientific matters of our world and the universe. Research can use the scientific method, but need not do so.

Scientific researc ı

The basic ai n of science is to explain, control and predict physical and social phenomena. Gene ation of knowledge is the progressive attempt at explaining these phenomena throug ı theorisation. Examining the history of science, it could be seen thaat the generation of knowledge has been following a chain of activiities involving the interaction betwee ı human mind and environment. This chain could be seen to involve two patterns of int eractions. One, a process involving casual observationsof phenomena followed by induc ively arriving at summaries of observational findings which lead to theory building. Tl e second, a process which starts with a proposed theory or a rational model governing t ıe relationships among various constructs in the phenomenon, from which could be c educed a set of hypotheses regarding the behaviour of the said phenomenon unde ı specified conditions. In fact, the process of generating knowledge involves a sysnthe sis of these two patterns. The observations made along with the existing structure of knowledge generate a working theoretical frame work. This theoretical frame vork would involve certain hypothetical relationships among the constructs inherent in the phenomenon. From this, certain observabel situations can further be deduce through analysis. These situations could be operationalised and utilised for testing the hypotheses. This testing process would validate the theoretical framework that ha been evolved and might suggest certain revisions, which in turn, would generate furt ıer testable hypthoses. Thus the evoultion of knowledge involves the cyclic process con sisting of propounded theories and progressively revising them through hypothetic deduction and empirical validation. This cyclic process of generating knowledge through systematic efforts may be termed as research.

Scientific re earch relies on the application of the scientific method, a harnessing of curiosity. This re earch provides scientific information and theories for the explanation of the nature and tl e properties of the world around us. It makes practical applications possible. Scientific esearch can be subdivided into different classifications according to their academic and a pplication disciplines.

Based on the above, we can define Research as *a systematic process of collecting and analyzing inf rmation (data) in order to increase our understanding of the phenomenon with w hich we are concerned or interested.* It is a process through which

we attempt to achieve systematically and with the support of data the answer to a question, the resolution of a problem, or a greater understanding of a phenomenon. This process, which is frequently called *research methodology,* has eight distinct characteristics:

1. Research originates with a question or problem.
2. Research requires a clear articulation of a goal.
3. Research follows a specific plan of procedure.
4. Research usually divides the principal problem into more manageable sub problems.
5. Research is guided by the specific research problem, question, or hypothesis.
6. Research accepts certain critical assumptions.
7. Research requires the collection and interpretation of data in attempting to resolve the problem that initiated the research.
8. Research is, by its nature is cyclical.

What Research is not?

- Research is not mere information gathering
- Research is not mere transportation of facts from one location to another.
- Research is not merely rummaging for information.
- Research is not a catchword used to get attention.

Research in Education

Education is a socially contrived system, which aims at enhancing the efficiency of societal functioning. It is concerned with societal development, and hence has under its purview all aspects of social life that would make development possible. This makes education as a discipline. The function of education as a discipline would be to identify the educational components wherever they exist, differentiate them and evolve suitable operational models for aiding the process of societal system with its value structure and all its other sub-systems, in relation to the societal development. Educational research, therefore, would include studies on the instructional process, its dynamics, its organizational structure, its relation with the total societal evolution, and its relation with

the individual and society. Obviously, educational research has social and behavioural aspects, and therefore, would have the limitation due to complexity and lack of precise measurement and rigorous control regarding social and behavioural systems in general

Educationa Research encompasses many different studies all of which attempt to better understand and improve the learning and educational process. These studies include research on topics such as Teaching, Classroom Management, Psychology, Child Development, Cognitive Science, curriculum studies, and evaluation.

Importance of research in Education

Objectives in education are influenced by education research and this research has contributed to the foundation of the base of knowledge in the field of education. The sad thing is that many teachers and administrators know little about neither how the research is obtained nor how to read the results that are presented. There is even a prevailing attitude that educational research is not practical to real word teaching. Now there is a growing appreciation among administrators and policy makers that research is important. Teaching methods and curriculum policies are now being scrutinized for evidence based research. Why is this paradigm shift happening?

The education field is maturing as teachers and administrators find that creating productive educational systems based on individual and group creativity is slowly starting to meet its potential. With qualitative and quantitative research the educational population can benefit from the statistical data and the narrative that supports it. Real world applications can then be created to support the data and positive results can be realized. The new interest in educational research has created an increase in empirical knowledge. The base of knowledge is expanding and a domino effect is propagating data that suggests that older methods of education might be ineffective in today's classroom.

Some of the areas that have more relevance to research to improve school education are as follows:

- Assessment and evaluation
- School management
- Learning and learning processes

- Achievement studies
- Educational technlogy
- ICT in learning
- Affective development
- Value education
- Environmental education
- Evaluation of textbooks and other instructional materials
- Guidance and vocational counselling
- Inclusive education
- Teacher competence
- Quality of teacher education
- Empowerment of teachers
- Role of community in functioning of schools
- Supervision and monitoring of schools
- Evaluation of in-service training programmes
- Health and physical education
- Socio and personal development of children
- Mulltigrade system- various issues and problems
- Innovative teaching practices and
- Leadership qualities of school administrators.

Basic, Applied and Developmental research in Education

Educational research may be broadly perceived as basic, applied and developmental studies. Basic researches are mainly aimed at understanding stable relationships existing among the innumerable variables in an educational situation, while applied researches are concerned with evolving workable models, inputs etc, by the application of various principles and establishing their effectiveness.

The main concern of Basic studies would be to understand the patterns of interaction among the variables in an educational setting, which may be relatively situation free. Studying such relationships as teacher behaviour, learning outcomes,

personality characteristics of students and achievement etc, represents investigations of this category. The underlying purpose of such studies is to at arrive at generalizations in the form of laws, principles, theories etc. Hence such investigations would demand greater sophistication with respect to sampling, observational techniques, controls, design, statistical techniques etc. This becomes essential in order that the generalizations drawn would carry greater validity and reliability.

Applied research encompasses studies designed to formulate practical paradigms, models etc, through its application of theories, laws, and principles generated by the basic researches. Such an application of laws and theories is essential to facilitate effective practice, which is field, based. For example, the programmed learning technique, which evolved as a result of operant conditioning learning theory, has been put into practice in the classroom situations. The effectiveness of this strategy has been studied by many researchers in different subject areas and at different levels of education. Similarly the activity-based learning, which has evolved through the principle of child centeredness, has been introduced as an approach to learning in the textbooks as well as in the regular classroom teaching. There are many research studies, which have been conducted to study the effect of activity based learning on the achievement of students. In all these studies attempts are made to validate the potential of various educational devices in several conditions. Such studies are conducted in manipulated conditions utilizing experimental designs. The significance of the applied researches is to evolve operative models, which although not universally applicable, would form practical framework for researchers in real educational situations.

Developmental researches are more akin to the applied researches, as the main focus in these also, is application of theoretical knowledge into practice. But it differs from the latter in the fact that they are conducted in real educational settings and they make attempts to study the functioning of educational inputs in the context of all the variables operating naturally in the setting. These studies are also referred to as longitudinal studies in developmental psychology or studies related to social development. The aim of such researches is to study the operation of practical paradigms in specific situations. Unlike the applied researches, developmental researches provide overriding importance to situational consideration as the emphasis of such studies is on

predictability and feasibility. As the basis in developmental studies is practicability in real situation, they are conducted without exercising any control on the condition prevailing setting. Thus sophisticated designs would be less appropriate; rather designs, which would accommodate the study of complex natural interplay of variables, may have to be evolved for conducting developmental studies. The education intervention under study would be validated, continuously through empirical evidences and examined against certain internal criteria. These internal criteria, for example, would be instructional objectives and feasibility aspects. The feedback received through such validation is consistently fed into the system under study to improve its functioning. It is important that while studying the functioning of the educational intervention, such as teaching through new innovative methods, focus should be no t only on those variables directly involved in the educational process, but also on the related subsystems of instruction such as administration, planning, institutional organization, resources etc. and their influence on instruction.

Proposed areas of research related to state educational system:

The State Education system such as DSCERT/DTERT/SCERTand DIETs have a major role in conducting research which help to promote the quality of education. Some of the areas on which one can plan and carry out research in education at state level are:

- Programme Evaluation
- Material development and validity
- Institutional assessment
- Teacher quality assessment
- Researches on classroom practices and evaluation
- Baseline studies

a. Programme Evaluation

A programme is a set of planned activities directed towards bringing about specified changes in an identified audience. It has two essential components, I) a documented plan ii) an action consistent with the information contained in the plan. Many educational programmes are described as educational interventions. An evaluation

of these interventions will help in knowing the effectiveness of the programme on the target to whom it was meant, and it might also lead to policy making and policy related decisions. For example, at the national level, certain schemes to promote the quality of education are introduced time and again. To mention a few, there were PMOST, OBB, and SOPT schemes funded by MHRD , under which the in-service training programmes were conducted under the leadership of NCERT. Many teachers across the country were covered during these training programmes. Recently the SSA scheme was launched in the states with an aim to promote quality education. It is essential to understand to what extent these programmes had an effect on the school system, quality of teachers, students and so on. This provides a feedback to the system regarding the action plans that need to be taken as measures to straighten the loopholes, and improve upon the shortcomings observed. The programme evaluation also helps in providing key knowledge of products, evidence, conclusions, judgments and recommendations related to a programme.

Similarly, there are many in-service training programmes organized for teachers and teacher educators and other stake holders at the state and at the district levels. Evaluating these programmes in order to study may carry out researches

- What is needed in this programme?
- What are the components of this programme and how do they relate to each other?
- What is happening in this programme?
- How is this programme performing on a continuous basis?
- How could we improve this programme?
- How could we repeat the success of this programme elsewhere?

b. Material development and validity

As you know, the states have the major responsibility towards education, especially towards school education. The production of text books, training of teachers, material development, conducting examinations, and, educational surveys in order to know the status and the quality of education etc are some of the major concerns of the states in the field of education. When the materials such as textbooks, teachers' manual or

handbooks, and other resource materials are produced, it is essential to try out them in the field and find out their practical use and feasibility of implementing them at a larger scale. Similarly, when some science and mathematics kits are produced, they need to be implemented for their effectiveness. In this context, researches may be conducted as field based studies, in order to validate the materials related to their practicability, feasibility, comprehensiveness, and other purposes for which they are intended. Once they are validated scientifically, the materials would be ready for use at a larger scale. The researches on these would be developmental in nature, where the materials are developed and validated. Based on the field experiences of implementation, the necessary changes or modifications are made in the materials.

c. Institutional Assessment

The quality of education is determined by many aspects – the students' achievement, their over all development, teachers' competence, their classroom practices, school infra structure with facilities, curriculum and administration, evaluation and monitoring practices and so on. The standards of schools can be assessed in comparison with the expected referenced norms internally and externally, which involve process and product evaluations. Researches in this area would provide a profile of the kinds of quality schools that the districts have in the state. The improvement in quality standards of institutions can be done by periodical quality reviews in an organizational system in which individual agencies are responsible for programme delivery within broad policy directives. The major proposition, which underlie the quality review, is that an organization provides guidelines for self-evaluation and improvement. This implies a need for research in institutional assessment in order to improve the quality standards. There is a need to research upon the school policies and procedures, and to recognize the importance of benchmarks in the calibration of delivered quality and academic standards. Through the evaluation and feedback obtained, the mechanisms to identify and disseminate examples of good professional practice may be established. The feedback obtained from institutional assessment should also help in arriving at decisions related to providing facilities and resources necessary to support activities to enhance and improve the quality. The arrangement to maintain and enhance education quality should be subject

to regular review and evaluation surveys of the educational sectors such as schools, non-formal agencies, DIETs, and all the other institutions, which are involved in promoting education.

d. Teacher quality assessment

Many researches in education are centered on teacher behaviour , teacher competence, classroom processes and professional development. Since the quality of education directly depends upon the teacher quality, it is utmost important to give attention to the status of teacher quality in our country, so that the observations and the results drawn would direct the policy programmes related to teacher education, and their effective implementation. For instance, studies are required to explore the teacher competence - minimum basic qualifications in the subject, command in the field of special competence, knowledge of areas, structure and skills in the particular discipline, pedagogical competence and so on. Studies may be carried out to study teacher motivation, commitment, job satisfaction and professional growth. Since so many in-service training programmes are carried out at the district and at the national levels, there is a need to follow it up to know how the training inputs provided in the programmes have helped the teachers in effective classroom transactions and in improving one's skills of teaching. The researches in teacher quality need to aim at identifying those areas in which the teachers lack competence, and based on this, they need to provide directions to plan the in-service training programmes. In the context of the paradigm shift from teacher-centered learning to learner-centered one, the approach to teaching learning processes in the classroom undergoes a great transformation. The teachers' role needs to be authenticated through observational and evaluative studies.

e. Researches on classroom practices and evaluation

As mentioned above, there is a growing awareness and a felt need to move away from the conventional teaching practices to a more learner centered ones. In this context, constructivism as an approach to learning need to be introduced in the classrooms, where the learners play an active role in the learning process, rather than being the passive recipients. The teachers may be trained in the constructivist modes of teaching and

learning. The textbooks and the other materials used should be designed in such a way that they facilitate the learning process in a constructive manner, rather than emphasizing on reproducing the information. Studies maybe planned to investigate the effect of the newly introduced approaches to learning on the learning achievement and the cognitive skills of learners. The roles of teachers and their perceptions about the approaches may also be studied. It is worth observing whether such approaches as constructivism is feasible in a large sized classrooms where the students' population is beyond 50. What could be done in such large classroom to facilitate the learning process is another important issue to be addressed through classroom research. The teachers may be encouraged to take up action research related to such issues and work out the possible solutions. The success stories of teachers through their active participation in teaching learning process, as well as in classroom research might serve as indicators for further research endeavours.

f. Base line studies

Baseline studies use a range of methods to establish a starting point for projects. They provide valuable social and economic information, which is critical to project decision-making and predict impacts. Some of the socio and cultural elements that provide a baseline for further planning of the projects are:

- Number of children enrolled in schools
- Socio and economic backgrounds of learners
- Socio-cultural resources
- Community profiling (health, housing, education, social issues, justice, *etc.*)
- Cultural background
- Cultural property identification
- Institutions and governance
- Cross-cultural mapping
- Micro/Macro analysis of infrastructure (local, regional, national)
- Development indicators and local capacity
- Physical infrastructure
- Stakeholder analysis

- Policy and regulatory systems and so on.
- Community Economic Development issues

The base line studies provide benchmark data related to the status of existing infra structure, achievement and the other aspects on a large scale. For example, baseline studies have been conducted before introducing the DPEP scheme in several districts of the states. Achievement studies were conducted through out the states to study the achievement levels of primary school students in language and mathematics. Which served as the bench mark data to know the achievement levels of students in the states.

The results showed that the achievement levels of students were very poor. Along with this the baseline studies also revealed that the quality of school inputs is low. The textbooks were found difficult, with many students unable to read them; their publication quality was low; and state textbook publication systems had many limitations in varying ways and to varying extent, from inefficient practices. While there were blackboards, consumable supplies and educational aids were conspicuous by their absence and, when present, by low utilization. Although most teachers were adequately educated and had formal pre-service training, they were not trained for multi-grade teaching in rural schools. It was also found that the weak supervision led to high rates of teacher absenteeism; in small schools, children without teachers. Buildings were poorly designed, inadequately maintained, and largely unfurnished. According to a 1986/87 national survey, 44 percent of lower primary schools did not have proper buildings; 66 percent had no furniture for students; 74 percent lacked libraries; and 95 percent lacked toilets. While the situation had improved in intervening years, conditions are still poor in many places.

Project baseline studies in three districts in Tamil Nadu, for example, revealed that more than 90 percent of schools lacked toilets, a quarter lacked furniture for students; in four districts of Assam, 80 percent of schools lack safe drinking water and fewer than 10 percent have toilets. In such circumstances, it is not surprising that many students lose interest in education, or leave school because of academic failure

The challenge to national, state and district education authorities are thus to improve the quality of basic services: pre-primary education, textbooks, learning materials, teacher competencies, and facilities. Nationally sponsored research and

development work aimed at improved curricula and textbooks began in response to the 1986 Policy. Known as Minimum Levels of Learning (MLL), this program had identified basic competencies in language, mathematics, and social/environmental studies. With trials largely completed, the challenge was to implement MLL standards through improved textbooks and in-service training of teachers. This was a massive task, requiring substantial investment and greatly strengthened institutional capacity for implementation, for supervision and monitoring, and for evaluation and research to determine the cost-effectiveness of alternative intervention strategies for achieving MLL. Simultaneously certain other systemic reforms were brought into focus to improve the quality of education at primary level.

As you may have experienced the changes that were brought about in the quality of school education after DPEP inception and SSA, you need to examine and explore, how the planners were able to arrive at a project formulation to reach the targeted groups, to provide adequate physical infra structure wherever required, and provide training for teachers in the required areas and so on. There are many areas of school education, which need to be improved in terms of quality. For example, assessment and evaluation, teacher education and curriculum and textbooks. These areas may be ventured by conducting baseline research, which provides the existing status, the perceptions and the experiences of students and teachers and the other stakeholders in the system. Based on this, the programmes or projects at the macro and micro levels may be planned for quality improvement.

Activity:

- Analyse the baseline studies that have been conducted in your state. What is the scenario of school education that is presented in the report? What are the policy formulations made to improve the quality of school education?
- What are the implementation measures adopted by the government based on the policy plans to improve school education?
- How did SSA begin in your state? What were the base line studies conducted before launching the SSA programme in your state? Write a brief account of SSA activities in the direction of promoting school education. What are your observations as a researcher? Discuss and share in the group.

Module Two

WRITING A RESEARCH/ PROJECT PROPOSAL

Getting Started

After going through this module, you will be able to

- Understand the meaning, need & importance of writing a Project/Research Proposal.
- Understand the important components of a Research/Project Proposal
- Familiarize yourself with the research proposal frameworks available for Central/State Government Projects.
- Prepare a research proposal on the problem identified by you.
- Analyze the research proposals prepared by others.

Meaning, need & importance of Project/Research Proposal

A Project/Research Proposal is a systematic plan, which brings to focus; the preliminary planning that will be needed to accomplish the purpose of the proposed study. It is just like a blue print, which the architect prepares before the construction of building starts. The initial draft of the proposal is subject to modification in the light of the constructive criticism, comments and suggestions of the experts in the field. These experts include researcher's supervisor, colleagues, research and statistical specialists, or other experienced researchers who act as members of the research committee of an institution or organization. The research proposal always goes through the developmental phases and therefore, deficiencies, if any may be corrected by discussing the same with the experts. An acceptable research proposal, therefore, is usually the result of several modifications and as such ,there should not be any haste on the part of researcher in its preparation.

The preparation of a research proposal is a prerequisite in the research process and needs to be submitted for its approval. This serves as a basis for determining the feasibility of the Project/Research and provides a systematic plan of procedure for the researcher to follow. It also gives the research supervisor a basis for guiding the researcher in the conduct of research study.

The first step in the research proposal is the choice of a suitable problem for investigation. It is only later, the designing a proposal systematically is possible. The following section deals with the selection of a research problem.

Selection of the problem

One must identify in which area one would like to work. For example, Education is a broad area, under which so many other areas such as educational administration and management, psychology of learner, value education, teacher education, science education and so on, may be identified as broad areas.

After selecting the broad area, the researcher must narrow it down to a specified research problem. Some of the sources of problems could be i) one's own professional experience which provides an insight into the educational problems that are significant ii) state's educational projects which are need based, like, survey studies, achievement studies, and so on, which provide a kind of bench mark or base line data for the state government to plan educational programmes iii) the educational policies which have been implemented and need to be researched upon to know their effect on the system iv) learning problems in different subject areas, v) teacher related problems such as their academic needs , professional growth, teacher quality etc, vi) school curriculum, text book and instructional materials , vii) enrolment, retention and improvement of school education and viii) implementation of evaluation policies of the state and their effect and so on.

Once the research problem is identified, one has to look into the relevant documents, and the literature to know if any studies related to the research area has been conducted in the area. This would help in sharpening the problem more precisely by considering the variables to be studied. The review of related literature in the beginning

would help a resea rcher in focusing upon the problem more scientifically and construct it better, so that it ca n be researched upon.

After the problem has been selected, the following components need to be followed in writing a research proposal.

Components of a Research/Project Proposal

A research proposal is a sort of blue print. A well-conceived research proposal will help in its effi ient implementation. Every effort made to formulate a proper research proposal will, ther efore pay rich dividends. There are certain specifications that are essential to a gooc research and, therefore, all such specifications should appear in each plan. A worthwhil research study is likely to result from a carefully planned and well-designed proposal. The following components need to be considered while preparing a research proposal.

i) Title of the study

The title of the proposal suggests the theme and sufficient information of the study. It includes sp ecification of the problem of the research indicating the kind of study and the variables in volved, and, sometimes, also the contexts in which the study will be conducted. For exar mple, look at the following titles of the study.

- A surve y of availability and utilization of science kits in upper primary schools of Dharmapuri district of Tamil Nadu and their effect on student's achieven ient in science.
- An inve stigation into the teachers competence in teaching of language at primary level in Kottayam district
- Effect of the in-service programmes conducted by SSA on improving teaching practices at primary and upper primary levels in Tamil Nadu.
- A study of the relationship between the intelligence, achievement and the socio ec nomic status of students at different levels of school education in Tamil Na du.
- Effect of the activity based learning on the achievement motivation of learners at primar y and upper primary level of school education in Tamil Nadir

The above titles of research studies reflect the nature of the research to be undertaken (survey, impact, correlation etc). Along with this, it is also seen that the variables to be studied, contexts and the population of the study are also included in the title. It is not necessary always to mention the particular location from where the sample will be drawn, unless and until it is very necessary to be included for highlighting its significance.

ii) Introduction

This includes a discussion of the background of the theme chosen. It generally orients one to the theme of the study, the perspectives, and the scope of research visualized in that area. Sometimes it also includes the conceptual background of the area, in which one has opted to work. Otherwise, there can be a separate section titled as "conceptual frame work of the study" under which the conceptual or the theoretical background of study, that has been reviewed from different sources, can be presented.

iii) Need and Context:

This component includes the contextual reference and the significance of the research problem undertaken. This component also deals with the theoretical and empirical framework from which the problem arises. Both conceptual and research literature are to be reviewed for this purpose. The latest research trends pertinent to the problem should also be mentioned in this section. The researcher has to make it clear that the problem has roots in the existing literature, but it needs further research and exploration. This contextual reference eliminates the risk of duplication of what has been done, and also provides base for formulating hypotheses.

A Research Proposal should justify the worth-while-ness and urgency of the research study. It should indicate clearly how the results of the research could influence educational theory and practice. Justification has to be made regarding the need of the study in the following ways.

- Does the present research fill the gaps in the existing knowledge?
- Does the present research support the findings of the earlier researches?
- Does the present research extend the findings, techniques or improve the existing educational conditions? Etc.

Whatever may be the problem taken up for investigation; it is invariably rooted in a complex and multifaceted social reality. It is, therefore, necessary to indicate the aspects of social reality most relevant for that particular problem. The determination of the appropriate aspects takes its character from the theoretical perspective one adopts. This also describes the boundary of research and provides a basis for ascertaining the objectives and the nature of data required for the conduct of enquiry. This will help in pin pointing the purpose(s) of doing the research.

iv) Review of Related literature

A brief resume of related studies found in journals, magazines, abstracts, and reports are discussed in this section. This provides evidence that the researcher is familiar with what is already known, and also with, what is unknown and improved. An analysis of the previous research eliminates the risk of duplication of what has been done and provides a basis for formulating hypotheses or raising research questions. The main purpose of this section is to trace the empirical studies as well as the theoretical concerns pertaining to the study. In light of the studies reviewed, the researcher has to present how he or she has evolved the research problem to be studied, what are the gaps or shortcomings observed in the studies already carried out, what further research scope was visualized in the studies reviewed, which had an implication in conceiving the research problem on hand. The researcher may also discuss the insights gained through reviewing that helped in perceiving the research problem with newer dimensions and perspectives.

iv) Statement of the problem

This is not exactly the same as the title of the study. It focuses on a clear goal of the study. It primarily is the expansion of the title. It must be in a declarative statement form. Sometimes it may also be written in the question form, which is followed, by several minor questions or statements and explanations.

v) **Objectives**

Based on the problem stated, and the insights gained through reviewing the related literature, the researcher needs to specify the purpose of the study in terms of objectives. The objectives should reflect the main purpose of the study, but not the procedural details.

vi) **Research Questions or Hypotheses**:

Given the conceptual framework and the specification of dimensions, the specific questions to be answered through the proposed research should be sharply formulated. In the case of any explanatory research design, specification of variables and posting of relationship among them through specific hypotheses must form a part of the research proposal.

vi) **Methodology of the study:**

This involves the design, sampling and the tools used, and the other procedural details of the study.

Design of the study

The design adopted in the study, i.e., whether it is a survey, or an experimental or a correlational study or an evaluative study must be stated. If it is an experimental study, it is necessary to mention the control groups and the conditions under which the variables are controlled. Along with this, in the light of the questions raised or the hypotheses proposed to be tested, sampling becomes necessary. Full information on the following points should be given:

(1) Universe of the study

(2) Sampling frame

(3) Sampling procedure

(4) Units of observation and sampling size

An explanation of the determination of size, and type of sample will also be necessary. Proposals not requiring a sample selection should specify their strategy

Appropriately and describe the rationale. The details regarding the different types of sampling and the procedures involved are discussed in detail in the following modules.

- **Tools or instruments of the study** :

The different types of data that are proposed to be should be specifically mentioned. The sources for each type of data and the tools and techniques that will be used for collecting different types of data should be specified.

For questionnaire or schedule to be used, the following should be indicated:

Distribution of questionnaire or schedule in different sections.

- Approximate number of questions to be asked from each respondent.
- Any scaling techniques to be included in the instrument
- Any projective tests incorporated to the questionnaire / schedule.
- Approximate needed for interview.
- Any plans for index-construction'

- Coding plan (whether the questions and responses will be pre-coded or not; whether the coding will be done for Computer, or for hand tabulation).

For interviews, the following details should be given.

(1) How they are to be conducted (free associational, non-directive, focused, Direct or on telephone).

(2) Particular characteristics that interviews must have.

- For the use of observation techniques, describe

(1) **The type of observation**: participant, quasi-participant, non-participant;

(2) Units of observation and

(3) Whether this will be the only technique or whether other techniques will also be employed.

Procedural details of the study or data collection details

Here the phases included in the study, such as preliminary details required, construction or development of tools and the materials, pilot study where the tools and the materials developed are validated, and implementation of tools and other innovations or procedures need to briefed. In case of tool administration, the scoring procedures and the procedures to be followed in administering the tools need to detail.

vii) Data Processing:

The manner in which the different types of data will be processed, the tabulation plan and the types of data that will be processed through the computer should be explained in detail

viii) Time budgeting.

The Project should be broken up in suitable stages and the time required for the completion of each stage of work should be specified. For instance, such stages may cover:

(1) Preparatory work, including selection and appointment of staff and their training.
(2) Pilot Study, if any.
(3) Drawing of sample.
(4) Tool construction (including their pre-testing and printing).
(5) Data collection.
(6) Data processing (which should include coding, editing, sorting, computer analysis)
(7) Data analysis.
(8) Report writing

ix) Cost estimation

This involves the estimated expenditure for each of the phases involved in the study. For instance, expenditure required for preparation of tools, administration of tools,

implementation of the study, processing the data and writing the research reports (typing, Xeroxing, binding etc.)

Some of the projects also involve appointment of project fellows. The expenditure required depending upon the period for which the person/s are appointed must be worked out. The expenditure also involves the travel expenses of the research investigator, and the purchase of books, standardized tools and the other type of materials depending upon the nature of the study.

x) Expected outcomes

The likely outcomes of the Study and benefits in the context of school education and teacher education need to be precisely stated.

Types of Research Proposals according to the purpose

According to the type and the purpose of the research study to be conducted, the ways of planning research proposals can be broadly classified into three groups.

i. The first type of Research Proposal is one prepared by those who wish to conduct research for their Master's Degree or Doctorate Degree in Education. Submission of a research proposal is a general requirement in most of the Universities for beginning researchers. A committee of experts to determine the feasibility of the study will evaluate the proposal.

ii. The second type of Research Proposal is one that is submitted by a researcher to any Private or Government agency for the financial assistance. Such assistance is given on the recommendation of panel of experts after evaluating the proposal.

iii. The third category of research proposal is that submitted by a college teacher to some other University or research organizations, such as, Indian Council of Social Sciences Research (ICSSR), National Council Educational Research and Training (NCERT), University Grants Commission, or any other autonomous research organization.

A Brief Outline Structure available for Central/State Government Schemes on writing a research proposal is as follows.

A. Guidelines for formulation of Research Proposal provided by Andhra Pradesh Government

The following Format was provided for the submission of Research Proposal for financial assistance to Andhra Pradesh Primary Project (APPEP) and District Primary Education Programme (DPEP)

1. Title of the Project
2. Name of the Principal Investigator with Designation
3. Name of the Institution with address
4. Collaborating Institution(s) if any
5. Co-investigator(s) if any (Name, designation, address)
6. Statement of the Problem
7. Objectives of the Study
8. Over view of literature
9. Theoretical Framework
10. Research Questions
11. Expected Outcomes & Educational Implications
12. Design of the Study
13. Methods of Data Collection
14. Data Analysis
15. Research Organization
16. Time Budgeting
17. Cost Estimates

B. Proforma for formulation of Research and Innovations Proposals provided by ERIC (Educational Research and Innovations Committee, NCERT, New Delhi-110016

The following Format was provided for the submission of Research Proposal for financial assistance to ERIC, NCERT, and New Delhi

1. **Title of the Study/Project:**

   (It should be brief, crisp, and communicate the intent of the study).

2. **Introduction:**

   (This section may focus on need of the study in the Indian context, overview of the work already done in the area and its linkage with the proposed study, and Theoretical perspective (if any to be followed). It will also include educational Significance along with rationale of the study).

3. **Objectives and / or Research Questions:**

   Specific achievable objectives and / or the corresponding research questions may be spelt out. Hypothesis, if any, be spelt out.

4. **Likely outcome and benefits:**

5. **Methodology:**

   This should include the details of the research design, the modality of collecting information and also the methodology of providing meaning to the collected information.

6. **Time Budgeting:**

   The proposal must include a statement about time duration in which the study is supposed to be completed. To make it more rational, it may be desirable to visualize various stages involved in the study vis-à-vis the time requirement for each stage.

7. **Organizational Framework:**

   An organizational chart indicating the tasks of the PI (Principal Investigator) Co-PIs (if any), and JPF (Junior Project Fellow) (if any) with their duration should be given.

8. **Cost Estimation:**

   The cost of the project is to be estimated in terms of the proposed duration of the Project and facilities needed. It may contain the following items:

   - Junior Project Fellow.
   - Travel expenses (TA/DA) of the Persons involved (Air travel not permitted).
   - Purchase of Books, Research tools, etc.
   - Expenses for development / adaptation of research tools and materials.

- Expenses for photocopying and printing tools.
- Hiring chares (Computer, video recording, etc.)
- Preparation of report (draft and final).
- Contingency (Stationery, Postage, etc.)
- Overhead charges (5 percent of the total cost of the project) admissible on production of certificate from the Institution other than NCERT.
- Printing of the Report. (After getting clearance from NCERT)

C. Guidelines for formulation of Research Proposal and filling the Performa provided by ICSSR (Indian Council of Social Science Research), New Delhi.

The following Format was provided for the submission of Research Proposal for financial assistance to ICSSR, New Delhi

Title of the Project

Statement of the Problem:

In the opening paragraphs of Research Proposal the problem to be investigated should be stated clearly and briefly. The Key questions and the location of the problem in the theoretical context of the concerned discipline should be specified. The significance of the problem, the contribution, which the proposed study is, expected to make to theory and methodology as well as its practical import, and national relevance should be specifically indicated.

2. Overview of Literature:

Summarizing the current status of research in the area, including major findings, the project proposal should clearly demonstrate the relevance or insufficiency of the findings or approaches for the investigation of the problem at hand.

3. **The Conceptual Framework:**

Given the problem and the theoretical perspective for investigating the problem, the proposal should clearly indicate the concepts o be used and demonstrate their

relevance for the study. It should further specify the dimensions of empirical reality that need to be explored for investigating the problem.

4. **Research Questions or Hypotheses:**

5. **Coverage:**

If in the light of the questions raised or the hypotheses proposed to be tested, sampling becomes necessary, full information on the following points should be given:

(1) Universe of the study

(2) Sampling frame

(3) Sampling procedure

(4) Units of observation and sampling size

If the study requires any control groups, these should be specifically mentioned. An explanation of the determination of size, and type of sample will also be necessary. Proposals not requiring a sample selection should specify their strategy appropriately and describe the rationale.

6. **Data Collection:**

7. **Data Processing:**

The manner in which the different types of data will be processed, the tabulation plan and the types of data that will be processed through the computer should be explained in detail.

8. The Project should be broken up in suitable stages and the time required for the completion of each stage of work should be specified. For instance, such stages may cover:

(1) Preparatory work, including selection and appointment of staff and their training.

(2) Pilot Study, if any.

(3) Drawing of sample.

(4) Tool construction (including their pre-testing and printing).

(5) Data collection.

(6) Data processing (which should include coding, editing, sorting, computer analysis)

(7) Data analysis.

(8) Report writing

9. Organizational Frame work:

An organizational chart indicating the position, tasks, and number of persons, their level of qualifications/training required to fill the different positions should be given

10. Cost Estimation:

The cost of the project is to be estimated in terms of total number of months and the facilities needed. Calculate it under the following headings:

(1) Personnel

Position required	No. Of Persons	Salary (including allowances, etc)	Duration	Amount
(1)	(2)	(3)	(4)	(5)

(2) Travel

(3) Data Processing

(4) Stationery and printing

(5) Equipment (total expenditure should not exceed 5 percent of the total budget)

(6) Books, journals, etc. (expenditure should not exceed 5 per cent of the total)

(7) Contingency expenses including postage

(8) Any other (specify)

(9) Overhead charges 5 percent of the cost

While suggesting budget estimates for the research proposal the project director should take into account the time, budget, as well as various steps involved in the conduct of the research proposal.

The rationale for the allocation of time and money for the various items of budget estimates must be furnished.

a) Format for submission of Proposal for Major Research Project provided by UGC (University Grants Commission), New Delhi.

The University Grants Commission has provided the following format for the submission of proposal to get financial assistance.

Proposed Research Work

1. Project Title
2. Introduction
   - (a) Origin of the Research Problem
   - (b) Interdisciplinary relevance
   - (c) Review of Research and Development in the subject
     - International Status
     - National Status
     - Significance of the study
3. Objectives
4. Methodology
5. Year wise Plan of work and targets to be achieved
6. Details of collaboration, if any intended
7. Financial Assistance required

Item	Estimated Expenditure
(i) Research Associate	
(ii) Project Associate	
(iii) Project Fellow	
(iv) Hiring Services	

(v) Field Work and Travel

(vi) Chemicals and Glassware

(vii) Contingency (including special needs)

(viii) Honorarium to the retired teacher

(ix) Books and Journals

(x) Equipment if needed (specify name and approx. cost)

Total:

8. Whether the teacher has received support for the research project from UGC under Major, Minor, scheme of support for research from any agency/ If so, give details:

Activity	
	• Prepare a research proposal by using any one of the formats given in this module on a research problem identified by you.
	• Below are given a few research contexts. Discuss them in your groups and state them in the form of research problems.
	i. Early childhood education programme implemented in the state. ii. Teachers' perception of newly introduced text books in the state at primary and upper primary level. iii. The factors influencing the students' achievement at primary level. iv. Quality indicators of effective schools v. The role of VECs in effective functioning of schools vi. Mid day meal programme in the state. vii. Continuous and comprehensive evaluation viii. What are the effects of SSA scheme on the quality of school education in the state? ix. What are the training needs of schoolteachers at different levels to promote quality school education? x. Factors responsible for dropout of students xi. Role of NGOs in improving alternative schooling.
After stating the above research contexts in the form of research problem, discuss their significance, how they can be carried out, methodological details etc, and make a presentation in front of the whole group.	

Module Three

REVIEW OF RELATED LITERATURE

Getting Started

After going through this module, you will be able to

- Understand the need and purpose of reviewing the research literature
- Explore different types of research literature and the journals to review the studies in order to identify a research area of your choice
- Analyse and interpret the outcomes of the studies reviewed in the context of the need and the trends in the area of research identified
- Identify the shortcomings and the merits of the studies reviewed, and synthesize the research outcomes.
- Plan a research problem in light of the understanding that is gained through the exercise of review of research in the area selected
- Recognize the importance of journals and other research documents and periodicals in research review exercises
- Recognize and use the research web sites in reviewing the research pertaining to the problem chosen.

Research in any field takes advantage of the knowledge that has been accumulated in the past as a result of constant inquiring mind and the endeavour of human beings. The research studies and the deliberation of human thoughts on various aspects of knowledge have been documented time and again in various forms, of which, the print media is the most common one. A careful review of the research theses, journals, documents, and books etc on the problem to be investigated is one of the important steps in planning of any research study. The review of research studies helps you in your research endeavour in the following ways.

Purpose of the review of related literature:

- It can reveal investigations similar to your own, and it can show you how the collateral researchers handled these situations.
- It can illuminate a method of dealing with a problem situation that may suggest avenues of approach to similar difficulties you may be facing.
- It can reveal to you sources of data that may not have known existed.
- It can introduce you to significant research personalities, of whose work and collateral writings you may have had no knowledge.
- It can help you to see your own study in historical and associational perspective in relation to earlier and earlier attempts on the same problem.
- It can provide you with new ideas and approaches that may not have occurred to you.
- It can help you evaluate your own research efforts by comparing them with the similar efforts of others.
- It also helps you in identifying a problem, which is potential, and a need of the time.

A literature review is an account of what has been published on a topic by accredited scholars and researchers. In writing the literature review, the purpose is to convey to the reader what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. As a piece of writing, the literature review must be defined by a guiding concept (Example, your research objective, the problem or issue one is discussing or the argumentative thesis). It is not just a descriptive list of the material available, or a set of summaries.

Reviewing literature in a specific area helps one to gain and demonstrate skills in two areas. They are

a) Information seeking: the ability to scan the literature efficiently, using manual or computerized methods, to identify a set of useful articles and books

b) Critical appraisal: the ability to apply principles of analysis to identify unbiased and valid studies.

The literature reviewed must be organized around and related directly to the thesis or research question you are developing, synthesize results into a summary of what is and is not known, identify areas of controversy in the literature and formulate questions that need further research

The process of reviewing the literature is a thoughtful one. Mere summaries of articles on topics related to the present study are inappropriate. It is important that the literature reviewed be critiqued openly and impartially. Each should be discussed in relation to the study undertaken. The literature reviewed should help in answering the following questions.

- How did the researcher conceptualize the problem?
- What were the assumptions? How do they fit with the assumptions of the study?
- Were the operational definitions similar to those in the study?
- how were the constructs measured?
- How is this research relevant to the study undertaken?
- How internally consistent is the study in terms of the theoretical framework, design, sampling, data analysis, and conclusions?

Guidelines to use the reviewed literature

- The literature review should be presented as an essay—not as an annotated list
- The literature review should emphasize findings of previous research, not just the methodologies and the variables studied.
- Point out trends and themes in the literature. Point out gaps as well.
- Use direct quotes sparingly, and only to make the point better than you could in your own words.
- Review of related literature answer questions like the following:

i. When examining high quality studies, which outcomes are consistently affected? The outcomes of a study are the effects that are expected or targeted. They may include knowledge, attitude, or behavioral changes.

ii. What are the characteristics of interventions and programs described in high-quality studies that are associated with good (or poor) outcomes?

iii. What are the characteristics of interventions and programmes that have no effects on outcomes?

iv. Do participants with certain demographic, educational, and health characteristics consistently appear to benefit (or not to benefit) from similar interventions tested in high quality studies?

- Who are the participants?
- What are the benefits?
- What are the interventions?
- For how long do the benefits last?
- Do certain costs appear inevitable? What are they?

v. What is the quality of the available literature?

When using information in research, you should understand:

- The importance of correct and sufficient information on which to base research conclusions
- The need to give a correct and full account of information used in a research project
- How to identify and evaluate information which can be used to test the research question or hypothesis
- The nature and value of primary sources of information
- The nature and use of secondary sources of information
- The precautions necessary when using published statistics

Some of the criteria of useful documentary information are:

Availability

Relevance

Sufficiency

Congruence

Authenticity

Limitations of modern records in a computer age

- Induction by enumeration

The fallacy of insufficient statistics

The fallacy of biased statistics

Statistical syllogism

- The requirements for correct argument from authority
- The requirements for correct induction by analogy

Reference materials in Education for the purpose of review

There are a number of references that may be useful to a researcher in the field of education. Some of them are as follows.

