Document Information

Analyzed document	Research Methodology And Statistics.pdf (D165878392)
Submitted	5/4/2023 1:09:00 PM
Submitted by	Mumtaz B
Submitter email	mumtaz@code.dbuniversity.ac.in
Similarity	21%
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Research Methodology and Statistics
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Social Work • Meaning of Social Work Research • Social Work Research – Definition • Relevance of Research in Social Work • Scope of Social Work Research • Goals and Limitations of Social Work Research • Social Research and Social Work Research •

Research Process ➢ Formulate the Problem ➢ Evaluate the cost of Research ➢ Prepare the list of Information ➢ Research design decision ➢ Data Collection ➢ Select the sample type ➢ Determine the sample size ➢ Organize the Field work ➢ Analyse the data and report preparation

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Introduction Man has always been interested in the facts and events that have been taking place around him. He has been exploring different sources of evidence concerning the facts and events to acquire reliable knowledge about the various aspects of human experience. However, it was observed that personal bias influenced the selection of sources of evidences and that care was not exercised to examine the authenticity of the evidence provided by these sources. The result was inconsistency in the explanation of the same facts and events time and again. Hence, to acquire reliable knowledge, scientists, thinkers and philosophers have used various methods. Among the various methods, the method of science is perhaps the most commonly used method of knowing or fixing beliefs. This is because more dependable knowledge is attained through science as it ultimately appeals and evidence and propositions are subjected to empirical tests. The method of science has one characteristic that no other method of attaining knowledge 1 has

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objectivity. There is a well – conceived self-control mechanism all along the way to the scientific knowledge. This mechanism is so designed that it not only controls and verifies the scientist's activities and conclusions but it also keeps the scientist away from his personal beliefs, perceptions, biases, values, attitudes and emotions. Thus the approach helps the scientist to attain objectivity. To what extent is the method of science useful in studying the problems of society? How can we acquire reliable knowledge about the various aspects of human experience? To be more specific how can the scientific approach be of value in understanding social phenomena? In response to these questions our approach would be first, to understand the meaning of science and then to examine the scientific approach, its assumptions and aims and finally to take a close look at the approach to find out how it can help social workers to understand social problems. Meaning of

Science The word science is derived from the Latin word 'scienta' which means 'to know'. Throughout history, people have been very keen to acquire knowledge by using various methods. However, it was felt necessary to evolve a method by which individual thinking has no effect on the conclusions. In other words, the method should be such that the ultimate conclusion of every man is the same. Endeavours to acquire knowledge, which involved such methods, came to be known as science. The term 'science' has been defined in different ways. To some, science means an objective investigation of empirical phenomena, to others, science denotes an accumulation of systematic knowledge; to still others, it means all knowledge collected by means of the scientific methodology. Nevertheless, whatever may be the way of defining, science is united by its methodology. Hence it would be easier to understand science if we first consider science as a method of approach, and then discuss its aims and functions. A method is a system of explicit rules and procedures. Thus methodologically an approach to acquire knowledge which follows certain explicit rules and procedures is science. Further the results – the acquired knowledge are evaluated in the light of the method. The process of study, which involves these steps, is science. Aim of Science The ultimate aim of science is to produce an accumulating body of reliable knowledge, which enable us to understand the world in which we live and its ways. First, science describes the various phenomena that interest us, such as: What was the population growth rate of our country in the last decade? Description of a phenomenon is followed by explanation. Explanation answers the question: Why is there a higher rate of population growth in underdeveloped countries than in developed countries? In other words, a scientist first describes the situation and 2
then explains it. The explanation of situation brings meaning to the description. Finally, science contributes to the body of knowledge by way of prediction. Prediction means making inferences from the facts. For example, if the present conditions continue, the population of the country will cross 1000 million by the end of this decade. It is true that the scientists rarely make absolute predictions, they instead infer in terms of probabilities. The final step of science prediction has been referred to as one of 'the most desirable fruits of scientific labour. What is Research? When we observe certain objects or phenomena, often unaware of our biases, we do not question them and so we attribute our observations entirely to the objects or phenomena being observed. In this process, it is possible to arrive at right decision on the basis of wrong reasons or vice versa. This questions the process of observation. Was the observation error free? Every method of knowing has certain limitations. While observing are we aware of our limitations?

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Any study to create new knowledge or aims to increase existing fund of knowledge may it be through observation or by some other methods, is called research

if it takes into account the biases, the errors and limitations. As such, research may be described as systematic and critical investigation of phenomena toward increasing the stream of knowledge. Scientific Research Science aims at description, explanation and understanding of various objects or phenomena in nature and research are special endeavours, which involves systematic and critical investigation. Thus, towards increasing the stream of knowledge now it is easier to define scientific research. We may define scientific research as a systematic and critical investigation about the natural phenomena to describe, explain and finally to understand the relations among them. Scientific Method It is obvious that it would be impossible to comprehend the nature and content of research without an appreciation of a method. The method used in scientific research is usually designated as scientific method.

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According to George Lundberg (1946), scientific method consists of three basic steps, systematic observation, classification and interpretation of data. Through these steps, scientific method brings

about not only verifiability of the facts, but also it lays the confidence in the validity of conclusions. The definition requires some more explanations. First when Lundberg (1946) says that scientific method is systematic observation, he means in effect, the scientific investigation is not ordered, it aims only at discovering facts as they actually are and not as they are desired to be and as such the investigators can have critical confidence in their conclusions. Second, the scientific 3 method is concerned with 'classes of objects' not 'individual objects'. Universality and predictability are other features of scientific method. The method makes it possible to predict about a phenomenon with sufficient accuracy. Use of Scientific Method in Social Work Social work primarily deals with human behaviour, which is, by and large, complex and dynamic in nature. One cannot, therefore investigate under guided conditions as in natural and physical sciences. This creates many problems to the researcher such as the problems of subjectivity and individualistic generalizations etc. The problem arising out of the nature and content of social work do not seriously diminish the importance of scientific method for social workers. Not withstanding the inherent limitations scientific method can be used for the study of problems related with social work so far as it helps to arrive at valid generalisations.

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Meaning of Social Work Research In a very broad sense, social work research is the application of research methods to solve problems that social workers confront in the practice of social work. It provides information that can be taken into consideration by social workers prior to making decisions, that affect their clients, programmes or agencies such as use of alternative intervention techniques or change or modification of programme/ client/objectives and so forth. Following are some of the situations which call for application of social work research methods and techniques: • A social caseworker is interested in assessing the nature and extent of the problem of her client who has been facing marital maladjustment. She may be interested in obtaining information about the actual or potential effectiveness of the client. She may also be keen to know to what extent the intervention would be effective. • A group worker wishes to assess

the extent to which

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the technique of role play is more or less effective than group discussion in increasing knowledge of drug abuse among school going children. • A community organiser wants to know the views of the community before he takes a decision to change the programme/objectives. • A director of special school for mentally retarded children wants to know whether group therapy is as effective as individual therapy in increasing adaptability of mentally retarded children. • A social work administrator is concerned about effectiveness of implementation of new programme launched. 4 Social Work Research:

Definition

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Social work research may be defined as systematic investigation into the problems in the field of social work. The study of concepts, principles, theories underlying social work methods and skills are the major areas of social work research. It involves the study of the relationship of social workers with their clients; individuals, groups or communities on various levels of interaction or therapy as well as their natural relationships and functioning within the organisational structure of social agencies.

While in the theoretical side,

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social work research re-examines the special body of knowledge; concepts and theories, where as in the area of social work practice

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it tries to evolve a systematic theory and valid concepts, to know the efficacy of different methods/interventions of social work as to search for alternate/innovative interventions

and treatments. Social work research, therefore, concerns itself with the problems faced by social workers. It encompasses those questions which are encountered in social work practices or in planning or administering social work services which can be solved through research and which are appropriate for investigation under social work auspices. Social work research utilizes the same

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scientific methods and techniques, as does social research. No doubt, when some (research designs) procedures of social research are not suitable to social work research it would be necessary to develop the tools which would be appropriate to social work research.