Encyclopedia

- Encyclopedia of educational Research. (Walter Scott Monroe 1950).
- Encyclopedia of Educational Research. (Robert,I.Ebel, 1969)
- Encyclopedia of Educational Research. Harold. E .Mitzel .ed 1982)
- International guide to educational documentation (1955-1960)
- The international encyclopedia of education. Torsten Husen and T.Neville Postlethwaite,1985.

Research survey documents

- M.B.Buch (1974) A survey of reearch in education, Center of Advanced Studies in Education, M.S. Univ. of Baroda.
- M.B.Buch (1979), Second survey of research in education (1972-79), society for educational research &Development. Baroda.
- Third survey of research in Education (1978-1988), M.B. Buch, pub. By NCERT. N.Delhi.
- Fourth survey of research in Education (1983-1988), M.B. Buch(1991) pub. By NCERT. N.Delhi.
- Fifth survey of Educational research (1988-1992), M.B. Buch (1991) Trend Reports, vol. 1 and 2, NCERT. N.Delhi.
- Researchers seminar 1985, C.H.K Misra (1985) NCERT, N.Delhi.
- Directorate of Educational Research Institutions in the Asian Region (1970) UNESCO Regional Office for Education in Asia, Bangkok.

- Report of the second regional seminar on educational research (1988) Dept of Policy research Planning & Programming , NCERT.N.Delhi.
- NCERT (1986-1999). Planning, Programming, Monitoring and evaluation division. NCERT,N.Delhi.
- Teacher Education in Asia- a regional survey (1972) NNESCO. Regional office for Education in Asia. Bangkok.
- Researchers' seminars- 1983. Collection of Papers, NCERT. N.Delhi.
- Education &Development, report of the Education Commission 1964-66 (1966) NCERT.N>Delhi.
- Research periodicals
- Abstracts (Sociological abstracts; Educational administration abstracts)

Annual Reviews and Reports

- Arun.C. Mehta (2004). Elementary Education in India. Where do we stand, District Report Cards? 2004, vol.11, NIEPA.N.Delhi.
- Arun.C. Mehta (2004). Elementary Education in India Analytical report (2004-05) ,NIEPA.N.Delhi.
- Arun.C. Mehta .Elementary education in India. Progress towards UEE, Analytical report, 2005-06, NIEPA.N.Delhi and other volumes
- Arun.C. Mehta .Elementary education in Rural India. Analytical report, 2004, NIEPA.N.Delhi
- Arun.C. Mehta. Elementary education in Urban India. Analytical report, 2005, NIEPA.N.Delhi
- Education in India (1968-69).Ministry of Education and social welfare, Govt. of India.
- Education and national development, Report of the Education commission. 1964-66, NCERT
- R. Govinda (2002). Indian Education report, a profile of basic education, NIEPA,N.Delhi.

- Education in India, Ministry of Education, India. Report of the University Education commission. Vol.1 and 2, manager of publication, Delhi.
- Education in the states 1961-62 (1965). Ministry of Education, Govt of India.
- Learning to live together- Teacher resource Book on Education for International Understanding, vol.1&2 (2004) UNESCO. Asia Pacific center for Education for International Understanding
- Dissertation Abstracts International
- Bulletins
- Theses and Dissertations
- Newspapers and pamphlets
- Government documents
- Monographs
- Indian educational abstracts, NCERT, N.Delhi
- Reference materials obtained from websites

Journals on Education

- Indian Education review, NCERT.
- Journal of Indian Education- NCERT
- Development Dialogue, Dag Hammarskjold Foundation, Sweden.
- Indian Journal of Adult Education, IP state, N.Delhi
- Journal of Educational technology, Manager Pub. Tamil Nadu, India. Some of the other journals that can be used as references are:
- American Educational Research Journal
- American Journal of Distance Education
- Communications Research
- Dissertation Abstracts International
- Early Childhood Research Quarterly
- Educational Technology Research and Development
- Environmental Research
- Journal of Educational Computing

- Journal of Educational Psychology
- Journal of Research on Computing in Education
- Journal of Speech, Language and Hearing Research
- Journal of the Learning Sciences
- Psychological Abstracts
- Psychological Bulletin
- Research in Physical Education
- Training and Development

Besides the above, there are certain web sites related to research such as "ERIC" that provide the abstracts of the researches carried out. One can also explore online journals and papers published for getting information about the trends in research in the area chosen.

Organizing the Related literature

After reviewing the related literature, the researcher has to organize the information in a systematic manner. This involves recording the essential reference material and arranging it according to the proposed outline of the study. In order to record the material and easily locate the material, the bibliography cards can be used.

The bibliography card should include name of the author with last name first, title of the book or article, name of the publication, name of the publisher, date of publication, volume number, page numbers, and library call number.

After recording the essential information on the bibliography cards it is necessary to arrange the cards according to the location of the material in the library. For example. The cards recorded on the periodicals may be arranged together. All the information to be used in the final report should be recorded on a separate card, which can serve as a 'reference card'. This may also include title of the book, author, page number and so on

Preparation of the related literature chapter in the report

While writing the chapter on related literature in the report, the researcher should arrange the bibliographic cards according to the proposed outline of the problem. This

can be done with the help of card code (the cards may be arranged alphabetically). The report of the related literature begins with an introductory paragraph describing the organization of the report. After the introduction, the researcher should present the studies most relevant to each aspect of the proposed problem outline. Studies with similar and contradictory results should be reported side by side without using excessive space. The researcher should conclude by discussing how the research studies reviewed had helped in carving out the research problem undertaken by him or her, and in what ways the study chosen is different from the studies reviewed, and how it supplements the gaps and the short coming observed in the other studies.

Activity:
1. Identify the journals and the periodicals in education published in your state universities.
2. What are the educational surveys and the documents that are available in your organization? In what ways are they helpful to you? Discuss.
3. What type of literature will you refer to, if you are asked to find out the number of primary schools district wise in your state, number of students enrolled, number of students dropped out, number of teachers at primary level and so on.

Module Four

HYPOTHESES AND RESEARCH QUESTIONS

Getting started

After going through this section of the module, you will be able to

- Understand the need for formulating hypotheses in educational research.
- Understand different ways of formulating hypotheses according to the need and the purpose of the study.
- Formulate hypotheses in the research problem identified by you.
- Formulate hypotheses in the research contexts created in this section.

Importance of the Hypotheses

Hypotheses facilitate the extension of knowledge in an area. They provide tentative explanations of facts and phenomena, and can be tested and validated. Such explanations, if held, lead to generalizations and thereby extend the existing knowledge in the area of a study. In educational research, the need for hypotheses become significant where the research study is of experimental in nature, as the researcher is interested in making predictions about the outcome of the experiment. In the historical or descriptive research, on the other hand, hypotheses may not be required as they are the fact-finding studies. These studies involve not only fact-finding but also interpretation of facts to draw generalizations. If a researcher is studying about the growth of an institution, the data he gathers will prove useful only if he is able to draw generalizations from them. Whenever possible, a hypotheses is recommended for all major studies to explain observed facts, conditions, pr behaviour and to serve as a guide in the research process. If the hypotheses are not constructed, a researcher may waste much time and energy in gathering extensive empirical data and then find that he cannot state facts clearly and detect relevant relationships between variables, as there are no hypotheses to guide him.

Meaning of Hypothesis

Hypothesis is a reasonable scientific proposal, which is not a statement of fact, but a statement that takes us beyond the known facts and logically anticipates the substance of new knowledge. A well-defined hypothesis crystallizes the research question and influences the statistical tests that will be used in analyzing the results.

According to Gay (1996, page 61),

- A hypothesis is a tentative explanation for certain behaviors, phenomena, or events that have occurred or will occur.
- The hypothesis states the researcher's expectations concerning the relationship between the variables in the research problem.
- The hypothesis is a refinement of the research problem. It is the most specific statement of the problem.
- The hypothesis states what the researcher thinks the outcome of the study will be.
- The researcher collects data that either supports the hypothesis or does not support it.
- The hypothesis is formulated following the review of related literature and prior to the execution of the study. The related literature leads the researcher to expect a certain relationship.
- "A good hypothesis states as clearly and concisely as possible the expected relationship (or difference) between two variables and defines those variables in operational, measurable terms." (Gay 1996, page 62).
- "A well-stated and defined hypothesis must be (and will be if well-formulated and stated) testable. It should be possible to support or not support the hypothesis by collecting and analyzing data." (Gay, 1996, page 62).
- A good hypothesis is based on sound reasoning; provides a reasonable explanation for the predicted outcome; clearly and concisely states the expected relationships between variables and it is testable.

Snow (1973) describes six levels of theory, with the first level being hypotheses formation. At this level, the theory developer has a hunch based on theory, past experience, observations, and /or information gained from others. A hypothesis is

formulated in such a way that this hunch can be tested. Based upon the findings of the subsequent research, the hypothesis is supported or rejected and more hypotheses are formulated to continue the process of building a theory.

To formulate a research hypothesis we start with a research question and:
Generate operational definitions for all variables, and formulate a research hypothesis keeping in mind the expected relationships or differences and the operational definitions.

Hypotheses can also be stated as research hypotheses (as we have considered them so far) or as **statistical hypotheses**. The statistical hypotheses consist of the **Null hypothesis (H_0),** the hypothesis of no difference and the **alternative hypothesis (H_1 or H_A),** which is similar in form to the research hypothesis. Two important functions that hypotheses serve in scientific inquiry are, the development of a theory and the statement of parts of an existing theory in testable form.

Types of Hypotheses:

1. In **Quantitative research**, a researcher predicts the tentative results of the research, which is formulated on the basis of knowledge of the underlying theory or implications from the literature review. Testing the hypotheses leads to support or rejection of the hypotheses.
2. In a **Qualitative research**, formal a-priori hypothesis are not stated. The focus is on generating new hypotheses as a result of the study (i.e., inductive hypotheses).

Two major types of Hypotheses are:
Inductive – a generalization made from a number of observations
Deductive – derived from theory and aimed at providing evidence to support, expand, or contradict aspects of that theory

A ***Research or scientific hypotheses*** is a formal affirmative statement predicting a single research outcome, a tentative explanation of the relationship between two or more variables. For the hypotheses to be testable, the variables must be operationally defined.

Thus the hypothesis focuses the investigation on a definite target and determines what observations, or measures are to be used. The types of Research hypothesis are:

Non-directional (Two- tailed hypotheses) – a statement that a relationship or difference exists between the variables

Directional (One-tailed hypotheses) – a statement of the expected direction of the relationship or difference between variables

Null hypotheses– a statement that no *statistically significant* relationship of difference exists between variable

Formulating research hypotheses for various types of research problems

Let's consider a model or formula for stating a research hypothesis for each of the types of quantitative research types that we have discussed.

A model for stating hypotheses for an experimental or causal- comparative study:

In an Experimental study, If X is the independent variable, Y is the dependent variable, and S is the Subject, we can state our research hypothesis as "Ss who get X do better on Y than subjects who do not get X (or get some other X)".

For example, the primary students who learn through ABL (activity based learning) achieve better in all subjects than the children who have not learnt through ABL approach.

In a Causal comparative research study, for example, one will hypothesize that first grade girls will show better reading comprehension than first grade boys. The research hypothesis can be stated, as "Girls will achieve higher reading comprehension test scores than boys at the end of the first grade".

Statistical Hypotheses: When one gets ready to analyze the data one might also wish to state statistical hypotheses for the problem. The statistical hypotheses consist of the null hypothesis (H_0) and the alternative hypothesis (H_1). If $\mu_1$stand for the mean of the girls and $\mu_2$stand for the mean of the boys, the null and alternative hypotheses would be:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 > \mu_2$

In other words the null hypothesis states that there is no difference between the two means on the reading comprehension test scores, while the alternative hypothesis states that the girls mean score on the reading comprehension test will significantly exceed than that of the boys. Generally we use a statistical test (e.g. the t-test) to decide if the girl's achievement is significantly higher than that of the boys.

A model for stating hypotheses for Correlation research:

If A and B are variables (note that we do not refer to them as independent and dependent variables in correlational research), and C is the subject we can state our research problem as the relationship between A and B for C. (What is the relationship between A and B for C)

We can state our research hypothesis as - There will be a significant positive correlation between A and B for C (or significant negative relationship or significant relationship without specifying direction). We will also need to provide operational definitions for A and B and describe C.

For Example, An instructor investigates the relationship between the number of minutes needed to complete an examination and the score on the examination. He wants to use the data to determine whether there is a significant negative relationship between these two variables.

Research Hypothesis: The length of time needed to complete an examination will be negatively correlated with the score on the examination for college students.

Statistical Hypotheses:

$H_1 : \rho = 0$

$H_1 : \rho < 0$

Applying the model to Descriptive research:

If A, B, C, and D are variables, and E is the subject or subject group, we can state the research problem as follows:

Research Problem: A, B, C, and D among E (How can E be described in terms of A, B, C, and D?). We will need operational definitions for A, B, C, and D and will need to describe E.

Research Hypothesis: There is no specified relationship between the variables thus there is no research hypothesis. There is a research problem but not a formal research hypothesis.

Example: A researcher wants to find out the educational characteristics of gifted students with learning disabilities in the middle school. When asked what is meant by "educational characteristics" the researcher lists the following variables - IQ, reading achievement, mathematics achievement, written language achievement, and locus of control (internal versus external locus of control).

Research Question: What is the average level of IQ, reading comprehension, and Mathematics performance, written language proficiency, and locus of control for gifted children with learning disabilities in the middle school.

At the beginning of a study, researchers state an affirmative scientific or research hypothesis as a prediction of the outcome that they propose to test. Later at the stage of the statistical analysis of the observed data, they restate this hypothesis in negative or null form, for example, the VII grade students taught through constructivist approach would score higher on their achievement in Science than those using the conventional method, would be restated as: There is no significant difference between the achievement in Science of the two groups.

The Research Questions:

Your research question is the most critical part of a research proposal—it defines the proposal, it guides ones arguments and inquiry, and it provokes the interests of the reviewer. If your question does not work well, no matter how strong the rest of the

proposal, the propc sal is unlikely to be successful. Because of this, it is common to spend more time on the r searching, conceptualizing and forming of each individual word of the research question han on any other part of the proposal. To write a strong research question you will ieed time. Listen to yourself and start formulating your question by following your ow interests. Remember, you will spend a lot of time researching and writing about the proposed project: if it does not interest you in the beginning, it will certainly become v ry difficult to write about in the end. Next, extensively research your topic. What have p ople said about it? How have they framed their research? What gaps, contradictions, or c oncerns arise for you as you read, talk to people, and visit places? A strong research que stion should be *evocative*, *relevant*, *clear*, and *researchable*.

Some of the chara teristics of a good Research Question are:

- The resea ch question should be evocative. Evocative questions are ones that catch the nterest of the reviewer and draw her/him into the proposal. Equally important, they easily adhere in the reviewers' memory after reading the proposal. Questions tend to be evocative because of *the ways they engage with challengin g topics*: they pose innovative approaches to the exploration of problems, and because of this the answers found are far from obvious. There is no single way to form a conceptually innovative question. However, some of the follow ng qualities are common to successful proposals.
- Make it ti nely. Evocative questions are often distilled from very contemporary social or t eoretical concerns.
- Frame it a s a paradox. Frame your question around a provocative paradox. For example, while the enrolment of boys is increased, while the enrolment of girls have decr ased? Or While the students choice for soft ware engineering is increased when compared to their choice for other courses?
- Take a disti ctive approach. Finally, a question that approaches an old problem in a refreshing y new way, or proposes a surprising angle of analysis on a difficult dilemma, is ikely to prove evocative for reviewers.

- The research question should be relevant. Questions that clearly demonstrate their relevance to society, a social group, or scholarly literature and debates are likely to be given more weight by reviewers.
- Fill in the missing piece. If your proposal can lay out a given field or dilemma and then point to a specific portion that is *missing* in that field or dilemma—a gap which will be filled by the answer to your research question.
- Make connections. Even if you are working on a narrow topic or in a specific place, ask questions that help relate the research to broader trends, patterns, and contexts.
- The research question should be clear. Clear questions tend to be short, conceptually straightforward, and jargon-free.
- Ground the questions: Keep your questions close to the topic or place you are researching.
- Limit variables. If a question is burdened with too many variables or too many clauses it becomes both difficult to read and difficult to research.
- The research question should be researchable.

Some guidelines for writing a Research question:

- What problem, person, relationship, event, circumstance, mystery, etc. do you plan to investigate?
- What specific aspects are you examining, and why? Has that particular aspect and your question about it been asked before, according to your research? If yes, are you satisfied with the answer(s)? If yes and you are satisfied, pick a new area for research; if no, what left you unsatisfied? Was the response or the research incomplete in some way? How? This is your chance to do a better job.
- What type of approach (es) will you use to conduct your inquiry? Is (are) t (they) appropriate to your subject? Would another method give a new focus?
- What type of sources do you need? What are the ideal sources, which could answer your question(s)? What is available to you? Can you imagine another way of using the available sources to provide data for your question if their relation is not obvious? Should you rephrase and refocus your question?

- Do your sources seem balanced - that is, if you have data for one side of a story, do you also have comparable data from another view? If not, rephrase your question and your title to indicate it is a one sided study.
- Can your topic question be researched and written up adequately in the space and time allotted?

Below are given some research problems. Formulate hypotheses or raise research questions according to the nature of the research problem.

Research Problems
1. A study of the reading ability of students belonging to government and private schools in English as a third language at upper primary level.
2. An investigation into the learning problems of students in mathematics at secondary level.
3. Relationship between the achievement of secondary school students in science and their attitude towards science- a study in Krishnagiri taluk
4. A study of the existing facilities in science laboratories for facilitating learning of science at secondary level.
5. A study of teachers questioning skills in science and its effect on students' effective learning in science.
6. Effect of the use of investigatory method in science on the pupils' achievement in science.
7. A study of the problems existing in multigrade schools.

Module Five

SAMPLING APPROACHES

Getting started

After going through this module you will be able to

- Understand the meaning and importance of sampling in Educational research.
- Understand the different methods of sampling.
- Use sampling techniques appropriately according the design and the purpose of the study while selecting the sample of the study.

Meaning of Sampling

Sampling is an act, process or technique by which a relatively small number of individuals or measures of individuals, objects or events is selected and analyzed in order to determine parameters or characteristics of the entire population from which it was selected. A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Webster 1985). When dealing with people it can be defined as a set of respondents (people) selected from a larger population for the purpose of a survey.

A sample is the group of elements, or a single element, from which subjects for data are obtained. It is a small portion of a population selected for observation and analysis by which one can make certain inferences about the characteristics of the population from which it is drawn. Samples are chosen in a systematically random way, so that the chance of probability can be utilized.

A population is any group of individuals that have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type, or a more restricted part of that group. Example: all the secondary school teachers teaching Biology.

Sampling is often desirable in order to reduce expenditure, save time and energy, permit measurement of greater scope, or produce greater precision and accuracy. Sampling procedure provides generalizations on the basis of a relatively small proportion of the population. While selecting a sample, the following need to be considered.

a. Defining the population
b. Sample size and representative ness

Defining the population

A sample should reflect the important characteristics of the population being studied. Defining the sample first depends on the constructs and hypothesis being investigated. When studying the behaviour of children, for instance, the sample and population should be composed of children of a specified age. Recognize, however, that a population is not a fixed entity defined by one variable. Members of population may differ along many variables. The population of children for example, may contain males and females from different cultures and backgrounds, with different abilities, and so on. How well results generalize to the population depends on how much the sample has in common with the population in terms of all the participant variables that influence the responses. If individuals having a particular characteristics are excluded, we may end up with a biases and unrepresentative example of the population, thus creating a biased picture of how all members of the population behave. In short, the selection criteria should produce a sample that is similar to the population along all relevant participant variables so that the sample is essentially a miniature version of the population.

Sample size and Representative ness

Working within the available population, we then seek to adequately represent it. An important aspect of this process is deciding on N: the symbol N stands for the number of participants in a study, and 'n' stands for the number of participants observed in a condition. To maximize external validity, the general rule is " the more the better". The larger a sample, the more of the population that is observed, so it is more likely that the sample will include all relevant types of participants. Therefore, we are more likely to obtain an accurate, representative sample rather than a biased, misleading one. Conversely, with only a few participants, we are more likely to obtain sample rather atypical characteristics, so that it is not representative of the population.

"The more the better" does not mean that you need to test hundred of participants per conditions. For example, in experimental research, where the participants are

subjected to some innovation strategy under controlled conditions may be of the size between 30 to 50 or a little more. Definitely with a large number of sample in an experimental set up, it would not be possible to have an in depth study of all possible effect that is taking place. On the contrary in the survey studies, where one has to collect information or data of certain kind, the larger the size of the sample, better the representation of that category of population.

Methods of Sampling

Sampling methods can be classified into two categories

i. Non probability sampling
ii. Probability sampling

i) Non probability sampling:

In many research designs it not feasible to obtain a probability sample. In this situation a non-probability sample is used. A non-probability sample is one in which the probability of including population elements is unknown. Usually, not every element in the population has a chance of being selected. It is also quite common for the population to be the same as the sample, in which case there is no immediate need to generalize to a larger population. Much of the educational research, especially experimental studies, uses a group of subjects that has not been selected from a larger population. Hence, a Non probability sampling includes the use subjects that are available, rather than following a specific subject selection process.

In **purposive sampling**, the researcher selects elements from the population that will be representative of the population. A judgment is made about which cases should be selected to provide the best information to address the purpose of the research. Here the units are selected at the discretion of the researcher. Such samples derive their control from the judgment of the researcher. The sample so selected is called a *judgment or purposive sample*. Such a sample is arbitrarily selected because there is good evidence that it is a representative for the total population. The evidence is based on experience. For Example, Selecting one division from class VI for conducting an experimental study.

Purposive sampling is not widely used in quantitative studies. In Qualitative research, on the other hand, some type of purposive sampling is almost always used.

Quota sampling is used when the researcher is unable to take a probability sample, but still wants a sample that is representative of the entire population. Different composite profiles of major groups in the population are identified, and then subjects are selected, non-randomly, to represent each group. For Example, represent geographic areas or types of communities, such as urban, rural, and suburban or suppose a researcher wants to study the reaction of teachers towards Constructivist approach at the secondary stage, he may fix a quota of 200 teachers and go on collecting data from all the 200. If the quota is not fixed and the researcher collects information from all the teachers that are conveniently available, then the sample is called *incidental sample*.

Probability Sampling

In Probability sampling, the concept of randomness is employed. It is based on the assumption that while individual events cannot be predicted with accuracy, aggregate events can. Randomization helps in selecting a group of individuals for observation who are representative of the population about which the researcher wishes to generalize. It also helps in equating Experimental and control groups.

Random sample may not necessarily be an identical representation of the population. Characteristics of random sample drawn from the same population may differ to some degree, but it is possible to estimate their variation from population characteristics and from each other.

Different types of Probability sampling:

1. **Simple random sampling or Unrestricted random sampling:**

Here the individual observation or individuals or each unit of a population has an equal chance of being selected, and each choice is independent of any other choice. Hence, a simple random sample is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected. A simple random

sample is free from sampling bias. This method is often used with a small population, For example, putting the names or numbers of all population members in a hat and drawing some out as the sample. However, using a random number table to choose the elementary units is often used. This approach is not convenient if the population is large and not numbered. The most common way of selecting a random sample from a large population is by computer. There are computer programs that will assign numbers to each element in the population, generate the sample numbers randomly, and then print out the names of the people corresponding to the numbers.

2. Systematic random sampling:

A systematic random sample is obtained by selecting one unit or individuals from a population on a random basis and choosing additional elementary units at evenly spaced intervals until the desired number of units is obtained. For example, there are 50 students in your class. You want a sample of 10 from these 50 and you have their name listed on a piece of paper may be in an alphabetical order. If you choose to use systematic random sampling, divide 50 by 10, you will get 5. Randomly select any number between 1 and five. Suppose the number you have picked is 3, that will be your starting number. So student number 3 has been selected. From there you will select every 5th name until you reach the last one, number fifty. You will end up with 10 selected students. It can be used when a population is accurately listed and is finite.

3. **Stratified sampling:**

A stratified sampling is a modification of either simple random or systematic random sampling. First, divide the population into homogeneous subgroups and then select subjects from each subgroup, using simple random or systematic procedures, rather than the population as a whole. Hence, a stratified sample is obtained by independently selecting a separate simple random sample or a systematic random sample from each population stratum. A population can be divided into different groups may be based on some characteristic or variable like 'Education'. Like any body with ten years of education will be in group A, between 10 and Post Graduate as B and between PG and Ph.D as group C. These groups are referred to as strata. You can then randomly select

from each stratum a given number of units which may be based on proportion like if group A has 100 persons while group B has 50, and C has 30 you may decide you will take 10% of each So you end up with 10 from group A, 5 from group B and 3 from group C.

4. **Cluster sampling:**

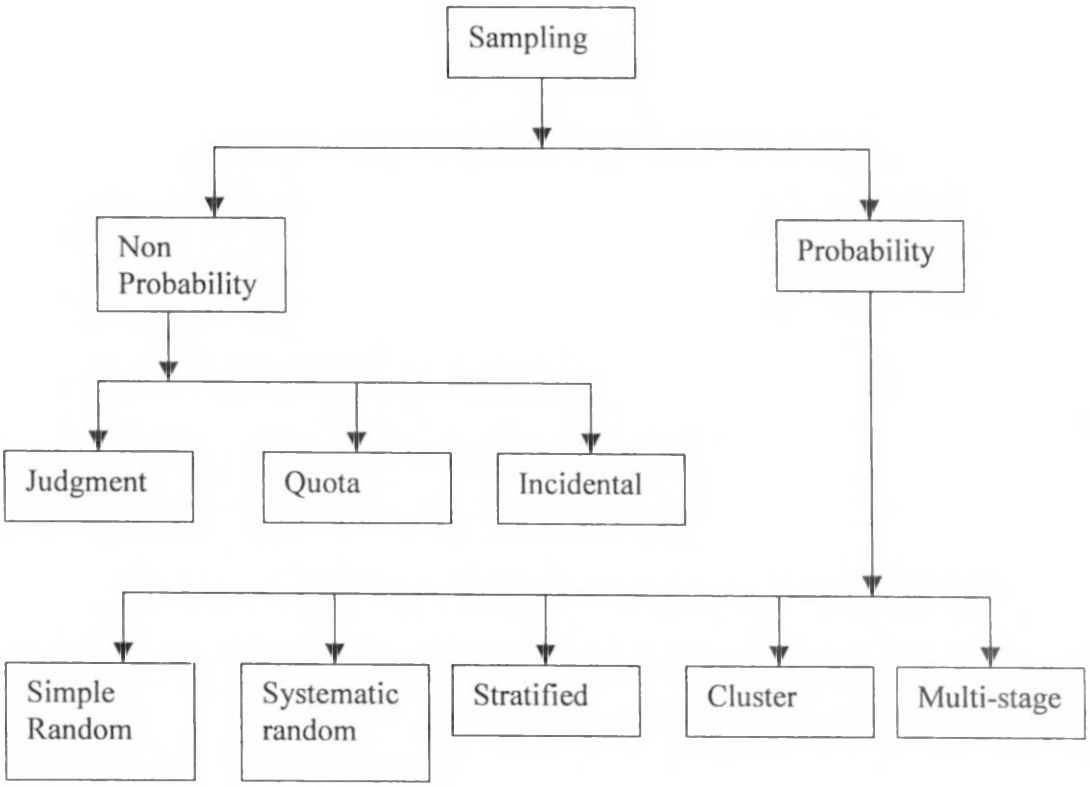
In Cluster sampling we divides the population into groups, or clusters. A number of clusters are selected randomly to represent the population, and then all units within selected clusters are included in the sample. No units from non-selected clusters are included in the sample. This differs from stratified sampling, where some units are selected from each group. A cluster sample is obtained by selecting clusters from the population on the basis of simple random sampling. It is used when the population is infinite, when the distribution of units is scattered or the sampling of individual units is not convenient. The sample comprises a census of each random cluster selected. For example, a cluster may be some thing like a village or a school, a state. So you decide all the elementary schools in Kerala State are clusters. You want 20 schools selected. You can use simple or systematic random sampling to select the schools, and then every school selected becomes a cluster. If your interest is to interview teachers on their opinion of SSA, which has been introduced, then all the teachers in a cluster must be interviewed. Though very economical, cluster sampling is very susceptible to sampling bias. Like for the above case, one is likely to get similar responses from teachers in one school due to the fact that they interact with one another.

5. **Multi-Stage Sampling**

It is used in large-scale surveys where the researcher has to use two, three or four stage sampling. This method helps to check the consistency of the information obtained from the first samples. With this sampling process the respondents are chosen through a process of defined stages. For example, a successive random sampling of states, districts, schools and finally of teachers constitute a multi-stage sample. In order to study the effect of implementation of SSA scheme in southern states, one can randomly select the districts in all the 4 states. Among the districts selected, one can randomly select the

taluks or mandals. Among the selected taluks , one may select the schools randomly. Once again, among the schools selected, the teachers may be selected randomly. These teachers may be administered the questionnaires or interviewed in order to know about the effect of the implementation of SSA scheme on the achievement, and attendance of students.

A Flowchart showing the different types of sampling techniques used in Educational Research is given below.



Activity
1) You are as ted to implement an innovative teaching strategy in teaching of science to standard eight. What kind of sampling procedure would you follow to implement this study?
2) Your state government must have carried out several project surveys in education. Write the p rpose of those projects and the sampling techniques adopted in those studies. If i nformation is not available with you, try to get the information from various sou ces such as reports, documents and so on.
3) What happ ns if we do not follow any sampling technique while conducting research? D iscuss

Module Six

QUANTITATIVE AND QUALITATIVE RESEARCH IN EDUCATION

Getting started

In this module, the Qualitative and Quantitative Research used in the field of Education are discussed. After going through this module, you will be able to:

- Understand the meaning of Quantitative and Qualitative Research;
- Understand the procedures used under these methods;
- Follow some of the precautions to be followed in undertaking Qualitative and Quantitative Research; and
- Know the various merits and limitations of Qualitative and Quantitative Research.
- Identify potential educational contexts that can be studied using these approaches

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Introduction

Quantitative and qualitative research approaches in education have emerged from different research needs. The quantitative research approach endlessly pursues facts while the qualitative research approach recognizes that the researcher's viewpoint is central. The quantitative research approach is used when the researcher desires to obtain entire trends or statistical truth in the research while the qualitative research approach is used, if the researcher wants to observe in detail by his/her own research viewpoint. First let us try to understand the concept of both the types of research in education.

What is Quantitative Research in Education?

Quantitative research in education developed from the quantitative research used in natural science . Carr and Kemmis (1986) explain that there were two reasons for accepting the quantitative research of natural science into the educational research area. First, the concepts, purposes and methods of quantitative research used in natural science were applicable to the education research area and second, it was able to provide logical standards for educational research. Quantitative research in education has, thus,

attempted to discover existing facts under the research belief that the research act must be a neutral activity from the researchers subjective viewpoint .

The research goal of quantitative research is a discovery of universal value. Universal value means that the research value is universally applicable regardless of time, place, culture and other factors. This concept is largely linked to the generalizability of research. In quantitative research, in order to make generalizability, objectivity of the research is particularly emphasized by using neutral scientific language.

Quantitative researchers attempt to keep themselves, away, from influencing the collection of data. The tools or instruments with established psychometric properties are used to collect data. Statistical methods are used for data-analysis and conclusion is drawn. Individual fluctuations in behaviour of course affect such a research paradigm and the researchers acknowledge the presence of such aspects. But they also believe there are general laws that hold across individuals. The quantitative researchers are likely to study a population or a sample rather than a few individuals. Rigorous sampling procedures are followed here.

Quantitative researchers attempt to design a study so that it will yield the strongest possible support or refute a knowledge claim. Research design can be defined as a process of creating an empirical test to support or refute a knowledge claim.

The Model of Research design, developed by David Krathwohl, consists of nine steps, which are follows.

Step. 1. Conclusion from Previous studies:

This step in designing a research study is to review previous research findings. Here, evidence already exists that could support when the knowledge claim is tested.

Step. 2. Explanations, rational, theory or point of view:

The knowledge claim gains in credibility if it is grounded in possible rational theory or point of view.

Step. 3. Questions Hypotheses, Prediction models

The third step in testing a knowledge claim is to state it in a form that can be tested in and that is related to previous step of the chain of reasoning.

Step. 4. Design of the study

This step involves the design of the empirical test of the knowledge claims.

Step. 5. Gathering the Data

After the design of the empirical test is designed, this step that is meant for executing the same is followed.

Step 6 & 7 the data are analysed, and summarised

The statistical significance of the results is determined. The collected data are in the numerical form. They must be analysed using statistical techniques to determine whether they support or refuse the knowledge claim.

Step. 8. Conclusion

The researcher must examine the results of the analysis of data based on which he draws conclusions, stating whether the knowledge claim is supported or not.

Step. 9. Report of the study

When a study is completed, it is reported in some from and thereby becomes part of the research literature.

What are the Characteristics of a quantitative research?

- The approach is deductive
- The sample studied is larger
- The emphasis is on precision in describing events
- The emphasis is on numbers rather than words
- A relationship between variables is anticipated (hypothesis), which is tested on the basis of data collected
- An attempt is made to convert the data into mathematical form
- Tools used are to be such as to yield data in numerical form
- The conclusions drawn from the sample are applicable to the total population, which the sample represents.
- It helps in objective study of phenomena
- Data is available for analysis on a computer and hence inferences can be easily drawn
- Demand on personalized ingenuity and skill is less for data collection
- These can be easily replicated and results verified

Purpose of quant tative research

- Standardiz: tion of tests
- Identifying characteristics of a group in quantitative terms
- Measureme nt of the effect of the experimental variable
- Compariso n of the characteristics of groups
- Studying th e relationships between the variables or characteristics.

Types of Quantit: tive Research

Under Quantitativ Research, the main types are:

- Surveys
- Correlational Studies
- Experimental
- Quasi-experimental

The above types of researches are discussed in the following modules in detail.

What is Qualitati e Research in Education?

In contrast t quantitative research in education, qualitative research in education recognizes that th researcher's subjectivity deeply affects the research. Qualitative research in educati n came into existence as a result of criticisms of quantitative research in education. Quan itative researchers in education often have encountered difficulties in expressing their d ta when using only the quantitative way. The researchers, therefore, have attempted t develop new paradigms based on the notions that missing in quantitative resear h in education was the ability to integrate the researcher's viewpoints into the research. Qualitative research in education, thus, accepted the researcher's viewpoint as a cruc ial factor of the research.

Qualitative research in education, thus, maintains that the researcher's subjectivity is central. In cons equence, the researcher's viewpoint and value judgments are deeply connected to the r search. In this view, the relationship of researcher and what is being researched is impo sible to separate. In other words, what a researcher chooses to study is related to his/her value judgment. There is a belief that research facts and researcher's

value judgments or interpretations of the research cannot exist separately. Rather, facts and the researcher's viewpoint are inextricably intertwined with each other. That is to say, a researcher is considered to be "an insider to the research" (Carr and Kemmis, 1986).. There is a belief that the researcher acts on the basis of his/her own value.

This research paradigm that has gained acceptance for the past twenty years, developed by anthropologists and sociologists, is usually called, 'qualitative', 'naturalistic', 'ethnographic', 'subjective' or 'post-positivistic' inquiry. Qualitative research paradigm is derived from the humanities with an emphasis on holistic and qualitative information and to interpretive approaches. If the findings are based on statements, description and other value loaded stories and anecdotes, these are called qualitative research.

Qualitative research uses different forms of data from those used in traditional research methods. As Patton (1990) sets forth:

Qualitative methods consist of three kinds of data collection:

1. In-depth, opened interviews;
2. Direct observation; and
3. Written documents.

Qualitative research studies use these techniques in isolation or in combination. The six assumptions of qualitative research include the following;

- It is descriptive;
- It involves fieldwork;
- It is "concerned primarily with process rather than outcomes or products"
- It is inductive in that researchers build abstractions, concepts, theory, and hypotheses from details;
- The "researcher is the primary instrument for data collection and analysis"; and
- It is primarily "interested in meaning-how people make sense of their lives, experiences, and their structure of the world".

What are the Characteristics of a qualitative research?

- The approach is inductive.
- Its focus is on specific situations, institutions, communities, groups of people, etc.

- Its emphasis is on causes, interpretations, and implications rather than quantitative scores, meas urement and statistical analysis.
- Its emphasis is on personalized experiences rather than structured tools
- It is based or smaller number of cases.

Purpose of qualitat ve research

- Understandin g the meaning of broad terms like attitude, prejudice, organizational climate, etc.
- Understandin g the context in which some behaviour finds expression or some phenomenon akes place .For example, the social and the cultural influences of a tribal commu ity on the health and hygienic habits of school students.
- Identifying a anticipated phenomenon. For example, anticipating the effect of some interver tion programme like training the rural neo literates on scientific literacy and tl e effect of it on their use of day-to-day applications of science in their lives in d ifferent ways.
- Understanding the process. For example, studying about the behaviour of learners in the groups a nd individually when some activity is given.
- Developing ca usal explanations
- In-depth study to find out the constellation of factors that determine a particular type of behavi our or lead to a particular phenomenon
- Studying inte r-relationships between various factors responsible for a phenomenon r a behaviour. Freud developed his theory of psychoanalysis through quali ative research; Piaget developed his theory of cognitive development b initially starting the study of language development in his own child.

Practical Uses of qual itative research

- Generating the ries that are understandable
- Conducting fo mative evaluation, intended to improve the existing practices rather than to si nply assess the value of programme or product being evaluated.

- Engaging in collaborative research with practitioners (for example, class room teachers).

Types of Qualitative Research

Under Qualitative Research, the main types are:

- Phenomenological
- Ethnographical
- Heuristic
- Case Studies
- Historical Studies and
- Philosophical studies

In education, some of the above types are used to study the educational phenomena. For example, historical studies are conducted to understand the progress and the evolution of school education (may be from Pre British India to the post Independence till the modern times). The committees and the commissions which played a great role since the time of independence time may be analysed for their implications on school education from the time of formulation and so on.

Similarly, case studies are conducted on the institutions to know their growth and development and their contribution to school education. Case studies are also conducted on eminent educationists, philosophers and those persons who have made a remarkable contribution to the field. These are conducted usually by interviewing the persons involved, analysing the documents and the literature and the works produced by the people concerned.

Research is also carried out ethnographically by studying certain social situations, communities which are governed by a set of culture and value norms and standards by observing and participating in the observations to understand the ethnic groups, their culture, values, living styles and belief system. Interviewing the people, anecdotes, observing the groups etc may be used to collect the data, which may be reported qualitatively. The data from interviews consist of direct quotations from people about their experiences, opinions, feelings and knowledge. The data from observations consist

of detailed descriptio ıs of people's activities, actions and the full range of interpersonal interactions and orga ıizational processes that are part of observable human experience. Document analysis ir qualitative inquiry yields excerpts, quotations, or entire passages from organizational cl inical or program records; memoranda and correspondence; official publications and re| orts, personal diaries; and open-ended written responses to questionnaires and su veys.

Activity
Below are given a few research situations. Identify what type of research (quantitative or qualitative) can be ı sed to study them.
▪ Achieveme ıt level of class V students in Language, Maths, and EVS.
▪ Teacher co npetence in teaching of mathematics.
▪ Influence c f home and cultural back ground in forming healthy and hygienic ha)its in children.
▪ Study of Sr Sai Baba institute in promoting value based education.
▪ Learner's a hievement in tribal blocks of Tamil Nadu.
▪ Factors infl ıencing the drop out rates of students in the tribal community of Irulas.
▪ What kind c f curriculum and the textbooks should be prepared for children living in the islands (for example, lakshadweep islands)?
▪ Study of Th iruvalluvar's Thirukural for its relevance to today's education system.

Module Seven

APPROACHES TO RESEARCH IN EDUCATION

Survey Research

Research methods are of utmost importance in a research process. Methods of research may be classified in a broad manner as follows:

- Historical method: this provides a method of investigation to describe, and interpret what existed in the past.
- Descriptive method: this provides a method of investigation to study, describe and interpret what exists at present.
- Experimental method: this provides a method of investigation to derive basic relationships among phenomena under controlled conditions or, more simply, to identify the conditions underlying the occurrence of the given phenomenon.