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Relevance of Research in Social Work Social work is a practice profession. As such, the major objective of social work research is to search for answers to questions raised regarding interventions or practice effectiveness. In other words social work research attempts to provide knowledge about what interventions or treatments really help or hinder the attainment of social work goals. In addition, it also helps in searching for answers to problems or difficulties faced by social work practitioners in the practice of their profession. Ultimately it helps building knowledge base for social work theory and practice. Social work research also deals with problems faced by professional social workers, social work agencies and community in its concern with social work functions. In other words in social work research the problems to be investigated are always found in the course of doing social work or planning to do it (

Dasgupta, 1968).

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It is obvious that in social work research the study of a problem is from the point of view of social work and that of professional social work. The designing of research problems, data collection and its interpretation will have to be attempted in a manner as would be useful to professional social work which would add new knowledge to the social work theory and practice and improve the efficiency of professional social workers. 5 Social work research is regarded as the systematic use of research concepts, methods, techniques and strategies to provide information related to the objectives of social work programmes and practices. Thus the unit of analysis of social work research could be individuals, groups, families or programme of the agency. That is, social work research, typically focuses on assessment of practitioner's work with individuals, groups, families, communities or appraisal of agencies or programmes that involve the continued efforts of practitioners with many clients. As such, the research design, data collection and analytic strategies in social work research vary as a function of unit of analysis and programme of agencies of social work practitioner. Social work research is the use of the scientific method in the search of knowledge, including knowledge of alternate practice and intervention techniques, which would be of direct use to the social work profession and thus enhance the practice of social work methods. Social work research focuses on or confines itself to select aspects of behaviour and alternate models of behaviour modifications. Social work research helps to find ways and means to enhance social functioning at the individual, group, community and societal levels. Social work research lays special emphasis on evaluation. This is one of the reasons that social work research is also understood as evaluative research. Under social work research, varieties of evaluative researches are undertaken. Some of the researches are on impacts or effects, efficacy and effectiveness. Evaluation of agencies and its projects and programmes are some of the specialized areas of social work research. Scope of Social Work Research Social work

profession has a scientific base, which consists of a special body of knowledge; tested knowledge, hypothetical knowledge and assumptive knowledge. Assumptive knowledge requires transformation into hypothetical knowledge, which in turn needs transformation into tested knowledge. Social work research has significant role in transforming the hypothetical and assumptive knowledge to tested knowledge (Khinduka,1965). Not all concepts or theories that are used by professional social workers have been tested and validated. Concerted efforts through social work research are very much required to conceptually articulate and validate the concepts and theories, which will in turn strengthen the scientific base of professional social work. Identification of social work

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needs and resources, evaluation of programmes and services of social work agencies

are some of the areas in which social work researches are undertaken. Social work research may be conducted

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to know the problems faced by professional social workers in social work agencies and communities in its concern with social work functions. Thus, social work research

embraces the entire gamut of social work profession; concepts, theories, methods, programmes, services and the problems faced by social workers in their practice.

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The areas of social work research may be broadly categorized as follows: 6 1) Studies to establish, identify and measure the need for service. 2) To measure the services offered as they relate to needs. 3) To test, gauge and evaluate results of social work intervention. 4) To list the efficacy of specific techniques of offering services. 5) Studies in methodology of social work. Social work is a diverse profession, possible broad research areas could be: i) Community Development ii) Community Health (Including Mental Health) iii) Child Welfare iv) Women Welfare

v) Youth Welfare vi) Aged Welfare vii) Welfare of SC & ST Groups viii) Poverty Alleviation ix) Physical and Mental Disabilities x) Juvenile Delinquency xi) Crime and Correction etc. xii) Management of Social Welfare Department and Organisation xiii) Disaster Management xiv) Industrial Social Work xv) Issues concerning Advocacy and Networking The list is not exhaustive, it's only an exemplary list which enlists broad areas which is very frequently studied by social workers. Again, within one or more problem areas research might

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focus on individuals, families, groups, community organisations or broad social systems. It might deal with characteristics of a larger population, and the services available to them.

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Goals and Limitations of Social Work Research Social work research offers an opportunity for all social workers to make differences in their practice. There is no doubt about the fact that social worker will be more effective practitioner guided by the findings of social work research. Thus, social work research seeks to accomplish the same humanistic goals, as does a social work method. Social work research deals with those methods and issues, which are useful in evaluating social work programmes and practices. It explains the methodology of social research and illustrates its applications in social work settings. 7

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A substantive part of social work practice is concerned with the micro-level practice, such as working with individuals, groups, or a community.

Social work

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research has to take into consideration the limitations of micro level design of study and techniques.

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Social work research is basically a practice based research which mostly draws its inferences through inductive reasoning. That is, inferring something about a whole group or a class of objects from the facts or knowledge of one or few members of that group/class. Thus, in practice based research inductive reasoning carries us from observation to theory through intervention/assessment. Practitioners, for example, may observe that delinquents tend to come from family with low socio-economic status. Based on the assumption that the parent-child bond is weaker in low socio-economic families and that such parents, therefore, have less control over their children, the practitioners may inductively conclude that a weak parent-child bond leads to delinquency.

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A substantive part of social work practice is concerned with the micro-level practice, such as working with individuals, groups, or a community. Practice based research has to take into consideration the limitations of micro level practice. Accordingly, practice based research has to have special design of study and techniques.

Social Research and Social Work Research Search implies thorough investigation and the term 'research' which has been derived from the French word 'rechercher', 're' and 'chercher', means a critical examination of a topic or subject to discover new facts for increasing the sum total of human knowledge. It is a method for discovery of new knowledge which augments to the existing body of organized facts, ideals and aspiration, "

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

Research per se constitutes a method for the discovery of truth which necessitates critical thinking. "
It

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comprises defining and redefining problems; formulating hypothesis or suggested solutions, collecting, organizing, and evaluating data; making deductions and reaching conclusions; and at least, carefully testing the conclusions to determine whether they fit the formulated hypotheses." "It is the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art." Thus, research is a "

systematized effort to, gain new knowledge."
Research is characterised by: (i) a specific problem. (ii) involvement in original work, 8
(iii) resting upon a mental attitude of curiosity, (iv) requirement of an open mind, (v) resting upon the assumption that everything is subject to law and order, (vi) discovery of laws and generalizations (vii) study of cause and effect (vii) measurement and (ix) involvement in a conscious technique. Social research implies discovery of some facts concealed in a social phenomenon or some laws governing it. It is mainly concerned with the cause and effect relationship of human behaviour and the discovery of new facts as well as the verification of old facts. Therefore, "we may define

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social research as the systematic method of discovering new facts or verifying old facts, their sequences, interrelationships, causal explanations and the natural laws which govern them."

While studying human behaviour and social problems and discovering new interrelations, new knowledge, new facts and verifying old ones, social research applies the scientific method and tries to establish the causal connection between various human activities and the natural laws governing them by means of logical and systematized methods because the human behaviour may be motivated by certain rules and laws and does not appear haphazardly. Briefly stated, social research implies scientific investigation conducted in the field of social as well as behaviour sciences. Social research has many objectives which may be discussed below: 1. Manipulation of things, concepts and symbols While dealing with things the scientist remains at the concrete level. He is able to purposefully handle things for experimentation. But at this level his results are at best limited to the particular thing in a specific situation and none else. Therefore the concepts symbolizing the things and their properties are also dealt with, so as to make much sense to conduct controlled inquiries through abstract notions. Use of concepts or symbols in the process of manipulation not only reduces the content and load of the things but also provides the scientist with greater facility and effect. 2. Generalization The sole purpose with which manipulation of things, concepts or symbols is undertaken is to arrive at statements of generality. It implies that the findings of controlled investigation should be a conclusion which "will enable us to expect that under certain class of conditions influencing a class of things, something will happen in a generalized manner, notwithstanding its degree. But in any case the absence in generality cannot characterise science. Therefore the propositions 9

derived on the basis of observations and through manipulation of things,concepts or symbols may vary in their levels of generality, may maintain a high or low degree but should never reach the null point. Otherwise those will move beyond the framework of science. In this regard, Slesinger and Stephenson have given the example of a physician or auto-mobile mechanic as playing the role of a researcher. Whereas the auto-mobile mechanic endeavors to generalize about the auto- mobiles, the physician attempts to make ailments for a given class of patients. 3. Verification of Old Facts A major purpose of social research is verification of conclusions which have already been accepted as established facts. Since there is no place for complacency in the arena of science, the established system of knowledge always warrant frequentative scrutiny so as to confirm whether or not the observations are in accordance with the predictions made on the basis of the established corpus of knowledge. In case it is confirmed, the empirical observation strengthens the established system of knowledge. Otherwise in the light of the research outcome, the system of established corpus of knowledge calls for revision or even rejection. 4. Extension of Knowledge As a sequel to generalization the seemingly inconsistencies in the existing corpus of knowledge are brought into light and attempts are made to reconcile these inconsistencies. The new general proposition, established as an outcome of research also identifies gaps in the established system of knowledge. A gap in knowledge implies the inadequacy of the theory as well as the failure of a conceptual scheme to explain and account for certain aspects of a social phenomenon. The gap is bridged up in the light of the new empirical observations. Thus knowledge gets expanded. The expansion of systematic knowledge occurs at least in a couple of ways. First in cognizing certain aspects of phenomena which were not examined in these terms prior to the advent of the new general proposition. Secondly in the light of new observation, the phenomena under investigation may be incorporated in a comparatively large class of phenomena, so as to be governed by a uniform law. As a result, the new system of knowledge not only accumulates more units under its conceptual scheme, but also appreciates greater depth of understanding and bettering of predictions. 5. Knowledge may be used for theory building or practical application By seeking to explain the unexplained social phenomena, clarifying the doubtful one and correcting the misconceived facts relating to it, social research provides the scope to use the fruits of research in two possible ways : (a) theory building (b) practical application. In its basic or pure form social research gathers knowledge for the sake of it, for building a theory in order to explain human behaviour in its totality, only for the satisfaction of knowing. For construction of theoretic 10
models, the researcher organizes knowledge into propositions and then meaningfully articulated those propositions to constitute a more abstract conceptual system pertaining to a class of phenomena, influenced by a certain class of conditions. In its practical or applied form, social research gathers information regarding the betterment of quality of life in social settings. The findings of social research are used as the means to an end, not construed just as an end in itself. From its utilitarian point of view the results of social research provide decision makers with proper guidelines for policy making, social welfare, amelioration of practical problems, mitigation or resolution of social conflict and tensions as well as rectification and removal of social evils. It is generally believed that social research and social work research do not have much difference as the purpose of promoting the welfare of the humanity through investigation remains common to both. Whereas the social work research commences with practical problems, social research aims at producing such knowledge that can be of use in planning and executing the social work programmes. Social research also has the objective of accumulating knowledge for understanding the social life of human beings. The social work research is an applied research which has the purpose of gaining knowledge in order to control or change human behaviour. On the other hand, social research may have practical as well as theoretical concern. Social work research serves the objectives of social work. On the contrary, social research does not have any specific goal. The main objective is to enhance in the knowledge of any social science. Moreover the social work research renders helps to the social workers for dealing which social problems relating to their client which may be afflicting either individual or the group or community. Social research may be of use to social worker as well as entire field of social work as it helps in enhancing the knowledge of dealing with and understating human behaviour. Research Process Until the sixteenth century, human inquiry was primarily based on introspection. The way to know things was to turn inward and use logic to seek the truth. This paradigm had endured for a millennium and was a well-established conceptual framework for understanding the world. The seeker of knowledge was an integral part of the inquiry process. A profound change occurred during the sixteenth and seventeenth centuries. The Scientific Revolution was born. Objectivity became a critical component of the new scientific method. The investigator was an observer, rather than a participant in the inquiry process. A mechanistic view of the universe evolved. We believed that we could understand the whole by performing an examination of the individual parts. Experimentation and deduction became the tools of the scholar. For two hundred years, the new paradigm slowly evolved to become part of the reality framework of society. The research process is a step-by-step process of developing a research paper. As you progress from one step to the next, it is commonly necessary to backup, revise, add additional 11

material or even change your topic completely. This will depend on what you discover during your research. There are many reasons for adjusting your plan. For example, you may find that your topic is too broad and needs to be narrowed, sufficient information resources may not be available, what you learn may not support your thesis, or the size of the project does not fit the requirements.

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The research process itself involves identifying, locating, assessing, analyzing, and then developing and expressing your ideas.

These are the same skills you will need outside the academic world when you write a report or proposal for your boss. There are nine steps in the research process, that can be followed while designing a research project. They are as follows: 1. Problem Formulation Problem formulation is the key to research process. For a researcher, problem formulation means converting the management problem to a research problem. In order to attain clarity, the MR manager and researcher must articulate clearly so that perfect understanding of each others is achieved. While problem is being formulated, the following should be taken into account: a. Determine the objective of the study b. Consider various environment factors c. Nature of the problem d. State the alternative a) Determine the Objective Objective may be general or specific. General - Would like to know, how effective was the advertising campaign. The above looks like a statement with objective. In reality, it is far from it. 12 Formulate the Problem Evaluate the cost of Research Prepare the list of Information Research Design Decisions Data Collection Select the Smaple Type Determine the sample Size Organize the Field Work Analyze the data and report Preparation
There are two ways of finding out the objectives precisely. (a) The researcher should clarify with the MR manager "What effective means". Does effective mean, awareness or does it refer to sales increase or does it mean, it has improved the knowledge of the audience, or the perception of audience about the product. In each of the above circumstances, the questions to be asked from audience varies (b) Another way to find objectives is to find out from the MR Manager, "What action will be taken, given the specified outcome of the study." Example: If research finding is that, the previous advertisement by the company was indeed ineffective, what course of action the company intends to take (a) Increase the budget for the next Ad (b) Use different appeal (c) Change the media (d) Go to a new agency. b) Consider Environmental Factors Environmental factors influence the outcome of the research and the decision. Therefore, the researcher must help the client to identify the environmental factors that are relevant. Example: Assume that the company wants to introduce a new product like Iced tea or frozen green peas or ready to eat chapathis. The following are the environmental factors to be considered: (a) Purchasing habit of consumers. (b) Presently, who are the other competitors in the market with same or similar product. (c) What is the perception of the people about the other products of the company, with respect to price, image of the company. (d) Size of the market and target audience. All the above factors could influence the decision. Therefore researcher must work very closely with his client. c) Nature of the problem By understanding the nature of the problem, the researcher can collect relevant data and help suggesting a suitable solution. Every problem is related to either one or more variable. Before starting the data collection, a preliminary investigation of the problem is necessary, for better understanding of the problem. Initial investigation could be, by using focus group of 13
consumers or sales representatives. If focus group is carried out with consumers, some of the following question will help the researcher to understand the problem better: (a) Did the customer ever included this company's product in his mental map? (b) If the customer is not buying the companies product, the reasons for the same. (c) Why did the customer go to the competitor? (d) Is the researcher contacting the right target audience? d) State the alternatives It is better for the researcher to generate as many alternatives as possible during problem formulation hypothesis. Example: Whether to introduce a Sachet form of packaging with a view to increase sales. The hypothesis will state that, acceptance of the sachet by the customer will increase the sales by 20%. Thereafter, the test marketing will be conducted before deciding whether to introduce sachet or not. Therefore for every alternative, a hypothesis is to be developed. 2. Evaluate the Cost of Research There are several methods to establish the value of research. Some of them are (1) Bayesian approach (2) Simple saving method (3) Return on investment (4) Cost benefit approach etc. Example: Company 'X' wants to launch a product. The company's intuitive feeling is that, the product failure possibilities is 35%. However, if research is conducted and appropriate data is gathered, the chances of failure can be reduced to 30%. Company also has calculated, that the loss would be 3,00,000 if product fails. The company has received a quote from MR agency. The cost of research is 75,000. The question is "Should the company spend this money to conduct research?" Solution: Loss without research = 3,00,000 × 0.35 = 1,05,000 Loss with research = 3,00,000 × 0.30 = 90,000 Value of research information = 1,05,000 – 90,000 = 15,000 14