Since most of the researches carried out in field conditions in the State, in pursue of quality of education, are related with the survey, developmental and some times with the experimental studies, this material deals with those types of researches which are more important in the said direction. This module and the following modules deal with the descriptive and the experimental types of research with suitable illustrations.

Getting started

After going through this module, you will be able to

- Understand the meaning of Survey method;
- Understand the concept and nature of descriptive survey, normative survey and analytical survey;
- Use the different types of Survey methods in Educational research;
- Plan a research study using the survey method
- Identify some of the precautions to be followed in undertaking survey of the educational details; and
- Become aware of the various merits and limitations of Survey methods.

Types of Descriptive Research

Descriptive studies have been classified into the following three categories.

- Survey studies
- Developmental studies
- Interrelationship studies

Meaning of Survey Research

Survey research is a method for collecting and analyzing data, obtained from large number of respondents representing a specific population collected through highly structured and detailed questionnaire or interviews.

The survey approach to educational problems is one of the most commonly used approaches. It is followed in studying local, as well as state, national and international aspects of education. It goes beyond mere gathering and tabulation of data. It involves interpretation, comparison, measurement, classification, evaluation and generalization - all directed towards a proper understanding and solution of significant educational problems. There are many numbers of questions that arise concerning current conditions in the educational world.

For example, one may ask:

- What kind of curriculum do people really want their children to have?
- At what age and grade level do pupils leave school?
- What happens to children after they leave school?
- What higher institutions or vocations do they enter?
- What is the average achievement level of school children in particular subjects at various grades in different schools or in different states?
- How are the private schools similar or different with government schools in their educational outcomes? And so on.

These bring into the focus of our attention, the existing educational problems, and also suggest ways of solving them. The good survey studies collect three types of information:

i. Of *what exists* by studying and analyzing important aspects of present situation;

ii. Of *what we want* by clarifying goals and objectives possibly through a study of the conditions existing elsewhere or what experts consider to be desirable; and

iii. Of *how to get* there through discovering the possible means of achieving the goals on the basis of the experiences of others or the opinions of experts.

Types of survey

Survey studies fall into a number of categories, depending on the nature and purpose. **Descriptive** studies are oriented towards the description of the present status of a given phenomenon, and **Analytical** studies in which phenomena are analyzed according to their basic components. The **Normative** survey study, attempts to describe and analyze the present educational conditions, practices, trends etc., with a view to have an accurate account of the present and establish norms which generally provide the basis for future planning and policy making. This module is devoted to survey research and its different categories

1. Descriptive Survey – Concept and Nature

"A descriptive study describes and interprets *what is*. It is concerned with conditions or relationships that exist, opinions 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 concurrent conditions" (John Best.1982).

Descriptive survey deals with identifying and predicting the relationships between the variables, the testing of hypotheses, and development of generalizations, principles, or theories that have universal validity. It involves events that have already taken place and may be related to a present condition.

Descriptive research has all the steps of research as normally any research study would have. It examines a problem situation, defines the problem and states its hypotheses, lists the assumptions on which the hypotheses and procedures are based, selects appropriate source materials and subjects, selects or constructs the techniques for collecting data, establishes categories for classifying data, validates the data gathering procedures, and techniques, and describes, and analyzes and interprets its findings in

clear precise terms. For example, the study of instructional and the evaluation practices in schools; the study of SSA implemented training programmes in the state; and a study of the role of Non-Governmental agencies in promoting elementary education.

Descriptive data may be expressed qualitatively in verbal symbols (word descriptions) or (2) quantitatively in mathematical symbols, which describe the factors, measured.

2. Normative Survey – Concept and Nature

Normative survey is concerned with conditions or relationships that exist, practices that prevail, beliefs, points of view or attitudes that are held, processes that are going on, effects that are being felt or trends that are developing. The term normative implies the determination of normal or typical conditions or practices. The term *normative-survey* is generally used for the type of research, which proposes to ascertain what is the normal or typical condition or practice at the present time.

The nature of the Normative Survey Research is as follows.

i. It gathers data from a relatively large number of cases.
ii. It is essentially cross-sectional, mostly of the *exists* type.
iii. It is concerned not with the characteristics of individuals but with generalized statistics of the whole population or a sample thereof.
iv. It does not aspire to develop an organized body of scientific laws but provides information useful to the solution of local problems. It may, however, provide data to form the basis of research of a more fundamental nature.
v. Surveys vary greatly in complexity, some concerning themselves only with the frequency count of events, while others seek to establish relationship among events.
vi. The great range of phenomena forming the subject of educational surveys may be classified as:
    a. Physical conditions related to learning (building, furniture and libraries, etc.).
    b. Behavioural conditions related to learning (behaviour of pupils, teachers and parents, etc.)

c. The results of learning or the pupils' ability to learn (achievement or basic skills, information or attitudes).

3. Analytical Survey – Concept and Nature

Fundamentally, analysis is a method, which underlies the whole process of research, from the selection of a problem and its reduction in size to the point where the data is processed and the conclusion is reached. Since most educational problems are too broad to be attacked as a unit, they must be analyzed into their constituent parts as the preliminary step to deriving significant relationships among them, to isolating relevant from irrelevant aspects, and to structuring them in their scientific contexts.

Generally the properties of a given phenomenon are predicted on the properties of its constituents, and the identification and understanding of these constituents. Thus, the identification of a child as an under-achiever provides considerable insight into many of his characteristics and his likely behaviour under certain circumstances.

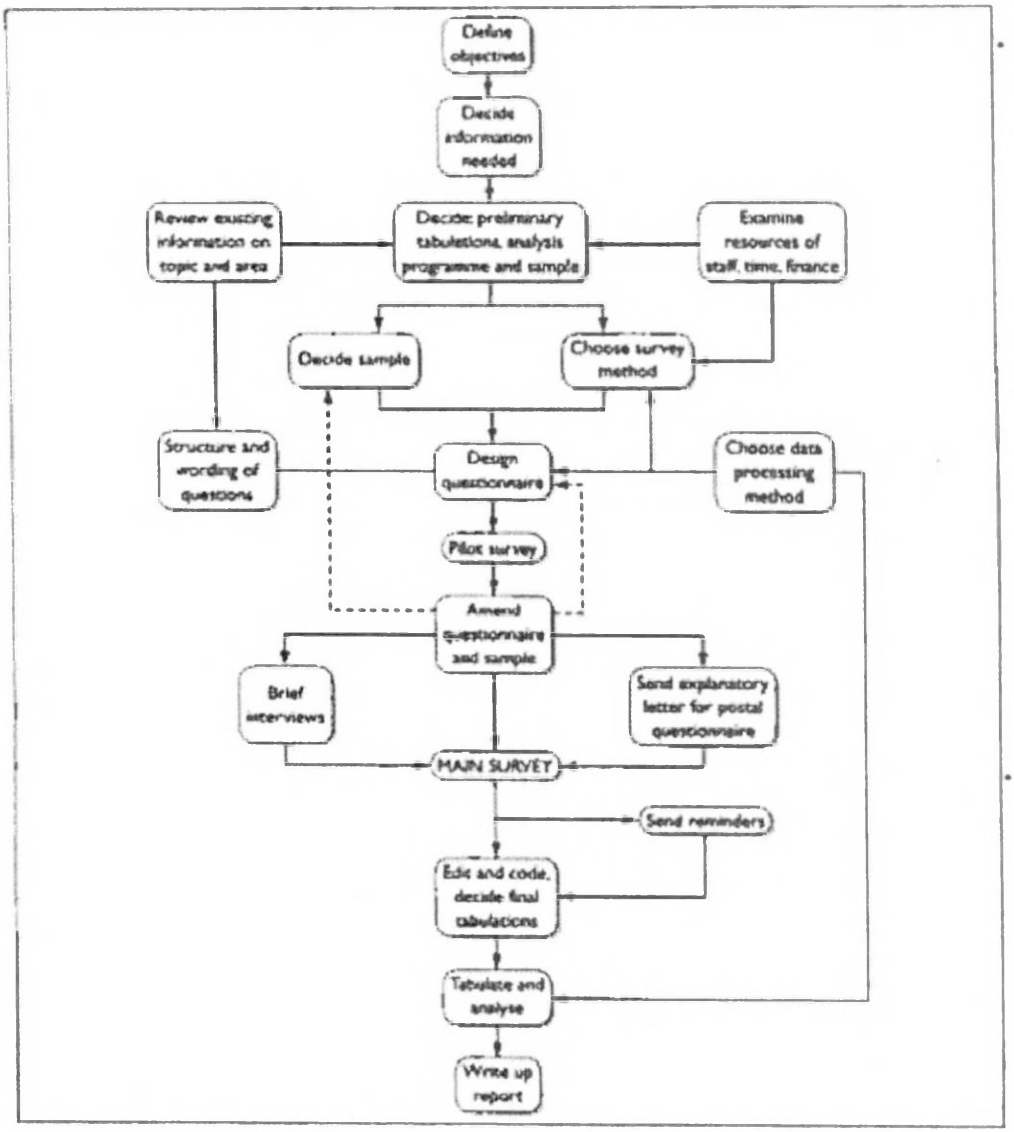
Analytical research – frequently called *content analysis* or *documentary analysis* – is generally associated with the analysis of the content of speeches, textbooks, editorials, TV programs, or, perhaps, essay examinations from the standpoint of prejudice, readability, and nature of the mental processes involved, and so on. Content analysis also involves the analysis of manuals, handbooks and the other curricular materials and job analysis

Job analysis attempts to analyze the nature of a job in order to permit a more adequate allocation of the worker to the job. Job or activity analysis in the field of education might comprise time-and-motion studies of the duties and responsibilities of school personnel at all levels. Such studies would be particularly valuable to the administrator in selecting personnel and in providing in-service training for meeting job requirements. A survey of job analysis of teachers and school administrators can be carried out in order to find out their effective performance in comparison with their role expectations.

Content analysis is of considerable value to education both in the derivation and revision of the curriculum and in the analysis of curricular materials and in the understanding of some of the complex variables encountered in the field.

Activities
• 1. Collect a few research studies that have been carried out by your organization / institution. Study them and identify under which category of survey research they can be included- whether they are of descriptive, analytical or normative in nature.
• 2. Formulate three Educational problems under each of the category- descriptive, normative and analytical with respect to school education.

Box 8.1
Stages in the planning of a survey



Source Adapted from Davidson, 1970

How does a Survey research help a researcher?

- To secure evidence concerning an existing situation or current condition. (Example: identifying the students drop out rate at the upper primary level-class VII
- To identify standards or norms with which to compare present conditions, in order to plan the next step (Example: comparing the enrolment rate at class I with the retention rate of students in class VII, and identify the causes drop outs)
- To determine how to make the next step (having determined the drop out rates and the causes, one can decide the interventions or measures to be taken for reducing the drop out rate)

Survey researches must do more than merely uncover data. They must interpret, synthesize, and integrate the data and point to implications and interrelationships.

Precautions to be taken

The precautions to be followed while conducting the survey research methods are as follows.

i. See that Information is available from all respondents.
ii. See that information obtained is relevant.
iii. A request for information that is considered secret should be avoided,
iv. Information about activities shared by a very small proportion of the population cannot be obtained in a reliable way.
v. Information obtained from a single survey is less reliable than trend data derived from two or more consecutive surveys made by the same methods.
vi. Surveys cannot be aimed at obtaining exact quantitative forecasts of things that might happen in future. For example, student enrolment and achievement in the future years.

Although the survey research is an important approach that has developed greatly since mid century, and is valuable for many purposes, it has certain limitations, in relation to social research, which are as follows:

- The data obtained are usually about individuals, with a tendency to treat the individual as the social unit, partly because only the individual can be interviewed and given questionnaires.
- The survey method works best across relatively narrow social distances in a society with a slow rate of change, little internal conflict, highly individualistic, inner directed and mobile, with a high degree of correspondence between thought, word, and deed.
- The survey method is too static' for example, it reveals the reactions of people at only one point of time, which means that a panel study of attitudes toward in service programmes may need to be repeated at intervals of a month or two.
- The survey method commonly is restricted to a middle range of social position; for example, problems of literacy and verbal facility for the lower strata in many countries limit the use of questionnaires and interviews.

Baseline Research

As already discussed in the first module, for taking any administrative decision of framing a policy we need some basic data. The studies which provide such basic data are known as baseline studies. A detailed version of the example provided under Base line studies in module one is as follows:

As already mentioned, during the DPEP intervention, a base line study was carried out in the states to study the achievement levels of students in language and the mathematics to identify their performance levels and other infra structural facilities existing in schools. This provided as the base for planning the intervention programmes to facilitate the instructional processes and improve the quality of education at primary level.

Here the data is collected through a survey method at district and sub district levels in order to (i) improve access to primary education; (ii) reduce dropout; and (iii) increase learning achievement, with special emphasis on interventions that would target working children, children with mild to moderate disabilities, females and scheduled caste (SC) and scheduled tribe (ST) students. The key indicators in this type of research in school education would be (i) trends in enrolment and dropout rates in the districts,

especially of the above-mentioned targeted group of children; and (ii) achievement scores with respect to reading and mathematics by state, gender and with respect to SC/ST students and so on.

The base line survey in school education, for example, would provide action points to a) building and strengthening State, District and Sub-district Institutional Capacity to: (i) appraise and supervise the implementation of district and sub-district-level programmes designed to enhance access to and improve the quality and efficiency of primary education; and (ii) provide technical support for program management, improved textbook and instructional materials development, enhanced teaching, strengthened educational planning and management and research and evaluation; (b) Expanding Access to Primary Education by: (i) constructing new classrooms and water and sanitation facilities and rehabilitating existing schools; (ii) providing targeted interventions and carrying-out awareness campaigns focused particularly on girls, scheduled caste (SC) and scheduled tribe (ST) students, children with mild to moderate learning disabilities and working children; (iii) strengthening of School/Community Organizations; and (iv) providing non-formal education for isolated small communities and for working children and supporting the design and trial of other alternative schooling modalities.

Activities
• Identify the base line studies conducted in school education, preferably, at the primary level and examine the findings. Find out in what ways the survey carried out has helped the state to make policy decisions regarding improving the educational situation at school level. What were the indicators for the action points or the measures adopted to improve the learning situations, school facilities and other supportive mechanisms that helped in improving the school education.
• What are your observations or comments upon the base line research survey conducted in your state/district? Do you think the survey has helped in understanding the existing situation and helped in appropriate planning and implementation of any innovativeness? Discuss in your groups and write a short report.

Module Eight

DEVELOPMENTAL STUDIES

In this module, the need and the importance of developmental studies in educational research are discussed. The different methods of carrying out developmental research in education are discussed with examples.

Getting started

After going through this module, you will be able to:

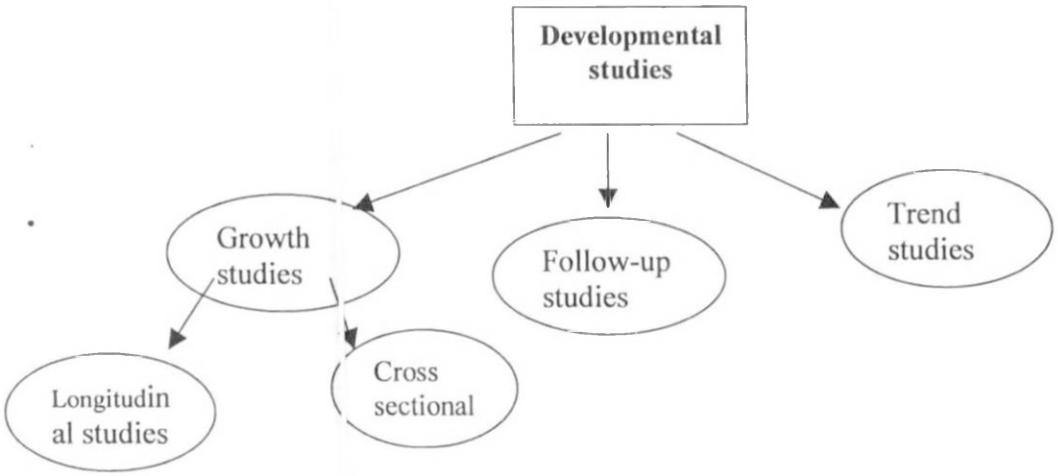
- Understand the meaning of Developmental Studies
- Realize the scope of Developmental Studies in Education
- Discuss the importance of longitudinal studies, cross-sectional studies, study of individuals and study of groups
- Explore some of the types of developmental studies that have been carried out in education field with specific reference to school education in the state.
- Formulate some research problems, which fall under the category of developmental studies.
- Follow the precautions in using various methods of Developmental Studies in Education
- Realize the merits and limitations of each method in Developmental Studies.

Meaning and the scope of developmental studies

Developmental study is ideally long-term investigation of origin, direction, trend, rate pattern, limit and decline of growth. Developmental research identifies causes, inter-relationship and patterns of development among such factors as experimental background, including both formal and informal teaching and learning, physiological age, mental age, degree of social maturity or social age, interests, needs, socio-economic status, motivation, attitude, methods of instruction, material of instruction, length and intensity of instruction, learning procedures, modifiability of nature ability, aims and objectives reading ability, habits and procedures of thinking and in problem solving of

the material to be learned. The developmental studies are used for investigating the characteristics of children and the ways in which these characteristics change with growth and development. Such studies are concerned not only with the present status and interrelationships of phenomena, but also with changes that take place as a function of time.

The developmental studies also help in knowing the trend in a particular area or the field. For example, a study related to the trend in the text books at school level, can reveal things like, how style of presentation. Content, illustrations, etc have changed from time to time depending upon the need of the hour. They are also called as genetic studies, which include the three different forms- growth studies, follow-up studies, and trend studies. Below is given a flow chart showing the types pf researches that can go under the developmental studies.



1.Growth studies: As you may be aware the developmental and the learning tasks of children at different levels have been designed based on the observations made by many psychologists and Educationists on the physical, mental, social and emotional development of children. This had led to the developmental and learning tasks at different stages of the learners according to their developmental stages. You must have also seen the way the curriculum and the learning materials designed according to the age and the mental abilities of children at different levels of school education. This implies that the growth studies play an important role in designing the purpose and the functions

accordingly. The teachers must have knowledge of the nature and rate of changes that take place in the children in order to teach them effectively. They must have an 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 growth. Developmental studies are useful to seek knowledge of the nature and rate of changes that take place in human organism. They are helpful to study when various aspects of growth among children are first observable, accelerate further, remain rather stationary, and attain optimal development and decline.

Child development studies are made of physical growth and social behaviour. Most child development studies are concerned with describing general variations in behaviour and growth from age to age. Appraisals are made of attitudes, values, and personality characteristics. The cognitive processes, such as perceptual, verbal, concept, problem solving and motor-skill learning are also investigated.

In this type of studies, the growth rates of the same children are measured at different ages. The same group of students might be tested on a number of variables when they are twelve, thirteen, fourteen and fifteen years of age and plot their individual development patterns for these factors during these years. But when conducting a cross-sectional study, rather than repeatedly measuring the same children, you make one set of measurements of different children from each age level. Then you calculate the average to depict the general development pattern of each variable for children from twelve to sixteen years of age. The growth studies can be either longitudinal or cross sectional.

a. Cross-sectional studies: include more subjects, but describe fewer growth factors than exploratory longitudinal studies. The cross-sectional technique has the advantage of gathering the data promptly, as in measuring at one time the height of the children in the first six grades, rather than waiting for the pupils in the first grade to grow in height through a period of six years (a longitudinal technique). Relatively large number of subjects are involved in cross sectional studies, in contrast to much smaller number followed over a period of time in longitudinal studies. When conducting cross-sectional study, rather than following the same group of individuals and taking their repeated measurements over a relatively long period of time, the random samples of individuals of

successive ages are selected and one set of measurements of different individuals from each age level are taken as the basis for developing growth norms. The statistics derived from the samples are compared and the conclusions are drawn about the growth of individuals with respect to the variables studied. It would be helpful to have norm for such every day activities as dressing habits, ordinary major performance and virtually all-practical skills. The cross sectional studies are economical in respect of energy because all the samples are available at a time. A few examples are as follows:

Example:

1. A study of the effect of ABL programme on different age level children.
2. A study of cross-cultural differences among the secondary level students of southern and northern parts of India towards gender roles.
3. An inquiry into the parental support in the learning of school going children from rural and urban areas.

When conducting cross-sectional study, rather than following the same group of individuals and taking their repeated measurements over a relatively long period of time the random samples of individuals of successive ages are selected and one set of measurements of different individuals form each age level are taken as the basis for developing growth norms. The statistics derived from the samples are compared and the conclusions are drawn about the growth of individual with respect to the variables studied.

b. Longitudinal studies

The longitudinal types of studies are mostly used in clinics and laboratories. However, its use in the field of education is not uncommon.

Longitudinal studies follow the same subject, a group of subject, or an institution over a relatively long period of time. It is a kind of extended case study as it involves a long-life span of the same subject, group or institution. A researcher, for example, may test and measure the same individual on his achievement motivation level from his primary years to his adult stage (20 years) and plot his individual achievement motivation during these years. Therefore, he could assess the change in the motivation over a period

of time at different age levels for the student. Since the researcher is dealing with the same student, the effects of such factors like family background, etc., will remain constant and the differences he observes between two age levels may be interpreted as change in the achievement motivation related to the growth of the student.

The longitudinal type of research is mostly used in clinics and laboratories. However, its use in the fields of education is not uncommon. A longitudinal study may be carried out in case of an educational programme, since its inception. For example, there were government-initiated programmes like, operation black board, SOPT in-service training, and DPEP programmes. One may study these programmes from their inception level to their end terms. As you are aware of, now SSA programmes are being carried out under the SSA scheme through out the country. One can study the impact of SSA in improving the quality of school education since its inception to the present year.

Longitudinal studies are also carried out in studying about the institutions. For example, the objectives with which an institution is started, the developmental phases, change in the objectives or the philosophy of the institution, the goals achieved and so on.

Some of the trend studies are longitudinal in nature. For example, (i) trends of growth of expenditure at the primary level in India during the planning era, (ii) trends in change of enrolments at the higher education level in India during 1950-1990, (iii) the changing age structure of the population etc. The State education departments may wish to study the progress that is being made in various areas or to measure the need for changes in syllabi, textbooks, guidance programmes and working conditions of teachers and other personnel.

Precautions to be taken

While conducting cross-sectional and longitudinal studies certain precautions are need to be followed. They are as follows:

Although wider use of the longitudinal method has been recommended, rather specific precautions are necessary in dealing with certain difficulties some of which are common to cross sectional studies.

- Difficulties in population sampling, such as the selective elimination of many of the original subjects during the course of the long-term investigation.

- Maintenance of satisfactory working relationships among subjects, parents, schools and investigators particularly as personnel changes takes place with the passing of time.
- Motivation of children to demonstrate totally rather than perfunctory performance.
- Systematic errors of measurement in the administration or scoring of mental or physical tests.
- Non-comparability or uncertainty of psychological equivalence of test used at different age level, especially when the time span is from early childhood to adolescence.
- Unequal experience of groups in terms of factors affecting the results of the measurement used, but not affecting the trait itself: for example, variation in previous experiences with standardized tests.
- Recording and collection of data may not be reliable if some untrained persons are involved. For example, the work of graduate students probably will not be as accurate and efficient as a highly trained permanent staff or skilled punch operators and statistical clerks.
- Mistakes or interpretation resulting from failure to take into account the principle of regression, particularly in its effects of measurement of gain or loss.

Some of the merits and the limitations in using longitudinal and the cross-sectional studies are as follows:

a. Longitudinal

- It deals with inter-relation of many variables in growth through the co-operation of socialist in a variety of field
- It represents the cross sectional of development stages of an individual child.
- Prediction can be made for a subject.
- Real development may be studied by this method

- While using this method, fewer problems may be faced while sampling the population and following the in statistical techniques in comparison to cross sectional method.
- Usually Small sample is selected.
- It can be used for the clinical purpose for a particular pupil.

However, some of the limitations seen in the longitudinal studies are as follows.

- It is not helpful in providing the norms for every day activities.
- Uniform sampling criteria, as employed in cross sectional studies, cannot be set up and applied for longitudinal data, since unpredictable and uncontrollable selective elimination almost inevitably occurs because of the causalities of death, illness, moving of families and changes in the co-operation of parents with the investigator.
- It is time consuming

b. Cross-sectional

- The cross-sectional studies have the advantage of gathering the data promptly, as in measuring at one time the height of the children in the first six grades, rather than waiting for the pupils in the first grade to grow in height through a period of six years (a longitudinal technique).
- It is economical in respect of time because the samples are available at a time.
- Relatively large number of subjects are involved in cross sectional studies, in contrast to much smaller number followed as in the case of longitudinal studies. Here more people have opportunity to be selected as sample.
- It is possible to develop norms for such every day activities such as dressing habits, hygienic habits, major performances and virtually all-practical skills.

Some of the disadvantages involved in this type of research approach are:

- Cross-sectional approach does not represent the developmental stages of an individual or child.
- Mostly no prediction can be made.

- This type of genetic research represents special difficulties in sampling and in statistical procedures.
- Large and many groups of samples are required.
- We cannot use it for clinical purpose for particular individuals.

Trend studies: Trend studies are used to obtain and analyse the different areas of study to identify trends and to predict what is likely to take place in the future. For example, the surveys of research in education brought out by CASE, Baroda, and NCERT are the outcomes of the research work carried out in the respective areas of education, which shows a trend of research in the present and also with the future possibilities. Trend studies are undertaken through documentary analysis or surveys at repeated intervals. Such surveys help the researchers to study the extent and the direction of changes and to use the trends in the particular area of educational research to predict the future course of direction. The trend study, sometimes, may combine historical, documentary, and survey techniques.

Follow-up studies: Follow-up studies are conducted to investigate the subsequent development of the individuals after a specific treatment or condition. In case studies, follow-up is carried out, in order to find out the effect of the treatment or counseling provided. Similarly, follow-up studies are carried out after conducting a training programme for a given set of teachers for a period of time with an aim to find out whether the teachers are using the training inputs provided during their class room instruction.

Activities
1. Plan a longitudinal study of an institution or a school in your district/ state, which is reputed for its systematic organization and functions and ideals.
2. Identify the areas of research in school context, which can be carried out by using cross-sectional research method.
3. Explore the research studies, which fall under longitudinal, and the cross-sectional types in education.
4. Prepare a report of any follow-up study that you have carried out after providing a training programme or any intervention to the schoolteachers.
5. Analyse the trend report on elementary education and identify the areas on which the research work seemed to be carried out in general. In your opinion, what are the aspects of elementary education that have been neglected and need to be researched?

Module Nine

INTERRELATIONSHIP STUDIES
CASE STUDIES

Certain researches in education do not merely collect facts to obtain description of existing phenomena, but they try to study relationships between the variables that will provide deeper insight into the phenomena. The studies that venture into discovering relationship between various facts of the existing phenomena are called interrelationship studies. These include: I) case studies, ii) correlation studies iii) cross cultural studies and causal- comparative studies. Among these, the types such as case studies and the correlation studies, which can be carried out in school context, are discussed separately.

Getting started

After going through this section of the module, you will be able to

- Understand the meaning and nature of Case Studies,
- Realize the need for carrying out case studies and its use in educational set ups.
- Understand the various steps involved in Case Studies,
- Identify the research problems that can be studied through conducting case studies,
- Explore various case studies conducted in educational research and their implications.

Meaning and Nature of Case Studies

Case study is a type of research method that comes under interrelationship studies, where interrelationships between facts are obtained to get deeper insights into the phenomena.

A case study is similar to a survey, but instead of gathering data concerning a few factors from a large number of social units, the investigator makes an intensive study of a

limited number of representative cases. A case study is more exhaustive and more qualitative in nature than a survey. Because word description reveals a wealth of enlightenment information that a quantitative study might not be able to produce, the case study is often used to supplement the survey method.

Here intensive investigation of a social unit is made. The researcher gathers pertinent data about the present status, past experiences, and environmental forces that contribute to the individuality and behaviour of the unit. After analyzing the sequence and interrelationship of these factors, he constructs a comprehensive, integrated picture of the social unit as it functions in a society.

Nature of case studies:

The intention of making case studies is to diagnose a particular condition and recommend therapeutic measures. The above aim of case studies is fulfilled by social workers and their intention is to find out the individual as a unique personality. Research workers on the other hand are interested in individuals as representative types. They gather data about a carefully selected sample of subjects with the intent of deriving valid generalizations about the population that the sample represents.

A case study can be carried out on students, administrators, teachers or schools. For example, a case study may be conducted on a student who exhibits behavioural problems in the class room; or who has severe learning difficulties; or who is extra ordinary in his talents and creative abilities along with high achievement in studies and so on. A case study may also be conducted on an institution to know about its philosophical ideals in promoting education, its mission and objectives, and functions with respect to producing quality education and with the society.

In case study attention may be focused on the total life cycle or a social unit or on some specific phase of it. A researcher may make a detailed study of the relationships of boys with members of their groups or the relationships of teachers with their administrators. On the other hand, if he wants to investigate as to what has contributed to the social maladjustment of some juvenile delinquents or to the success of teachers, he may investigate almost every aspect of their lives-their childhood, home, school, work, social experience, and many of their behavioural traits.

Subjects are selected for case studies that sharply delineate the phenomena being studied and who do not present irrelevant that will make it difficult to discern the operation of the phenomena. If relevant variables cannot be eliminated an effort may be made to control them.

A case study is cast within an adequate social framework, and the nature of the case determines the dimensions of the framework. Human beings interact in diverse and dynamic environmental and social cultural setting; consequently their behaviour cannot be understood without examining these varied relationships. When case studies are confined to a fragment of a human life or an isolated educational setting, they do not usually produce enough data to discover the fundamental cause and effect relationship.

While conducting a case study, the investigator observes events both within and outside the educational setting in their full actuality. He notes events in terms of their location in space and time the physical surroundings and objects present, the actions and interactions of the people and institutions involved. He pays particular attention to the interdependence of these relationships and does not overlook the nonverbal actions, unspoken understandings and covert or informal networks of relations.

Some case studies over emphasize observational methods and neglect other methods. A multi method approach may serve as a more valid test of a hypothesis. An investigator may ask subjects to recall past experiences, or to express present wishes, in interviews or in questionnaires. Personal documents, such on diaries and letters and various physical / psychological, or sociological, measurements may yield valuable information.

In a case study, the element of typicalness, rather than uniqueness, is the focus of attention, because an emphasis upon uniqueness would preclude scientific abstraction and generalization of findings.

"A 'case' is not only about a 'person' but also about that 'kind of person'. A case is an exemplar of, perhaps even a prototype for, a category of individuals". Thus the selection of the subject of the individual study needs to be done carefully in order to assure that he or she is typical of those to whom we wish to generalize.

A single individual study emphasizes analysis in depth. Though it may be fruitful in developing hypotheses to be tested, it is not directed towards broad generalizations.

One cannot generalize from a number (N) of 1. To the extent that a single individual may represent a typical situation, the observation is sound. But if the objective analysis of an adequate sample of cases leads researchers to consistent observations of significant variable relationships, hypotheses may be confirmed, leading to valid generalizations.

Steps involved in conducting a case study

The following steps are involved in the conduct of the case study :

1. ***Status of the situation or unit of attention*:** This involves identification of the need – situation, aspect of behaviour, or phase of the life process as the unit for study.
   Collection of data: Collection of data is the basis for diagnosis or identification of the causal factors operating. Data may be gathered by a wide variety of methods, including
   - Observation by the researcher or his or her informants of physical characteristics, social qualities, or behaviour
   - Interviews with the subject(s), relatives, friends, teachers, counsellors, and others
   - Questionnaires, opinionnaires, psychological tests and inventories
   - Recorded data from newspapers, schools, courts, clinics, government agencies, or other sources.

2 *a.* ***Examination and History Outlines:*** The range of data useful in studying the circumstance associated with the particular situation of unit is well illustrated in the following abbreviated outline for use in pedagogical case study.
   - Examination: Psycho – physical; Health; Educational d. Mentality
   - Health History
   - School History
   - Family History and Home Conditions
   - Social History and Contacts

   b. ***Personal Documents*:** Documents such as the life history, biography, autobiography, diaries, and journals, letters records of dreams and expressive interview are valuable. These are collected according to the particular purpose of

the study in hand. The data bear specifically upon the questions to be answered by the study.

c. ***Life History:*** Life history differs from the usual autobiography in its emphasis on the natural history of the individual, his reactions to early social stimuli that have led to development of attitudes and values, evolutions of a philosophy of life, personal experiences, mental and social conflict, crises, adjustments, accommodations and release of tensions. For example.

- The subject must be viewed in his or her own cultural background.
- The peculiar role of the family group in transmitting the culture must be recognized.
- The continuous related character of experience from childhood through adulthood must be stressed.
- The social situation must be carefully and continuously specified as a factor.
- The life – history material itself must be organized and conceptualized.

d. ***Autobiography, Biography and Diaries:*** As historical narration autobiography is usually a relatively formal document, written with an eye on the judgment of the public, such as case of the diaries of distinguished persons. While entries in a diary are recorded concurrently as experiences and events take place autobiography and biography are written in retrospect.

3. ***Diagnosis and identification of causal factors*:** The structural pattern of diagnosis is the formulation of a theory or hypothesis of causation. From causation diagnosis looks towards the possibilities for growth and adjustment of the individual as a personality and as a social being who shares experiences with others.

- It must provide valid evidence of strength and weakness related to the objectives.
- It must be reliable, so that repeated diagnosis of other samples, from the same learners will give similar results.
- It must be carried to a satisfactory level of specificity.

It must provide comparable data, measurement of progress at intervals, equivalent test forms or procedures adequately standardized and controlled.

- It must provide sufficiently exact data for diagnostic purposes. The measuring instruments should be discriminating enough to indicate in units of weeks or months rather in semester of year.
- It must be comprehensive or complete. In a particular subject deficiencies in memorization of facts are analyzed, without determining the ability to use these facts in reflective thinking or problem solving.

4. **Techniques of diagnosis:** (this is in case of identifying the causes for maladjustment or behavioural problems or learning problems or students suffering from certain emotional and behavioural problems due to low self esteem)
    - Tests of general intelligence, aptitude, personality and achievement. There are standardized tests available to measure these variables.
    - Observation of the pupil's study habits, attitudes and reactions.
    - Analysis of the pupil's written work.
    - Analysis of the oral responses and reactions of the learner.
    - Objective devices to determine the nature and significance of faults, as illustrated by diagnostic handwriting charts.
    - The interview, and
    - Clinical procedures.

5. ***Follow up measures:*** The case studies may be followed by appropriate measures to be taken. For example, in case of exceptional children (say, a maladjusted child) appropriate remedial measures may be planned with the help of counsellor. The case studies carried out on eminent educationists might lead to drawing the philosophical essence of their thoughts to enrich our educational practices.

Some of the examples of case studies are as follows:

Examples of case studies

- Case study of an Institution (to know its back ground, philosophy of its functioning, present status, their goals and aims etc...). Eg. Ramakrishana Institute, Sathya sai school, Kalakshetra school and other indigenous schools.
- Case study of ex-President Sri Abdul kalam

In what situations case studies can be conducted?

- The case study method is a useful mode of investigation into the causal relationships of complex educational phenomenon.
- It is frequently employed in studying cases of problem children, maladjusted students and students showing academic and other difficulties.
- It is also employed in finding out the general characteristics of phenomenon of a given class or an area. For example, case studies of truant students in slum area or learning difficulties of students in mathematics.
- Sometimes case study method is employed in studying the teaching difficulties of beginning teachers.
- More recently case study method has been extended in the investigation of normal and gifted children also.
- Case study method is also employed to find out the factors, which are responsible for successful institutions and groups.
- Case study has been extended to the investigation of ideal teachers.
- Case study method forms the basis of guidance in preventing maladjustment.
- Case study method is obviously an important source of educational programmes and reforms.

What are the drawbacks or shortcoming of a case study?

- A generalization drawn from a single case or a few casually selected cases is not applicable to all cases in a population.
- It is very difficult to select subjects or units for a study that are representative or typical.

- Sources of data may not be very reliable.
- Source of data may be reliable, but data may suffer from overemphasis on unusual events or distortion.
- Subjective bias is a constant threat to objective data gathering and analysis.
- Effects may be wrongly attributed to factors that are merely associated rather than cause and effect related.
- For using this method effectively the researcher must be thoroughly familiar with the existing knowledge of the field of enquiry and should be skilful in isolating the significant variables from the irrelevant variables.

A case study may provide insights that will help an investigator formulate a fruitful hypothesis, for knowledge that a particular condition exists in a unique instance suggests a factor to look for in other cases. A generalization drawn from a single case or a few casually selected ones cannot be applied to all cases in a community, country or the world, but a negative piece of evidence produced in a single case will alert the investigator to the possibility that he may need to modify his hypothesis.

Sometimes case study data are subjective. But weight and height data are objective. Data about motives and character are subjective. An investigator must guard against permitting personal biases and standards to influence his interpretation. Facts must be reported precisely and objectively and judgments must be suspended until adequate evidence supports a conclusion.

Activities
1. Identify those students who exhibit some behavioural problems, or learning problems. The information may be obtained through teachers who are teaching in that particular class. The records and other documentary particulars may also be used as the sources to identify. Conduct a case study of the student. Write your plans and the resources and the tools that you would use to collect information about the student. How will use the data obtained to help the student?
2. In order to conduct a case study of an institution, how would you go about planning and collecting information?
3. Identify some examples of case studies that have been conducted by the researchers. Write a critical review of it.

Module Ten

COHORT STUDIES

As you all know a number of methodologies have been evolved over the years for measuring the extent of educational wastage. These are largely based on the specific definition of the concept as accepted by the research scholars and also on the data available in different countries. In all countries of the Asian Region, the data which are relevant for measuring educational wastage e.g., grade-wise enrolment for different levels and types of education by sex and by rural and urban areas, the results of terminal examinations, particularly at the second and third levels, are now available for a series of years and are also being collected regularly every year as part of national statistics. In about two-third of the countries, data on repeaters by grades are also being collected. The cohort studies are a kind of longitudinal studies, which keeps track of the samples involved in the study. This module discusses about the cohort method and its use in the educational context.

Getting Started

After studying this module, you will be able to:

- Understand the meaning and nature of Cohort Studies in the field of Education;
- Explore the need for Cohort Studies in various issues related to Education
- Analyse the research studies conducted using cohort approach in your state.
- Visualize and plan a study using cohort approach

Meaning

Cohort: A group of persons who experience a certain event in a specified period of time thus a birth cohort is a synonym for generation (i.e., group of persons born within a specified period of time). It might be useful to define the work 'cohort' in demographic terms before considering its actual utilization in educational statistics. For the purpose of this study, however, 'cohort' will refer to a group of pupils joining the beginning grade of a course in a given year.

Three major approaches can be distinguished: (a) 'true cohort' method (b) an 'apparent cohort' method, and (c) a 'reconstructed cohort' method.

The true Cohort Method

The only sure way to determine the school career of a cohort and to measure precisely its flow patterns and its output sequence is through an individualized data system where each student has his own reference number and can be followed throughout his career.

As a substitute, one could use a cohort coding system' whereby all students in a cohort experiencing the same educational events received the same coding number, as is used in Mauritius. The data thus collected permit the derivation, through the aggregation of yearly data, of the movements of school population.

Under this method, the career of a single group of pupils who enter the beginning grade of the stage/course of education under enquiry in a given year is followed up in subsequent years till they graduate from the final grade. This requires longitudinal studies, so that it can be seen how many leave school and at what point, how many migrate to other schools of the same type or of other types within the country, how many migrate to other countries, how many repeat grades and with what frequency, how many die, how many get accelerated promotions, how many rejoin school after dropping out, and how long all those who ultimately complete the course successfully take to do so.

Some of the researches in India, using the true cohort data, have applied the following formula to compute the Index of Stagnation (Is)

$$Is = 1 - \frac{\text{Total optimum years}}{\text{Actually used years}}$$

The expression 'total optimum years' denotes the total number of years required for a cohort to complete the prescribed stage/course of education on the assumption that every pupil will make normal and regular progress from year to year. The actually used years are calculated by counting every year spent in school by every pupil in the cohort. This formula does not appear to be satisfactory because of the fact that sometimes the

total optimum years will exceed the actually used years with the result that the value of is obtained will turn out to be negative. This situation can arise when a large number of pupils drop out from the lower grades and the number of pupils drops out from the lower grades and the number of pupils completing the course within the prescribed minimum duration is also quite high.