Since the value of information namely 15000 is lower than the cost of research 75,000, conducting research is not recommended. 3. Preparing a List of Needed Information Assume that company 'X' wants to introduce a new product (Tea powder). Before introducing it, the product has to be test marketed. The company needs to know the extent of competition, price and quality acceptance from the market. In this context, following are the list of information required. a) Total demand and company sales Example: What is the overall industry demand? What is the share of the competitor? The above information will help the management to estimate overall share and its own shares, in the market. b) Distribution Coverage Example: (a) Availability of products at different outlets. (b) Effect of shelf display on sales. c) Market awareness, attitude and usage Example: "What percentage of target population are aware of firm's product"? "Do customers know about the product"? "What is the customers' attitude towards the product"? "What percentage of customers repurchased the product"? d) Marketing Expenditure Example: "What has been the marketing expenditure"? "How much was spent on promotion"? e) Competitors marketing expenditure: Example: "How much competitor spent, to market a similar product"? 4. Decision on Research Design 1. Should the research be exploratory or conclusive? a) Exploratory research Example: "Causes for decline in sales of a specific company's product in a specific territory under a specific salesman". The researcher may explore all possibilities why sales in falling? (a) Faulty product planning (b) Higher price (c) Less discount (d) Less availability 15
(e) Inefficient advertising/salesmanship (f) Poor quality of salesmanship (g) Less awareness Not all factors are responsible for decline in sales. b) Conclusive Research Narrow down the option. Only one or two factors are responsible for decline in sales. Therefore zero down, and use judgment and past experience. 2. Who should be interviewed for collecting data? If the study is undertaken to determine whether, children influence the brand, for ready - to eat cereal (corn flakes) purchased by their parents. The researcher must decide, if only adults are to be studied or children are also to be included. The researcher must decide if data is to be collected by observation method or by interviewing. If interviewed, "Is it a personal interview or telephonic interview or questionnaire?" 3. Should a few cases be studied or choose a large sample? The researcher may feel that, there are some cases available which are identical and similar in nature. He may decide to use these cases for formulating the initial hypothesis. If suitable cases are not available, then the researcher may decide to choose a large sample. 4. How to incorporate experiment in research? If it is an experiment, "Where and when measurement should take place?", should be decided. Example: In a test of advertising copy, the respondents can first be interviewed to measure their present awareness, and their attitudes towards certain brands. Then, they can be shown a pilot version of the proposed advertisement copy, following this, their attitude also is to be measured once again, to see if the proposed copy had any effect on them. If it is a questionnaire, (a) What are the contents of the questionnaire? (b) What type of questions to be asked? Like pointed questions, general questions etc. (c) In what sequence should it be asked? (d) Should there be a fixed set of alternatives or should it be open ended. (e) Should the Notes purpose be made clear to the respondents or should it be disguised are to be determined well in advance. 5. Data Collection The collection of data is a critical step in providing the information needed to answer the research question. Every study includes the collection of some type of data - whether it is from the literature or from subjects - to answer the research question. Data can be collected in the form of 16
words on a survey, with a questionnaire, through observations, or from the literature. In the obesity study, the programmers will be collecting data on the defined variables: weight, percentage of body fat, cholesterol levels, and the number of days the person walked a total of 10,000 steps during the class. The researcher collects these data at the first session and at the last session of the program. These two sets of data are necessary to determine the effect of the walking program on weight, body fat, and cholesterol level. Once the data are collected on the variables, the researcher is ready to move to the final step of the process, which is the data analysis. 6. Select the Sample Types The first task is to carefully select "What groups of people or stores are to be sampled". For example, collecting the data from a fast food chain. Here, it is necessary to define what is meant by fast food chain. Also precise geographical location should be mentioned. Next step is to decide whether to choose probability sampling or non-probability sampling. Probability sampling is one, in which each element has a known chance of being selected. A non-probability sampling can be convenience or judgment sampling. 7. Determine the Sample Size • Smaller the sample size, larger the error, vice versa. • Sample size depends up on (a) Accuracy required (b) Time available (c) Cost involved. • Sample size depends on the size of the sample frame/universe. Example: Survey on the attitudes towards the use of shampoo with reference to a specific brand, where husbands, wives or combination of all of them are to be surveyed or a specific segment is to be surveyed. While selecting the sample, the sample unit has to be clearly specified. 8. Organize the Fieldwork This includes selection, training and evaluating the field sales force to collect the data. (a) How to analyzing the field work? (b) What type of questionnaire - structured/unstructured to use? (c) How to approach the respondents? (d) Week, day and time to meet the specific respondents etc., are to be decided. 9. Analyze the Data and Report Preparation This involves (a) Editing, (b) Tabulating, (c) Codifying etc. 17

1. The data collected should be scanned, to make sure that it is complete and all the instructions are followed. This process is called editing. Once these forms have been edited, they must be coded. 2. Coding means, assigning numbers to each of the answers, so that they can be analyzed. 3. The final step is called as data tabulation. It is the orderly arrangement of the data in a tabular form. Also at the time of analyzing the data, the statistical tests to be used must be finalized such as T-Test, Z-test, Chi-square Test, ANOVA, etc. 18
Unit: 02 Research Designs, Approaches, and Types In this unit, you will learn about, • Research Designs ➢ Descriptive Research Design ➢ Exploratory Research Design ➢ Experimental Research Design • Research Approaches ➢ Action Research ➢ Participatory Research ➢ Evaluation Research ➢ Qualitative Research ➢ Quantitative Research Research Designs 1) Descriptive Research Design The name itself reveals that, it is essentially a research to describe something. For example, it can describe the characteristics of a group such as – customers, organisations, markets, etc. Descriptive research provides "association between two variables" like income and place of shopping, age and preferences. Descriptive research inform us about the proportions of high and low income customers in a particular territory. It is desirable when we wish to project a study's findings to a larger population, if the study's sample is representative. What descriptive research cannot indicate is that it cannot establish a cause and effect relationship between the characteristics of interest. This is the distinct disadvantage of

63%	MATCHING BLOCK 26/101	W

descriptive research. Descriptive study requires a clear specification of "Who, what, when, where, why and how" of the research.

For example, consider a situation of convenience stores (food world) planning to open a new outlet. The company wants to determine, "How people come to patronize a new outlet?"

100%	MATCHING BLOCK 27/101	W

Some of the questions that need to be answered before data collection for this descriptive study are as follows: 1. Who?