Some of the researchers in India using the true cohort data, have applied the formula given below to measure the effectiveness or internal efficiency (Ie) of a school system:

$$Ie = 1 - \frac{\text{Effective school years}}{\text{Actual school years}}$$

The expression actual school years means the same thing as actually used years referred to in the previous paragraph. The term effective school years denote the number of pupil-years profitably used by the pupil in a cohort in their school life. For example, if 100 pupils in a cohort take 2 years to pass grade I, the actual school years in their case would be 200, while the effective school years would be only 100. According to the above formula, when the index of internal efficiency (Ie) becomes known, the index of wastage (Iw) can be easily derived by subtracting the value of internal efficiency index from 1.

$$Iw = I - Ie$$

For computing the index of internal efficiency of an educational system, some of the studies conducted in India have suggested sophistication by way of giving weights to the pupils according to the number of years spent by them in the system. For instance, the weights proposed for the completion of grades I, II, III and IV are 1, 2, 3, and 4 respectively. Half the credits are advocated for those who appears in the final examination of these grades, but do not pass. No credits are however, recommended for those who absent themselves at the final examination or for those who absent themselves at the final examination or for those who leave school during the year. But Chickermane, on the other hand, suggested weights also for those who withdrew from school in the course of the year. In other words, he suggested the 'month' and not the 'year' as the temporal unit of enquiry. The weights proposed by him for the completion of grades I, II,

III and IV are 10, 20, 30 and 40 respectively on assumption that there are ten working months in an academic year. The basis for these weights appears to be questionable because the actual number of working months in an academic year ranges between 7 – 8. According to the weights suggested by Chickermane, each completed month of the academic year entitles a pupil to a score of 1, 2, 3, and 4 in grades I, II, III and IV respectively. Thus one who leaves the school just after passing grade I, has a score of 10 in terms of using the school and wastage of 90 due to him. Similarly, one who leaves after grade I but having studied in grade II for two months has a score of 14 in terms of using the school and wastage of 86 due to him. As already stated, it may not be possible to give weights at the first level, because of the intervention of the phenomenon of "lapse into illiteracy". At the second and third levels, however, the weight system can be safely applied.

Although the true cohort method is considered to be the most scientific, it has not been possible to apply it on a wide scale in any of the countries of the Asian Region for obvious reasons. The method involves the use of a continuous record card giving detailed information about every pupil in the cohort to be filled in by the teacher, which does not just exist; introducing record cards for all pupils in the system is quite expensive which the developing countries are not able to afford; and lastly, forward looking longitudinal studies using the true cohort data are time-consuming. But there is one way out to overcome these difficulties and that is that such studies need not be conducted on a countrywide basis, but should cover small areas. The technical seminar on Educational Wastage and School Dropouts convened by UNESCO in Bangkok in 1966 recommended that overlapping longitudinal studies should be devised, using the true cohort data. The format of such a study as suggested in the final report of the Seminar is shown below:

Grade	I	II	III	IV	V	VI	VII
Year in which information is collected	1	2	3		1	2	3
			1	2	3		

According to this format, a 7-year grade cycle can be studied over a period of three years. The overlapping groups (grades III and V) make possible some observation of changes, which may have taken place at grade level during the period of the study.

First Level (Grades I – VI) – Males and Females – Hypothetical Cohort Starting From 1991

Year	Grades						Graduates
	I	II	III	IV	V	VI	
1991	E 1000						
	d 72						
1992	r 90						
	p -	838					
	E 90	838					
	d 6	22					
1993	r 8	54	-				
	p -	76	762				
	E 8	130	762				
	d 1	3	52				
1994	r 1	8	42	-			
	p -	6	119	668			
	E 1	14	161	668			
	d -	-	11	73			
1995	r	1	9	47	-		
	p	1	13	141	548		
	E	2	22	188	548		
	d	-	1	20	71		
1996	r		1	13	33	-	
	p		2	20	155	444	
	E		3	33	188	444	391
	d		-	4	24	26	
1997	r			2	11	27	
	p			3	27	153	
	E			5	38	180	159
	d			1	5	10	
1998	r				2	11	
	p				4	31	
	E				6	42	37
	d				1	2	
1999	r					3	
	p					5	
	E					8	7
	d					-	

Legend: r=repeaters, p = promotes, E = enrolment, d = dropouts

Calculation of Internal Efficiency of the School System (First Level) Using Figures Given above and the Formula given in the Text for Determining the Total Enrolment and the Number of Graduates

Size of the cohort (N) = 1,000

	I	II	III	IV	V	VI
Repeater Rate (%)	9.0	6.4	5.5	6.9	5.9	6.1
Dropout Rate (%)	7.2	2.5	6.7	11.0	12.9	5.8
Promotion Rate (%)	83.8	91.1	87.8	82.1	81.1	-
Graduation Rate (%)	-	-	-	-	-	88.1
Non-repeater Rate (%)	91.0	93.6	94.5	93.0	94.0	93.9
Progression Rate (%)	0.8953	0.9640	0.9431	0.8725	0.8647	

$$\text{Total Enrolment in Grade I} = \frac{N}{\text{Non-repeater rate of grade I}} = \frac{1000}{91} = 1099$$

" " Grade II = 1099 x 0.8953 = 984
" " Grade III = 984 x 0.9640 = 948
" " Grade IV = 948 x 0.9431 = 894
" " Grade V = 894 x 0.8725 = 780
" " Grade VI = 780 x 0.8647 = 674

Enrolment in the System (TE) = 1099 + 984 + 948 + 894 + 780 + 674 = 5379

Number of Graduates Produced (G) = Enrolment in the last grade x graduation rate
= 674 x 88.1
= 594

$$\text{Measure of Internal Efficiency} = \frac{\text{Total Enrolment in the System}}{\text{No. Of Graduates Produced x duration of the course}}$$

$$= \frac{5379}{594 \times 6} = \frac{5379}{3564} = 1.50926$$

The Apparent Cohort Method

In this method the enrolment in grade 1 in a particular year is compared with enrolment in successive grades during successive years and it is assumed that the decrease from each grade to the next corresponds to wastage. This method, the most commonly used so far, produces very approximate estimates of dropout; but its main weakness is that it assumes that children are either promoted or else dropout of the school system. Repetition is thus ignored and therefore a factor, very often of paramount

importance, is overlooked. The difference between considering the repetition factor and neglecting, but it is clear that the estimation of wastage by this method is incorrect. A still more questionable application of this method consists of using cross sectional year-grade data (i.e., enrolment in all grades in a single year).

An alternative approach, suggested by J.D. Chesswas, mainly consists of calculating the rations of the enrolment in a grade in a given year to the enrolment in this previous grade in the previous year (defined as 'progression' rate) for all the grades and for all the years in a time-series data. In spite of the limitations mentioned above namely, the ignoring of repetition), in those cases where data on repeaters are not available the apparent cohort method can naturally provide some indications as to the working of the education system and particularly with regard to transition. The complement to transition, however, should not be confused with educational wastage.

The Reconstructed Cohort method

When the enrolment by grade and the pupils repeating each grade in each year are known, it is possible to derive the rates of promotion, repetition and dropout. In other words, we can reconstruct the school 'history' for each grade from one year to the following year. Two major phases lead to the reconstruction of a cohort) (a) the computation of the relevant rates – promotion, repetition and dropout; and (b) their application on a year-by-year basis to establish flow diagram.

When the enrolment by grade and the pupils repeating each grade in each year are known, it is possible to derive the rates of promotion, repetition and dropout. In other words, we can reconstruct the school 'history' for each grade from one year to the following year. The example below shows the empirical treatment of the statistical data in the case of India.

Year and category	Total all grades first level	*Grade*				
		1	2	3	4	5
2001						
Total Enrolment	25,86,288	1019967	628069	408427	298992	230833

Of which repeaters	4,82,400	246532	125036	58811	32592	19429
2002						
Total Enrolment	27,33,432	1056066	659476	449154	317862	250874
Of which repeaters	4,84,884	244402	118862	64053	35112	22455

The above data call for various comments. First they indicate the total number of newcomers into first level education. This is in fact the net intake of the educational system and is obtained by subtracting the corresponding repeaters from grade 1 enrolment, as follows

Year	Grade 1 Enrolment	Minus	Grade Repetition	Equals	Newcomers into the Level
2001	1019967		246532		773
2002	1056066		244402		811664

Secondly, we can derive the proportion of repeaters (not to be confused with the rate of repetition which will be defined below), which in itself is a very useful piece of information. This is obtained by dividing the repeaters by the enrolment in its corresponding grade, thus we estimate the proportion of repeaters in grade 1 in 2001 at 24.2 per cent (i.e., 246532/1019967), which means that 24.2 per cent of the pupils enrolled in first grade in 2001 were repeaters. The following table shows the proportion of repeaters in each grade, for 2001.

Year and category	Total all grades first level	*Grade*				
		1	2	3	4	5
2001	18.7	24.2	19.9	14.4	10.9	8.4
2002	17.7	23.1	18.0	14.3	11.0	9.0

Thirdly, we can reconstruct the movement of each grade from one year to the following year, thus showing the dynamics of the education system. This may be compared to the 'apparent cohort' method. We could, by this last method, estimate a transition from 1 to grade 2 of 64.7 per cent (i.e., 659476/1019967) and, consequently, a dropout of 35.3 per cent (i.e., 100.0-64.7 per cent).

This data, in fact, is distorted and the data available in the extract from the statistical questionnaire enables a logical reconstruction to be opposed to the apparent ratio.

If we consider the 1,019967 pupils enrolled in grade 1 in 2001 we can make the following estimations:

a) It is true that the following year (2002) there were 659476 in the following grade (grade 2). But, of these, 118862 were repeaters and therefore came from grade 2 in 2001. Thus, only 540614 (i.e., 659476 – 118868) came from grade 1 in 1967 and can be considered as promoted.
b) In 2002 there were 244402 pupils who repeated grade 1 and, by definition, came from grade 1in 2001.
c) If we subtract from grade 1 enrolment in 2001 (i.e., 1019967) the pupils promoted and the pupils repeating (i.e., 540,614 + 244,402 = 785016), it appears that there are as many as 234951 pupils who are no longer at school the following year and we can consider them as dropouts.

Activity:
• An educational survey using cohort method has been conducted in Tamil Nadu. Read the report and make a brief review of it.
• Identify the educational problems/ contexts where cohort method can be used effectively, discuss in your groups and make a presentation.

Module Ten

INTERRELATIONSHIP STUDIES
CORRELATIONAL STUDIES

Getting started

After going through this module, you will be able to:

- Understand the meaning and the nature of Correlational Studies in the field of Education.
- Explore the need for Correlational Studies in various issues related to Education.
- Identify the studies that are correlational in nature.
- Identify the variables that are related to each other in education context.
- Hypothesize the relationships between certain variables based on certain experiences and assumptions.

Correlational studies – Meaning and Importance

Correlational studies are a type of descriptive research concerned with determining the extent of relationship existing between variables. Correlational studies can be either prediction studies or relationship studies. In prediction studies, the researcher is interested in using one or more variables to project performance on one or more other variables. For example, kindergarten test scores can be used to predict first grade test scores, if there is a strong relationship between the two sets of scores. In prediction studies, it is important to be aware of any other variables related to performance on the criterion variable. Relationship studies usually explore the relationships between measures of different variables obtained from the same individuals at approximately the same time to gain a better understanding of factors that contribute to a more complex characteristic.

It is important to realize that the correlation coefficient can range between ±1.00. The closer the correlation coefficient is to ± 1.00, the stronger the relationship. A positive correlation means that the two variables increase or decrease together. For example, a positive correlation might exist between age and reading skills, meaning that older

children tend to exhibit higher reading skills. A negative correlation means that the two variables differ inversely; that is, as one goes up, the other goes down, For example, reading skills may be higher for children with less severe hearing loss – for example, as hearing loss goes up, reading skills go down. If the correlation coefficient is near zero, no relationship exists. For example, lip reading ability might be unrelated to reading skills in deaf children.

A word of caution should be noted here regarding the inadvisability of assuming cause and effect from correlational data. It is possible to calculate a correlation coefficient between any two sets of numbers, but they may not hold a logical reason to be related to each other. For example, read the following statements and decide whether there can be any logical relationship

Between the variables stated.

- The height of students and their achievement
- Religion of the students and their interest in science
- Weight of the students and their aptitude to music

Generally the relationship between variables is found and such a situation is called zero order correlation situations. We use product movement correlation formulae to find out this relationship. On the other hand the relationship between one dependent variable and many (usually not more than 10 to 11) independent variables could also be found out. Such a situation would use multiple correlation (R) formulae. For example, students' achievement (dependent variable) may be related to a number of other variables such as Home environment, parents' educational back ground, SES, study habits, teacher effectiveness, instructional facilities ((independent) and so on.

In addition whether it is a two variable situation or a multiple variables (one dependent and many independent) situation the calculation of correlation may be under the assumption of linear situation or a curvilinear situation.

In correlation the variations that occur in one variable (usually the dependent variable) due to the variations that occur in the independent variable are found out. The magnitude of the relationship is found out by the use of the coefficient of correlation. The relationship may be positive or it may be negative. The relationship between intelligence and performance or the relationship between extra diet and the increase in

weight are positive relationships. The relationship between time and speed, or the relationship between fatigue and learning are negative relationships.

In the case of a two variable correlation situation you have a dependent variable and an independent variable. It is presumed that such a relationship exists. When such a situation is examined, the influence of the dependent variable on the independent variable is kept in pending and it is only the influence of the independent variable on the dependent variable that is explored. Correlation is not causation, since the independent variable does not cause the dependent variable.

Correlational studies are easy to conduct. It involves collection of data on two or more sets of measurements of a sample of subjects and computation of the correlation coefficient between these sets of measurements.

As has been given already the relationship between two variables is direct in the sense if one variable increases the other also increases. This is a situation of positive correlation. There may be indirect relationship between these two variables where the correlation is negative. Sometimes there will be no relationship between the variables. The correlation coefficients ranges between + 1 to – 1. Positive perfect correlation is a + 1 situation and negative perfect correlation is a – 1 situation.

Need for Correlational Studies

The correlational approach is especially useful in the problems of education and the other behavioural sciences. Its principal advantage is that it permits measuring a number of variables and their interrelationships simultaneously. In the experimental research, we see that it permits the manipulation of only a single variable and is most applicable to the problems of the physical sciences in which simple causal relationships are found much more frequently than in the behavioural sciences. As you all know in behavioural sciences, we deal with the human beings rather than inanimate objects. In the behavioural sciences, instead of a single direct cause, we are frequently confronted with situations in which a large number of variables are contributing causes of a particular pattern of behaviour. For example, if person A is having a personality problem, it is attributed to so many factors such as home background, emotional environmental in home, person's self esteem, experiences undergone and so on. In the correlational

approach, though less rigorous, permits the studying of behaviour in a far more realistic setting unlike the experimental set up where the situation is artificial because of the control of variables in a strict sense.

Another advantage of the correlational approach is that it provides us with information concerning the degree of relationship between the variables being studied. For example, if we are studying the relationship between the health status and the nutritional intake of students, we not only know that there is a relationship between both, but also know to what extent the health status is influenced by the nutritional intake of students.

The causal-comparative studies which also comes under the interrelationship studies also deals with the relationships and the causes behind the differences that are observed. For example,

A study involved with teaching ability generally start with the identification of a group of good and poor teachers. Comparisons are then made between the two groups on a number of dependent variables in order to identify possible causes for differences in teaching ability. It is obvious, however, that such a dichotomy is artificial because, within both of these groups of teachers, some will certainly be better than others, and these differences in degree are ignored when using the causal-comparative approach. In reality what we have in this population is not two groups of teachers of distinctly different, ability but a single group ranging in degree of teaching ability from very poor to very good. Furthermore, certain characteristics might be more important at some levels of teaching ability than at others. Knowledge of the degree of relationships, as provided by the correlation coefficient, can therefore give us deeper insights into the relationships we are studying than are possible with research designs that do not yield some estimate of degree.

Steps involved in conducting correlational research :

The following steps are used in conducting a correlational research

1. Identify an appropriate problem.
2. Identify variables to be included in the study.
3. Identify the appropriate research participants.

4. Collect quantifiable data.
5. Analyze the data and interpret the results.

1. Identify an appropriate problem: The first step in correlational research, as in all other approaches, is to identify an appropriate problem. Remember, correlational research can be either for prediction purposes or to explain relationships between variables. Steps for conducting a relationship study are explained here, and the following section contains information specific to prediction studies.

2. **Identify variables to be included in the study:** The second step in a relationship study is to identify the variables to be included in the study. The variables in correlational research are sometimes called explanatory or predictor variables instead of independent variables , because they are not experimentally manipulated. The dependent variable is then termed the outcome or criterion variable.

One advantage of correlational research is that several variables can be included in one study (more easily than in experimental or causal comparative designs). (Of course, the number of variables is moderated by sample size. The recommended number of participants per variables is 15, at a minimum). However, the choice of variables should be done using a theoretical framework rather than a shotgun approach (Gall, Gall, & Borg, 2003).

3. Identify the appropriate research participants: In order to identify appropriate participants, Borg and Gall (1989) suggest that the groups be homogeneous or that subgroup analyses by done, because variance in the criterion variable may be explained by different sets of variables for different subgroups, For example, in explaining the dropout behaviour in children at elementary level could be socio –economic and the cultural factors .

4. **Collect quantifiable data**: Collect data according to the variables to be studied. Sometimes the causes for certain kinds of behaviour may be explored by collecting the data based on the hypotheses formulated. For example, a questionnaire can be developed to identify why the children have dropped out .The questions may be centered around the

economic, social and the cultural factors, as well as on factors such as teacher, school, instruction , motivation and so on.

5.**Analyze the data and interpret the results:** For the purpose of analysis and interpretation, the researcher has a number of options for correlational analysis, including simple correlation, regression analysis, multiple regression analysis, discriminate function analysis, canonical correlation, path analysis, and factor analysis. For simple correlational survey studies , one can use product moment coefficient of correlation or Rank order correlation.

Some of the examples of correlational studies

- Relationship between the students intelligence and achievement (any subject)
- Relationship between the students' achievement in science and their scientific interest.
- A study of home factors on the achievement of students
- A study of school factors on the achievement of students
- Relationship between job satisfaction of teachers and their performance in teaching
- Relationship between the attendance of students and the mid day meal programme in schools.

Similarly, you can study relationships among different variables that are operating in the education environment. You can study relationships among the teacher factors; school curriculum; instructional materials; and parents and community support to school education and different other variables that are associated and interact with the main research elements. Some of the variables in the educational context which can be associated relevantly and studied are: achievement, attitude, interest, socio and economic back grounds, cultural back ground, age, occupation, and training experiences, types of schools, medium of instruction, syllabus , home background and so on.

Following are some of the benefits of conducting correlational studies.

- The concept of correlation is fundamental to prediction based on association among variables. It must be realized that correlation is not synonymous with

causation; correlation simply implies concomitance. It is used to predict scholastic success by utilizing available data, or special data from the use of aptitude or prognostic tests.

- It is used to measure the strength of association or the degree to which variation in one factor, or set of factors, is associated with variation in another factor, or set of factors, is associated with variation in others.
- It may be used to predict teaching success and select teachers according to a composite criterion of teaching success, which is secured through the technique of multiple correlations, taking into account of many variables at once.
- It may also be used to analyze cause and effect. For example, from observing typing classes you have decided that the most of time spent in glancing away from the copy is inversely related to typing speed. To test this hypothesis, you may have the students type the same copy. After recording the typing speed of each student and the amount of time spent in glancing away time and discover that a negative correlation exists *i.e.*, the lower the typing speed a student achieves, the more time he spends glancing away from his copy.
- It can also help in predicting school population, which is a necessary aspect of educational planning (number of enrolment, number of drop outs, number of retained etc.)
- It helps in fundamental research through (a) the construction of data-gathering tools e.g. tests, and the determination of their reliability and validity; (b) factorial analysis *i.e.* an analysis of some psychological phenomenon like intelligence.

Some of the drawbacks of correlational studies are as follows :

- Coefficients of correlation do not represent percent of anything. They are pure mathematical symbols and should never be mistaken for anything else.
- They are not to be interpreted in a linear sense *i.e.* a coefficient of 80 is not to be regarded as twice as high as a coefficient of 40.

- Errors of measurement are important factors and should always be accounted for. These errors, if variable and if not correlated with the magnitude of the measurements, will lower the calculated value of r.
- Size of' r' depends largely on the range of measurements used in the calculation. That is, a higher correlation will be found between the mental age of pupils and their chronological age if we collect the data, for example, eight grades than if we use the data from a single grade.
- Allowance must be made for a sampling variation in the magnitude of r with the help of the measure of Probable Error.
- If any two traits that are being correlated happen to be ratios with a common denominator, such as age of pupils, the resulting correlation coefficient will probably be spuriously high for ordinary purposes. It must not be used as an indication of the relationship between the numerators.
- A big R between factors in social sciences denote only occurrence – not causation necessarily. Partial Correlation and Analysis of Variance might be useful devices in such cases.
- Series of data in education are not good measures of what they are presumed to measure, so that the relationship found, though true within the limits of sampling fluctuation for the data used, may not represent well the relationship between the factors which one desires to study.

Activity
1.Below are given a few areas .Identify the variables that are in operation in these areas. Plan a correlational study involving those variables and write the statement of problem.
• School climate • Factors influencing teachers attitude towards teaching profession • Class room environment • Parental involvement in effective school functioning • Role of village education committee, • Role of head masters • Learning problems in mathematics/science • Indiscipline problems in schools
2. Below are given two correlational studies. Analyse the problems and list down how these studies can be carried out. • Relationship between teacher competence and learners achievement in mathematics at primary level in Dharmapuri District of Tamil Nadu • A study of environmental awareness and environmental attitude of students at secondary level in Karnataka

Module Eleven

EXPERIMENTAL RESEARCH

Getting Started

In this module, the nature and the simple types of Experimental Methods in Education that can be used by the field practitioners are discussed. After going through this section, you will be able to:

- Understand the nature of Experimental Method and its related concepts ;
- Recognise the role of control, manipulation, observation and replication in Experimental Method ;
- Realize the value of Experimental Method in Education ;
- Identify the educational problems in school context in which experimental methods can be followed.
- Formulate Experimental designs for each of the problems identified.

Experimental method – Nature and Related Concepts

Before we go into the details of experimental designs in education, it is necessary to know the concepts of experimental research and experimental design.

- **Experimental Research** - In an experimental research an attempt is made by the researcher to maintain control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may occur.
- **Experimental Design** – An experimental design is a blueprint of the procedure that enables the researcher to test his hypothesis by reaching valid conclusions about relationships between independent and dependent variables. It refers to the conceptual framework within which the experiment is conducted.

Significance of Experimental Design in Education

Experimentation is the classic method of the science laboratory, where elements manipulated and effects observed can be controlled. It is the most sophisticated, exacting and powerful method for discovering and developing an organized body of knowledge.

Although the experimental method finds its greatest utility in the laboratory, it has been effectively applied within non-laboratory settings such as the classroom, where significant factors or variables can be controlled to some degree. The immediate purpose of experimentation is to predict events in the experimental setting. The ultimate purpose is to generalize the variable relationships, so that they may be applied outside the laboratory to a wider population of interest.

Experimental design provides a systematic and logical method for answering the question, "If this is done under carefully controlled conditions, what will happen?" Experimenters manipulate certain stimuli, treatments, or environmental conditions and observe how the condition or behaviour of the subject is affected or changed. Their manipulation is deliberate and systematic. They must be aware of other factors that could influence the outcome and remove or control them, so that they can establish a logical association between manipulated factors and observed effects.

Experimentation involves testing of hypotheses. When once the problem is identified and defined in a precise and comprehendible manner, the experimenters propose a tentative answer, or hypothesis related to the problem. They test the hypothesis and confirm or disconfirm it in the light of the controlled variable relationship that they have observed. It is important to note that the confirmation or rejection of the hypothesis is stated in terms of probability rather than certainty.

Essentials of Experimental Research

Experimentation can be considered as a technique of deliberately staging a situation designed to force nature to provide a "yes" or "no" answer to a specific hypothesis concerning the phenomenon under discussion. If experimentation is to provide a meaningful solution to a problem, it is essential that the experiment contain, within itself, the means for answering its own questions. This, in turn calls for the satisfaction of four basic and interrelated conditions – *control, manipulation, observation*

and replication. Unless these conditions are fulfilled, the experiment cannot be interpreted for it cannot eliminate the possibility that the results obtained were caused by factors other than that under investigation.

Control: refers to the extent to which different factors in an experiment are accounted for. The main purpose of control in an experiment is to arrange in which the effect of variables can be measured. For example, if you wanted to study the effectiveness of ABL programme over the conventional method of teaching in science, you have to frame two groups of students who are identical in every aspect in which they are taught science in a particular class (say class VI).since it is impossible to have two absolutely identical groups of students, you may have to establish two groups that are as identical as possible in respect to those variables that are related the achievement in science. For this you will have to select the variables like, intelligence, aptitude in science, motivation , study habits and so on. Thus in experimental research, the researcher has to direct his efforts towards controlling the variables which are related to dependent variable.

Manipulation refers to a deliberate operation of the conditions by the researcher . Here, the researcher sets the stage for the occurrence of other factor whose performance is to be studied under conditions in which all other factors which might complicate the observation are controlled or eliminated . For example, if you are studying the effect of ABL approach to learning, the ABL approach which you are manipulating is known as independent variable or treatment variable experimental variable. since the effect of ABL approach is seen on the achievement of students, the achievement becomes the dependent variable.

Observation: In the experimental research the effect is observed of the manipulation of the independent variable on the dependent variable. The dependent variable, therefore, is scores on a test or observations with respect to some characteristics of the behaviour of the subjects used in the experiment. For example, if one wants to study the effect of ABL programme on the students' achievement in language , the ABL programme becomes the independent variable which is manipulated according to the experimental set up and the requirements. The effect of ABL programme (independent variable) may be observed on

the dependent variable i.e; achievement of students in language. Selecting tools that are appropriate to measure the outcomes of the effect of the independent variable carries out observation.

Replication: No matter how carefully one attempts to control all the factors that might influence the results on the basis of which the operation of the independent variable is to be appraised, nor how randomly the methods and the subjects are assigned to the experimental and control groups, slight discrepancies invariably remain. These are taken care of through the replication of the study, which, in essence, is a matter of conducting a number of sub-experiments within the framework of an overall experimental design. Thus rather than comparing a single control case with a single experimental case, the investigator makes a multiple comparison of a number of cases of the control group and a number of cases of the experimental group, all within the same experiment.

Methods of Experimental Control

a. **Physical Control :**

- Gives all subjects equal exposure to the independent variable.
- Controls non experimental variables that affect the dependent variable.

b. **Selective Control** : Manipulate indirectly by selecting in or out variables that cannot be controlled.

c. **Statistical Control** : Variables not conducive to physical or selective manipulation may be controlled by statistical techniques (example: covariance).

Validity of Experimental Design

There are two ways of validating the experimental design which are as follows.

Internal Validity asks

"did the experimental treatment make the difference in this specific instance rather than other extraneous variables?"

External Validity asks

"to what populations, settings, treatment variables, and measurement variables can this observed effect be generalized?"

There are certain factors that affect the internal and the external validity of the experiment which are as follows.

Factors affecting Internal Validity

1. The events occurring between the first and second tests in addition to the experimental variable which might affect the measurement.

***Example*:** A researcher conducts an achievement test before and after a 5 day programme on environmental education using innovative methods of teaching. During the intervention, two films on environmental education by a private organization was screened and results of the study may be affected because of this interference. One cannot be sure if the achievement profile of students on environmental education (high or low) is due to the programme intervention or due to the films shown on the theme in between the experimental phase.

2. Sometimes the students or the subjects under the experimental treatment become tired after completing a training session, and their responses on the Post-test are affected. Sometimes when the research is initiated, the age of the subjects may be around 12 years. Because of some reason or the other, the experiment gets postponed or delayed unduly, during which the subjects of the study would have grown by one year more. The process of maturing which takes place in the individual during the duration of the experiment which is not a result of specific events, but of simply growing older, growing more tired, or similar changes can also affect the results of the experiment.

3. Sometimes the effect created on the second measurement (post test) by having a measurement before the experiment can affect the results. For example, Subjects take a Pretest and think about some of the items. On the Post-test they change to answers they feel are more acceptable. Experimental group learns from the pre-test.

4. Sometimes Changes in instruments, calibration of instruments, observers, or scorers may cause changes in the measurements. For Example, Interviewers are very careful with their first two or three interviews but on the 4th, 5th, 6th become fatigued and are less careful and make errors.

5. Groups are chosen because of extreme scores of measurements; those scores or measurements tend to move toward the mean with repeated measurements even without

an experimental variable. For example, students who are performing poorly are selected for the experimental treatment. Their average Post-test scores will be higher than their Pre-test scores because of statistical regression, even if no experimental treatment was given.

6. Different individuals or groups would have different previous knowledge or ability, which would affect the final measurement if not taken into account. For Example, a group of subjects who have viewed a TV programme on wild life conservation is compared with a group, which has not. There is no way of knowing that the groups would have been equivalent since they were not randomly assigned to view the TV programme.

7. The loss of subjects from comparison groups could greatly affect the comparisons because of unique characteristics of those subjects. Groups to be compared need to be the same after as before the experiment. For example, Over a 6 month experiment aimed to change the reading ability of Tamil speaking students in English, 12 students drop out of the experimental group and none drop out of the control group. Not only is there differential loss in the two groups, but the 12 dropouts may be very different from those who remained in the experimental group.

Factors affecting External Validity or Generalizability

1. Individuals who were pretested might be less or more sensitive to the experimental variable or might have "learned" from the pre-test making them unrepresentative of the population who had not been pre-tested. For example, prior to viewing a film on Environmental pollution, a group of subjects is given a 30 item test on environmental pollution. Taking the Pre-test may increase the effect of the film. The film may not be effective for a non pretested group.

2. The selection of the subjects determines how the findings can be generalized. Subjects selected from a small group or one with particular characteristics would limit generalizability. Randomly chosen subjects from the entire population could be generalized to the entire population. For *example*, a Researcher, requesting permission to conduct experiment, is turned down by 11 schools, but the 12th school has granted permission. The 12th school is obviously different than the others, because they accepted. Thus subjects in the 12th school may be more accepting or sensitive to the treatment.

3. The experimental procedures and arrangements have a certain amount of effect on the subjects in the experimental settings. For example, the teachers may realize that they are being studied for their attitude towards new system of education and try to guess what the experimenter wants and respond accordingly rather than respond to the treatment.

4. If the subjects are exposed to more than one treatment then the findings could only be generalized to individuals exposed to the same treatments in the same order of presentation. For example, a group of teachers are given training in dealing with disabled children followed by training in dealing with slow learners. Since training effects cannot be deleted, the first training will affect the second.

Steps in Experimental Method

The steps of the experimental method are essentially those of the scientific method. For the sake of clarification, they may be listed as follows:

- Identify and define the problem.
- Formulate hypotheses and deduce their consequences.
- Construct an experimental design that represents all the elements, conditions, and relations of the consequences.
- Select sample of subjects.
- Group or pair subjects according to the sampling procedure followed.
- Identify and control non experimental factors.
- Select or construct, and validate instruments to measure outcomes.
- Conduct pilot study.
- Determine place, time, and duration of the experiment.
- Conduct the experiment.
- Compile raw data and reduce to usable form.
- Apply an appropriate test of significance. Interpret the results
- Verify the hypotheses. Accept or reject the hypotheses based on the evidences of the results obtained.
- Write the report

EXPERIMENTAL DESIGNS

Experimental designs very in complexity and adequacy, depending on such factors as the nature of the problem under investigation, the nature of the data, and the facilities for carrying out the study, and especially, the research sophistication and competence of the investigator. Although there are a number of combinations of the various experimental procedures, only few are discussed here , so as to empower the SSA functionaries and the other field practitioners for their practical use n the field.

- The single-group design,
- The parallel-group design,

The Single-Group Design

The single-group experiment is the most elementary and least rigorous design. It consists of comparing the growth of a single group under two different sets of conditions , that is, of subjecting the group successively to an experimental and to a control factor for equivalent periods of time and then comparing the outcomes. The procedure involved is as follows:

Example 1

Let the problem be : Effectiveness of cooperative learning on the achievement of students in mathematics of std VII.

Using the single group design, a batch of standard VII students may be administered a pre test on environmental awareness. Following the pre test, the students may be taught a few classes of environmental education. This may be followed by a post test in which the same test which was administered as a pre test is administered again. The gain between the pre and the post test scores shows the effectiveness of the environmental awareness programme.

Example 2

- Test the group; introduce Method A; test the group again; and note the gains.
- Allow for a period of transition.

- Test the group again; introduce Method B; test the group once more; note the gain.
- Compare the gains in 1 and 3.

This experimental design has a number of limitations that need to be clearly recognized. On the favourable side, it permits an experiment to be conducted by a teacher in his own classroom without assistance, and on the surface, since the same group and the same teacher are involved, it seems to make a fair attempt at equating the factors of the ability and background of the subject and the general characteristics of the experimental situation. On the other hand, this does not necessarily establish experimental control; the students may not be equally motivated by the two methods nor is the teacher necessarily equally effective and enthusiastic about both. The novelty factor is also uncontrolled.

The one-group method of experimentation is relatively inadequate, except for purposes of crude experimentation, in as much as it fails to comply adequately with the requirements of control and replication. One might go as far as to say that the single-group experiment is not research at all, for it is doubtful if one group's performance on a task can act as its own control for previous achievement under different conditions. Equally faulty is the common one-group experimental design based on the comparison of the growth of the experimental group with that of the norm group on which the test was standardized. This design also would lack control since the norms of the test were not derived under experimental conditions. An extension of the one-group technique consists of having a group alternate from Method A to Method B, back to Method A, and perhaps back again to Method B, at periodic intervals. Such an approach, while undoubtedly a little more dependable, is still subject to essentially the same criticism as attributed to the method in general.

The Parallel or Equivalent-Group Design

A more adequate experimental design is the parallel or equivalent-group technique in which the relative effects of two treatments are compared on the basis of two or more groups, which are equated in all relevant aspects. In an educational experiment,

the groups being com pared generally are equated on chronological age, IQ, motivation, sex, general scholarsh p, general background, and any other factor considered relevant to the problem under investigation. The basic design of parallel-group experimentation might be represented as follows:

Equivalent groups

	Experimental group	*Control group*
1.	Pre-test	Pre-test
2.	Treatment	No treatment
3.	Post test	Post test
4.	Comparison of gains	

Example : Let us see how the earlier problem can be worked out under the Equivalence group design.

Steps:

1. Select two equivalent groups based on extraneous variables like age, IQ, SES, and the std/class.
2. Consider one as the experimental group and the other as the control group.
3. Give a pre test of achievement on selected units according to the needs of the study to both the groups.
4. Record the achievement scores of the two groups.
5. Administer the treatment (teaching through cooperative learning or t inquiry or activity based method) to the experimental group and the teach the control group as usual (mostly conventional method as practiced regularly).
6. After the experimental treatment is over, administer the achievement test (which was given prior to the treatment) as post test to both the groups.
7. Record the scores of achievement of both the groups.
8. Study the gain scores from the pre to post test of both the groups.
9. Compare the two gains statistically (applying two tailed test of significance) which show the difference between the two mean scores obtained between pre and post test performance of students.

10. Going through the results obtained in steps 8 and 9, it can be determined whether cooperative learning was effective or not.

Here equivalence of the groups has been established, by the matched pair technique by matching the groups on some variables. Such a design can generally provide reasonably dependable conclusions relative to the operation of a given factor, and, of course, the greater the control exercised, the greater the precision of the results.

On the other hand, an equivalent-group design based on matched pairs suffers from obvious practical difficulties. Despite the fact that there tends to be a correlation among the usual bases of pairing–for example, IQ, mental age, scholarship, and pre-test scores, invariably only a fraction of the members of a population can be paired on a multiple basis with any degree of precision. In a school situation where it is possible to shift students from one class to another, a few more pairs can generally be located, but invariably a substantial segment of each class matches no one in the other group, and the investigator is almost forced to exclude them from the study. This not only reduces sample size but also may introduce artificiality into the situation by reducing the class size below normal enrolment. If the unmatched students are simply allowed to remain in the class but are not included in the experiment, they introduce a disturbing effect, which can invalidate the experiment. In an extended study there is also a possibility that subjects will dropout from one or the other of the two groups, forcing the removal of their mates – thus reducing sample size and decreasing the precision of the experiment.

From an administrative point of view, it is more convenient to match groups rather than pairs where two groups are considered equivalent when they have equal means and equal standard deviations in each of the variables considered relevant to the purposes of the investigation.

Analysis of Covariance : In certain situations, it may be impractical to get matched pairs. Then the investigator can resort to a statistical way of equating the groups through using ANCOVA. (Analysis of Co-variance).

This technique is a procedure, which permits statistical adjustments to be made in the dependent variable in order to compensate for any lack of equivalence between the

groups in the independent variables. For example, in the study of academic growth associated with different teaching methods, analysis of covariance would permit an adjustment to be made in the test gains for slight differences that might exist in the IQ levels of the groups.

In practice, the investigator first attempts to obtain general equivalence of the groups in such major factors as IQ, since, obviously, no statistical technique will permit a precise adjustment for the effects of IQ on academic achievement when the two groups consist one of slow learner, and one of geniuses. If only a small discrepancy is involved – either due to failure to equate the groups completely in the first place or due to dropouts , an adjustment can be made through analysis of covariance that will permit the comparison of the two groups on the dependent variable, as if they had been equated.

Precautions to be taken

While conducting experimental research, the following precautions are to be taken:

- The subjects should be representative as to the age, sex, grade, intelligence, etc.
- Such subjects should be selected as are reasonably expected to be available throughout the period of the experiment.
- The number of subjects should be adequately large to allow for losses for elimination on account of absences from one or more tests.
- The materials must be appropriate to the subjects and the experimenter.
- The place in which the experiment is to be conducted must be typical of the situations to which the results of the experiments are expected to apply.
- Appropriate measuring instruments should be used.
- Since the effectiveness of teaching learning in any classroom situation can rarely be attributed to a single factor, it is very essential to exercise great caution in interpreting the resulting experimental conclusions. The basic conditions of 'other things being equal' are difficult of fulfillment in educational research. Besides the control group and the experimental group are never as identical as they ought to be for an exact experiment.

Some of the uses of an experimental method are:

- ***Establishing direction of causality*** – The most important advantage of the experiment is that the relationship that you actually observe is clear in its casual directional
- ***Low cost*** – Compared to that of alternative research methods, the laboratory cost of a laboratory experiment can often be low.
- ***Convenience*** – An experiment can be done whenever you like, to suit your convenience.
- ***Adjustability of variables and parameters*** – Unlike a survey, an experiment permits us to arrange the parameters and vary the variables in whatever fashion we desire, to look for whatever effects interest us.
- In experimentation we can systematically refine the relationship we are investigating.
- ***Replication*** – By repeating (replicating) an experiment, we can obtain an average result; our conclusion is not based on a single observation that might be unusually high or unusually low. Replication is one of the most useful tools in obtaining valid results.
- ***Unraveling Multivariable Causation*** – If two independent variables are closely related in the world outside the laboratory, a survey cannot easily determine which of them causes variation in the dependent variable. A laboratory experimenter can track down the extent to which each is responsible for change in the independent variable because the laboratory experiment hold some factors constant as it varies others and *vice versa.*

Some of the limitations that the experimental are:

- ***Extraneous Variables*** – In educational experiments, a number of extraneous variables are present in the situation or are generated by the experimental design and procedures, which influence the results of the experiment in ways which are difficult to evaluate.
- ***Concept of Causation*** – Causation means an invariant one-to-one relationship between certain antecedents and certain consequents. It is almost impossible

to equate into situations in all respects except for the factor whose effect is being investigated.

- ***Experimental Control*** – Imposed control in an educational situation tends to make it artificial.
- ***Maturation*** – There is every possibility that between initial and subsequent observations, children may become tired or wiser or influenced by incidental learning and experiences that they encounter through normal maturation.
- ***Testing*** – Testing may sensitize children by making them more aware of the concealed purposes of the researcher and may serve as a stimulus to change.
- ***Unsuitable Instruments*** – Use of unsuitable instruments or techniques to describe and measure various aspects of behaviour of children is likely to affect the validity of an experiment.
- ***Differential Selection*** – Selection bias is represented by the non-equivalence of control and experimental groups.
- ***Contamination*** – Contamination is a type of bias introduced when a researcher has some previous knowledge about the children involved in an experiment.

Experimental method can be followed by the educational functionaries if they wanted to try out certain new schemes or approaches or programmes related to certain policy implementations with careful and systematic planning and monitoring at frequent intervals with the help of the teachers who are the class room practitioners.. This method can be followed, if some innovative practice has to be implemented and tested for its effect. If it proves to be an effective method, it can be tried out in many contexts and situations. For example, studies such as the following can be experimented for their effective use at a large scale later.

- Trying out a new method of teaching such as ABL or cooperative learning, or constructivist approach to teaching and learning
- Implementation of continuous and comprehensive evaluation and its effectiveness in improving the achievement of learners.
- Improving reading and the writing ability of students in language through using the materials prepared.

- Implementation of different remedial teaching techniques on children with learning difficulties in maths/language and their effectiveness .
- Effect of self learning materials on the students' achievement in science.

Activities
• Identify some research problems in school education, and discuss how using single group design or parallel group design can carry them out.
• Review some of the experimental researches in education and identify the designs that have been used.
• Do you as an education personnel visualize some problems in carrying out the experimental research in schools? If so, list those problems and discuss in your groups. What are the types of problems that can be foreseen? (for example, are they administrative in nature? large class room size? Lack of cooperation from teachers? Lack of encouragement from higher authorities? Lack of confidence in carrying out a research? Lack of adequate competence in planning and executing? Not able to visualize the problems tenable for research? And so on) . Discuss the possibilities of overcoming those problems and make a presentation in front of the whole group.

Module Twelve

DATA GATHERING TOOLS AND TECHNIQUES

This module discusses about the different types of tools that are helpful in gathering research data of various kinds under different sections. observation as a tool of research with different techniques that can be used in different contexts are discussed. The tools that can be used to record the observations as well as which serve as the inquiry forms are discussed with examples. The rating scale, with its characteristics, and the different types such as Numerical, graphic, and descriptive graphic scales are provided with examples. The checklist and the anecdotal records and the other tools such as photographic record, time sampling observations etc have been discussed with examples from the field contexts. The questionnaire with different types, procedure involved in construction , interview techniques, focus group discussion and scales such attitude and value measurement, inventories are discussed by highlighting their features, construction details and the contexts in which they can be used with examples. The activities provided in the module aim to generate in the participants an ability to analyse and evaluate the contexts to decide upon the kind of tools to be used and to apply the procedures in constructing the tools for collecting the data required.

Getting started

After going through this module, you will be able to

- Understand different types of research tools that can be used in different types of educational research carried out in different contexts.
- Understand the characteristics of a good measuring tool.
- Understand that observation can be used as an effective technique in research contexts that provide both quantitative as well as qualitative data.
- Identify the contexts in which different types of research tools can be used..
- vise or plan different types of research tools suiting the objectives of the research and the contexts.

- Apply or administer the constructed research tools in different types of research contexts.
- Analyse the different types of research tools which are available and used by the Education functionaries for their characteristics, purposes and validity.

Introduction

To carry out any types of research, data must be gathered for which tools are essential. There are different types of tools particularly appropriate for certain sources of data, yielding information of the kind and in the form that can be most effectively used. This module describes in detail, the different types of research tools, which can be effectively used in educational research under different sections.

Section 1

Why research tools are required to gather information or data?

In a scientific research, the scientist designs the study, which involve the study of a few variables, which he may manipulate under experimental conditions. During experimentation process, the scientist uses various tools, or equipments that may measure the results of the experiment. In social sciences and Educational research we deal most of the times with the human variables to study different types of conditions or contexts, or human behaviour. As carried out in scientific research, it may not be possible to control or to manipulate variables in a strict experimental condition, as the very nature of discipline and the contexts with which we interact are very unique with different characteristics. Above all, the human beings are not constant variables whom we can control and manipulate in the directions we like in order to produce the desired results. In such cases where the individual and the social phenomena are under investigation, there are many factors that play a role, which may not be possible to control or manipulate by the researcher. However, the research designs are evolved in educational and psychological research in such a manner that they take care of the limitations and help to arrive at the research findings as objectively and scientifically as possible. A various types of tools are used depending on the purpose and the context of the study. The research tools used in educational research help in

- ❖ Providing information about the context / the environmental conditions in which the study is implemented
- ❖ getting information about the individuals' attitudes and opinions regarding certain ideas, issues, events , people etc.
- ❖ Observing individuals to study their behaviour related to the variables of the study
- ❖ Exploring and inquiring into various phenomena related to the individuals, society, resources and materials
- ❖ Studying the group phenomena to study the interactions, and different group dynamics behaviour
- ❖ Providing information about the institutions, quality of different aspects of education and gives direction for necessary modifications and for future action measures

There are many more ways in which the research tools help a researcher. You may explore the different ways in which the research tools have helped you in the past in knowing the educational contexts and the improvement measures that have been adopted at the state level towards the quality betterment of education at different levels.

Before getting to know about the different types of research tools, it is necessary to understand about the characteristics of a good research tool which is discussed in the following subsections of this module.

Characteristics of a good research tool

Research is always dependent upon measurement of some kind or the other. There are two important characteristics that every measuring instrument should possess, i.e., the validity and the reliability of a tool.

Validity and Reliability

Validity

The validity question is concerned with the extent to which an instrument measures what one thinks it is measuring. It is absolutely essential that the researcher ask the following kinds of questions regarding the use of instrument.

- ❖ Does this test really measure what is intended?
- ❖ Does this test measure other qualities as well?
- ❖ Could one make useful predictions based on scores of this test?
- ❖ Is it an appropriate instrument for use with all students or should it be used only with certain groups?

The question of a tool's validity is always specific to the particular situation and to the particular purpose for which it is being used. A test that has validity in one situation may not be valid in a different situation. The purpose for which the test is being used is also a major factor in validity. Both logical and empirical approaches are employed in determining validity. Validity of a tool can be analyzed in different ways depending upon the purpose. The types of validity that can be used in standardizing a tool are Content validity, Criterion- validity and Construct validity.

The content validity question is- how does the content of the test sample the subject matter domain about which conclusions are to be drawn? This approach measures the degree to which the test items represent the domain or universe of the trait or property being measured. In order to establish the content validity of a measuring instrument, the researcher must identify the overall content to be represented. Items must then be randomly chosen from this content that will accurately represent the information in all areas. By using this method the researcher should obtain a group of items that is representative of the content of the trait or property to be measured.

Identifying the universe of content is not an easy task. It is, therefore, usually suggested that a panel of experts in the field to be studied be used to identify a content area. For example, in the case of researching the knowledge of teachers about a new curriculum, a group of curriculum and teacher education experts might be asked to identify the content of the test to be developed. This type of validity is to be established in case of achievement test

The criterion-related question is- with what criteria do scores on the test correlate and how will do they correlate? What kind of performance can be predicted from this test? This approach is concerned with detecting the presence or absence of one or more criteria considered to represent traits or constructs of interest. One of the easiest

ways to test for criter on-related validity is to administer the instrument to a group that is known to exhibit the trait to be measured. A panel of experts may identify this group. A wide range of items should be developed for the test with invalid questions culled after the control group has taken the test. Items should be omitted that are drastically inconsistent with respect to the responses made among individual members of the group. If the researcher has developed quality items for the instrument, the culling process should leave only those items that will consistently measure the trait or construct being studied. For example, suppose one wanted to develop an instrument that would identify teachers who are good at dealing with abused children. First, a panel of unbiased experts identifies 100 teachers out of a larger group that they judge to be best at handling abused children.

The researcher develops 400 yes/no items that will be administered to the whole group of teachers, including those identified by the experts. The responses are analyzed and the items to which the expert identified teachers and other teachers responding differently are seen as those questions that will identify teachers who are good at dealing with abused children.

The construct-validity questions are- what psychological or educational constructs does the test measure? What is the relationship between the content and the rationale of the test? There are two parts to the evaluation of the construct validity of a test. First and most important, the theory underlying the construct to be measured must be considered. Second the adequacy of the test in measuring the construct is evaluated (Mason and Bramble, 1989). For example, suppose that a researcher is interested in measuring the introverted nature of first year teachers. The researcher defines introverted as the overall lack of social skills such as conversing, meeting and greeting people, and attending faculty social functions. This definition is based upon the researcher's own observations. A panel of experts is then asked to evaluate this construct of introversion. The panel cannot agree that the qualities pointed out by the researcher adequately define the construct of introversion. Furthermore, the researcher cannot find evidence in the research literature supporting the introversion construct as defined here. Using this information, the validity of the construct itself can be questioned. In this case the researcher must reformulate the previous definition of the construct.

Once the researcher has developed a meaningful, useable construct, the adequacy of the test used to measure it must be evaluated. First, data concerning the trait being measured should be gathered and compared with data from the test being assessed. The data from other sources should be similar or convergent. If convergence exists, construct validity is supported.

After establishing convergence the discriminate validity of the test must be determined. This involves demonstrating that the construct can be differentiated from other constructs that may be somewhat similar. In other words, the researcher must show that the construct being measured is not the same as one that was measured under a different name.

The researcher must always evaluate the validity of an instrument to be used in a study. It is important to know what use is to be made of test scores. A test may be valid for one use and invalid for other uses. The construct validity may be established in case of attitude scale construction

Reliability

The reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring. This duality is essential in any kind of measurement. A researcher must ask, "How consistently does the test measure whatever it does measure?" No test can have validity unless it measures accurately and consistently, i.e., unless it is reliable specifically, reliability refers to the extent of which an individual remains nearly the same in repeated measurements that may be indicated by a high reliability coefficient. The reliability coefficient shows the extent to which random errors of measurement influence scores on the test. There are a number of types of reliability.

Test-Retest Method

One of the easiest ways to determine the reliability of empirical measurements is by the retest method in which the same test is given to the same people after a period of time. The reliability of the test (instrument) can be estimated by examining the consistency of the responses between the two tests.

If the researcher obtains the same results on the two administrations of the instrument, then the reliability coefficient will be 1.00. Normally, the correlation of measurements across time will be less than perfect due to different experiences and attitudes that respondents have encountered from the time of the first test.

The test-retest method is a simple, clear-cut way to determine reliability, but it can be costly and impractical. Researchers are often only able to obtain measurements at a single point in time or do not have the resources for multiple administration.

Alternative Form Method

Like the retest method, this method also requires two testing with the same people. However, the same test is not given each time. Each of the two tests must be designed to measure the same thing and should not differ in any systematic way. One-way to help ensure this is to use random procedures to select items for the different tests.

The alternative form method is viewed as superior to the retest method because a respondent's memory of test items is not as likely to play a role in the data received. One drawback of this method is the practical difficulty in developing test items that are consistent in the measurement of a specific phenomenon.

Split-Halves Method

This method is more practical in that it does not require two administrations of the same or an alternative form test. In the split-halves method, the total number of items is divided into halves, and a correlation taken between the two halves. This correlation only estimates the reliability of each half of the test. It is necessary then to use a statistical correction to estimate the reliability of the whole test. This correction is known as the Spearman-Brown prophecy formula (Carmines & Zeller, 1979)

$$Pxx'' = 2Pxx'/1+Pxx'$$

where Pxx" is the reliability coefficient for the whole test and Pxx' is the split-half correlation.

Example

If the correlation between the halves is .75, the reliability for the total test is:

$Pxx'' = [(2)\ (.75)]/(1 + .75) = 1.5/1.75 = .857$

There are many ways to divide the items in an instrument into halves. The most typical way is to assign the odd numbered items to one half and the even numbered items to the other half of the test. One drawback of the split-halves method is that the correlation between the two halves is dependent upon the method used to divide the items.

Internal Consistency Method

This method requires neither the splitting of items into halves nor the multiple administration of instruments. The internal consistency method provides a unique estimate of reliability for the given test administration. The most popular internal consistency reliability estimate is given by Cronbach's alpha. It is expressed as follows:

Where N equals the number of items; equals the sum of item variance and equals the variance of the total composite. If one is using the correlation matrix rather than the variance-covariance matrix then alpha reduces to the following:

$$\text{alpha} = Np/[1+p\,(N-1)]$$

Where N equals the number of items and p equals the mean interterm correlation.

Example

The average Interco relation of a six-item scale is .5, and then the alpha for the scale would be:

alpha = 6(.5)/[1+.5(6-1)]

= 3/3.5 = .857

An example of how alpha can be calculated can be given by using the 10 item self-esteem scale developed by Rosenberg (1965). (See table) The 45 correlations in the table are first summed: .185+.451+.048+ . . . +.233= 14.487. Then the mean interterm correlation is found by dividing this sum by 45: 14.487/45= .32. Now use this number to calculate alpha:

Alpha = 10(.32)/[1+.32(10-1)]

= 3.20/3.88

= .802

The coefficient alpha is an internal consistency index designed for use with tests containing items that have no right answer. This is a very useful tool in educational and social science research because instruments in these areas often ask respondents to rate the degree to which they agree or disagree with a statement on a particular scale.

Cronbach's Alpha Example

Questions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	2	2	2	3	4	5	2	1	2	4
2	1	1	2	4	5	5	1	2	2	2
3	1	2	2	5	5	4	1	2	2	1
4	3	2	2	2	1	3	2	2	2	2
5	5	5	5	4	4	3	3	2	3	4
6	1	1	1	1	5	1	1	1	1	1
7	2	2	2	2	2	2	2	2	2	2
8	2	1	2	2	4	1	3	3	1	1
9	5	5	1	1	1	2	1	2	5	4
10	4	3	3	3	1	2	1	1	3	4
N	10	10	10	10	10	10	10	10	10	10
	26	24	22	27	32	27	17	18	23	25
	2.6	2.4	2.2	2.7	3.2	2.8	1.7	1.8	2.3	2.5
	90	78	60	89	130	98	35	36	65	79
	22.4	20.4	11.6	16.1	27.6	19.6	6.1	3.6	12.1	16.5
S^2	2.5	2.3	1.3	1.8	3.1	2.2	.68	.4	1.3	1.8

= .917 .467 .337 .455 .014 -.146 .512 -.06 .74

=P = Mean Interitem Correlation

alpha = Np / [1+p(N-1)]

= (10)(.36)/[1+.36(10-1)]

= 3.6/4.24

=.849

This is usable in case of open-ended questions.

Inters corer Reliability: This can be done by having two persons independently score the same set of test papers and then calculating a correlation between their scores determined by the scores

Evidence of validity and reliability is very important, especially in Educational research, because most of the measurements obtained in this area are indirect. One needs to assess to what extent an educational or psychological measuring instrument measures precisely and dependably what is intended to measure. If a researcher's data were not obtained with valid and reliable instruments, one would have little faith in the results obtained or in the conclusions based on the results.

Activity:
Select a standardized achievement test that you have used in collecting data on any SSA project in which you were involved. Obtain the necessary validity and the reliability data on the test.

Section 2

There are different types of tools of research. They are broadly classified into the following categories.

1. Psychological tests
2. Observation
3. Inquiry forms
4. Sociometric techniques

In this section, the tools such as observation , and the inquiry forms which include questionnaire, rating scale, check list , attitude scales etc which are most commonly used in the educational research surveys are discussed.

1. Observation as a tool of research

Observation is used as one of the most important tools in certain research endeavors to build up knowledge systematically pertaining to that particular discipline. The term observation is used by a scientist in a different sense from that in which it is generally used. The data that form the central core of a scientific study and from which the results and conclusions are ultimately derived consists of observations. In Education and Psychology, observation may be made in two direct areas: i) concerning the situations to which individuals are exposed. ii) Concerning the response of persons to those situations.

Observation method may be described as a scientific technique to the extent that I) it serves a formulated research purpose, ii) is planned systematically rather than occurring haphazardly, iii) is systematically recorded and IV) is subjected to checks and controls with respect to validity, reliability and precision. It is a procedure for classifying and recording events according to some plan or scheme that is commonly referred to as the frame of reference of the observer. This technique is employed as a data gathering technique in many general and educational situations. In education, where teaching-learning situation form a center core, the classroom observation plays an important role. Besides this, observation can also be used to study children's behaviour in many contexts.

A. Meaning of Observation

A measurement for which the primary data source is the viewing of and/or listening to what occurs in a classroom or in a teaching-learning environment in a classroom observation. A classroom teacher can observe his/her pupils in a number of situations in the classroom, on the playground, in a social gathering, in a field trip, in the laboratory, etc. Observation is a method of evaluation, which requires an observer to record the activities, experiences and expressions of individual pupil either separately or in a group.

When collecting data for a research study, the researcher will undoubtedly need to observe phenomena he or use the observation of others. Here the term phenomena is sued to indicate that in educational research, the observations are derived from environmental

conditions, from behaviour, or from certain characteristics of the individuals, such as height, appearance and so on. These sources of observations are referred collectively as phenomena. The researcher's observation may take many forms and have different functions depending upon his specific purpose and frame of the investigation. The researcher may manipulate and observe phenomena whose variables he /she can control as is done in lab experiments or may observe phenomena over which he/she has little or no direct control. Hence there are different types of observations depending upon the purpose and the frame of research investigation, which are as follows.

B. Types of Observation

i. Direct and Formal Observation

When observation is restricted to selected aspects of individual's behaviour, and when records are made systematically and as objective as possible, this technique becomes an effective and a more reliable tool. this is known as the **Direct Observation**. It is a structure and a formal observation system, where the observer's attention is limited to certain preplanned set of behaviours to be observed.

Example: As a SSA member, you may be involved in assisting the teachers in their classroom instruction and assessment. You may observe the teachers' instructional behaviour directly under few categories like

a. How does the teacher motivate the students to the learning tasks?
b. How does the teacher provide instructions to the tasks to be carried out by the students?
c. How is the content transacted?
d. How are the students assessed?
e. How does the teacher encourage students' participation in the learning process?
f. In order to observe some of the teachers' classroom behaviour, it is essential to draw upon certain criteria before observing the teacher. In formal observation situations, the observer systematically plans what to observe, how much time to spend on observation, and the criteria under each aspect or behaviour to be observed. In this approach, the observer is well aware of the purpose of observation, and has a predetermined set of criteria of observation in the form of

schedule or a profile. The person who is being is observed is also aware of that he /she is being observed.

The guidelines required in direct observation are as follows:

- **Selecting the aspect of behavior to be observed.** An observer cannot notice everything that happens. Select first the behavior upon which the investigator wishes to focus.
- **Defining the behavior that fall within a category**. Know in advance what will or will not be classified as aggressive behavior, problem-solving behavior or any other classification of interest.
- **Training observers**. Observers must be trained for uniformity of interpretation and standard application of the observation categories.
- **Quantifying observations**. An observation system must include a standard method for counting behaviors.
- **Developing procedures to facilitate recording**. Procedures to facilitate recording must be developed to avoid errors of selectivity of memory. A useful technique is to develop a coding plan that enables observers to record their observations with a single letter or digit rather than in narrative form.

ii. Indirect and Informal Observation

Here the observation is carried out in an informal and in an indirect manner, where the person being observed is not aware of his/her behaviour being observed. As in the direct and formal observation, no predetermined or structured criteria or schedule is used by the observed. For example,

An Education officer might observe a teacher's pedagogic competencies and communication skills either in the classroom or outside the classroom without any predetermined or preplanned categories. The officer might just step into the situation without any purpose in mind to evaluate the teacher, and may learn about the teacher's skills informally as the situation emerges.

Observation about an individual may also be obtained through certain indirect approaches like self-reporting, self-assessment and other psychological tools.

iii. Participatory and Non- Participatory Observation

In the study of various aspects of social phenomena, the researcher may observe the individuals or groups of individuals or groups of individuals in situations to which they are exposed and their responses to those situations. The researcher may act as a member of the group (participant observer) or as an outsider (non-participant observer). If he is a participant observer, he commonly lives with or shares in the activities of the group under study, disguising himself to be accepted as a member of the group. By establishing favourable rapport with the group, he may observe what required for an extended period of time and collect wider range of materials. In non-participant observation, the observer remains aloof from the group, keeps his observation as inconspicuous as possible. Non-participant observations are difficult to make because the presence of an outsider may influence those observed to react somewhat differently or restrain from reacting spontaneously. Sometimes observation may also be made by using certain mechanical devices which can collect data about a group without being present or which permit the observer to observe without others knowing he is present. These devices include the one-way mirror, audio recorders and photographic equipments, which can provide records of events of as they occur.

Activity.
• Identify the situations/ contexts where the different types of observation described can be used.
• List the advantages and the disadvantages of a) Direct observation and b) Indirect Observation in the learning contexts of the schools with examples.

C. Certain basic guidelines to good observation

Although there are several observational techniques, there are certain basic guidelines, which are applicable to all of them. They are as follows.

a. **Obtain prior knowledge of what to observe**

Before approaching the situation, the researcher should decide what aspects of an individual's behaviour to be observed and recorded (excepting informal observation where observation is incidental sometimes).

b. **Examine general and specific objectives**

The formulation of the research problem and the specific variables needing investigation dictate what should be observed and provide some control over the observer. A review of related studies and the research which have a bearing upon the research study will also provide ideas as to what to observe and record.

Example: A study on teacher's performance in the classroom

i. A review of studies related to teacher's competencies, teacher behaviour, and so on will enlighten the researcher in knowing what characteristics of a teacher to be observed and recorded. Specifying the behaviour, interaction patterns or nay other phenomena to be studies as clearly as possible will enable the investigator to make an objective observation and record the same.
ii. Devise a method of recording results.
iii. Appropriate the timing and distribution of observation periods.
iv. Define and establish criteria.
v. Observe carefully and objectively.
vi. Rate specific phenomena independently
vii. Become well acquainted with recording.
viii. Record the observations promptly, so that none of the important details are forgotten or left out.
ix. Be conscious of the danger of misinterpretation through the confusion of different behaviours to be observed.
x. Generalization from observation should be arrived only after careful study.

In order to collect reliable observational data, it is usually necessary to train observers in the observation process. Such training along with

information on the reliability of the observational data, is included in most good observational studies, and should be looked into when research reports are reviewed.

Activity :
• Do you visualize that observation as a research technique can be used in some of your SSA activities. If so, list the situations in which it may be used.
• You must have used observation technique in some occasion or the other as a part of some of the research projects in which you have been involved or you must have used it during your supervision to the schools. What are the situations you observed and how did the data gathered through observation helped you to arrive at a conclusion about the observed situations /contexts?

Activity:
• Recollect your experiences in the field as an observer in some capacity or the other. Based on your experiences
• List some of the precautionary measures that a researcher must bear in mind while using observation as a tool in a research study.
• Do you visualize that observation as a research tool may be misused at times by the researcher? If so, list the ways in which it may be misused.

2. Tools of recording observed data

Observations may be recorded in several forms depending on their proposed uses. They are as follows:

Observational Tools

i. Checklists

ii. Rating scales

iii. Anecdotal records

iv. Periodic summaries

v. Photographic records and recording tapes

vi. Time sampling observations

vii. Observational schedules

viii. Self observation and self reporting

The above mentioned tools are discussed in detail with some examples in this sub- section of the Module.

3. Rating Scales

These are also known as inquiry forms as they try to provide information about the existing condition of a situation or the behaviour or traits of a person. These are the condensed method of recording quantitative and qualitative observations. Rating is a way by which numerous events that are observed are somehow summarized and combined. It is a device for obtaining judgments of the degree to which an individual possesses certain behavioural traits and attributes. Rating scales may be devised for evaluating a great variety of traits such as presence of certain competencies in teachers, their pedagogic styles, and certain personal and social traits of students such as generosity, leadership, co-operativeness, resourcefulness, emotional stability, discipline, civic sense, initiative, attitudes, interests and so on which imply qualitative assessment. It is the qualitative nature of evidence that cannot be rated quantitatively. In all these cases, the evidence has to be expressed in terms of the degree to which the particular behaviour or skill is present in a person.

Rating scales are also found for evaluating certain skills like, experimental skills, observational skills of students, handling equipments, playing on an instrument, handwriting, reading skills, etc. Typically, a rating scale consists of a set of characteristics or qualities to be judged and a scale for indicating the degree to which each attribute is present. There are different types of rating scales such as Numerical Rating Scale, Graphic Rating Scale, and Descriptive Graphic Rating Scale.

i. Numerical Rating Scale

This is the simplest type of rating scale which a classroom teacher can use, wherein the teacher can check or circle a number to indicate the degree to which a characteristic is present. Each of a series of numbers is given a verbal description which remains constant from one characteristic or another. This type is useful when the characteristics or qualities to be rated can be classified into a number of limited categories, and when there is general agreement concerning the categories represented by each number. Look into the following example given in environmental studies at primary level

Example : children are observed in an activity situation and rated as follows.

	Behaviour to be observed	**Name**	**1**	**2**	**3**	**4**	**5**
1.	Collects different materials/objects of various types.						
2.	Observes the materials carefully.						
3.	Follows the instructions systematically.						
4.	Classifies the objects into different categories						
5.	Sees the similarities and differences between objects						
6.	Generalises the characteristics of different matters						
7.	Records the information						

1. Outstanding, 2. Above average 3. Average
4. Below average 5. Unsatisfactory

ii. Graphic Rating Scale

Here each characteristic is followed by a horizontal line. The researcher can evaluate the student by placing a check or a cross on a line to indicate the presence or absence of a given trait. Various categories are marked on the line and the teacher is free to check between these points if he so desires.

Example :

1. To what extent the student is involved in the given activity in Environmental Studies ?

Never	Seldom	Occasionally	Frequently	Always

2. To what extent the students cooperates with his/her group while doing a task ?

Never	Seldom	Occasionally	Frequently	Always

iii. Descriptive Graphic Rating Scale

This rating form uses descriptive phrases to identify the pupils on a graphic scale. The descriptions convey in behavioural terms what the students are like. This scale is very useful in the sense that it clarifies to both the teacher and the pupil, the types of behaviour that represents different degrees of progress. The specific descriptions not only show the objectivity, but also helps in making efforts towards an improvement of a particular behaviour.

Example

1. To what extent does the pupil participate in the given activity ?

Never Participates	Participates when specifically asked to do	Participates actively as much as other group members	Participates more than other group members

Though Rating scales are considered to be one of the good means to obtain and record observation, a certain amount of control has to be exercised over the rating scale in order to make it a good tool for recording observation. Control could be exercised over both the nature of the information that is used, and the way in which it is used. Any rating procedure developed should be such that it can be communicated to others. The results of many studies that involve ratings produce only a mass of data to which there is little or no reason and from which no useful scientific knowledge is obtained due to lack of precision of event sot be observed. Hence it is necessary to control both the types of quantity and quality of information to be used by the rater and processing the information, so that the product is meaningful.

A few guidelines, which are the requirements of a good rating scale, are given as follows.

Requirements of a good rating scale

- Traits must be clearly defined, so that not only the researcher who evaluates would benefit, but also the other teachers who would like to use it. For this purpose, brief descriptions can be used with the descriptive graphic rating scales.
- Number of divisions on the scale should be optimum. They should not be more or few in number. Utmost they can be between 5 to 7.restrict each rating scale to a narrow range of behaviour that can be well defined.
- Researcher should be clear about his/her rating. That is, the rating should be supported with sound rationale and good judgment which will avoid careless rating on part of the teacher.
- The researcher should avoid certain errors which may affect the rating of the individuals. For example, personal bias affects the objectivity and the tendency to rate always either too high or low or avoiding both the ends. This will affect the objectivity of observation and recording.
- Change the ends of the scale so that the "good" end is not always at the top or always at the bottom of the scale.

- avoid words such as "average" in the middle range of the scale. The rater who does not wish to give too much effort to the rating procedure is likely to class too many as "average".
- In the directions, indicate the need for honest rating, and whenever possible, state that a low rating will not have a consequence for the person rated, either direct or indirect (this is applicable in case of indirect observation).
- Assure the rater that his anonymity will be safeguarded.

• **Activity:** • Prepare a Rating scale to record the teacher's questioning skills in the classroom. Prepare the criteria that is involved in questioning skills and the scale on which you would like to rate the teachers
• Discuss the three types of rating scales in your groups, and discuss their relative merits and demerits.
• you must have trained the teachers in your block to evaluate the skills in co-curricular areas and the personal and social qualities of children. What measures have you suggested to them to record their observation and assessment of students in the co-curricular areas and personal and social qualities? Do you think the teachers can adopt rating scale as one of the tools to record their observation? If so, which type of rating scale would you suggest to the teachers to follow and why.

4. Checklists

A checklist is often used in making observations to ensure that the observer looks for every bit of evidence that he has previously determined as essential. It should be prepared in advance of the observation, but should include blank space for recording the phenomena which were not anticipated. Though a checklist is similar in appearance and use to the Rating Scale, it differs in the type of judgment called for. For instance, a rating scale provides an opportunity to indicate the degree to which a particular characteristic or a trait is present in an individual. The checklist, on the other hand, calls

for a simple 'yes-no' judgment. It is fundamentally a method of recording whether a characteristic is present or absent. Following is given a checklist to measure the work habit of teachers

Example

A Checklist for Evaluating the Work Habits of Teachers

Name :

School

Names	Comes regularly to work	Takes classes regulary	Assesses students regularly	Plans for teaching regulary	Uses resources properly for teaching	Takes up responsibility in all school activities	Checks students home work regularly
T1							
T2							
.T3							
.T4							
.T5							
.T6							
.T7							

In making a checklist, the researcher must first decide what kind of behaviours are important enough to be recorded. One may break down the broad skills or content areas and broad personality traits into a large number of more limited and specific components. All that a researcher has to do is to observe the individuals in the contexts required and tick mark (✓) under 'yes' and 'no' category against the characteristic/attribute listed, as may be seen in the example format provided above.

Activity:
• Prepare a checklist to assess the teacher's skills in classroom instruction.
• Activity. Identify research situations where checklist can be used as a tool

5. Photographic records and recording tapes

These may be used to record the data required and to preserve them for an intensive study later. This helps the researcher in analyzing the activities or situations that could not be studied in detailed attention at the time they occurred or at the normal speed of their occurrence.

For example, in Activity based learning situation, the children doing the tasks in their groups and the teacher's role in facilitating the learning the activity-based learning may be photographed. Later they may be played back for an intensive study to know how students are involved in performing the tasks in the groups; are all students involved in the task; the participation and the discussion skills of students; social skills in the group; teacher's facilitation role in the group activities and so on.

A teacher's classroom behaviour may also be audio or video recorded to study the i) teacher's interaction with students, I) skills of teaching, iii) students' interaction with teacher, and the with the peer group, iv) handling of students' responses, v) experimental sills (if there is), vi) questioning skills and other aspects of teacher's behaviour which provide a picture of effective classroom teaching.

They also can be used to training observers to improve the reliability and validity of their observations.

6. Time-sample observations

This consists of recording of activities for a definite period at a particular time of a day. Through this, a researcher can obtain the evidence about the varying patterns of behaviour of an individual at different periods of the day.

For example, in order to know the study habits of a student, one can record everything a student does for a five or ten minutes during study session. A different student might be chosen another day and observed for the same time.

This technique requires main considerations like

a. careful selection of definition of the behaviour to be observed.
b. Careful limitation of the length of the period of observation
c. Multiplication of observations to be certain that the behaviour of the individual has been sampled in an adequate fashion.

d. Study of variables such as situation, time of day, and other factors, which may have influenced the behaviour.

7. Classroom observation schedule

The observation of the behavior in the classroom and in other complex situations usually requires the use of observation schedules. They should include no more items than the observer can remember and easily locate on the schedule. The schedule should usually refer to items of behaviour that occur with fair frequency. It should also be easy to recognize when an item of behaviour has or has or occurred. In most observation schedules, an attempt is made to measure the verbal communication and the other transactions that occur between the students and the teacher. Certain dimensions of teacher's behavior are measured through these schedules, thereby exploring the usefulness of those dimensions on teaching –learning contexts. A number of different techniques have been developed for recording classroom interactions.

An illustration of the observation schedule developed at Regional Institute of Education to observe the student teacher's classroom behaviour is given as follows.

Student Teaching profile (Science, Mathematics, Social Science)

Name of the school ---------- **standard** ---------- **Date**---------

Name of the student teacher **period time** ---------- **Subject/Topic**

Institute supervisor **Lesson.No**

	Aspect: criteria	Comments/suggestions	Rating scale
1.	**Lesson Plan**		**Poor** **Excellent** 1 2 3 4 5 6 7 8 9 10
1.1	**Content(teaching points)** a. clarity b. adequacy c. accuracy d. relevance		

1.2	**Instructional Objectives** a. clarity b. adequacy c. Accuracy d. relevance		
1.3	**Learning activities** a. appropriateness b. adequacy c. variety		
1.4	**Review and assignment** a. coverage of objectives b. continuous c. appropriateness d. techniques adopted		
2.	**Teaching learning process**		
2.1	**Lesson introduction** Appropriateness and effectiveness to arouse interest, method adopted		
2.2	**Development of lesson**		
	a. logical and sequential development b. use of appropriate skills and strategies c. adequacy and appropriateness of learning activities d effective explanation and questioning e pupil's participation f budgeting of time		
2.3	**Content competence** a. accuracy of the content b. use of appropriate examples/non-examples c. application in different situations		

2.4	**Teaching learning materials** a. appropriate and effective use of charts/models/maps etc. b. demonstration of experiments c. legible and effective use of Black board d. neat diagrams and sketches with proper labeling.		
2.5	**Review and evaluation** a. effective closure of the lesson b. attainment of objectives c. continuous evaluation d. relevance and variety of questions e. assignment (relevance, variety and interesting)		
3	**Classroom management**		
	a. overall appearance of the teachers b. communication and confidence c. democratic atmosphere of the class d. meeting the individual differences		
	Overall comments		

Name and signature of the supervisor with date

Activity.

- You may have developed some observation schedule to supervise the teachers in their classroom. Analyse the schedule to see if all the components of classroom behaviour are included, and also analyse the scale on which you rate the teachers. compare it with other observation schedules used in the other districts or institutions. Discuss the schedules in your groups about their merits and demerits for their improvement.

- What measures are taken to provide a feed back to the teacher about his or her classroom performance? Discuss.

8. Anecdotal Records

Anecdotal Records are cumulative notes of an individual's behaviour observed in typical situations, activities and experiences. Sometimes the quantitative data obtained through questionnaires or rating scales may not provide all details or give an insight into the research situation. The unique incidents that describe in detail about the person 's qualities may be sued in research, which can be analysed and reported qualitatively.

Anecdotes are the objective description of the behaviour. They are a series of notes on exactly what a child or a teacher said or did in concrete situations. An anecdotal record is a factual description of meaningful events which a teacher has observed of her/his pupils in everyday in and out of classroom situations. Each event is described shortly after it happens. A good anecdotal record consists of an objective description of an incident and includes an interpretation of the observed behaviour As the researcher goes on making successive observations, they become cumulative containing a variety and continuity of evidence which gives a clear picture of the child's behaviour pattern and growth, or the teacher's creative potentials for teaching , interests and attitudes, strength and weaknesses and problems. which can be used even by the researcher for further actions .

Example 1 (Record of student A)

Step 1 :

1. Student 'A' does not mix with other children in the class. He stands alone always.
2. Does not participate in the classroom discussion.
3. Feels nervous to speak to the teacher. Avoids the teacher as far as possible.
4. Does not show improvement in learning. Scores very less marks in all subjects. Every test show a marked decline of the pupil in almost all the subjects.
5. Does not do the home assignments given.
6. Does not respond to teacher's questions.

Step 2 :

7. In one Arithmetic class, he cried helplessly when he was asked to work out the problem on the blackboard.
8. Stammers, if he is forced to read aloud from a book or made to answer a question.
9. Does not involve in any activity. Never showed enthusiasm at any time to participate in any activity.
10. Always prefers to sit in the last bench. He looked very nervous and afraid, when he was asked twice or thrice by the teacher to sit in the front bench.

Teacher's Comment

Student 'A' is found to be having a personality problem. He feels nervous, shy and inferior and unable to mix with others. This is having an adverse effect on his learning and achievement. Because of his nervousness, he seems to be having a speech problem too. Hence steps should be taken to (i) meet his parents and have a frank discussions in order to know the causes, (ii) to help the student to overcome his problems, and become confident, social and aspirant in nature.

The anecdotal records may be developed in case of teachers also.

Precautions to be borne in mind while writing anecdotal record

- Make a record soon after the incident is observed. Otherwise, the observation becomes imprecise and distorted with the lapse of time.
- Do not interpret an incident out of context, other than in which it had occurred.
- Limit each anecdote to a brief description of a single specific incident.
- Keep the factual description of the incident and the interpretation of it separate.
- See to that the description of the incident as objective as possible. Avoid using terms like lazy, unhappy, shy, hostile, ambitious, etc. since such terms reflect your views, you may use such words when you interpret the behaviour.
- Collect a number of anecdotes on a pupil or a teacher before drawing inferences concerning the typical behaviour. Because a single behavioural incident does not say anything about an individual.. Everyone's behaviour fluctuates somewhat from situation to situation. For eg. Manu appears interested in Maths class, but disinterested in English class. Therefore, before arriving at any conclusion, it is better to observe him over a period of time and in a variety of situations.
- Record both positive and negative behavioural incidents.

Objectives that can be evaluated by anecdotal records

Objectives where anecdotal records are most valuable are in the areas of social adjustment, personal and emotional adjustment and growth and certain interesting behaviour , where the child or teacher may react in a novel way either through a discussion, or through responding to a question or through certain enquiries. Below are given a few examples of human behaviour which may be recorded and assessed qualitatively through anecdotal records.

Social Adjustment

Teacher's relationship with other colleagues

- Child's relationship with children
- Whether he works well with a group.
- Whether he leaves the group if he cannot get his own way.
- Quarrels with other teachers in meetings

- Whether he demands much attention or affection from others
- Adjusts well with juniors, but poorly with seniors.
- Fearful or antagonistic towards school Head..

Personal and Emotional Adjustment

- Whether the teacher is independent or dependent.
- His manners of meeting new situations.
- His assumption of responsibilities.
- His imitative nature in completing a task.
- His demonstration of certain interests and attitudes.
- His pattern of emotional reactions (cheerful, laughs, cries easily, hurries, fearful, enthusiastic is easily discouraged, displays temper tantrums).

Certain Professional achievements

- Something extraordinary in performing a specific skill (eg producing a creative material, designs an improvised experiment).
- Conducting a unique action research, which has great impact on learning situation, and attracts every body's attention in the field.
- Writes a research paper, which is a great contribution to school education and gets an award for it. Presents the paper in the national forums, which raises quite a lot of wonder and concern for the innovation.
- Prepares innovative materials, teaching aids and experiments, which are useful to improve learning of students.

Maintaining records of this kind will also help to diagnose certain special abilities or talents of each teacher which may be nourished. Besides you can provide a direction to the teacher in his/her future regarding further professional development.

Certain important standards for recording anecdotes

The following list includes some of the essentials for any anecdotal record keeping.

- Each entry should be dated, so that the sequence and lapse of time are clear when the record is reviewed to know about the person. Incidents should be recorded on the day on which they occur before memory of them becomes distorted.
- Each entry should contain some description of the situation in which the incident occurred, so that it can be properly interpreted.

Examples :

25.2.1996 During the class instruction

04.03.1996 In teachers meetings

07.03.1996 While discussing

- Entries should be objective reporting of facts as far as possible. The reporting of specific incidents should be based upon adequate facts observed. One should avoid making subjective statements of opinion concerning interpretation.
- Entries of incidents should reflect passive, inconspicuous or non-participating behaviour on the part of the researcher so as to give a true picture of the child or the teacher who is under observation..
- In case of a child, information about the child from parents may be obtained, since it may contribute clues to the interpretation of the child's behaviour.
- Adequate number and sequence of anecdotal entries upon which to base judgments and interpretations of behaviour is essential.

Methods of Recording Anecdotes

Anecdotal records may be prepared on simple formats. A sample format is given here.

ANECDOTAL RECORD	
Name of the teacher :	**school**
	Date : 29.3.08
A. Incident 1	
B. Interpretation	

Name of the Observer

The data obtained through anecdotal records may be interpreted qualitatively to arrive at any conclusions about the individual who has been observed. This forms a wealth of information which might have got lost, if any questionnaire or any other tool which have their own limitations in knowing the qualities of an individual is administered.

Activity :

- You must have come across certain incidents in schools related to teacher or student during your supervision or interaction period. You must have carried the incident in your mind and discussed later with your colleagues as a matter of academic discussion. Write down such incidents in detail and try to recollect how those incidents impressed you or affected you. What was your reaction to the incident?
- Plan an anecdotal record (if any unique situation or an incident occurs in schools which can tell you more about it and which may be of some research value). Try to follow up of the observation of the individual on whom the record was made to get more details. Follow the procedures given above and interpret .