Who is regarded as a shopper responsible for the success of the shop, whose demographic profile is required by the retailer? 2. What? What characteristics of the shopper should be measured? 19
3. Is it the age of the shopper, sex, income or residential address? 4. When? When shall we measure? 5. Should the measurement be made while the shopper is shopping or at a later time? 6. Where? Where shall we measure the shoppers? 7. Should it be outside the stores, soon after they visit or should we contact them at their residence? 8. Why? Why do you want to measure them? 9. What is the purpose of measurement? Based on the information, are there any strategies which will help the retailer to boost the sales? Does the retailer want to predict future sales based on the data obtained? 10. Answer to some of the above questions will help us in formulating the hypothesis. 11. How to measure? Is it a 'structured' questionnaire, 'disguised' or 'undisguised' questionnaire? When to use Descriptive Study? 1. To determine the characteristics of market such as: (a) Size of the market (b) Buying power of the consumer (c) Product usage pattern (d) To find out the market share for the product (e) To track the performance of a brand. 2. To determine the association of the two variables such as Ad and sales. 3. To make a prediction. We might be interested in sales forecasting for the next three years, so that we can plan for training of new sales representatives. 4. To estimate the proportion of people in a specific population, who behave in a particular way? Example: What percentage of population in a particular geographical location would be shopping in a particular shop? Hypothesis study at the descriptive research stage (to demonstrate the characteristics of the group): Management Problems Research Problem Hyphothesis How should a new product be distributed? Where do customers buy a similar product right now? Upper class buyers use 'Shopper's stop' and middle class buyers buy from local departmental stores What will be the target What kind of people buy our Senior citizens buy our 20

segment? product now? products. Young and married buy our competitors products. Types of Descriptive Studies 1. Cross Sectional Study Cross sectional studies measures units from a sample of the population at only one point in time(or "snapshot"). It is one of the most important types of descriptive research, it can be done in two ways: a) Field Study: This includes a depth study. Field study involves an in-depth study of a problem, such as reaction of young men and women towards a product. Example: Reaction of Indian men towards branded ready-to-wear suit. Field study is carried out in real world environment settings. Test marketing is an example of field study. b) Field Survey: Large samples are a feature of the study. The biggest limitations of this survey are cost and time. Also, if the respondent is cautious, then he might answer the questions in a different manner. Finally, field survey requires good knowledge like constructing a questionnaire, sampling techniques used, etc. Example: Suppose the management believes that geographical factor is an important attribute in determining the consumption of a product, like sales of a woolen wear in a particular location. Suppose that the proposition to be examined is that, the urban population is more likely to use the product than the semi-urban population. This hypothesis can be examined in a cross- sectional study. Measurement can be taken from a representative sample of the population in both geographical locations with respect to the occupation and use of the products. In case of tabulation, researcher can count the number of cases that fall into each of the following classes: (i) Urban population which uses the product - Category I (ii) Semi-urban population which uses the product - Category II (iii) Urban population which does not use the product - Category III 21 Descriptive Study Cross - Sectional Study Longitudnal Study Survey Observation Study
(iv) Semi-urban population which does not use the product - Category IV. Here, we should know that the hypothesis need to be supported and tested by the sample data i.e., the proportion of urbanities using the product should exceed the semi-urban population using the product. 2. Longitudinal Study These are the studies in which an event or occurrence is measured again and again over a period of time. This is also known as 'Time Series Study'. Since, they involve multiple measuremenrs overt time, they are often described as 'movies" of the population. Through longitudinal study, the researcher comes to know how the market changes over time. Longitudinal studies involve panels. Panel once constituted will have certain elements. These elements may be individuals, stores, dealers, etc. The panel or sample remains constant throughout the period. There may be some dropouts and additions. The sample members in the panel are being measured repeatedly. The periodicity of the study may be monthly or quarterly etc. Example: For longitudinal study, assume a market research is conducted on ready to eat food at two different points of time T 1 and T 2 with a gap of 4 months. Each of the above two times, a sample of 2000 household is chosen and interviewed. The brands used most in the household is recorded as follows. Brands At T 1 At T 2 Brand X 500(25%) 600(30%) Brand Y 700(35%) 650(32.5%) Brand Z 400(20%) 300(15%) Brand M 200(10%) 250(12.5%) All others 200(10%) 250(12.5%) 200 100% As can be seen between period T1 and T2 Brand X and Brand M has shown an improvement in market share. Brand Y and Brand Z has decrease in market share, where as all other cate gories remains the same. This shows that Brand A and M has gained market share at the cost of Y and Z. There are two types of panels: (a) True panel (b) Omnibus panel. (a) True Panel: This involves repeat measurement of the same variables. Example: Perception towards frozen peas or iced tea. Each member of the panel is examined at a different time, to arrive at a conclusion on the above subject. 22
(b) Omnibus Panel: In omnibus panel too, a sample of elements is being selected and maintained, but the information collected from the member varies. At a certain point of time, the attitude of panel members "towards an advertisement" may be measured. At some other point of time the same panel member may be questioned about the "product performance". (c) Continuous Panel: Continous panel ask panel members the same questions on each panel measurement. • Brand Switching Studies: Studies examining how many consumers switched brand. • Market- Tracking Studies: those that measure some variable(s) of interest such as market share or unit sales – overtime. (d) Discontinuos Panel: Discontinous Panels vary questions from one panel measurement to the next. These are sometimes referred to as omnibus panels. Discontinous panel are demographically matched to some larger entity, implying representatives. It represent sources of information that may be quickly accessed for a wide variety of purposes. Advantages of Panel Data (a) We can find out what proportion of those who bought our brand and those who did not. This is computed using the brand switching matrix. (b) The study also helps to identify and target the group which needs promotional effort. (c) Panel members are willing persons, hence a lot of data can be collected. This is because becoming a member of a panel is purely voluntary. (d) The greatest advantage of panel data is that it is analytical in nature. (e) Panel data is more accurate than cross-sectional data because it is free from the error associated with reporting past behaviour. Errors occur in past behaviour because of time that has elapsed or forgetfulness. Disadvantages of Panel Data (a) The sample may not be representative. This is because sometimes, panels may be selected on account of convenience. (b) The panel members who provide the data, may not be interested to continue as panel members. There could be dropouts, migration, etc. Members who replace them may differ vastly from the original member. (c) Remuneration given to panel members may not be attractive. Therefore, people may not 23

like to be panel members. (d) Sometimes the panel members may show disinterest and non-committed. (e) A lengthy period of membership in the panel may cause respondents to start imagining themselves to be experts and professionals. They may start responding like experts and consultants and not like respondents. To avoid this, no one should be retained as a member for more than 6 months. 3. Survey The survey is a research technique in which data are gathered by asking questions of respondents.

94% **MATCHING BLOCK 30/101** SA markiii_mr.pdf (D112190661)

Survey research is one of the most important areas of measurement in applied social research. The broad area of survey research encompasses any measurement procedures that involve asking questions of respondents. A "survey" can be anything form a short paper-and- pencil feedback form to an intensive one-on-one in-depth interview.

Types of Surveys

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Surveys can be divided into two broad categories: the questionnaire and the interview. Questionnaires are usually paper-and-pencil instruments that the respondent completes. Interviews are completed by the interviewer based on the

respondent says. Sometimes, it's hard to tell the difference between a questionnaire and an interview. For instance, some people think that questionnaires always ask short closed-ended questions while interviews always ask broad open-ended ones. But you will see questionnaires with open-ended questions (although they do tend to be shorter than in interviews) and there will often be a series of closed-ended questions asked in an interview. Survey research has changed dramatically in the last ten years. We have automated telephone surveys that use random dialing methods. There are computerized kiosks in public places that allows people to ask for input. A whole new variation of group interview has evolved as focus group methodology. Increasingly, survey research is tightly integrated with the delivery of service. Your hotel room has a survey on the desk. Your waiter presents a short customer satisfaction survey with your check. You get a call for an interview several days after your last call to a computer company for technical assistance. You're asked to complete a short survey when you visit a web site. Selecting the Survey Method Selecting the type of survey you are going to use is one of the most critical decisions in many social research contexts. You'll see that there are very few simple rules that will make the decision for you – you have to use your judgment to balance the advantages and disadvantages of different survey types. Here, all I want to do is give you a number of questions you might ask that 24 can help guide your decision. Population Issues He first set of considerations have to do with the population and its accessibility. 1. Can the population be enumerated? For some populations, you have a complete listing of the units that will be sampled. For others, such a list is difficult or impossible to compile. For instance, there are complete listings of registered voters or person with active drivers licenses. But no one keeps a complete list of homeless people. If you are doing a study that requires input from homeless persons, you are very likely going to need to go and find the respondents personally. In such contexts, you can pretty much rule out the idea of mail surveys or telephone interviews. 2. Is the population literate? Questionnaires require that your respondents can read. While this might seem initially like a reasonable assumption for many adult populations, we know from recent research that the instance of adult illiteracy is alarmingly high. And, even if your respondents can read to some degree, your questionnaire may contain difficult or technical vocabulary. Clearly, there are some populations that you would expect to be illiterate. Young children would not be good targets for questionnaires. 3. Are there language issues? We live in a multilingual world. Virtually every society has members who speak other than the predominant language. Some countries (like Canada) are officially multilingual. And, our increasingly global economy requires us to do research that spans countries and language groups. Can you produce multiple versions of your questionnaire? For mail instruments, can you know in advance the language your respondent speaks, or do you send multiple translations of your instrument? Can you be confident that important connotations in your instrument are not culturally specific? Could some of the important nuances get lost in the process of translating your questions? 4. Will the population cooperate? People who do research on immigration issues have a difficult methodological problem. They often need to speak with undocumented immigrants or people who may be able to identify others who are. Why would we expect those respondents to cooperate? Although the researcher may mean no harm, the respondents are at considerable risk legally if information they divulge should get into the hand of the authorities. The same can be said for any target group that is 25