There are other information gathering tools such as questionnaire, interviews and so on which inquire into the different contexts and provide information to the researcher. The following section deals with those techniques.

Section. 3

1. Questionnaires

A questionnaire is one of the most commonly used ways to collect data for a survey project or research. It is a device consisting of a series of questions dealing with some psychological, social, educational, etc; given to an individual or a group of individuals , with the object of obtaining data with regard to some problems under investigation. It is widely used in educational research to obtain information about certain conditions and practices, and to inquire into opinions of people. A questionnaire is either administered personally to an individual or it is mailed to them to save a great deal of time and money in travel.

The questionnaire can be classified in terms of the nature of the questions, which are used. They may be asked in a closed or an open form. Sometimes they be used in a combination too depending upon the purpose. The respondent is invariably permitted to reply with 'yes', or 'no', or is requested to select an answer from a short list of possible responses. He is asked to place a tick mark in a space provided on the answer sheet or he may be requested to underline a response . while using closed-type of question items, it is advisable to provide for unanticipated responses by allowing an 'open' category of response with a request to 'specify' or 'kindly mention'.

The open- form or unrestricted type of questionnaire calls for a free response in the respondent's own words. The form of the question is unstructured and no cues are provided to the respondent. The open form of questions provides for greater depth of response and the greatest advantage of this type of questions is freedom that is given to the respondent to reveal his opinion and to clarify his responses, however, the responses to such type of questions are sometimes difficult to quantify. But qualitatively one can report such responses. For example,

Open ended

"What did you like least about the session?"

"You have been trained in using activity base learning (ABL). In your opinion, what impact it has on children's academic improvement? If given a choice, would you prefer to continue using this method? And why what ever your response may be.

Closed

For example: Do you use corporal punishment in the class?(circle one) **Yes/No**

Here is a suggested process for constructing your own questionnaire.

Steps involved in construction of a questionnaire

Step 1 Write down the broad areas you want to cover in your questionnaire. Do not turn them into questions just yet. The point is to make sure you have covered all topic areas adequately

Step 2 Think about what you are trying to measure(knowledge, behaviour, information about school , learning conditions, availability of resources, needs and interests) The purpose will determine the style of question

Step 3 Write your questions. While constructing the questionnaire, the following be considered

- are all questions relevant and necessary? Is the language appropriate and specific enough?
- if self-administered (that is, the person fills in the questionnaire), are instructions on how to complete the questionnaire clear?
- is it well laid out on the page with space to write answers?
- is it too long? Long questionnaires are very tedious and strenuous for the respondents to answer

Step 4 gives it your colleagues and experts in the field for their observations and comments on the tool

Step 5 Get feedback on the questionnaire from colleagues or experts in the field.

Step 6 Modify your questionnaire based on comments from colleagues or experts. Keep the questionnaire simple and clear

Step 7 Pilot the modified questionnaire with a few people from the target group. Piloting means testing your questionnaire to make sure that there are no flaws in it and you are getting the information that you need. This is necessary to determine the extent to which the questionnaire fulfils the following criteria

- Does the questionnaire promote a congenial and appropriate relationship with respondents?
- Do respondents understand the questions without having to be explained or reworded?

Step 8 Validate the questionnaire by utilizing the principles and the procedures involved in validation of any tool. Find out the reliability of the tool by using test-retest method or split –half method. Establish the validly and the reliability values of the questionnaire.

Step 9 Administration of the questionnaire

Step 10 Analyzing and interpreting questionnaire responses

Quantification of data obtained by this tool is generally achieved through tabulation and counting. The totals are converted into proportions or percentages. The responses obtained through open-ended form is analysed qualitatively.

Some of the important points to be borne in mind while constructing a questionnaire

- Determine the purpose of the questionnaire
  Use the language appropriately so that it communicates what you intend to seek.
- Define terms that could be misinterpreted (for example, terms like, child-centeredness, activity based, curriculum, evaluation etc).
- Be careful of inadequate alternatives. For example, are you married? Just giving 'Yes' or 'no' does not refer to the marital status at present-whether separated or divorced and so on.
- Design questions that will give a complete response

- Keep the questionnaire simple and clear
- There are different ways to ask questions. Consider having a mix of question types.

There are certain things to be avoided while constructing a questionnaire. They are as follows

  - Asking two questions in one ('double-barrelled' questions).
  - Questions using unfamiliar technical language or strange words.
  - Questions that suggest an answer ('leading' questions).
  - Overly long questions

- Put sensitive questions later in the questionnaire
- Ensure questions are in a logical sequence
- Ensure questions will generate valid and reliable data
- Think carefully about how you are going to analyse the data and whether any of the responses can be quantified

Sometimes the questionnaires that are sent to the individuals either comes back without the responses or never returned to the researcher at all what could be the reasons? There are certain factors that may be affecting the questionnaires due to which they are not being responded.

Factors affecting the questionnaires

- Length of the questionnaire.
- Reputation of the sponsoring agency.
- Complexity of the questions asked.
- Relative importance of the study as determined by the potential respondent.
- Extent to which the respondent believes that his responses are important.
- Quality and design of the questionnaire.
- Time of year the questionnaires are sent out.
- The questionnaire often may be poorly organized and vaguely worded.

2. Interviews

Observations provide teachers, supervisors, and researchers with first hand direct practical experience to events and activities. Interviews provide channels through which teachers, supervisors and researchers gain second hand information about events, activities and thoughts experienced by others. Interviewing is one of the most important methods used in project planning and evaluation. An interview is a face-to-face meeting between two or more people where an interviewer asks questions to obtain information from one or more respondents. It is a well established method of data collection which is widely used by many researchers. The rapport established with the subjects provide for a co-operative atmosphere in which truthful information can be obtained. Sometimes interviews take place by telephone.

There are two main types of interviews:

- individual interview, where there is one interviewer and one respondent
- group interview, where there is one interviewer and several respondents

The interviews can be structured or unstructured, the details of which is given below.

Structured and Unstructured Interviews

a. **Structured Interviews**

Structured interviews are interviews in which the question and answer categories have been pre-determined. Specific questions are asked in a specific order. The interviewer uses a questionnaire that is followed exactly. Therefore, respondents are limited in how they can answer the questions. This type of interview can produce both qualitative and quantitative data. The advantage of this approach is that it is standardized and therefore the answers can be easily classified and analysed. Its disadvantage is that it is very formal and not flexible. Restrictions that one puts on this type of interview increases their reliability, but may decrease their depth

b. **Unstructured interviews**

Unstructured interviews have no fixed wording of questions or ordering of questions. The interviewer has a list of the main topics and some open questions (called 'probes') to be covered so that the interview does not go too far off track. Respondents have more scope in how they answer the questions. They are more informal, flexible and usually planned to suit the subjects and the conditions within which the interviews take place. The respondents are given freed on to go beyond simple responses to the questions asked and reveal their views in a manner they wish. This kind of interview requires expert, skillful, and alert interviewers. It helps to generate and clarify dimensions present in the topic under consideration. This type of interview generates qualitative data.

Example : In order to develop a science curriculum which is a learner- centered one the researcher might conduct unstructured interviews to find out the needs and the interests of students to learning different aspects of science. One more example to show how items are used in unstructured interview is as follows.

Example: About teaching

1. when you think back on your experience s of teaching this year, what things stand out in your mind as having gone particularly well?
2. what were the factors that made it difficult for you to teach effectively?
3. tell me about some particularly troublesome problems you faced during your teaching profession.

Activity.
• Here is an example of a research study where in the teachers opinions have to be sought regarding using the grading system at elementary level. Prepare a structured interview to obtain the above information.
• Prepare an unstructured interview to know about the perceptions of teachers about the professional satisfaction of school teachers

Interviews are sometimes classified into different categories according to their purpose. They are as follows.

1. **Survey interviews** are used to obtain information from persons considered to be authorities in their fields or representatives of groups about which information is desired. Sometimes they are also used to obtain opinions regarding certain issues. This type of interview is commonly used in surveying attitudes about educational programmes or about school climate, in determining views about quality of school education, and in collecting information or other problems which may affect policy and decision makers in educational institutions.
2. **Diagnostic interview** is to understand a problem, the causes that gave rise to it, its present status, and its seriousness.
3. therapeutic interview is to help an interviewer to understand himself and to plan appropriate therapy. This seeks to eliminate, or ameliorate, causal factors and to promote the improvement of the interviewers.' emotional life.
4. **counseling interview** is to enable the interviewer working together with the counselor, to gain greater insight into personal or vocational problems and to make sound plans to solve the problems.

It is obvious that of these four types of interviews, the survey interview has the greatest application for research problems in the field of Education, although some problems may require the use of the other types.

Some of the interviewing tips that you may follow while interviewing the subjects of your research investigation are given here

Interviewing tips

When collecting information through a personal interview, it is necessary to have a plan which takes into account not only the data required , but also the personalities of the researcher and the individuals to be interviewed. The following are some of the guidelines that can be followed while planning and carrying out the interviews.

- Determine who is to be interviewed. It is important for a researcher to determine at the outset how many he/she see in order to obtain sufficient information to serve as a basis for reliable generalizations and whether or not people are representative of the group being studied.
- Choose the right setting. Find a place that will be comfortable for the respondent. Determine who is to be interviewed.
- Be organised. Determine the questions to be asked.
- At the beginning of the interview explain who you are and why you want to do the interview, and how the information will be used.
- If you intend to use a tape recorder, ask first. Remember that some people do not feel comfortable speaking with a tape recorder running . Make a written record of the interview as soon as possible.
- Relax. If you do, there is more chance that the person you are interviewing will also relax
- If people are used to speaking in a language other than English or the local language (which you know) try to get an interpreter. The people belonging to tribal areas who are not very familiar with the standard local language may feel more comfortable with an interviewer who is from the same tribal place. So also the young people feel comfortable being interviewed by other young people and so on.
- Listen carefully. Be aware of your body language
- Do not express an opinion; remain impartial. Especially, do not argue
- When you get to the end of the interview, ask the person if there is anything else he/she would like to say or if there are any questions. Thank the person for his/her time and interest.

The following are the few functions of an interview as a data gathering tool.

i. It affords opportunities to observe individuals and groups in action and to learn facts, opinions, and beliefs which may vary with particular persons in particular circumstances.

ii. It may serve to corroborate data already obtained from various independent sources and to identify contradictions or discrepancies among sources.

iii. It can aid in theoretical evaluation of other sources of data and act as a check on the reliability of data obtained by other techniques.

Activity.
• List some of the survey research situations or contexts where interviews can be used to obtain information.
• Prepare an interview schedule to interview the teachers and students regarding the new text books that are introduced in the State.
• Prepare an interview schedule to interview the teachers to know about their opinions regarding the evaluation policy in the State..

Section. 4

3. Scales

A scale is a set of numerical values assigned to subjects, objects, or behaviors for the purpose of quantifying the measuring qualities. Scales are used to measure attitudes, values, and interests. They measure the degree to which an individual possesses the characteristic of interest. It is

- Used as a measuring instrument.
- Used to indicate a measuring instrument.
- Used to indicate the systematized numerals of the measuring instrument

There are scales used to measure attitudes, interests, personality traits , value, and so on.

In this section, the attitude scale and the value scales are discussed with examples.

1. Attitude Measurement

This is a kind of self-report inventory which is very useful in measuring the attitude of teachers, administrators, students, parents and other stakeholders who are involved in some way or the other in the education system. For example, we may wish to obtain measures of students' attitudes toward certain classroom activities, the textbook, laboratory experiences, or our own instruction, so that needed adjustments can be made. Some information concerning attitudes can, of course, be discovered by observation, but a more complete assessment requires that observation be supplemented by reports of the students' feelings and opinions. As a part of a survey research , sometimes we may want to study about teachers' attitude. For example,

In a research survey that intends to study the school factors and the teacher factors which influences the achievement of students, one may want to study the attitude of teachers towards teaching profession. This is a very important factor which affects teacher's instruction and consequently the students' achievement too. Likewise, there are several issues towards which we can measure the attitude of a person. Studying the attitude of a person towards an event, issue, system etc, will help sometimes not only to know what exactly the mental predisposition of that person is towards, but also helps in planning certain learning experiences or eventualities in a series, for that person, so that the person might improve upon his or her attitude through the exposure of fresh experiences which are positively directed.

Before venturing into the construction of an attitude scale, let us try to understand the meaning of attitude.

Attitude is an integral part of the personality (as to the way we think, feel, perceive, and behave toward a cognitive objective). We may feel and behave towards a particular issue depending upon the kind of attitude we have. For example, when a person having a favourable attitude and sensitivity towards environment, will never tolerate when trees are destroyed , or any harm done to the environment for human benefits.

There are different ways of measuring the attitude of an individual, like Thurston's "Method of equal-appearing intervals" and Likert's " method of summated ratings" and cumulative or Guttman scales.

The *summated rating scale* is a set of attitude items, all of which are considered of approximately equal attitude value and to which the subjects respond with degrees of agreement or disagreement (intensity). The scores of the items of such a scale are summed or summated and averaged to yield an individual's attitude score.

Equal-Appearing Interval Scales are used to scale the attitude items. Each item is assigned a scale value, and the scale value indicates the strength of attitude of an agreement response to the item. The universe of items is considered to be an ordered set, items differ in scale value. The scaling procedure finds these scale values. In addition, the items of the final scale to be used are so selected that the intervals between them are equal, a most important and desirable psychometric feature.

Cumulative or Guttman Scale consists of a relatively small set of homogeneous items that are unidimensional (or supposed to be). Unidimensional scale measures one variable and only one variable. The scale gets its name from the cumulative relation between items and the total scores of individuals.

Summated Rating Scales concentrate on the subject and their places on the scale, most useful in behavioral research. Equal-Appearing Interval Scales concentrate on the items and their place on the scale. Cumulative Scales concentrate on the scalability of sets of items and on the scale position of individuals.

The simple technique of measuring attitude is by using Likert's method summated ratings which is discussed as follows with examples.

Likert Scale

A simple and widely used self-report method for measuring attitude is to list clearly favourable or unfavourable attitude statements and to ask the students to respond to each statement on the following five-point scale: *strongly agree (SA), agree (A), Undecided (U), disagree (D), and strongly disagree (SD).* This is called a **Likert Scale**, named after its originator, and it is very easily constructed and scored. The construction involves the following steps :

1. Write a series of statements expressing positive and negative opinions toward some attitude object. For example, in preparing a scale to measure attitude toward school, a number of items like the following might be written.

- School is exciting.
- School is a waste of time.
- School is important only to get into higher education,
- If given a choice, I would never want my children to go to school.
- School helps not only in the knowledge gain, but also in the personality development of students.

To get a measure of student self-concept in mathematics, items such as the following might be used.

- I am good at solving mathematical problems.
- I usually cannot solve a new mathematics problem.
- I would like to try new problems which are not given in the text book.

A good pool of such items can be obtained by having the students in the class write several positive and negative statements.

2. Select the best statements (at least 10), with a balance of positive and negative opinions, and edit as needed.
3. List the statements, mixing up the positive and negative, and put the letters of the five-point scale (SA, A, U, D, SD) to the left of each statement for easy marking. For students at the elementary level, it might be best to list the five points in multiple-choice fashion with the words written out (e.g. *strongly agree).*
4. Add the directions telling students how to mark their answers, and include a key at the top of the page if letters are used for each statement (SA, A, U, D, SD).
5. Some prefer to drop the *undecided* category so that respondents will be forced to show agreement or disagreement. Others have expanded the scale by adding the categories *slightly agree* and *slightly disagree*. Although such changes might be useful for some purposes, the five-point scale is quite satisfactory for most uses. Here is an example of an attitude scale for children belonging to lower classes.

Things we do	I like a lot 	It's OK 	Don't like it 
Counting			
Adding			
Subtracting			
Story problems			
Math games			
Drawing shapes			
Measuring			
Telling time			
Making change			

See another example of an attitude scale to study the attitude of students towards science subject.

Example

Directions : Indicate how much you agree or disagree with each statement by circling the appropriate letter(s).

Key : SA – Strongly Agree; A – Agree; U – Undecided;
SD – Strongly Disagree

SA	A	U	D	SD	1.	Science classes are interesting.
SA	A	U	D	SD	2.	Science laboratory is dull and boring.
SA	A	U	D	SD	3.	It is fun working on science problems.
SA	A	U	D	SD	4.	Class activities are good.
SA	A	U	D	SD	5.	Reading the textbook is a waste of time.
SA	A	U	D	SD	6.	The laboratory experiments are interesting.
SA	A	U	D	SD	7.	Most class activities are monotonous.
SA	A	U	D	SD	8.	I enjoy reading the textbook.
SA	A	U	D	SD	9.	The problems we are studying are unimportant.
SA	A	U	D	SD	10.	I am *not* very enthusiastic about science.

6. **The try out**: the preliminary draft of the scale must be tried out as a pilot study on a sample of students who are selected from the population for which the scale has to be constructed. Each item , or statement as indicated in the example, is followed by five responses, one of which is checked by the subject. In some situations, 'approve-disapprove' are used in place of 'agree- disagree'. Arbitrary scoring weights of 5,4,3,2, and 1 are used for SA,A,UD,D and SD for the statements favouring a point of view. On the other hand, the scoring weights of 1,2,3,4,and 5 are used for the respective response for statements opposing this point of view. An individual's score on a particular attitude scale is the sum of his /her ratings on all items.

7. **Selection of items and preparation of the final draft.** In order to select the items and prepare a final draft, item analysis may be carried out. On the basis of scores based upon the responses to all statements, 25% of the students with the highest scores and 25% of the students with the lowest total scores are taken. These two groups provide criterion groups in terms of which to evaluate the individual statements. In evaluating the responses of high and low groups to the individual statements, a ratio of 't' is found out. The value of 't' is a measure of the event to which a given statement differentiates between the high and low groups. A t- value equal to or greater to a statement differs significantly. Finally, 20 to 25 statements with the largest t-values ($t>1.75$ are selected for the final draft of the attitude scale.

The other way of doing item analysis is by using the correlation method .The scores for each item is correlated with the total score. Only those items that correlates significantly with the total score are selected. The testing for internal consistency helps in eliminating the statements that are ambiguous or that are not of the same type as the rest of the scale.

2. **Value scale** is a culturally weighted reference for a thing or things for people, for institutions, or for some kind of behavior. Values express the good, bad, should, and ought of human behavior.

Example : Value scale (for students)

Below are given some pairs of statements. Each statement is important, but you have to compare to judge which statement is more important out of each pair. You have to make a cross(X) in the square box given against the statement which you think is more important. There are no right or wrong answers.

You would like to have concern for environment

- By using water judiciously ☐
- By not wasting paper ☐
- By discouraging other from damaging plants ☐
- By discouraging others from planting new trees ☐

- By protecting animals ☐
- By being kind to animals ☐

- By keeping your room clean ☐
- By keeping home surroundings clean ☐

- By respecting nature ☐
- By appreciating nature ☐

Dignity of labour can be observed if:

- One has readiness to do any job ☐
- One takes the job by status ☐

- One respects any kind of job ☐
- One takes simple jobs only ☐

- One concentrates on his job ☐
- One takes all the responsibilities ☐

- One is pleased to take any job ☐
- One thinks properly before taking the job ☐

- One has deep faith in himself ☐
- One has faith in co-workers ☐

- One tries till the success in his job ☐
- One tries once and withdraws from the job ☐

Semantic Differential

The semantic differential (SD) is a method of observing and measuring the psychological meaning of words, usually concepts. A SD consists of a number of bipolar adjective pair which are usually a seven-point rating scale. There are different types of SD scales- evaluative, potency and activity SD scale.

Evaluative scale include pairs, such as, good-bad, bitter-sweet, large-small, and dirty-clean. A second cluster has adjectives that seem to share strength or potency ideas (strong-weak, rugged-delicate). A third scale is called activity because its adjectives seem to express motion and action (fast-slow, hot-cold).

Steps in construction of Semantic Differential scale

1. Choose the concepts or other stimuli to be rated with bipolar adjectives. The researcher needs to choose a number of concepts that are relevant to the research problem. A sample of concepts must be judiciously chosen to represent some part of the semantic space.
2. Select appropriate scales or adjective pairs. Two main criterion determine the selection including factor representatives and relevance to the concept used.
3. The respondent may be asked to mark on the scale according to their feeling

The semantic differential is a useful technique for measuring attitudes and one's value preferences.

Example 1

Describe how you feel about the Primary **school curriculum in Tamil Nadu** by placing a check in one of the seven spaces between each word pair.

traditional ___ ___ ___ ___ ___ ___ ___ progressive

subject dominated ___ ____ ____ ____ ___ ____ ____child -friendly

systematic ____ ____ ____ ____ ____ _____ _____unsystematic

rigid ____ ____ ____ ____ ____ _____ _____ flexible

content-oriented ____ ____ ____ ____ ____ _____ _____ activity oriented

product oriented ____ ____ ____ ____ ____ _____ _____ process oriented

certificate oriented____ ____ ____ ____ ____ _____ ____application oriented

Section.5

Besides the tools what have been discussed in the preceding sections, there are other types of tools which help in gathering data of different kinds and types. Some of them are discussed here.

1. **Inventories**

Inventories are instruments that attempt to "take stock" of one or more aspects of an individual's behavior rather than to measure in the usual sense. Inventories have been used in educational research to obtain trait descriptions of certain defined groups such as underachievers, dropouts, members of minority groups, etc. They have also been used in research concerned with interrelationships between personality traits and such variables as intelligence, achievement, and attitudes, and interests

To validate an inventory, one must demonstrates that the scores obtained on it agree highly with some other reliable device for measuring the factor under study.

Following is an example which shows how an inventory can be developed.

Interest Inventories

As with attitude measurement, information about students' interests can be gathered from simple self-report devices prepared by the teacher. An interest inventory for reading, for example, might be no more than a list of types of books with the students asked to mark whether they like or dislike each type.

Reading Interest Inventory

Directions: For each type of book listed below, circle L if you like reading that type of book and circle D if you dislike reading that type. List any other types of books you like to read on the lines below :

L	D	1.	Adventure	L	D	10.	Mystery
L	D	2.	Animal	L	D	11.	Short stories
L	D	3.	Art	L	D	12.	Comedy
L	D	4.	Biography	L	D	13.	Romance

L D 5. Dance
L D 6. Health
L D 7. History
L D 8. Hobbies
L D 9. Music
L D 14. Science
L D 15. Science fiction
L D 16. Literature
L D 17. Sports

List if any other interest here ---------- ---------- ----------
---------- ---------- ---------- ----------

A simpler version of this inventory could be developed for students at the primary level by using broader categories (e.g. animals, people, places).

Various methods of responding can be used with informal interest inventories. The simple like – dislike response method can be expanded to more points, such as *like, indifferent, dislike* or *strongly like, like, indifferent, dislike, strongly dislike*. When there are relatively few items to respond to, the students can rank them in order from *list most* to *like least,* as in the following example :

Rank	**Type of Reading**
----------	Fiction
----------	Nonfiction
----------	Poetry
----------	Drama

The students are instructed to mark the type of reading that they most prefer in each pair. A simple tally of the number of marks for each type of reading will indicate the students' relative preference.

Using any of the preceding response methods, we can obtain an interest score for each individual student, or we can combine the results for the entire class. Although students can fake responses to informal interest inventories, they seldom do. There are

no right or wrong answers, and the results are usually used to plan classroom activities or to develop individual learning programs.

2. Conference

The Conference technique is another way of collecting data regarding a particular issue, or views regarding initiating a course, or introducing an innovative idea and so on. This involves face-to-face discussion of a topic of interest. For example, since few years there has been a lot of discussion about introducing grading system, especially after the national curriculum frame work- 2000 proposed the need for reforms in evaluation and examination system. In order to know about introducing grading system in schools at all levels, a conference may be organized. The steps that are followed in collecting data through this method are as follows.

- Experts are brought together at a common site.
- The group brainstorms to generate as many ideas on the problem as possible. The only rule regarding this step is that there are no negative reactions to any suggestions.
- The experts then evaluate and rate the suggestions.
- The most popular responses are determined, and an arbitrary number are chosen based on natural breaks or logic.
- Finally, the group discusses the strengths and weaknesses of the suggestions and ranks the final choices.

One major drawback to this method of data gathering is the influence of certain personalities as a strong factor in determining consensus.

3. Focus Group Discussion

The focus group discussion is a research tool that holds great promise for application in educational and psychological research to address research issues that cannot be adequately investigated through individual interviews or survey measures.

The focus group is unique from these other procedures; it allows for group interaction and greater insight into why certain opinions are held. Focus groups can

improve the planning and design of new programs, provide means of evaluating existing programs, and produce insights for developing marketing strategies.

Meaning of Focus group discussion

Focus group is an informal discussion among selected individuals about specific topics relevant to the situation at hand .One of the characteristics that distinguishes focus groups from other qualitative interview procedures is the group discussion. The major assumption of this technique is, it fosters a range of opinions, a more complete and revealing understanding of issues in a permissive atmosphere. They are the organized group discussion which are focused around a single theme. The goal is to create a candid, normal conversation that addresses, in depth, a selected topic or an issue

Focus group discussion are known by at least three names; focus group interviews, focused interviews and group depth interviews.

Characteristics

- The Focus group is an informal assembly typically composed of 6 to 10 people, but the size can range from as few as 4 to as many as 12. The members are requested to address a selected topic.
- It must be small enough for everyone to have opportunity to share insights and yet large enough to provide diversity of perceptions.
- It is conducted in series in Multiple groups
- The. Participants are reasonably homogeneous and unfamiliar with each other.
- A trained moderator with prepared questions and probes sets the stage and induces participants' responses.
- The goal is to elicit perceptions, feelings, attitudes, and ideas of participants about a selected topic.
- Focus groups do not generated quantitative information that can be projected to a larger population.
    - It produces qualitative data
    - It is a socially oriented research procedure.

- The format allows the moderator or the researcher to probe into issues, or points.
- The Discussions have high face validity with relatively low cost.
- The format can provide speedy results.
- Focus groups enable the researcher to increase the sample size of qualitative studies.

Some of the limitations of focus group discussions are :

- The researcher has less control in the group interview as compared to the individual interview.
- Data are more difficult to analyze.
- The technique requires carefully trained interviewers.
- Groups can vary considerably.
- Groups are difficult to assemble
- The discussion must be conducted in an environment conducive to conversation.

Types of Focus Group Questions

Opening Question. This is the round robin question that everyone answers at the beginning of the focus group. It is designed to be answered rather quickly (within 10-20 seconds) and to identify characteristics that the participants have in common. Usually it is preferable that these questions are factual as opposed to attitude or opinion-based questions.

Introductory Questions. These questions introduce the general topic of discussion and/or provide participants an opportunity to reflect on past experiences and their connection with the overall topic. Usually these questions are not critical to the analysis and are intended to foster conversation and interaction among the participants.

Transition Questions. These move the conversation into the key questions that drive the study. The transition questions help the participants envision the topic in a broader scope. They serve as the logical link between the introductory questions and the key questions. The participants are becoming aware of how others view the topic.

Key Questions. These questions drive the study. Typically, there are two to five questions in this category. These are usually the first questions to be developed and also the ones that require the greatest attention in the subsequent analysis.

Ending Questions. These questions bring closure to the discussion, enable participants to reflect back on previous comments, and are critical to analysis. These questions can be of three types:

1. *All Things Considered Question.* This allows the participants to state their final position on critical areas of concern.
2. *Summary Question.*
3. *Final Question.*

Use of focus groups

- Focus groups can be used alone or with other methods (qualitative or quantitative) for a wide range of purposes.
- Focus groups offer new dimension to data collection because of their emphasis on dynamic group interaction
- Focus groups can yield a great deal of specific information on a selected topic in a relatively short period of time.
- Focus group discussion/interviews is helpful in collection of four types of data:
    a. **range**: a full spectrum responses to a stimulus or issue
    b. **specificity**: detail about reactions and responses
    c. **depth**: a rich understanding of cognitive and affective responses and
    d. **personal context**: information regarding characteristics and experiences influencing responses

Focus groups can also be used to determine perceptions of individuals who participate in a research study.

Application in action research

As you are aware of, teachers have been encouraged to become actively involved in what is called Action research. In this , partnership of teachers, teachers and administrators, and teachers and DIET faculty members and teachers and university researchers have to be formed to explore research topics that are of interest to teachers and that have a bearing on class room practice. Possible uses of focus groups in action research include needs assessment for parenting workshops and student reactions to new interactional practices. Focus group discussions and interviews have the potential to elicit a great deal of information in a short period of time form those most directly involved, this method has a promise in action research. They are however not for the novice or inexperienced researcher, as there are many potential abuses of focus group discussions that can impact the validity of results as will as the relationships with participants and target audiences. Some of the situations in which Focus group discussions can be used are as follows.

Example 1: Teachers involved in ABL approach to classroom teaching can be interviewed in groups to find out their perceptions about the use of the method in the classroom- its success and limitations.

Example 2 : Similarly, focus groups provide an opportunity to obtain the perceptions and attitudes of key stakeholders regarding new policies in improving the quality of education.

Example 3 : Since few years attempts are being made to bring an awareness in teachers about continuous and comprehensive evaluation and grading system to be practiced in schools. In order to know teachers perceptions about CCE and grading system to be introduced in schools as a regular feature, one might arrange for focus group discussion of teachers in small groups and initiate discussion raising questions like

1. What are the problems involved in following CCE in schools?
2. can be it be used at all levels of school education without any problems ?

3. if problems are being experienced, what kind of problems are they- administrative, academic, personal, time management etc.
4. how does grading system might help students?
5. what are the problems that one can foresee in introducing grading system in schools?
6. does it reduce the teachers' authenticity and commitment in teaching and assessing children sincerely?
7. are the students and the parents convinced about grading system?
8. what are your (teachers) perceptions about introducing grading system in your state?

Activities

1. You are planning a programme to educate the teachers on AIDS Education. How might you use focus group discussion in planning and evaluating the programme.
2. construct research questions that would be appropriate to study the teachers belief systems in introducing value education in schools.
3. organize a focus group discussion to study the perceptions of teachers about the existing text books at school level in your state.
4. collect the research project samples conducted under SSA where focus group discussions are held to collect information related to the research project.

A researcher requires many data gathering tools and techniques which may vary in their purpose, complexity, design and administration and interpretation. Each tool is appropriate for the collection of certain type of evidence or information. The researcher has to select from the available techniques, which will provide data that he requires to test his hypotheses. Sometimes there are standardized tools available to test several abilities such as intelligence, achievement , creativity, attitudes, personality, vocational interest, and so on. Depending upon the nature of the study and the variables involved , the researcher has to decide upon the selection of such tools. A researcher has to be careful

while making a selection of standardized tools, because some of them may not be culture free ,and hence may not suit our Indian context and the purpose of the study. A careful planning, construction and validation of tools is essential as they play a very important role in collecting the kind of information that is required for the study.

Module Thirteen

DATA MANAGEMENT AND PROCESSING

Getting started

After going through this module, you will be able to

- Understand that the data of any research project is managed and processed based on the nature of variables and on the nature of scale of measurement.
  Differentiate between descriptive statistics of a data worked out for qualitative and quantitative data.
- Infer population values (parameters) from sample values (Statistics).
- Test hypotheses and to interpret results meaningfully
- Apply different Software programmes like SPSS, Nvivo, Microsoft Excel etc. effectively for data analysis.

Statistics is a branch of scientific methodology. It deals with techniques of collection, classification, description and interpretation of data obtained by the conduct of surveys and experiments. Its essential purpose is to describe and draw inferences about the numerical properties (like averages, variability, relationship etc) of populations. This module on Data Management and Processing is prepared with an objective that you may get an idea about the different techniques of describing data and the different techniques of statistical inference called tests of significances.

To understand this module, knowledge of the following *concepts* are essential *as precursors* to statistical analysis.

Basic Concepts in Research and Statistics

1. Research Question

A research question *states the aim* of a research project in terms of *cases of interest* and *the variables* upon which these cases differ.

Example: 1) Is there relationship between achievement of students in mathematics and their gender?

Here cases of interest are mathematics students and variables are their achievement in maths and gender.

2) Does there exist a difference in Achievement in mathematics between High Intelligent and Low-Intelligent Secondary School pupils?

Here cases of interest are secondary school pupils and variables are Achievement in mathematics and Intelligence.

2. Case

A case is an entity (living or nonliving) that displays or possesses the traits of a variable.

Example: Is there relation between the number of books in the school library and Achievement of Students at Secondary Level?

Here cases of interest are *Secondary Schools* and variables are Number of books and Achievement of Students.

3. Variable

A condition or quality or characteristic/attribute that differ between cases of interest of a research population (see previous examples).

4. Variables can be *qualitative* and *quantitative*.

5. *Qualitative Variables* are those which differ in *kind* rather than dExampleree.

Qualitative data can be dichotomous having two catExampleories of the variable (for example gender –male and female) or multinomial having more than two catExampleories of the variable involved (for example Length of teaching experience as experience less than five years; experience between 5 and 15 years; experience between 16 and 26 years and experience greater than 26 years).

6. *Quantitative Variables*: Quantitative variables are those which differ in dExampleree rather than kind.

Example: Intelligence - [High intelligence, Average Intelligence, Low Intelligence]

Attitude - [Favourable, Indifferent, Unfavourable]

*7. **Population***: Set of all possible *cases of Interest* that have some common characteristic.

Population is often considered to be composed of an *infinite number* of cases, even though there are exceptions to this.

Example: All students admitted at Plus-two Level of a state.

8. *Sample*: It is a subset of the population of cases of interest

Often, the size of the population will be infinite or too large finite to be handled. In such cases samples of the population are used for study and later results of the population will be *inferred* or generalized from the results of the sample. Thus sample is a key concept in statistic and so also the process of sampling.

Example: Students of Plus-two from two schools each of a district of the state.

9. *Measurement*: It is the process of determining and recording *the extent* to which traits of variable are present in the cases of a population/sample.

Example: The variable 'Gender' has two traits or characteristics viz., male and female. (In a group, if we count the number of males and females, it is measurement of the variable Gender).

The variable Birth order has traits viz., first born, second born, third born etc. If we count the number of such cases in a population/sample, it is measurement.

The variable intelligence has traits viz., High Intelligence, Average Intelligence and Low Intelligence and these can be decided by giving a Test of Intelligence.

Thus 'measurement' in statistical terms means deciding into which of these Examples of a case falls.

10. *Scales of Measurement*

A scale of measurement specifies a range of scores (also called points on the scale) that can be assigned to cases during the process of measurement.

In constructing a scale of measurement for any variable, two rules are to be cared. (i) The scale must capture sufficient variation to allow us to answer our research question. (ii) A scale must allow us to assign each case into one and only one of the points in the scale.

11. *Levels of Measurement*

Scale of measurement allows us to collect measures of the variables (i.e., to gather data) in any one of the four levels viz., *Nominal, Ordinal. Interval and Ratio.*We say *level of measurement* because higher the level of measurement, the more information we get about the variable. Further, these levels determine *what processing/analysis we can do with the data.* [You will understand this after you go through this module].

12. Nominal Scale of Measurement: Allows for the mere classification of cases *into catExampleories* which does not permit any quantitative ordering. Operation permitted is making of statements of equality or difference. i.e., *same as* or different from another number.

(*A variable measured at the Nominal Level varies qualitatively but not quantitatively*)

Example: Assume that the variable is 'Religion'. Then cases of a population/ sample can be categorized and counted as Hindus, Muslims, Christian, Jewish, Sikhs and Others. In this, it can be noted that no ordering of the categories is possible. The data available is in the form of number of counts in each category.

13. Ordinal Scale of Measurement

In addition to the function of classification , this scale allows *cases to be ordered by dExampleree*. This becomes possible if we can assign *magnitude to the trait or variable*. That is, ordinal scale enables to rank cases based on the dExampleree of measurement.

Unlike Nominal data, in ordinal scale a case in one catExampleory is not only different to a case in another, it is higher/stronger/bigger/more intense etc to another catExampleory.

Example: Variable Height. Using measures of this variable, we can order the cases as taller, less taller, shorter etc.

14. Interval Scale of Measurement. This indicates rank and distance from on arbitrary zero measured in equal intervals

Equal interval means that the magnitude of the attribute represented by a unit of measurement on the scale is equal to the magnitude of the attribute rExampleardless of where on the scale the unit falls. The operation permits making of statements of equality of intervals in addition to statements of sameness or difference or greater than or less, than.

An interval scale does not have a 'true' zero point although a zero point may for convenience be arbitrarily defined.

Examples: Variables height, weight, Fahrenheit and Celsius temperature.

In the case of the variable height, the magnitude of height represented by 1 cm at any place of the scale is equal. Similar equality can be seen to variables like temperature and weight.

15. Ratio Scales of Measurement

This scale allows for ranking of measures and for counting distance from a natural or absolute zero point. In this scale, one measure can be spoken as of double or triple another, because of the existence of an absolute or true zero point in the scale.

An absolute zero point in a scale is a value which indicates that nothing at all of the attribute being measured exists. This scale of measurement is termed 'ratio' because the collection of properties that it possess allows for the framing of ratio statements. Thus if an adult is 160 cm tall and another one is 80 cm, then it is correct to state that the person with 160 cm is twice as tall as the latter.

Thus, the major distinction between Nominal, ordinal, interval and Ratio scales is summarized in Table 1.

Table 1: Properties of the Four Levels of Measurement

Level of Measurement	Example of the Variable	Measurement Procedure	Operations Permitted
Nominal	Gender, Birth order, Marital Status	Classification into catExampleories	Counting Number of cases in each catExampleory (frequencies) and comparing frequencies between each catExampleory

Ordinal	Achievement Scores, Intelligence scores	Classification + ranking of catExampleories	Above + Making judgements of greater than or less than
Interval/Ratio	Age in Years, Height, Weight	Classification + ranking + description of distances between sores in terms of equal units	All above + Mathematical operations such as Addition, Subtraction, Multiplication and Division

- *Nominal and ordinal scales are collectively called catExampleorical scales.*
- *Any variable can be measured by different scales, depending on its operational definition.*
- *A Higher order scale of measurement allows for lower order operations also but not the reverse. The variable height can be seen as a Nominal Variable. But the variable gender is never an internal/ration variable.*
- *Nature of the scale of measurement affects or determines Data analysis.*

16. Qualitative Research

Broadly, research in Behavioural Science can be classified into two viz., Qualitative Research and Quantitative Research.

Qualitative research involves collecting data by way of indepth interviews, observation, open ended questionnaire etc. Researcher himself is the primary data collection instrument, and the data is collected in the form of words, images, patterns etc. *Data analysis involves searching for patterns, themes and holistic features.* Results of such research are likely to be context specific and reproducing takes the form of a narrative with contextual description and direct quotations from researchers.

Grounded theory, Phenomenology, ethnomethodology, ethnography, hermeneutics, socio-linguistics, narratives and feminist research are qualitative researches. In educational context, the qualitative research can be carried out where ever the data is gathered by conducting in depth interviews, focus group discussions on certain educational issues and policy matters. The class room observations, case studies of students and institutions, content analysis of curricular materials, participatory

observations in certain ethnic groups to study the influence of culture and ethnic life styles over learning achievement etc can be analysed using qualitative research methods.

17. ***Quantitative Research***

Quantitative Research involves collecting quantitative data based on precise measurement using structured, reliable and validated data collection instruments. *The nature of the data is in the form of scores or measures of variables and data analysis involves establishing statistical relationships using descriptive and inferential statistics.*

Quantitative research could be classified into two groups depending on the nature of the problem, research design and data collection methodologies as experimental and non experimental research.

18. ***Experimental Research*****:** The main purpose of experimental research is to establish a cause and effect relationship. The defining characteristics of experimental research are active manipulation of independent variables, control of the extraneous variables, and the random assignment of participants to the conditions which represent these variations.

To depict the way experiments are conducted, we use the term *Design of Experiment*: (Between subjects Design, Within subjects design/ Repeated Measures Design and Mixed Design). In a between subjects design, we randomly assign different participants to different conditions. In a within subjects Design, the same participants are randomly allocated to more than one condition. In a mixed design, both the patterns will be there.

19. ***Non Experimental Research***

This kind of research is often done with the help of a survey. There is no random assignment of participants to a particular group, nor do we manipulate the independent variables nor do we control the effect of extraneous variables. As a result, one cannot establish a cause and effect relationship through non-experimental or survey research.