engaging in illegal or unpopular activities. 5. What are the geographic restrictions? Is your population of interest dispersed over too broad a geographic range for you to study feasibly with a personal interview? It may be possible for you to send a mail instrument to a nationwide sample. You may be able to conduct phone interviews with them. But it will almost certainly be less feasible to do research that requires interviewers to visit directly with respondents if they are widely dispersed. Sampling Issues The sample is the actual group you will have to contact in some way. There are several important sampling issues you need to consider when doing survey research. 1. What data is available? What information do you have about your sample? Do you know their current addresses? Their current phone numbers? Are your contact lists up to date? 2. Can respondents be found? Can your respondents be located? Some people are very busy. Some travel a lot. Some work the night shift. Even if you have an accurate phone or address, you may not be able to locate or make contact with your sample. 3. Who is the respondent? Who is the respondent in your study? Let's say you draw a sample of households in a small city. A household is not a respondent. Do you want to interview a specific individual? Do you want to talk only to the "head of household" (and how is that person defined)? Are you willing to talk to any member of the household? Do you state that you will speak to the first adult member of the household who opens the door? What if that person is unwilling to be interviewed but someone else in the house is willing? How do you deal with multi-family households? Similar problems arise when you sample groups, agencies, or companies. Can you survey any member of the organization? Or, do you only want to speak to the Director of Human Resources? What if the person you would like to interview is unwilling or unable to participate? Do you use another member of the organization? 4. Can all members of population be sampled? If you have an incomplete list of the population Notes (i.e., sampling frame) you may not be able to sample every member of the population. Lists of various groups are extremely hard to keep up to date. People move or change their names. Even though they are on your sampling 26
frame listing, you may not be able to get to them. And, it's possible they are not even on the list. 5. Are response rates likely to be a problem? Even if you are able to solve all of the other population and sampling problems, you still have to deal with the issue of response rates. Some members of your sample will simply refuse to respond. Others have the best of intentions, but can't seem to find the time to send in your questionnaire by the due date. Still others misplace the instrument or forget about the appointment for an interview. Low response rates are among the most difficult of problems in survey research. They can ruin an otherwise well-designed survey effort. Question Issues Sometimes the nature of what you want to ask respondents will determine the type of survey you select. 1. What types of questions can be asked? Are you going to be asking personal questions? Are you going to need to get lots of detail in the responses? Can you anticipate the most frequent or important types of responses and develop reasonable closed-ended questions? 2. How complex will the questions be? Sometimes you are dealing with a complex subject or topic. The questions you want to ask are going to have multiple parts. You may need to branch to sub-questions. 3. Will screening questions be needed? A screening question may be needed to determine whether the respondent is qualified to answer your question of interest. For instance, you wouldn't want to ask someone their opinions about a specific computer program without first "screening" them to find out whether they have any experience using the program. Sometimes you have to screen on several variables (e.g., age, gender, experience). The more complicated the screening, the less likely it is that you can rely on paper-and-pencil instruments without confusing the respondent. 4. Can question sequence be controlled? Is your survey one where you can construct in advance a reasonable sequence of questions? Or, are you doing an initial exploratory study where you may need to ask lots of follow- up questions that you can't easily anticipate? 5. Will lengthy questions be asked? If your subject matter is complicated, you may need to give the respondent some detailed background for a question. Can you reasonably expect your respondent to sit still long enough in a 27

phone interview to ask your question? 6. Will long response scales be used? If you are asking people about the different computer equipment they use, you may have to have a lengthy response list (CD-ROM drive, floppy drive, mouse, touch pad, modem, network connection, external speakers, etc.). Clearly, it may be difficult to ask about each of these in a short phone interview. Content Issues The content of your study can also pose challenges for the different survey types you might utilize. 1. Can the respondents be expected to know about the issue? If the respondent does not keep up with the news (e.g., by reading the newspaper, watching television news, or talking with others), they may not even know about the news issue you want to ask them about. Or, if you want to do a study of family finances and you are talking to the spouse who doesn't pay the bills on a regular basis, they may not have the information to answer your questions. 2. Will respondent need to consult records? Even if the respondent understands what you're asking about, you may need to allow them to consult their records in order to get an accurate answer. For instance, if you ask them how much money they spent on food in the past month, they may need to look up their personal check and credit card records. In this case, you don't want to be involved in an interview where they would have to go look things up while they keep you waiting (they wouldn't be comfortable with that). Bias Issues People come to the research endeavor with their own sets of biases and prejudices. Sometimes, these biases will be less of a problem with certain types of survey approaches. 1. Can social desirability be avoided? Respondents generally want to "look good" in the eyes of others. None of us likes to look like we don't know an answer. We don't want to say anything that would be embarrassing. If you ask people about information that may put them in this kind of position, they may not tell you the truth, or they may "spin" the response so that it makes them look better. This may be more of a problem in an interview situation where they are face-to face or on the phone with a live interviewer. 28

2. Can interviewer distortion and subversion be controlled? Interviewers may distort an interview as well. They may not ask questions that make them uncomfortable. They may not listen carefully to respondents on topics for which they have strong opinions. They may make the judgment that they already know what the respondent would say to a question based on their prior responses, even though that may not be true. 3. Can false respondents be avoided? With mail surveys it may be difficult to know who actually responded. Did the head of household complete the survey or someone else? Did the CEO actually give the responses or instead pass the task off to a subordinate? Is the person you're speaking with on the phone actually who they say they are? At least with personal interviews, you have a reasonable chance of knowing who you are speaking with. In mail surveys or phone interviews, this may not be the case. Administrative Issues Last, but certainly not least, you have to consider the feasibility of the survey method for your study 1. Costs: Cost is often the major determining factor in selecting survey type. You might Notes prefer to do personal interviews, but can't justify the high cost of training and paying for the interviewers. You may prefer to send out an extensive mailing but can't afford the postage to do so. 2. Facilities: Do you have the facilities (or access to them) to process and manage your study? In phone interviews, do you have well-equipped phone surveying facilities? For focus groups, do you have a comfortable and accessible room to host the group? Do you have the equipment needed to record and transcribe responses? 3. Time: Some types of surveys take longer than others. Do you need responses immediately (as in an overnight public opinion poll)? Have you budgeted enough time for your study to send out mail surveys and follow-up reminders, and to get the responses back by mail? Have you allowed for enough time to get enough personal interviews to justify that approach? 4. Personnel: Different types of surveys make different demands of personnel. Interviews require 29 interviewers who are motivated and well-trained. Group administered surveys require people who are trained in group facilitation. Some studies may be in a technical area that requires some degree of expertise in the interviewer. Clearly, there are lots of issues to consider when you are selecting which type of survey you wish to use in your study. And there is no clear and easy way to make this decision in many contexts. There may not be one approach which is clearly the best. You may have to make tradeoffs of advantages and disadvantages. There is judgment involved. Two expert researchers may, or the very same problem or issue, select entirely different survey methods. But, if you select a method that isn't appropriate or doesn't fit the context, you can doom a study before you even begin designing the instruments or questions themselves. 4. Observation Study Observation studies are involved in both quantitative and qualitative research methods. However, in quantitative methods, the focus of observation studies is on a particular factor of behaviour and it is quantified. In this type of design, a researcher will try to maintain objectivity in assessing the behaviour being studied. Table 1 summarises some strategies used in this design. Table 1 – Strategies used in observation studies S.No Strategies Description 1 Using rating scale Using rating scale (e.g. Likert Scale) to evaluate the behaviour in terms of specific factor or reasons. 2 Defining the behaviour Defining the behaviour being studied in a precise and solid manner so that the behaviour is easily recognised during its occurence. 3 Rated by two or more individuals Having two or more individual ratings the same behaviour independently, without the knowledge of one another's ratings. 4 Clustering the observation periods Divide observation period into small clusters and then record whether the behaviour does or does not occur during each cluster or segment. Time period may be assigned with some intervals depending on the studies requirement. 5 Train the rater(s) Train the rater(s) of the behaviour to follow some specific requirement until consistent ratings are obtained during any of the behaviour occurences. 30