20. ***Univariate/ Bivariate/Multivariate Analysis***

Two major factors that determine the nature of statistical analysis of a data are,

i) Scale of measurement of the variable

ii) Number of variables involved

In a research question involving one variable, the data analysis is *univariate*; if Research question involves two variables, then data analysis is *bivariate* and if the research question involves more than two variables, then data analysis is *multivariate*.

21. ***Variables as Independent/Dependent***

Variables as independent or dependent arises in Experimental and relationship studies: A variable is designated as independent or dependent depending on the nature of the research question for a study. .

If the variation of a variable affects the variation of another variable, the first one will be independent and the latter dependent. *The independent variable generally forms the groups to be compared.* That is to see how variation in the different levels of an independent variable affects the dependent variable.

- *The factors that affect the distribution of the independent variables lie out side the scope of a study*

DATA ANALYSIS

(Data Analysis means what we do with measurements of variables)

The two major approaches to Data Analysis are I)Descriptive Statistics and ii)Inferential Statistics.

i) Descriptive Statistics: These are used to summarize and present the data in a meaningful manner, so that the underlying information is easily understood. Descriptive statistics helps to reduce a large data into a few statistics, into some pictures such as Graph or Table so that the results of research can be clearly and concisely presented.

- *Descriptive Statistics are the numerical, graphical and tabular techniques for organizing, analyzing and presenting data into meaningful forms of description*

ii) **Inferential Statistics:** These are the statistical techniques for making inferences about the population values of some variables (called parameters) based on the measures/values of those variables obtained from a sample of the population (called statistic/s).

The major objective of any research is to study the population characteristics and not the sample characteristics. But in many situation, the population will be too finite or infinite in size and as a result, studying the population characteristics directly will be impossible and impractical. In such situations, it is an accepted practice to take a representative sample of the population and to study the sample characteristics.

Then how the population values or parameters are known?

The process of predicting a parameter value by the knowledge of sample value the statistic applying the principle of probability or chance is called statistical inference. Totality of such statistical procedures is known as inferential statistics. The process of inferential statistics is illustrated in Fig. 1.

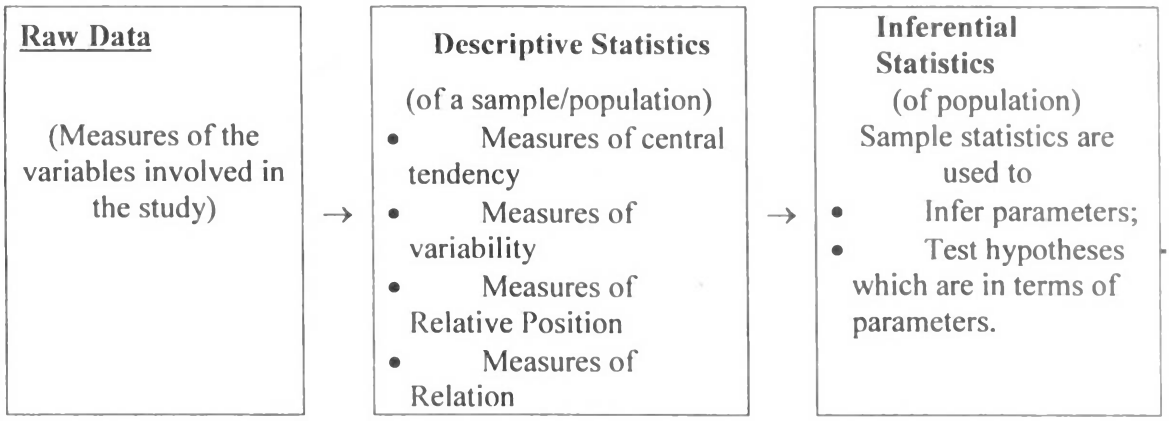


Fig 1: ***The Process of Inferential Analysis***

DESCRIPTIVE STATISTICS

Assume that there are measures on the age of 20 students as follows:

18, 21, 20, 18, 19, 18, 22, 19, 20, 18, 19, 22, 19, 20, 18, 21, 19, 18, 20, 21.

This arrangement of the measures of the variable age is called *a distribution or raw data.* We know this distribution of measures won't give much information on the nature of the variable. But when this set of measures is turned into the form of frequency distribution, graphs, tables etc., we will be able to describe meaningfully the nature of the variable. Totality of this summarizing procedure is known as the descriptive statistics.

Various ways of describing data are summarized and presented in Table 2.

Table 2: Types of Descriptive Statistics

Types	Function	Examples	
Graph	Provides a visual presentation of the distribution of a variable or variables.	Pie, Bar, Histogram, Frequency polygon, Ogive (Univariate)	For N, O, I/R Scales
		Clustered Pie, Clustered/Stacked Bar (Bivariate)	N/O Scales
		Scatter Plot (Bivariate)	I/R Scales
Tables	Provides frequency distribution of the variable or variables.	Frequency Table (Univariate) Cross tabulations (Bivariate/ Multivariate)	
Numerical measures	Provides indices as representatives of the distribution of measures	Measures of central tendency (Univariate) Measures of variation (Univariate) Measures of relative position (Univariate) Measures of relation, RExampleression (Bivariate)	

❖ The choice on the type of descriptive statistics to use depends on the research questions of a study.

Graphs

The most striking method of summarizing a distribution is often a graph. A graph provides a quick visual sense of the main features of a distribution. The power of graphs is their simplicity and the visual impact of a graph often conveys a message better than most advanced statistics.

The graph that can be constructed in any given context is determined largely by whether the variable is *discrete* (usually measured on a nominal/ ordinal scale) or *continuous* (usually measured on an Interval/Ratio Scale and the number of variables to be described by the graph. This is illustrated in Table 3.

Table 3: Graphs by Type and Number of Variables

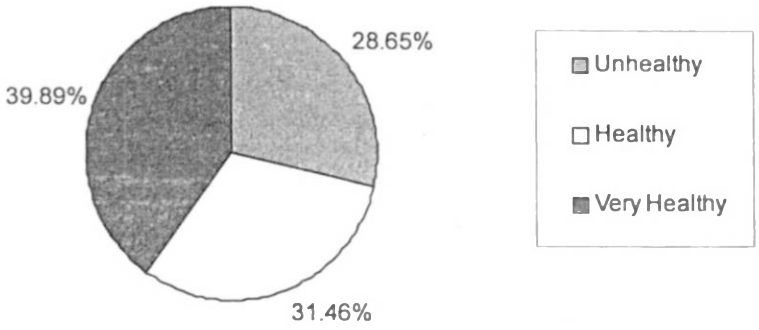
Type of Variables	Univariate Graph	Multivariate Graph
Discrete (Variable Nominal or Ordinal)	Pie Bar	Clustered Pie Clustered Bar Stacked Bar
Continuous (Variable Interval/Ratio)	Histogram Frequency Polygon Ogive	Scatter Plot

In order for a graph to be a self contained description of the data, it is needed to:

- Give the graph an appropriate title
- Clearly identify the catExampleories or values of the variable
- Indicate for interval/ratio data, the units of measurement
- Indicate the total number of cases
- Indicate the source of the data

Pie Diagram presents the distribution of cases in the form of a circle. The relative size of each slice of the pie is equal to the proportion of cases within the catExampleory represented by the slice.

A model Pie Diagram is given in Fig. 1.



❖ ***Pie Graphs thus emphasize the relative importance of a particular catExampleory to the total***

Here we can see the high proportion of cases rated as very healthy when compared to healthy and unhealthy areas.

Bar Graph: Emphasizes the frequency of cases in each catExampleory relative to each other.

To generate a Bar/Histogram/Frequency Polygon/Ogive, the following convention are to be met.

1. These graphs are to be depicted in a plane containing two intersecting axes – one horizontal and the other vertical.
2. Along the Horizontal Axis (Known as Abscissa) mark the catExampleories/Classes of measurement.
3. Along the vertical axis (known as Ordinate) mark the frequencies expressed either as the raw count or as percentages of the total member of cases.
4. Along the Abscissa mark the catExampleories or measures starting from the point of intersection of the axes to the right.
5. Along the ordinate mark the frequencies from the point of intersection of the axes to upwards.
6. The height of the Graph be around ¾ of the width of the Graph.

A Model Bar Diagram:

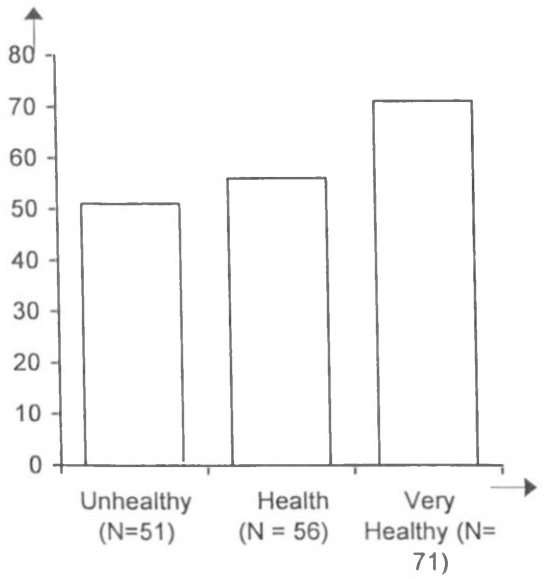
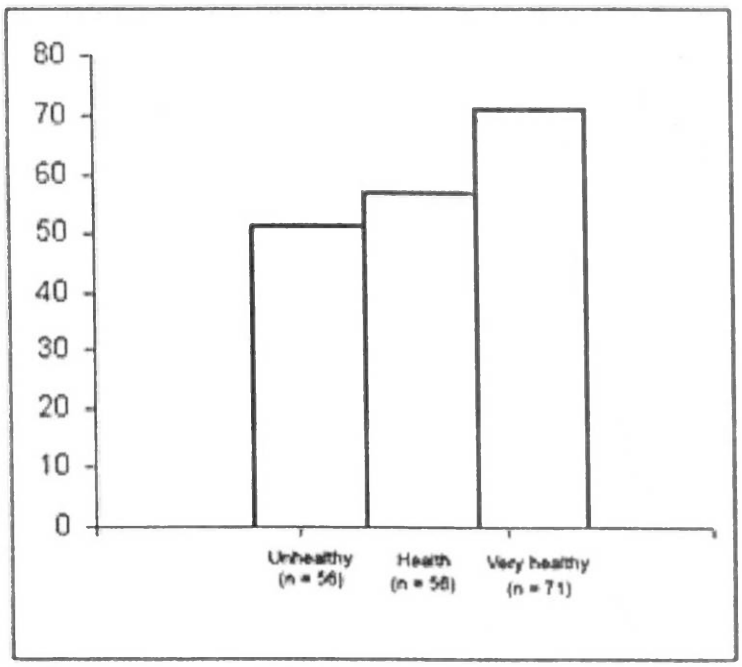


Fig 3: ***Model Bar Diagram***

In a Bar Diagram, width of the Bars should be equal and so also the gaps between Bars

Histograms and Frequency Polygons

Bar graphs constructed will always have gaps between bars. But in a Histogram Bars are pushed together leaving no space between bars.



A *Frequency Polygon* is a continuous polygon shaped line graph by plotting points over the midpoints of the classes of measures (marked along the horizontal axis) and indicating the respective frequencies of each class.

A polygon is constructed in such a way that the area under the curve between any-two points on the horizontal is equal to the proportion of valid cases in the distribution that have that range of values. i.e., the area under the polygon is proportional to the total number of cases.

Model Frequency Polygon

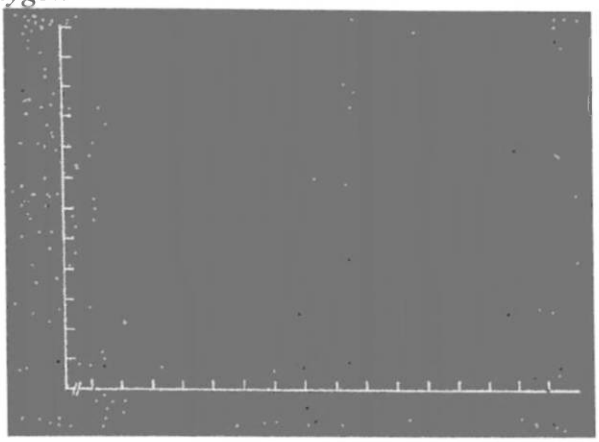


Fig 5: *Model Frequency Polygon*

In a frequency polygon, the first plotted pointed is to be connected with the origin, the point of interaction of the axes and the last plotted point is to be joined with the next anticipated midpoint along the abscissa; so that the graph will be in the form of a polygon.

Interpreting Univariate Graphs

For meaningful interpretation of a graph consideration of three aspects are important. These are, Shape, Centre and Spread.

There are certain common shapes for distributions viz., symmetric (Bell shaped), J shaped, U shaped, S shaped etc. From the shape of the distribution, it can be determined whether the data or distribution is

(i) Symmetrical (whether Half of the cases lie equally to the left and right of the point representing centre of Gravity of distribution).

(ii) Positively skewed (whether majority of measures cluster towards left/lower part of the graph and fewer measures towards the right side of the curve)

(iii) NExampleatively skewed (whether majority of measures cluster at the right or higher part of the curve and fewer measures towards the left or lower part of the curve)

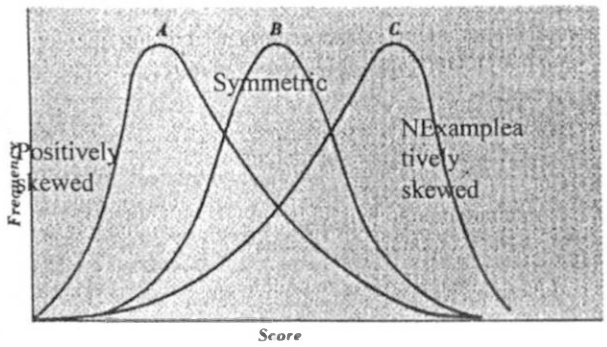


Fig 6: ***Three frequency distributions differing in skewness***

(iv) Leptokurtic (A curve with most cases clustered at the middle and lie very closely together) so that it is more peaked.

(v) Platy Kurtic (A curve having a wide distribution of scores which flatten the fails) so that the curve is less peaked.

(vi) Mesokurtic (A curve in between Leptokurtic and platykurtic positions and with moderate peakedness).

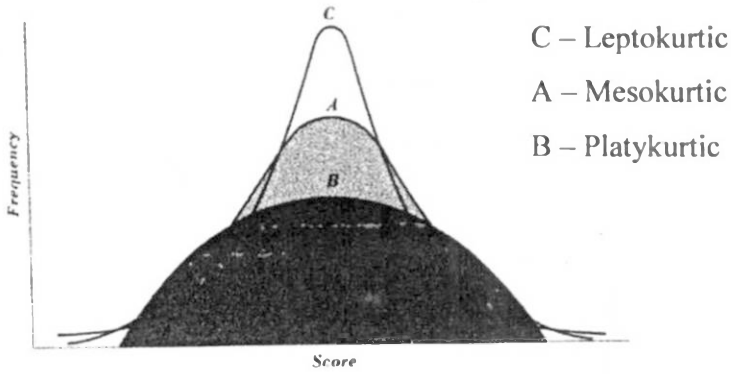


Fig 7: ***Three Frequency Distributions Differing in Kurtosis***

The *centre* of the distribution refers to the point at which the distribution balances (geometrically this point is called the centre of gravity) and mathematically the point of mean.

The *spread* of the distribution refers to the scattering or wideness of the distribution from the central position.

The above suggests that frequency distribution differ three major characteristics viz., shape, centre and spread.

Evidences to these are in terms of

(i) Coefficient of Skewness

(ii) Coefficient of Kurtosis

(iii) Measures of Central Position

(iv) Measures of Variability

Coefficient of Skewness

In Fig. 6, it is seen that skewness refers to the asymmetry of the frequency distribution.

If a distribution is asymmetrical in shape and the larger frequencies tend to be concentrated towards the low end of the frequency distribution (or of the graph representing it) and smaller frequencies towards the higher end, the distribution is said to be *positively skewed* or skewed to the right.

If the distribution is asymmetrical in shape and larger frequencies tend to concentrate at the higher end of the frequency distribution and smaller frequencies towards the lower end, the distribution is said to be nExampleatively skewed to the left.

The commentary used measure of skewness is in terms of *moments* and is defined by,

$$g_1 = \frac{m_3}{m_2\sqrt{M_2}}$$

when a *distribution is symmetrical*, the sum of deviations of measures above the mean, when raised to the third power, will balance the sum of deviations below mean and hence $m_3 = 0$ and $g_1 = 0$.

Moments are also descriptive statistics and are related to both mean and standard deviation.

m_1, m_2, m_3 and m_4, the moments, about mean are defined as,

$$m_1 = \frac{1}{N}\sum(X - \bar{X}) = 0$$

$$m_2 = \frac{1}{N}\sum(X - \bar{X})^2 = \sigma^2$$

$$m_3 = \frac{1}{N}\sum(X - \bar{X})^3$$

$$m_4 = \frac{1}{N}\sum(X - \bar{X})^4$$

Thus for an asymmetrical distribution, $m_3 \neq 0$ and $g_1 \neq 0$. When the distribution is positively skewed, m_3 will be greater than zero or positive and as such g_1 will be positive.

When the distribution is nExampleatively skewed, m_3 will be nExampleative. So also g_1.

* *g_1, a measure of skewness, is independent of the scale of measurement and the coefficient g_1 obtained from different distributions are comparable.*

* There are also other ways of estimating skewness like

$$SK = \frac{3(\text{mean} - \text{median})}{\text{Standard deviation}}$$

and $sk = \frac{1}{2}(p_{90} + p_{10}) - p_{50}$ (* p_{90}, p_{10} and p_{50} are percentiles and explanations on these are following)

In these, if SK = 0, the distribution is symmetrical

SK > 0, the distribution is positively skewed

SK < 0, the distribution is nExampleatively skewed

Coefficient of Kurtosis

In Fig. 7, you have seen that Kurtosis refers to the Peakedness or height of the distribution and that a distribution is said as leptokurtic or platykurtic by comparing it with the mesokurtic distribution, a distribution having normal height or with normal peakedness.

A comparison or description of these three positions is clear from the coefficient of kurtosis.

A commonly used measure of kurtosis is,

$$G_2 = \frac{m_4}{m_2^2} - 3$$

For a mesokurtic distribution, $g_2 = 0$, or $\frac{m_4}{m_2^2} = 3$

For a leptokurtic distribution, $g_2 > 0$

For a platykurtic distribution, $g_2 < 0$

- *Like g_1 is also independent of the scale of measurement.*
- *Even though there are other ways of estimating skewness and kurtosis (in terms of measures of central positions and percentiles), SPSS uses the coefficient in terms of g_1 and g_2*

Hypothetical data illustrating frequency distributions of different shapes is given as Table 4

Table 4:

Hypothetical data illustrating frequency distributions of different shapes

1 Class interval	2 Symmetrical binomial	3 Leptokurtic	4 Platykurtic	5 Rectangular	6 Bimodal	7 U-shaped	8 Positively skewed	9 Negatively skewed	10 J-shaped
70–79	1	3	5	16	5	30	2	10	50
60–69	7	8	14	16	10	20	6	25	30
50–59	21	13	20	16	35	10	10	40	20
40–49	35	40	25	16	14	4	15	20	10
30–39	35	40	25	16	14	4	20	15	7
20–29	21	13	20	16	35	10	40	10	5
10–19	7	8	14	16	10	20	25	6	4
0–9	1	3	5	16	5	30	10	2	2
N	128	128	128	128	128	128	128	128	128

Graphing Two Variables

When the research question is on the relationship between two variables Graphing of the two variables so as to reveal the relationship can be drawn.

For Example: The research question is; Is health affected by gender?

Here health is the dependent variable and gender, the independent variable. Graphing of the two variables can then be done by catExampleorizing the independent variable Gender into male and female.

Stacked Bar Graph (Component Bar Graph):

In this, each bar is divided into layers with the area of each layer proportional to the frequency of the catExampleory it represents. Thus it is using similar to a pie chart, but using a rectangle rather than a circle.

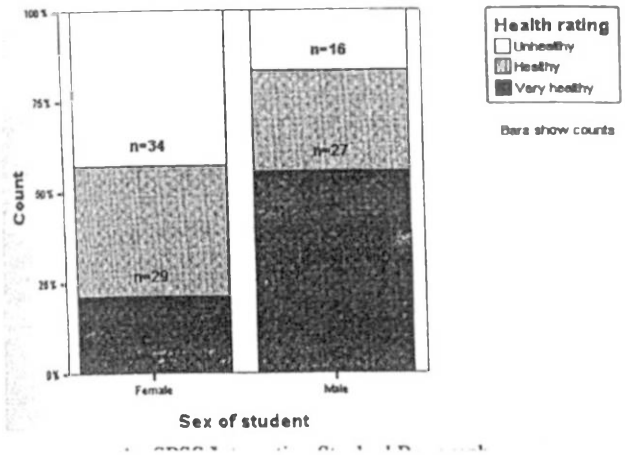


Fig 8: *Stacked Bar Graph*

Stacked bars have limitations when there are more layers to express.

To generate a Stacked Bar Graph, in SPSS, use the Graphs/Interactive/Bar Command

Cluster Bar Graph

A cluster graph is useful when we want to observe how the frequency of cases in individual catExampleories of the dependant variable differs across the comparison groups.

(Command in the SPSS: Create Bar Chart ↓ **Cluster)**

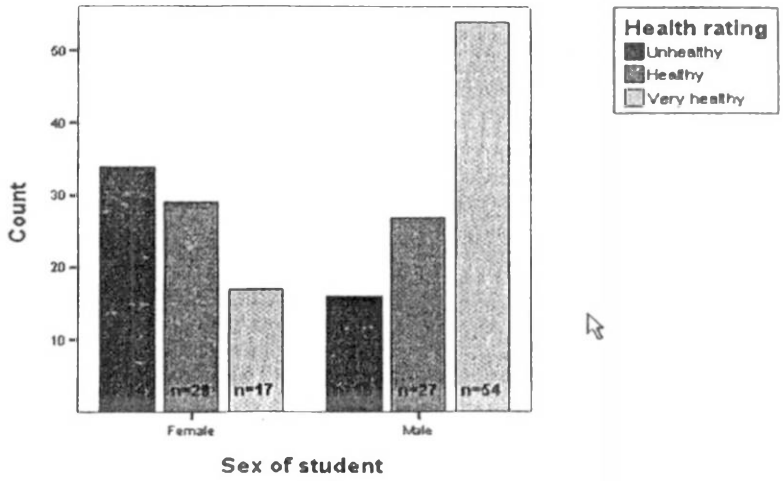


Fig 9: *Cluster Bar Graph*

Common Problems of Graphs

1. The same data can give different graphical pictures depending on the relative size of the plane containing the two axes. By stretching the abscissa, the graph can be flattered and by stretching the ordinate, the graph can be peaked.

   To avoid this, there is no hard and fast rule about what should be the sizes of the two axes. But there is a convention that wherever possible *the vertical axis be around ¾th of the length of the horizontal.*

2. Representing each catExampleory in a graph as a 3-dimensional shape.

   This often distorts the meaning of data since 3-D shape of some bars would impress a huge size.

Activities

1. Draw Histogram for the following data.

Marks	Number of students
0-20	05
20-40	11
40-50	07
50-60	12
60-100	15

2. Draw the frequency polygon of the data given

Mid value	No. of students
10	05
30	11
45	07
55	07
80	15

3. Collect data related to class room achievement of students in any subject of a class during your school visits, and represent them graphically by using any

of the graphs and interpret the data and share with the teachers about the profile of students' performance.

4. Initiate teachers into presenting the students performance in different subjects and their over all performance through graphs and to get a complete picture of students achievement. Have a sharing session with the teachers about interpretation of the graphs and their use in providing a feed back .

TABLES

Obtaining more details of a distribution usually bExampleins with the construction of *frequency tables.*

Different forms of frequency tables are the following:

- Listed Data Tables
- Simple frequency Tables
- Cumulative frequency Table
- Tables with percentiles

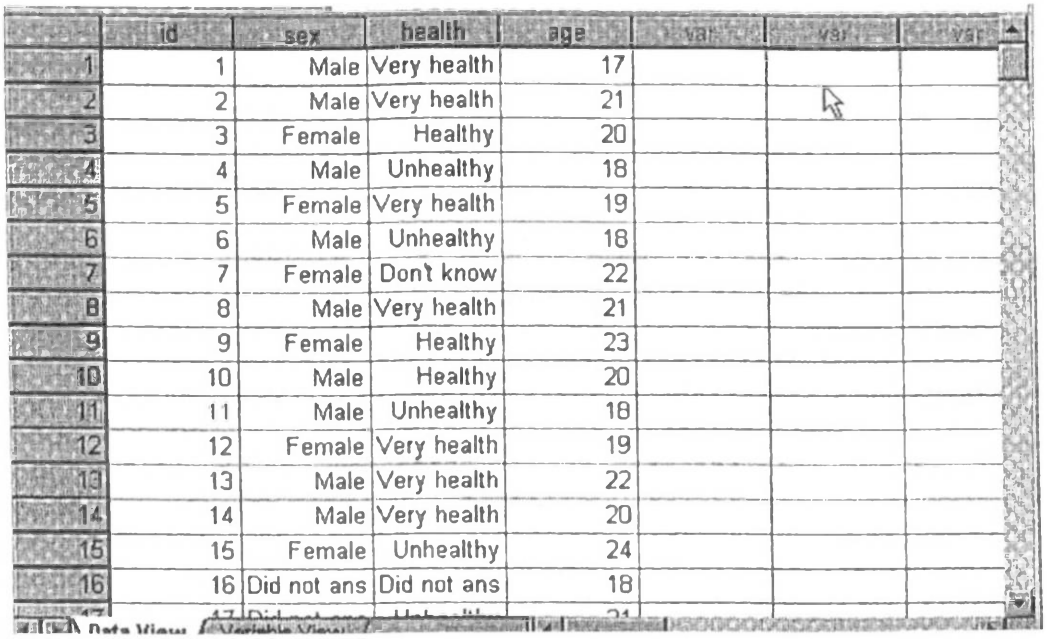
Listed Data Tables

Listing separately the score (measure) of each case for each variable in a tabular form is listed Data Tables.

- ***SPSS uses listed data as its format for data entry*** **(see Table 5)**

This method is not much informative and also is impractical when there are a large number of cases.

Table 5: Model Listed Table



	id	sex	health	age	var	var	var
1	1	Male	Very health	17			
2	2	Male	Very health	21			
3	3	Female	Healthy	20			
4	4	Male	Unhealthy	18			
5	5	Female	Very health	19			
6	6	Male	Unhealthy	18			
7	7	Female	Don't know	22			
8	8	Male	Very health	21			
9	9	Female	Healthy	23			
10	10	Male	Healthy	20			
11	11	Male	Unhealthy	18			
12	12	Female	Very health	19			
13	13	Male	Very health	22			
14	14	Male	Very health	20			
15	15	Female	Unhealthy	24			
16	16	Did not ans	Did not ans	18			

Simple Frequency Tables

This tabular form gives, for each value of the variable the number of cases (frequency) having that value.

This format consists of two columns – the first one values of the variable and the second one-respective frequencies.

Cumulative Frequency Tables

Such a table can be prepared in the case of Interval/Ratio data.

A cumulative frequency table shows, for each value in a distribution, *the number of cases upto and including that value* (see Table 6).

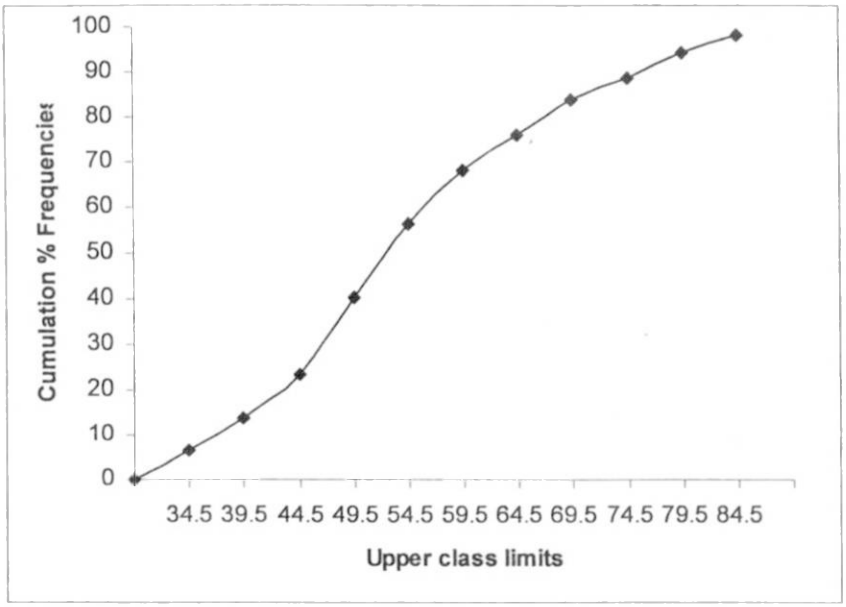
Cumulative Relative Frequency Table (Ogive):

This table shows, for each value in a distribution, *the percentage or proportion of the total numbers of cases upto and including that value* (see Table 6).

Table 6: Model Cumulative Table

Class interval	Frequency	Cumulative frequency	Cumulative % frequency
80–84	2	50	100
75–79	3	48	96
70–74	5	45	90
65–69	4	40	80
60–64	6	36	72
55–59	6	30	60
50–54	8	24	48
45–49	7	16	32
40–44	4	9	18
35–39	3	5	10
30–34	2	2	4
Total	50		

Cumulative frequency polygon (Also called Ogive) drawn for data in Table 6 is given as Fig.



The drawing of a cumulative frequency polygon differs from that of a frequency polygon in two ways.

i) Instead of plotting points corresponding to frequencies, plot points corresponding to cumulative percentage frequencies.

ii) Instead of plotting points above the midpoints of each classes on the horizontal axis, plot points above the exact upper limit of each class marked along the horizontal axis, (Because, cumulative % frequencies tell what % of

frequencies or cases fall below a particular value of the frequency distribution)

Note: Percentiles and Percentile Ranks which tell us the relative positions of scores can be worked out from cumulative relative frequency Tables.

See explanation on these after the description on percentiles and Percentile Ranks

Which command is to give for generating frequency Tables described above are given in Table 7 below.

Table 7: Commands for Generating Frequency Tables

SPSS Command	Outcome/Output
From the menu, select Analyse/ Descriptive Statistics/Frequencies	A dialog box headed 'Frequencies'.
Select the Variable(s) to generate a frequency table for by clicking on their name(s).	Frequency Tables are generated by pasting more than one variable into the variable(s): box
Click on ▶	Paste the selected variable(s) into the area below variable (s)
Click on OK	

Valid Cases and Missing Values

In the SPSS output for frequency tables, there are columns headed *Percent* and another headed *Valid Percent*. The reason for this is that data sometimes include cases for which a variable has not been adequately measured. These are called missing cases.

The number of valid cases = Total cases – missing cases

Cross Tabulations as Descriptive Statistics

To answer a possible relationship that may exist between variables measured with scales that have only a few points, we use a bivariate table which is also known as a contingency table or cross tabulation (crosstab).

Table 8: Crosstab

Health rating by sex of students: Column percentages

Health rating	Sex		
	Female	Male	Total
Unhealthy	$\frac{34}{80}\times 100 = 43\%$	16%	28%
Healthy	$\frac{29}{80}\times 100 = 36\%$	28%	32%
Very healthy	$\frac{17}{80}\times 100 = 21\%$	56%	40%
Total	100% (80)	100% (97)	100% (177)

A cross tab shows the *joint frequency distribution* for two variables, since we can 'read off' the score any given case has for each of the variables simultaneously.

Since such bivariate tables describe data in a way that reveals this joint distribution, it allows as to report/comment on the possible relationship between the two variables. In order for this, the cross tab is to be constructed following the below rules.

1. Give the table an appropriate title with labelling for both the variables
2. Place the appropriate variables in the rows and columns. (The independent variable should be arranged along the columns and the dependant variable down the rows).
3. Label the rows and columns as catExampleories of the row wise variable and column wise variable. Maintain the ordering of catExampleories such that values of the independent variable increase across the page from left to right and the values of the dependent variable increase, down the page.
4. Indicate the source of data

In describing cross tab, the following terminology also need mention.

*(1) **Size/dimension of the Crosstab***

The size/dimension of the crosstab is defined as the number of catExampleories for the row variable *times* the number of catExampleories for the column variable.

In general, if a crosstab consists of 'r' rows and 'c' columns, the size of the crosstab is defined as r x c read as r-by-c.

***(2) Cells of the Table*:** Each square in the table indicating the number of cases on the combination of a specific row and column is called a *cell*.

(3) Marginals

Column wise total number of cases is called *column marginals* and row wise total number of cases is called *row marginals*.

Crosstab can also be prepared with relative frequencies as in the case of univariate frequency distributions.

Generating Crosstab using SPSS is detailed in Table 9.

Table 9: Generating Crosstab

SPSS Command	Outcome/Output
From the menu, select Analyse/ Descriptive Statistics/crosstab	Brings crosstab dialog box
Click on the variable in the source list that will form rows of the table	Highlights the row variable
Click on ▶ pointing to the row variable	Pastes the variable into the row: target list
Click on the variable in the source list that forms the column of the table	This highlights the column variable
Click on ▶ to the target list headed columns	This pastes column variable into the column: target list
click on Ok	

Interpreting a Cross Tab

For this, two factures are looked into viz., pattern and strength.

By looking at the changes in the number of cases columnwise, we can say on the possible relationship-whether there is or not and what will be its strength.

A *positive relationship* exists when movement along the scale of one variable in one direction is associated with a movement in the same direction along the scale of the other variable. A *nExampleative relationship* exists when movement along the scale of one variable in one direction is associated with a movement in the opposite direction along the scale of the other variable

In the crosstab given as Table 8, it can be understood that there is a relationship between the two variables 'Health' and 'Gender' and that this relationship is nExampleative as

movement along the column of females is followed by movement in the opposite direction for males.

Descriptive Statistics: Numerical Measures

A. Measures of Central Tendency

A measure of central tendency indicates the typical or average value for a distribution. (or the central position of a distribution of measures).

There are three common measures of averages viz., mean, median and mode, each measure embodying a different notion of average.

Mean is the *sum of all scores* (measures) in a distribution divided by the total number of cases.

When X is the variable, mean is calculated by the formula,

$$\bar{X} = \frac{\sum X}{n}$$ [From sample values and from listed data]

$$\mu = \frac{\sum X}{N}$$ [from population values and from listed data]

(Mu) - μ the Greek letter is the symbol for the population mean [called parameter]

$$\bar{X} = \frac{\sum fX}{n}$$ [Statistic, from frequency tables]

$$\mu = \frac{\sum fX}{N}$$ [Parameter, from frequency tables]

In this case, X stands as the mid points of the class intervals in frequency distributions.

$$\text{Midpoint of a class} = \frac{\text{exact lower limit} + \text{exact upper limit}}{2}$$

Example: For the data, 93, 25, 87, 13, 56, 64, 12

$$\text{Mean} = \frac{93+25+87+13+56+64+2}{7} = \frac{350}{7} = 50$$

Symbols used for certain descriptive statistics are important to know. Very often to understand a mathematical formula, a knowledge of this becomes highly essential. The symbols used for some basic statistics are given in Table 10.

Table 10: Symbols for Statistics and Parameters

Descriptive Statistics	Statistic	Parameters
Size of the data	n	N
Mean	$\overline{X}$ for $1/R$ data	μ (Mu)
Median	Media for ordinal	Median
Mode	Mode for nominal and $1/R$ data	Mode
Standard deviation	S for $1/R$ data	σ (sigma)
Mean deviation	MD for $1/R$ data	MD
Quartile deviation	QD for ordinal data	QD
Correlation	r for $1/R$ data ρ for ordinal c for nominal	ρ (rho)

Median: In an ordered data, i.e., when measures are arranged in the ascending order, median is the point below which and above which lie equal number of cases (or half of the cases or 50% of the cases).

Thus when the number of cases is odd, median is the middle measure score. When the number of cases is even, median is the mean of middle two measures.

Example: When the measures are 5, 4, 6, 7, 8, median is 6

For measures 5, 4, 6, 7, 8, 9, Median = 6.5

Estimation of Median in the Case of Frequency Distribution is by the Formula,

Median $= L + \frac{i}{f}\left[\frac{N}{2} - F\right]$ **in which**

L, indicates the exact lower limits of the class in which median lies;

i – the class interval,

N – the total number of cases,

F – the cumulative frequency upto L

f – the actual frequency of the class containing median

- **Estimation of median by the above formula is not attempted as SPSS allows for such calculation**

Mode: ***Mode is the value in*** **a distribution with the highest frequency.**

For measures 5, 4, 4, 6, 7, 7, 7, 8, 9 mode is 7

* Mode has one limitation that in a distribution, these may be more than one mode.

* When the distribution is non skewed or symmetrical, the three measures of central tendencies will be equal.

* In a skewed distribution (Positively or NExampleatively) there will be difference in the three measures of central tendencies.

Relative positions of mean, median and mode are illustrated in Figure 10 (Symmetrical), Figure 11 (Positively skewed) and Figure 12 (NExampleatively Skewed).

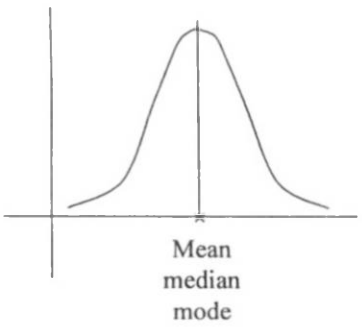


Fig: 10

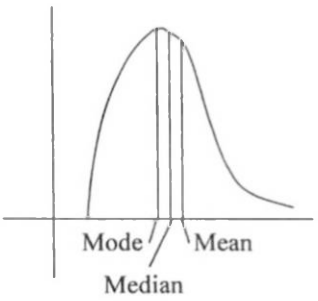


Fig: 11

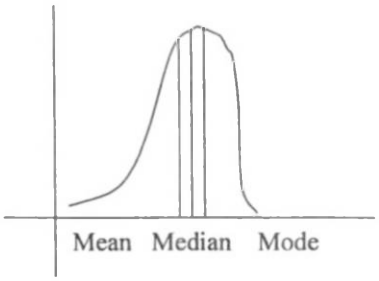


Fig: 12

In Figures 10, 11 and 12, it can be seen that, in a symmetrical distribution,

(Fig. 10), mean = median = mode. In a positively skewed distribution (Fig. 11), mean > median > mode. In nExampleatively skewed distribution (Fig. 12), mean < median < mode.

B. Measures of Dispersion

Consider the following distributions

1) 7, 7, 7, 7, 7
2) 5, 6, 7, 8, 9
3) 0, 1, 1, 0, 33
4) 0, 0, 30, 5, 0
5) 1, 5, 10, 15, 4

In all these distributions, you can note that mean is the same, 7. But by looking at the distributions, it suggests that there are differences in the spread of measures from the mean between distributions.

A measure of this spread of scores from the mean in a distribution is the *measure of dispersion.*

The common measures of dispersion are Range, Standard Deviation, Quartile Deviation and Mean Deviation.

Range is the difference between the lowest score and highest score in a distribution.

In the above examples, range/s are 0, 4, 33, 30, 14 respectively.

Quartile deviation, Q is half the difference between 1st and 3rd quartiles in a frequency distribution. In that way, it is semi inter quartile range.

* The first quartile, Q_1, is the point in a distribution ordered, below which lies 25% of cases and above which lies 75% of cases

* The 2nd quartile, Q_2, the median, is the point in an ordered distribution, below which and above which lies 50% of the total number of cases

* The 3rd quartile, Q_3, is the point in an ordered distribution below which lies 75% of the total number of cases and above which lies 25% of the cases.

Thus quartile deviation, $Q = \frac{1}{2}[Q_3 - Q_1]$

Q_1 and Q_3 being the 1st and 3rd quartiles of a distribution and since Q_2, the 2nd quartile is the median, estimation of Q_1 and Q_3 are very analogous to the estimation of Q_2, the median.

$$\mathbf{Q_1 = L + \frac{i}{f}\left[\frac{N}{4} - F\right]}$$

$\mathbf{Q_3 = L + \frac{i}{f}\left[\frac{3N}{4} - F\right]}$**, the meaning of the letters remain the same as that for** $\mathbf{Q_2}$**.**

Standard Deviation is defined as the arithmetic mean of the sum of squares of deviation of measures from the mean.