2. Exploratory Research Design

76%	MATCHING BLOCK 34/101	SA	542E1240-Bio Statistics Research Methodology - ... (D165249397)

The major emphasis in exploratory research is on converting broad, vague problem statements into small, precise sub-problem statements,

which is done in order

33%	MATCHING BLOCK 36/101	SA	DEMGN832_RESEARCH_METHODOLOGY.pdf (D142326368)

to formulate specific hypothesis. The hypothesis is a statement that specifies, "how two or more variables are related?" In the early stages of research, we usually lack from sufficient understanding

of the problem to formulate a specific hypothesis. Further, there are often several tentative explanations. Example • "Sales are down because our prices are too high", • "our dealers or sales representatives are not doing a good job", • "our advertisement is weak" and so on. In this scenario, very little information is available to point out, what is the actual cause of the problem. We can say that the major purpose of exploratory research is to identify the problem more specifically. Therefore, exploratory study is used in the initial stages of research. Under what circumstances is exploratory study ideal?

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The following are the circumstances in which exploratory study would be ideally suited: 1. To gain an insight into

the problem 2. To generate new product ideas 3. To list all possibilities. Among the several possibilities, we need to prioritize the possibilities which seem likely 4. To develop hypothesis occasionally. Exploratory study is

95%	MATCHING BLOCK 33/101	W

also used to increase the analyst's familiarity with the problem.

This is particularly true,

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when the analyst is new to the problem area. Example: A market researcher working for (new entrant) a company for the first time 5.

To establish priorities so that further research can be conducted. 6.

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Exploratory studies may be used to clarify concepts and help in formulating precise problems.

Example: The management is considering a change in the contract policy, which it hopes, will result in improved satisfaction for channel members. An exploratory study can be used to clarify the present state of channel members' satisfaction and to develop a method by which satisfaction level of channel members is measured 7.

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To pre-test a draft questionnaire 8. In general, exploratory research is appropriate to any problem about which very little is known. This research is the foundation for any future study. 31

Uses of Exploratory Research 1. Gain Background information 2. Define Terms 3. Clarify Problems and Hypothesis 4. Establish Research Priorities Characteristics of Exploratory Stage 1. Exploratory research is flexible and very versatile. 2. For data collection structured forms are not used. 3.

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Experimentation is not a requirement. 4. Cost incurred to conduct study is low. 5. This type of research allows very wide exploration of views. 6. Research is interactive in nature and also it is open ended. Hypothesis Development at Exploratory Research Stage 1. Sometimes, it may not be possible to develop any hypothesis at all,

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if the situation is being investigated for the first time.

This is because no previous data is available. 2.

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Sometimes, some information may be available and it may be possible to formulate a tentative hypothesis. 3. In other cases, most of the data is available and it may be possible to provide answers to the problem.

The examples given below indicate each of the above type: Research Purpose Research Question Hyphothesis 1. What product feature, if stated, will be the most effective in the advertisement? What benefit do people derive from this Ad appeal? No hyphothesis formulation is possible 2. What new packaging is to be developed by the company(with respect to soft drink)? What alternatives exist to provide a container for soft drink? Paper cup is better than any other forms such as a bottle 3. How can our insurance services be improved? What is the nature of customer dissatisfaction? Impersonalization is the problem In example 1: The research question is posed to determine "What benefit do people seek from the Ad?" Since no previous research is done on consumer benefit for this product, it is not possible to form any hypothesis. 32
In example 2: Some information is currently available about packaging for a soft drink. Here it is possible to formulate a hypothesis which is purely tentative. The hypothesis formulated here may be only one of the several alternatives available. In example 3: The root cause of customer dissatisfaction is known, i.e. lack of personalised service. In this case, it is possible to verify whether this is a cause or not. Formulation of Hypothesis in Exploratory Research The quickest and the cheapest way to formulate a hypothesis in exploratory research is by using any of the five methods: 1. Literature Search: This

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refers to "referring to a literature to develop a new hypothesis".

The literature referred are – trade journals, professional journals, market research finding publications, statistical publications etc. For example, suppose a problem is "Why are sales down?" This can quickly be analysed with the help of published data which should indicate, "whether the problem" is an "industry problem" or a "firm problem". Three possibilities exist to formulate the hypothesis. (a) The company's market share has declined but industry's figures are normal. (b) The industry is declining and hence the company's market share is also declining. (c) The industry's share is going up but the company's share is declining. If we accept the situation that our company's sales are down despite the market showing an upward trend, then we need to analyse the marketing mix variables. Example: (a) A TV manufacturing company feels that its market share is declining whereas the overall television industry is doing very well. (b) Due to a trade embargo imposed by a country, textiles exports are down and hence sales of a company making garment for exports is on the decline. The above information may be used to pinpoint the reason for declining sales. 2. Experience Survey: In experience surveys, it is desirable to talk to persons who are well informed in the area being investigated. These people may be company executives or persons outside the organisation. Here, no questionnaire is required. The approach adopted in an experience survey should be highly unstructured, so that the respondent can give divergent views. 33

Example: (a) A group of housewives may be approached for their choice for a "ready to cook product". (b) A publisher might want to find out the reason for poor circulation of newspaper introduced recently. He might meet (i) Newspaper sellers (ii) Public reading room (iii) General public (iv) Business community, etc. These are experienced persons whose knowledge researcher can use. 3. Focus Group: Another widely used technique in exploratory research is the focus group. In a focus group, a small number of individuals are brought together to study and talk about some topic of interest. The discussion is co-ordinated by a moderator. The group usually is of 8-12 persons. While selecting these persons, care has to be taken to see that they should have a common background and have similar experiences in buying. This is required because there should not be a conflict among the group members on the common issues that are being discussed. During the discussion, future buying attitudes, present buying opinion, etc., are gathered. Most of the companies conducting the focus groups first screen the candidates to determine who will compose the particular group. Firms also take care to avoid groups, in which some of the participants have their friends and relatives, because this leads to a biased discussion. Normally, a number of such groups are constituted and the final conclusion of various groups are taken for formulating the hypothesis. Therefore a key factor in focus group is to have similar groups. Normally there are 4-5 groups. Some of them may even have 6-8 groups. The guiding criteria is to see whether the latter groups are generating additional ideas or repeating the same with respect to the subject under study. When this shows a diminishing return from the group, the discussions stopped. The typical focus group lasts for 1-30 hours to 2 hours. The moderator under the focus group has a key role. His job is to guide the group to proceed in the right direction. The following should be the characteristics of a moderator/facilitator: (a) Listening: He must have a good listening ability. The moderator must not miss the participant's comment, due to lack of attention. (b) Permissive: The moderator must be permissive, yet alert to the signs that the group is disintegrating. (c) Memory: He must have a good memory. The moderator must be able to remember the comments of the participants. Example: A discussion is centered around a new advertisement by a telecom company. The participant may make a statement early and make another statement later, which is opposite to what was said earlier. Example: The participant may say that s(he) never subscribed to the views expressed in the advertisement by the competitor, but 34
subsequently may say that the "current advertisement of competitor is excellent". (d) Encouragement: The moderator must encourage unresponsive members to participate. (e) Learning: He should be a quick learner. (f) Sensitivity: The moderator must be sensitive enough to guide the group discussion. (g) Intelligence: He must be a person whose intelligence is above the average. (h) Kind/firm: He must combine detachment with empathy. 4. Case Studies: Analysing a selected case sometimes gives an insight into the problem which is being researched. Case histories of companies which have undergone a similar situation may be available. These case studies are well suited to carry out exploratory research. However, the result of investigation of case histories are always considered suggestive, rather than conclusive. In case of preference to "ready to eat food", many case histories may be available in the form of previous studies made by competitors. We must carefully examine the already published case studies with regard to other variables such as price, advertisement, changes in the taste, etc. 5. Secondary Data Analysis: Secondary data Analysis is the process of searching for interpreting existing information relevant to the research topic. 3) Experimental Designs The various experimental designs are as follows: 1. After only design 2. Before-after design 3. Factorial design 4. Latin square design 5. Ex-post facto design 1) After only Design In this design, dependent variable is measured, after exposing the test units to the experimental variable. This can be understood with the help of following example. Assume M/s Hindustan Lever Ltd. wants to conduct an experiment on "Impact of free sample on the sale of toilet soaps". A small sample of toilet soap is mailed to a selected set of customers in a locality. After one month, 25 paise off on one cake of soap coupon is mailed to each of the customers to whom free sample has been sent earlier. An equal number of these coupons are also mailed, to people in another similar locality in the neighborhood. The coupons are coded, to keep an account of the number of coupons redeemed from each locality. Suppose, 400 coupons were redeemed 35