In a listed data, for the variable X, Standard Deviation, $\sigma = \sqrt{\frac{\sum(X - \bar{X})^2}{N}}$

and $s = \sqrt{\frac{\sum (X - \bar{X})^2}{n-1}}$

In a frequency table,

$\sigma = \sqrt{\frac{\sum f(X - \bar{X})^2}{N}}$ and $s = \sqrt{\frac{\sum f(X - \bar{X})^2}{n-1}}$

* σ - the symbol of SD for population measures
* s – the symbol of SD for sample measures

- *Quartile deviation, Q has a limitation that it gives the measure of the deviation of the middle 50% measures only.*

- *The larger the spread of the distributions, greater will be the value of standard deviation*

- *A measure of Standard Deviation as measure of dispersion is advised when mean as a measure of central location is estimated*

- *A measure of Quartile Deviation is advised when median as a measure of central location is estimated*

- *Estimation of Range is better when mode is the measure of central location*

Coefficient of Relative Variation: (CRV)

The coefficient of Relative variation is used in the following contexts.

- ❖ For comparing distributions measured in the same units but which have different means.
- ❖ For comparing distributions measured in different units.

In either case, $CRV = \frac{S}{\bar{X}} x100$

- CRV is standardized measure of dispersion

Comparing CRV'S, it can be determined which distribution has more spread from the means.

Measures of Relative Position

Suppose in an Achievement Test in Mathematics of 100 marks, student A gets 90 marks. More knowledge of this mark does not convey more information. If it is also known that the mean score of that test is 70, then it can be said that student A's performance is better. Here, the index of average helped for describing the score 90. likewise there are many indices which help us to know the relative positions of individual scores. Such indices are known as *Percentiles* and *Percentile Ranks*.

Percentiles are points on a frequency distribution below which lie given percentage of cases.

We know median, Q_2, is a point on a frequency distribution below which lie 50% of the measures of that distribution. in that way, median, Q_2, is also known as the 50^{th} percentile and is indicated by the symbol P_{50}.

Similarly Q_1 is the point of a distribution below which lies 25% of the measures of that distribution. thus Q_1, the first quartile is also known as P_{25} or 25^{th} percentile.

Q_3 is the point of a distribution below which lies 75% of the measures of a distribution and thus Q_3 is P_{75} or 75^{th} percentile.

Thus, P_p, the P^{th} percentile of a frequency distribution is the point below which lies P% of the measures of that distribution. percentile being a concept very similar to that of median, estimation of P_p is also analogous to that of median. The formula for P_p is,

$$P_p = L + \frac{i}{f}\left[\frac{N}{100} - F\right]$$, P being the given percentage.

* In a frequency distribution, percentile points vary between P_0 and P_{100}, P_0 being the least measure and P_{100} being the highest measure.

Percentile Rank of a score or measure suggests what percentage of measures or scores lie below that given score or measure.

Thus, if we know 50% of measures lie below a given score, then the percentile rank of that score is 50; if 80% of measures lie below a given score, then the percentile rank (PR) of the given score is 80. That is, what percentage of measures lie below a given score indicates the percentile rank of that score.

$$\text{Percentile Rank of a given score} = \left[F + (\text{given score} - L)\frac{f}{i}\right]\frac{100}{N}$$ in

which N – the total number of cases

f – the actual frequency of the class containing the given score

i – the class interval

L – the exact lower limit of the class containing the given measure

F – the cumulative frequency up to L.

C. **Measures of Correlation and RExampleression**

Crosstabulation is a descriptive technique to examine whether there is relation between two catExampleorized variables. But when data for the two variables are collected at the interval/ratio scale and when they have large values, crosstab is not a means to examine the possible relationship between two variables. In the latter case, a better descriptive technique is a *scatterplot*.

- A satterplot displays the joint distribution for two continuous variables in a co-ordinate plane. In the co-ordinate plane, each pair of measure (for the two variables of a case) will be represented by a point in the plane. In the scatterplot, it is the convention to put the independent variable (X) along the horizontal Axis and the dependent variable Y along the vertical Axis.

If we can imagine *a sloping straight line* through the plotted points in the scatter plot, it can be said that there exists an association between the two variables X and Y.

The direction of association is indicated by whether the imaginary line slopes up (Positive association) or slopes down (nExampleative association).

We can give quantitative expression to this sloping straight line and to the slope through the calculation of linear rExampleression statistics.

Linear RExampleression Statistics

Thousands of straight lines can be drawn through the space in the scatter plot and each and every line can be represented by a mathematical equation in the form,

$Y = a + b X$ where

Y – is the dependent variable

X – the independent variable

a – the Y intercept (the value of Y when $X = 0$)

b – the slope of the line (+b indicates positive association and – b indicates nExampleative association)

But to identify or determine the line which best represents the plotted points in the scatter plot (the line of best fit) a combination of values a and b are highly essential. 'b' the slope of the line is defined as $\frac{\text{rise (distance)}}{\text{run (distance)}}$ (see figure 18)

- The process of fitting the line of best fit is RExampleression Analysis

The following Figures indicates the nature of relation and the line of best fit.

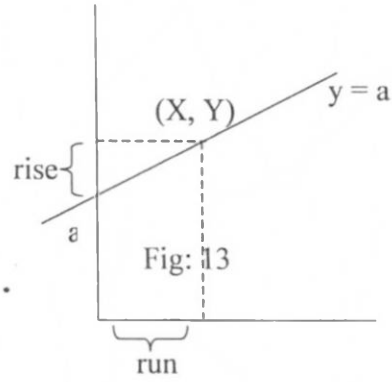


Fig: 13

(Positive Correlation)

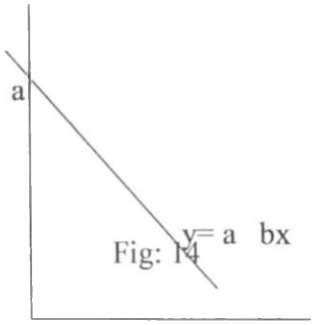


Fig: 14

(NExampleative relation)

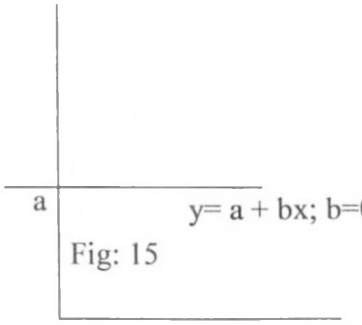


Fig: 15

(No relation)

- b is the slope of the rExampleression line or line of best fit.
- b is also called the coefficient of the rExampleression line.

Through RExampleression Analysis, the line of best fit is determined applying the *Principle of Least Squares*. The principle of Least Squares states that the line of best fit is the one that minimizes the *Sum of squares of residuals*.

- A residual or error term is the difference between the observed value of the dependent variable and the value of the dependent variable predicted by the rExampleression line. (Geometrically, a residual is the perpendicular distance from each plotted point to the line of best fit in a scatter plot)
- *Following two mathematical rules can also be applied in deriving the least squares rExampleression line.*

1. The rExampleression line must pass through a point whose coordinates are the averages of both X and Y. i.e., through the point $(\overline{X}, \overline{Y})$.
2. The slope of the rExampleression line, b, is also defined by the formula,

$$b = \frac{\sum(X - \overline{X})(Y - \overline{Y})}{\sum(X - \overline{X})^2} \text{ or}$$

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - \left(\sum X\right)^2}$$ [A more convenient formula]

- The rExampleression coefficient, b, indicates by how many units the dependent variable will change for a unit change in the independent variable

Estimate of the Extent of Association:

b, the rExampleression coefficient is *an indicator* of whether a correlation exists between two variables measured at the Interval/Ration scale and also an indicator of the direction of such relation.

Then a measure of the extent/strength/ dExampleree of relation is taken *as the standardized form of b* (as the value of b is affected by the units of measurement) called *Pearson's product moment coefficient of correlation* (indicated by the symbol r for statistic and ρ for parameter)

The formula for Pearson's $r = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum (X - \bar{X})^2 \sum (Y - Y)^2}}$

or $\frac{n\sum XY - \sum X \sum Y}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$ [More convenient]

Properties of r

1. The value of Pearson r varies between –1 through zero to + 1
2. r = -1 indicates a perfect nExampleative relation
3. r = 0 indicates no relation
4. r = +1 indicates perfect positive relation

Explaining Values of r

r from 0.00 ± 0.20 denotes indifferent or nExampleligible relationship

r from ± 0.20 to ± 0.40 denotes low correlation, present but slight.

r from ± 0.40 to ± 0.70 denotes substantial or marked relationship

r from ± 0.70 to ± 1.00 denotes high to very high relationship

Relationship between r and r^2

r^2 the square of the correlation coefficient is interpreted as the proportion of

variance in Y (Dependant variable) attributable to differences in X (Independent Variable). r^2 is thus known as the *coefficient of Determination or as Shared variance.*

If $r = 0.50$ then

$r^2 = 0.25$

This suggests that even though a substantial relationship of 0.50 exists between variables Y and X, only 25% of the variance in Y is associated with Variance in X. That is, 75% of the variability in Y is associated with factors other than X.

- One needs a correlation of 0.71 before one can say that half of the variability in Y is attributable to X since $r^2 = 0.49$

Causality and Correlation

It is to be noted that the correlation coefficient represents the dExampleree of observed association between two variables and *not the extent of causal relationship.*

If X correlates with Y, three possible causal relationships exist.

X causes Y

Y causes X

An extraneous variable causes both X and Y.

Example: It is a common saying that smoking is related to Lung Cancer. That is, more the smoking more the possibility of lung cancer. It may be likely that smoking causes Lung Cancer. But there may be some other factors like nervousness of the person resulting in much smoking and thereby in lung cancer.

- Combined coefficient of correlation for two groups cannot be estimated rightly from the separate correlations for the two groups. But this combined estimate is possible in the case of mean and standard deviation.

Relation between Correlation and RExampleression

Relation between correlations and RExampleression is evidenced by the Mathematical relation

$$r_{yx} = b_{yx} \frac{S_x}{S_y}$$

That is, the correlation coefficient is a joint function of the rExampleression coefficient and of the standard deviation of the two variables.

Basic Assumptions in Estimating Pearson's r

Certain basic assumption are to be met for estimating Pearson's Product Moment Coefficient of Correlation, r.

These are the following

1. Linearity of the Relationship

Expected relation should be linear. Then only the line of best fit known as rExampleression line can be established following the Principle of Least Squares Residual.

2. The distribution of the dependent variable should follow normality. (or should follow approximately a normal distribution).

- *Normal distribution is a nonskewed (Symmetric), mesokurtic distribution, so that the index of Skewness =0 and the index of Kurtosis = 0.263.*

  A Normal distribution has the following additional characteristics.

  1. *The Three measures of central tendencies will coincide at one point, the point at which the highest ordinate meets the horizontal axis.*
  2. $\overline{X} \pm \sigma$, $\overline{X} \pm 2\sigma$, *and* $\overline{X} \pm 3\sigma$ *are the turning points of the curve. That is at these points, the shape of the curve changes from concave to convex and convex to concave etc.*
  3. *99% of the total number of cases of a normal distribution lies between the pair of points viz.,* $\overline{X} \pm 2.58\sigma$. *(or between z =* $\pm$ *2.58) where z is the standard score of x, defined by* $Z = \frac{X - \overline{X}}{\sigma}$
  4. *95% of the total number of cases lies between the pair of points viz.,* $\overline{X} \pm 1.96\sigma$ *or between Z =* $\pm$ *1.96.*
  5. *Standard Normal Distribution is the Standardized distribution having mean = 0 and standard deviation = 1, i.e., Z = 0 and* $\sigma = 1$.

  Model Normal Distribution is given as Figure 16.

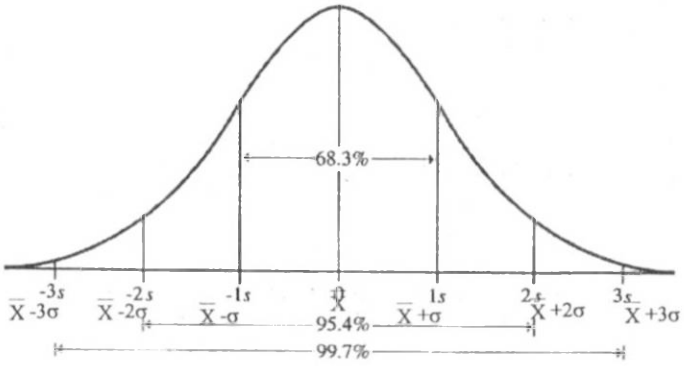


Fig 16: *Areas Under the Standard Normal Curve*

Further, $\bar{x}$

- The Normal Curve is an aid to data description

  The properties of the normal curve can be used for describing this, if the distribution follows normality or near normality.

- The Normal Curve is a Tool for Inferential Statistics

  Properties of the normal curve forms the basis of the procedures that allow us to make inferences of the parameters from sample statistics.

3. Homoseedasticity

That is, variance of the residuals (error terms) of a rExampleression line is constant. This is easily evidenced by a scatter plot, which is illustrated below.

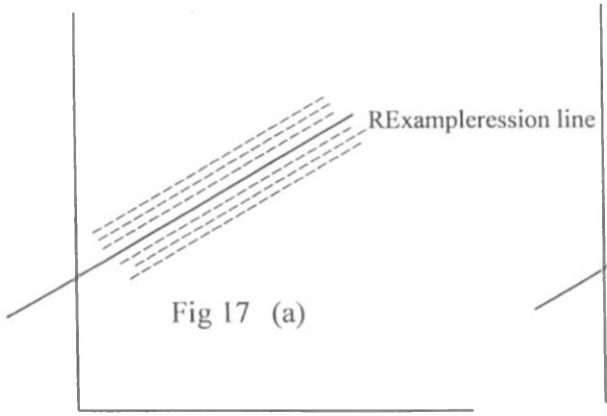


Fig 17 (a)

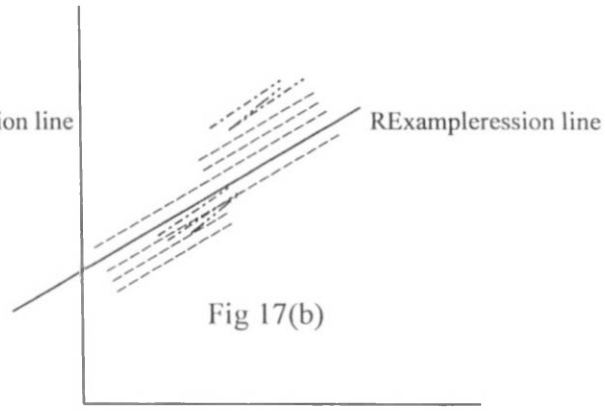


Fig 17(b)

- In Fig (a), the spread of the plotted points around the rExampleression line is a constant so that variance of the residuals will also be a constant.

In Fig (b), the spread of the plotted points around the rExampleression line is not constant (different at different places) so that variance of the residuals will not be a constant.

Spearman's Rank-order Correlation Coefficient

When the variables are continuous and measured in an ordinal scale, (or one ordinal and the other interval/ratio), then the coefficient of relation can be estimated using the method of Spearman's rank order Correlation coefficient indicated by the symbol ρ (rho).

- *Spearman's ρ is in fact a particular application of Pearsons r.*

Spearman's ρ is calculated by the formula,

$$\rho = 1 - \frac{6\Sigma D^2}{n(n^2 - 1)}$$

where D is the difference between each pair of ranks and n, the size of the sample

The C-Coefficient of Contingency

When the variables are measured in a Nominal scale, the relationship between the two variables can be estimated by the formula,

$$C = \frac{\chi^2}{\sqrt{n + \chi^2}}$$

where χ^2 is the value obtained for the χ^2 test of independence between two variables measured in the Nominal Scale.

χ^2 test of independence is a test of significance to determine whether two nominal variables (and hence the data will be in the form of frequencies) are associated or not.

χ^2 test of independence comes under the inferential part.

INFERENTIAL STATISTICS

As described earlier, inferential statistics deals with procedures on the estimation/inference of parameters from sample statistics (*See page 8 -9*).

- Inferential statistics are the statistical techniques for making conclusions about a population value based on the information/statistics obtained from a random sample drawn from that population.

- Different methods of random sampling are there- Stratified sampling, snow-ball sampling, etc. Random Sampling is a method in which each member of the population has the same chance of being selected in the sample.

Some *concepts as Precursors* to Inferential Statistics:

Sampling Distribution of a Sample Statistic

If we theoretically take an infinite number of random samples of equal size from the same population and prepare the distribution of a particular statistic- let it be mean- then the resulting distribution of the sample means is called the sampling distribution of the statistic, mean.

If we prepare the distribution of the sample standard deviations, by repeated sampling, the resulting distribution is sampling distribution of standard deviations.

Standard Error

The standard deviation of the sampling distribution which is an index of the spread of the sample statistics from the population value, parameter, is termed as Standard Error. Thus standard Error of a sampling distribution is the index of sampling error which is the difference between parameter and statistic.

The Standard Error of different statistics have been worked out by statisticians and these are as follows:

$$SE_{mean} = \frac{S}{\sqrt{n}} \qquad SE_r = \frac{1 - r^2}{\sqrt{N - 1}}$$

$$SE_{median} = \frac{1.253}{\sqrt{N}} \qquad SE_{\%} = \sqrt{\frac{pq}{n}}$$

$$SE_{\sigma} = \frac{S}{\sqrt{2n}} \qquad SE_{QD} = \frac{0.786\sigma}{\sqrt{N}}$$

Where p is the % of occurrence of an event and q = 100-p

Properties of Sampling Distribution

The whole inferential statistics is based on these two properties.

1. The mean of the sampling distribution of means is equal to the population mean. (That is average of the averages is the population mean)
2. The sampling distribution will be normal distribution, when the size of the samples are infinitely large (Central limit theorem)

Activities
1. Discuss-How is Standard Error of a sampling distribution, index of sampling error?
2. Identify the educational contexts in which the descriptive and inferential statistics can be used.

Hypothesis Testing

The purpose of inferential statistics is to assist in making inferences and judgements about what exists on the basis of only partial evidence. This is accomplished by using probability (called level of significance) and indicated by the symbol 'α' (Alpha).

Steps in Hypothesis Testing:

Step 1: State *the null and alternative hypotheses.* In Hypothesis Testing it is customary to state *two mutually exclusive hypotheses:* the null hypothesis (indicated by the symbol H_0) and the alternative/research hypothesis (indicated by symbol H_1).

These Hypotheses indicate

i) the population of the study

ii) the variables for which we will gather data

iii) the relevant descriptive statistic to be tested

The hypothesis H_0 is termed null in the sense that it is going to be tested and disprove or nullify. The hypothesis thus that is tentatively held to be true is called the null-hypothesis.

- The alternative hypothesis H_1 is the statement of assumption to be accepted in the case of rejection of H_0.

- Statistical techniques are to test H_0 and not H_1

Step 2 : Choose the test of significance

The Test of significance means the statistical procedure to test a particular Hypothesis H_0. It is the method of estimating the probability that a statistic falls in the RExampleion of Rejection when H_0 is true.

There are a number of tests of significance. Which test is to be used is based on the following factors.

- What is H_0 and H_1?
- Which *statistic* is to be tested?
- What is the type of the variable (Nominal/ordinal/interval/ratio)?
- The *number* and *size* of the samples from which inferences are to be made
- Whether the samples are independent or dependent? (That is, are you using data from different sets of people or different data from the same pupils)?

> A sample is considered as large if the size of it is greater than 100. i.e., n>100. Some statisticians have made the size limit as 40 for the sample to be considered as large.

- Whether the test is two-tailed or on-tailed?

  A test is two-tailed, if no direction of the test is not involved.

  Example: H_0: $r = 0$; H_1 $r \neq 0$

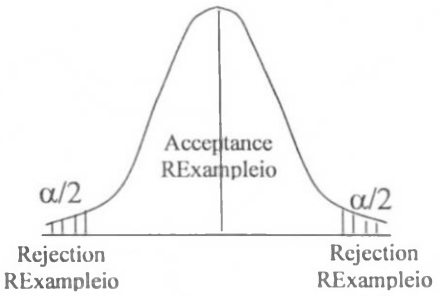
  $H_0 : \mu_1 - \mu_2$; H_1 $\mu_1 \neq \mu_2$

  A test is one-tailed, if direction is involved in the test

  Example: H_0: $r \geq 0$; H_1 $r < 0$

  $H_0 : \mu_1 \geq \mu_2$; $\mu_1 < \mu_2$

- In a two-tailed, the two-tails of the distribution are used for estimating 'α', the level of significance of the test
- In a one-tailed test, either the right tail or the left tail will be used for estimating 'α'.



In the output of SPSS, tests are often two-tailed.

If we want to make a one-tailed application, then take half of the two-tailed probability for interpreting the results.

Step 3: Describe the test statistic and derive the p-value.

This is the process of calculating the relevant descriptive statistics for the sample as defined by the null hypothesis we are testing and this is determined by the research question.

To derive the probability value for test of significance:

First transform the sample statistic into a *standardized test statistic* (called Critical Ratio). Then determine the probability of obtaining a particular sample Z score if the null hypothesis is true.

i.e., | Sample statistic → Test statistic → p-value |

Step 4: Decide at what probability level (or Alpha level) the result is statistically significant.

At what point does the probability get small enough for us to say that the null hypothesis is not true? Determining this cut-off point is called choosing the alpha (α) level.

- α, the level of significance, of a test of significance is the probability of occurring Type I Error viz., Rejecting H_0 is true.
- There are *two* approaches for this- traditional approach and the deterministic approach.
- In the traditional approach, we determine in advance an α level that delineates the rExampleion of acceptance (A test statistic falling in this rExampleion results in the acceptance of H_0) and (test statistic falling in the rExampleion of rejection results in the rejection of H_0).
- The deterministic approach indicates at what α level, the null hypothesis H_0 can be rejected. α level is determined also by looking into the nature of the test as one tailed or two-tailed.
- Whether test is one-tailed or two-tailed is based on H_0. If H_0 is purely null (if H_0 is in terms of *no difference*, *no relation* etc) then test is two-tailed or non-

directional test (the two tails of the sampling distribution will be used for determining α level). If H_0 is directional, then test is also directional or one tailed. (Either left or right tail of the sampling distribution will be used for determining α level).

Whether the estimated value of the test statistic exceeds the concerned tabled value. If the estimated value exceeds the tabled value for a specified level of significance, the inference is to reject H_0 and to accept H_1. otherwise Accept H_0. This is done by looking into

Step 5: Report the Results

Results are to be conveyed as H_0 is accepted or rejected.

Decision Rule

In all the cases, the decision rule is as follows:

1) When samples are large.

(The test statistic is Normal). Then the cut off values between RExampleion of acceptance and RExampleion of rejection are:

When $\alpha = 0.05$, $Z = \pm 1.96$ (When test is two-tailed)

$\alpha = 0.01$, $Z = \pm 2.58$ (When test is two-tailed)

$\alpha = 0.05$, $Z = \pm 1.645$ (test is one-tailed)

$\alpha = 0.01$, $Z = \pm 2.33$ (test is one-tailed)

2) When sample is small.

Then the cut off values between Acceptance RExampleion and Rejection RExampleion is to be find out by referring to the Table of 't' distribution for given level of α; nature of test as two-tailed/one-tailed/ and the dExamplerees of freedom for the test statistic.

3) IN the case of 'F' test. (Test is two tailed only) refer to the Table of 'F' distribution for (K-1)df for the Numerator and (N-K) df for the Denominator. The F value for specified α level will determine the cut off values between Acceptance RExampleion and Rejection rExampleion.

4) χ^2 test. To find the cut off values, refer the Table of χ^2 distribution for given value of α and for the concerned df.

Table 15: Different Tests of significance of Hypothesis (Parametric)

Statistic in the Research Question	Size and nature of sample	Test of significance with critical ration	
1. One sample test H_0: $\mu = a$ H_1: $\mu \neq a$ One sample Z/ 't' test for a mean	Large Small	Z test; $Z = \frac{\bar{X} - \mu}{S/\sqrt{N}}$	Critical ratio ≥ 1.96 ($P < 0.05$) Critical ration ≥ 2.58 ($P<0.01$)
		t test; $t = \frac{\bar{X} - \mu}{S/\sqrt{N}}$ for N df	α is determined by referring to the table of t
2. Difference between two population means a) H_0: $\mu_1 = \mu_2$ or H_1: $\mu_1 \neq \mu_2$ b) H_0: $\mu_1 \leq \mu_2$ H_1: $\mu_1 > \mu_2$ or c) H_0: $\mu_1 > \mu_2$ H_1: $\mu_1 < \mu_2$ (Z test/ t test)		$Z = \frac{\bar{X}_1 - \bar{X}_2}{SE_{\bar{X}_1 - \bar{X}_2}} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$	(when samples are large and independent)
		$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sum x_1^2 + \sum x_2^2}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ (When samples are small and independent)	
		Paired 't' test $t = \frac{\sum D}{\frac{1}{N-1}\sqrt{N\sum D^2 - (\sum D)^2}}$ with (N-1) df when sample is small and dependent. 'D' being the difference between each pair of measure	
3. Difference between two percentages or proportion of an event.		$Z = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$ where P_1 and P_2 are the two sample % of an event	

$H_0: P_1 = P_2$ (Only two-tailed test and when samples are large) $H_1: P_1 \neq P_2$	and P, the combined estimate of P_1 and P_2 calculated by the formula, $P = \frac{N_1P_1 + N_2P_2}{N_1 + N_2}$ and Q = 100-P.
4. Significance of r (Fisher's 't' test) $H_0: \rho = o$ $H_1: \rho \neq o$	$t = r\sqrt{\frac{N-2}{1-r^2}}$ for (N-2) df if $t \geq 2.58$, r significant at 0.01 level $t \geq 1.96$ r significant at 0.05 level
5. Significance of difference between two r's $H_0: r_1 = r_2$ $H_1: r_1 \neq r_2$	$Z = \frac{Z_1 - Z_2}{\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$ Where Z_1 and Z_2 are the Fisher's equivalents of r_1 and r_2
6. Significance of difference between *more than* two group means. $H_0: \mu_1 = \mu_2 = \mu_3 = ...$ $H_1: \mu_1 \neq \mu_2 \neq \mu_3 = ...$	ANOVA Test Critical Ratio is, $F = \frac{MSS_B}{MSS_w}$ for (Number of groups – 1)df for between variance in the numerator and with (N-K)df for the denominator for within variance.
7. Significance of difference between observed frequencies and expected frequencies $H_0: O = E$ $H_1: O \neq E$	χ^2 test (Chi Square) with critical ration as $\chi^2 = \sum\frac{(O-E)^2}{E}$ where O is the observed frequency and E – the expected frequency. E, the expected frequencies are derived based on H_0 in the test.
8. Significance of Dependency between two Nominal variables H_0: The two variables are independent H_1: The two variables are dependent	χ^2 test of independence. $\chi^2 = 2^{-1}\frac{(O-E)^2}{E}$ where E's are calculated on the assumption of H_0.

Degrees of Freedom (df)

The concept of df plays an important role in the statistical analysis of data.

The df for any statistic is equal to the number of independent scores – Number of constraints for the computation of that statistic.

If there is a total of *n scores* and, for a specific statistic, the df is n-K, this implies that there are K independent constraints for the computation of that statistic.

For Example:

1) The mean of n scores has n df since there is no constraint placed on the scores during computation of the mean.

2) The variance of n scores has only (n-1) df since the constraint $\sum Y = n\,\bar{Y}$ is placed on the scores during the computation of the variances.

Thus df for mean is n

df for SD, σ = n-1

df for r = n-2

and so on.

Activity
• Review some educational research reports and identify the kind of statistical analysis carried out. Analyse the statistical analysis carried out with reference to the objectives, Hypotheses and the design of the study .

Module Fourteen

WRITING A RESEARCH REPORT/ARTICLE

Getting Started

After going through this module, you will be able to

- Understand the procedure , format, and the style used in writing a research or a project report
- Write a research or a project report after you complete your data collection and analysis.
- Be familiar with the APA format of writing the references in the report.

This module deals with the procedure followed in reporting a research work. It is necessary to give a detailed picture of the research carried out by spelling out all the details and the procedure involved in the research. Such a comprehensive and detailed account of research experience is called a research report. It is essential for a researcher to know about the research format and the style used in writing a research report. A knowledge of the format and techniques involved in writing a research report will help the researcher to write a good report or a research article. The format used by the researchers in India in the field of Education in writing a report is discussed in the following sections. At the same time the standard format of American Psychological Association of the American Psychological society is also discussed here.

General format of the Research Report

There are many styles of writing research reports , but all formats are somewhat similar to the following outline which comprises of three main sections.1) the preliminary section.2) the body of the report and 3) the reference section. Each section has several sub sections.

Preliminary section

The following are included under this section.

1. Title page

2. Preface
3. Acknowledgements
4. Table of contents
5. List of tables (if any)
6. List of figures, maps or illustrations

Body of the Research Report

1. Introduction

a. Conceptual frame work of the study
b. Significance of the study
c. Statement of the problem
d. Operational definitions of the terms used
e. Variables used in the study
f. Objectives of the study
g. Assumptions underlying the hypotheses
h. Research questions/ Hypotheses of the study
i. Statement of hypotheses
j. Delimitations of the study

2. Review of the Related literature

a. Historical development of the research area or the problem under study (depending upon the kind of the problem chosen for research)
b. Analysis of previous research related to the different variables used.
c. Relation of present problem to theoretical position of the previous research

3. Design of the study

a. Design of the study (whether survey, or experimental or if any other)
b. Sample of the study
c. Data gathering instruments or tools
d. Procedure or methodological details of the study

4. Analysis and interpretation of the data

a. Analysis of the data with reference to the research questions or the hypotheses stated followed by interpretation of the data
b. Tables with reference to the variables involved in the analysis of the data

c. Figures or graphs in relation to the analysis of the variables involved in the data.
d. Verification of hypotheses formulated while interpreting the data analysed
e. Discussion of the analysis of the data

5. **Summary and conclusions of the study**
   a. Brief restatement of problem and procedures
   b. Major findings and conclusions with their practical implications
   c. Suggestions for further research.

Reference

Reference of the books, journals, documents, articles and the web sites with proper quoting of year, page numbers, authors and the publications.

The details included under the above sections of the report are discussed here under.

Preliminary section

1. **Title Page**

This includes the Title of the project, Name of the organization, Name of the researcher and the year.

The title of the study should provide sufficient information for readers to determine whether the study is relevant to their literature search. Choose terms that are specific and never use abbreviations or terms that need to be defined. For example, we might use title such as " Effect of inquiry techniques on the reasoning ability of students" This title identifies the variables, specifying that we are studying the reasoning ability of students which is the dependent variable where as the inquiry technique is the independent variable.

2. **Preface**

The preface includes a brief statement of the purpose and the scope of the report, and the sponsoring or the funding agency, which sponsored the expenditure of the project. This also includes sometimes the acknowledgements to those persons who have contributed to the research project , or helped by providing necessary guidance through out the project implementation. The list of acknowledgements should be simple and brief and sincere in expression. The list of acknowledgement should not be long and flattery. If

the researcher wishes, one can also write acknowledgement as a separate one from preface section.

3. **Table of contents**

The table of contents includes the major divisions of the report, such as introduction, the chapters with subsections, the design of the study, tools, reference, and appendix . The contents may be given the respective page numbers on which they appear. Before beginning with the chapters and their page numbers, the preface, acknowledgements, table of contents and figures and maps should be given . These may not be given the page numbers. They may be indicated by the Roman numbers (small). The reference list and the appendices should be included at the end of the table of contents marked by the Roman numbers. The table of contents provides a complete portrait of the report and facilitates a reader to locate easily the required sections of the report.

Body of the research report

Introduction

This involves the conceptual frame work of the study, and the significance of the study which highlights the need for conducting the research in the area. Along with this, the problem is stated in a definitional form, with the objectives and the hypotheses that are stated based on certain assumptions. The details under each of these are discussed separately as follows.

Conceptual framework and the significance of the study

The introduction of the research report should be presented in a simple , precise and complete form. The conceptual framework of the area from which the problem is identified needs to be discussed. For example, if the study is related to the "study of SSA programmes in the state in improving the quality of primary education", it is required to discuss the status of primary education and the different schemes introduced in the country prior to SSA in improving the quality of primary education, and the outcomes and the gaps realized over a period of time. In light of the growing concern for the

improvement of quality in schools, the intervention like SSA with its salient features and the major objectives and the goals may be highlighted.

Besides the conceptual features of the area, the significance of the research problem undertaken need to discussed by providing insights into the area and the needs and the concerns that have emerged through empirical observations, and discussions of various committees and policies. It is required to highlight how the research problem undertaken is significant in the present demanding contexts and a need for an investigation in the specified area. A review of related studies and literature is very much an essential task in order to get a comprehensive picture of the area and its status in the current period, so that the researcher can logically and relevantly place the importance of the research problem.

Statement of the problem and the operational definitions of the terms used

In light of the conceptual back ground built about the area, and its significance to be researched upon, the problem may be stated in a precise manner. The important terms and the variables used in the statement of the research problem need to be defined operationally. For example, in a study that is titled as " Effect of activity based teaching on the students' achievement and attitude of students towards mathematics", the variables that have to be operationally defined are I) activity based teaching ,ii) achievement and iii) attitude. For this purpose, one may quote the technical definitions of the variables along with their source. For example, an encyclopedia, dictionary, or authors and books. This may be followed by the way researcher has attempted to view the variables operationally in his research study.

Objectives of the study

This includes the statements of the purpose of the study. The objectives spelt out should reflect the directions on which the research is carried out. If the objectives are not clear, and precise, it would be very confusing for the reader to understand what the research is aiming at.

The research questions and the Hypotheses of the study

Research questions related to the research problem (if any) may be included. The hypotheses depending upon the kind of research questions that the researcher had in mind may be written. As mentioned in the earlier modules , the hypotheses may be written in different forms depending upon the kind of things to be studied and the underlying assumptions. The major hypotheses with their sub hypotheses may be listed for better understanding.

Delimitations of the study

The delimitations perceived in the study , for example, with respect to sample, design, area of study and so on may be written.

2. **Review of the related literature**

This includes reporting of the review carried out related to the research problem undertaken. Sometimes reporting of the review of literature may be sectioned into the variables of the study. For example, if the study is related to the scientific attitude and the attitude of students towards science, the studies reviewed may be related to these areas, and discussed separately under different sections. The review of studies and the literature should lead to agreements and disagreements and show how the present study arose from contradictions or inadequacies of earlier investigations. The concluding section of this chapter should include how taking the cues from the earlier researchers , the present study has been perceived, the advantage that the study has over the earlier studies with respect to newer dimensions, contexts, design followed and so on.

3. **Methodology of the study**

This section explains the design adopted in the study in detail. It provides the kind of research design used, for example, whether it is a survey, or case study, or experimental type and so on. This also includes the details of the population from which the sample is drawn, size of the sample, and rationale for the size of the sample, the method of sampling and so on. The other details like the construction of tools, their purpose in gathering data are also explained. If any standardized tools are used, their

details like, validity and reliability values are also provided. The other methodological details like administration of the tests, implementation of the interventions and the way the data has been gathered etc, are explained. In case of an experimental study, the measures taken to control the variables etc may be explained. The section ends with the measures how the data is organized and presented for analysis and presentation.

4. Analysis and interpretation of the data

The analysis and the interpretation of the data by using various statistical techniques is presented in this chapter. The data is presented in the form of tables and figures accompanied by textual discussion. They should be presented in such a manner that they clarify relationships and become self-explanatory. The statistical procedures used in the analysis should be clearly specified and explained in detail . A valid justification needs to be provided for the choice of a particular statistical procedure for analysis of data. The reasons for selecting a particular test of significance, the assumptions underlying its use and the confidence levels chosen in arriving at the results must be presented carefully. Sometimes the analysis reveal some unexpected results which may not have been visualized or they may be totally defeating the purpose of the study. Irrespective of the results that are obtained, the reporting must be authentic. Any weakness in the research design, or selection of sample etc must be discussed rationally along with the factors that may have affected the study during its implementation. The analysis and interpretation of the data should be preceded by the hypotheses formulated or the research questions raised. The interpretation should include the rejection or the acceptance of the hypotheses formulated depending upon the kind of results obtained. The ways to use the tables and the figures in a research report is as follows.

Tables and figures in the Research Report

Create a table of results rather than a figure when it is important for the reader to see the precise numerical values of means , percentages and so on. A table is called for only when there are too many numbers to efficiently include in the narrative. All tables are numbered consecutively, and, as with figures, the reader is directed to them at appropriate points by you in the Result section. The actual tables are placed at the end of

the manuscript. Not e that you do place the title for each table on the table itself. For example, say that we had reason to compare male versus female students , and we examined their achievement in science as result of innovative approaches on few units. The table may be planned as follows.

Table. 2.1: Comparison of the achievement of male and female students in science on the given units

Units	Achievement			
	Male		Female	
	M	SD	M	SD
Human	2.33	0.68	3.55	1.01
Animals	2.14	0.46	4.21	0.98
Plants	5.70	1.86	3.23	2,79
Objects	4.99	2.30	1.45	0.99

Because of cost and space considerations, include graphs and other art work only when information is complicated enough that the reader will benefit from a visual presentation. Usually graphs called " figures" provide a clear way to summarize the pattern in a relationship. However, the researcher should also have something to say about each figure, telling what the reader should see in it. Every figure needs to be numbered. At the point in the narrative where readers should look at the figure, you should direct their attention to it, saying something like " as can be seen in Figure 1....".If the figure has more than one line in the body of the graph, use different symbols for each (for eg, one thick line and one dashed). Then provide a key to the symbols at the side of the figure. Every figure has an explanatory title called the figure caption, which briefly identifies the variables and relationships depicted.

In the discussion of the results, the report should not repeat all the detailed information that is provided in the tables and figures. It should only point out to important facts and relationships to give meaning to the data and make certain

generalizations about the data. In this section you should interpret the results and draw conclusions. Here the questions originally posed in the introduction are answered. The Discussion section begins at the point where you have already reported a significant relationship. The discussion need to also refer to the results of the earlier studies reviewed which may be in congruence with the present research results or in disagreement with the results obtained.

5. Summary and conclusions of the study

The summary and conclusion section of the report is very important as it reviews all the information that has been presented in its previous sections. Most of the readers will scan this section of the report in order to get an overview of the study.

This section includes a brief summarization of the problem, its conceptual background, need and significance of the problem undertaken, along with the objectives and hypotheses of the study. The design , sample , tools used, and the other methodological details need to be summarized briefly. The analysis and interpretation of the data need to be abridged , of course, in a sensible form. The major findings of the study are presented concisely and in relation to the hypotheses that were tested. They confirm whether the research questions raised are answered , or whether the hypotheses were rejected or accepted . The findings will also convey the extent to which the findings obtained can be generalized to the population from which the sample is drawn.

Some of the observations by their nature may not yield themselves to quantitative measurement. In such cases, the researcher may qualitatively report those observations which are valuable in themselves. Sometimes the researcher may have encountered problems which need to be researched further, or some questions which have not been answered through the study undertaken. Such questions and the problems may be suggested for further research .

Most research ideas come from the literature. Authors may suggest rival explanations for their results, or point our untested hypotheses. Also, you may discover tow published studies that contradict each other, so you may discuss what your study is reflecting and the valid explanation for the same.

6. **Reference**

The final section following the Discussion is the Reference page. This lists alphabetically the complete references for all sources cited in the article. Each source should be one that you have read. As shown in the figure , each reference is typed as a paragraph. The published version will be converted to the normal hanging-indent format, as in the Reference book. For the journal article, provide the last name and the first initials of all authors, listed in the same order as they appear in the article. Next give the year of publication, the article's title, and the title of the journal, its volume number, and the page numbers of the article. The publication manual provides slightly different rules for referencing books, book chapters, monthly magazine and so on.

There are several other formats of writing a research report. Among them the most accepted format internationally is the APA Format The following are the components of an APA style in the order in which they occur.

- Title Page
- Abstract Page
- Introduction
- Methods

  Participants

  Materials

  Procedure
- Results
- Discussion
- References
- Tables and Figures

Activity :
1. .Analyse any research report in Education to know how the content has been formatted and the other details that are pertaining to a research report.
2. Write Research Report following the format given in this module on any research study that you have conducted and present it in brief in an academic forum like a training programme. Conference and so on.
3. Have you written a research article or a report at any time during your professional period. If so, in what ways it is different from the format presented in this module. In what ways the format produced here will help you in improving your reporting skills of a research. Discuss in groups and make a presentation.
4. Discuss in groups the problems and the constraints faced by you and your colleagues in conducting a research study and writing a research report.

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