from the experimental group and 250 coupons are redeemed from the control group. The difference of 150 is supposed to be the effect of the free samples. In this method conclusion can be drawn only after conducting the experiment. 2) Before-after Design In this method, measurements are made before as well as after. Example: Let us say that, an experiment is conducted to test an advertisement which is aimed at reducing the alcoholism. Attitude and perception towards consuming liquor is measured before exposure to Ad. The group is exposed to an advertisement, which tells them the consequences, and attitude is again measured after several days. The difference, if any, shows the effectiveness of advertisement. The above example of "Before-after" suffers from validity threat due to the following: 1. Before measure effect: It alerts the respondents to the fact that they are being studied. The respondents may discuss the topics with friends and relatives and change their behaviour. 2. Instrumentation effect: This can be due to two different instruments being used, one before and one after, change in the interviewers before and after, results in instrumentation effect. 3) Factorial Design Factorial design permits the researcher to test two or more variables at the same time. Factorial design helps to determine the effect of each of the variables and also measure the interacting effect of the several variables. Example: A departmental store wants to study the impact of price reduction for a product. Given that, there is also promotion (POP) being carried out in the stores (a) near the entrance (b) at usual place, at the same time. Now assume that there are two price levels namely regular price A 1 and reduced price A 2 . Let there be three types of POP namely B 1 , B 2 , & B 3 . There are 3 × 2 = 6 combinations possible. The combinations possible are

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B 1 A 1 , B 1 A 2 , B 2 A 1 , B 2 A 2 , B 3 A 1 , B 3 A 2 .

Which of these combinations is best suited is what the researcher is interested. Suppose there are 60 departmental stores of the chain divided into groups of 10 stores. Now, randomly assign the above combination to each of these 10 stores as follows: S1 TO S6 represents the sales resulting out of each variable. The data gathered will provide details on product sales on account of two independent variables. 36
The two questions that will be answered are: 1. Is the reduced price more effective than regular price? 2. Is the display at the entrance more effective than the display at usual location? Also the research will tell us about the interaction effect of the two variables. Outcome of the experiment on sales is as follows: 1. Price reduction with display at the entrance. 2. Price reduction with display at usual place. 3. No display and regular price applicable 4. Display at the entrance with regular price applicable. 4) Latin Square Design Researcher chooses 3 shelf arrangements in three stores. He would like to observe the sales generated in each stores at different period. Researcher must make sure that one type of shelf arrangement is used in each store only once. In Latin square design, only one variable is tested. As an example of Latin square design assume that a super market chain is interested in the effect of in store promotion on sales. Suppose there are three promotions considered as follows: 1. No promotion 2. Free sample with demonstration 3. Window display Which of the 3 will be effective? The out come may be affected by the size of the stores and the time period. If we choose 3 stores and 3 time periods, the total number of combination is 33 = 9. The arrangement is as follows: Latin square is concerned with effectiveness of each kind of promotion on sales. 5) Ex-post Facto Design This is a variation of "after only design". The groups such as experiment and control are identified only after they are exposed to the experiment. Let us assume that a magazine publisher wants to know the impact of advertisement on 37
knitting in 'Women's Era' magazine. The subscribers of magazines are asked whether they have seen this advertisement on "knitting". Those who have read and not read, are asked about the price, design etc. of the product. The difference indicates the effectiveness of advertisement. In this design, the experimental group is set to receive the treatment rather than exposing it to the treatment by its choice. Action Research

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Action research is a form of self-reflective enquiry undertaken by participants in serial situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of practices and the situations in which these practices are carried out.

Groups of participants can be teachers, students, principals, parents and other community members. In education, action research has been employed in school based curriculum development, professional development, school improvement programmes and systems planning and policy development (for example, in relation to policy about classroom rules, school policies about non- competitive assessment, and state policies about the conduct of school improvement programmes.) The idea of linking of terms "action" and "research" highlights the essential feature of the approach: trying out ideas in practice as a means of improvement and as a means of increasing knowledge about curriculum, teaching and learning. The result is improvement in what happens in the classroom and school. Action research provides away of working which links theory and practice into the one whole: ideas- in- action. A reflective practice seeks to make sense of processes, problems, issues, and constraints made available in strategic action. takes account of the variety of perspectives, possible in the social situation and comprehends the issues and circumstances in which they arise. Refection leads to the reconstruction of the meaning of school situation and provides the basis for the revised plan. Reflection has evaluative aspect- it asks action researchers to weigh their experience – to judge whether effects and issues which arose were desirable, and suggest ways of proceeding. According to

immediate application, not on the development of a theory, not upon general application. It has placed its emphasis on a problem here and now in a local setting.

Many Action Research projects are carried out in a classroom by a single teacher. As it becomes more extensive it becomes more similar to other types of educational research. The emphasis is Action Research, not on obtaining generalisable scientific knowledge about educational problems but on obtaining knowledge concerning a specific local problem. The function of action research therefore, is to combine the research function with teacher growth in such qualities as objective thinking, skill in research processes, ability to work harmoniously with others and develop professional spirit. Quite often, many teachers will not have the time, resources, or technical background to engage in formal research activity but more teachers can be involved in action research activity and model studies may be undertaken for the purpose of trying to improve local classroom practices. Characteristic features of Action Research Borgia and Schuler describe the components of action research as the Five C's Commitment, Collaboration, Concern, Consideration, and Change. 1) Commitment: Action research takes time. The participants need time to get to know and trust each other and to observe practice, consider changes, try new approaches, and document , reflect, and interpret the results. Those who agree to participate should know that they will be involved with the project for some time and that the time commitment is a factor that all participants should consider carefully. 2) Collaboration: In action research, the power relations among participants are equal; each person contributes and each person has a stake. Collaboration is not the same as compromise, but involves a cyclical process of sharing, of giving, and of taking. The ideas and suggestions of each person should be listened to, reflected on, and respected. 3) Concern: The interpretive nature of action research (for example, relying on personal dialogue and a close working relationship) means that the participants will develop a support group of critical friends. Trust in each other and in the value of the project is important. 4) Consideration: Reflective practice is the mindful review of one's actions, specifically one's 39

professional actions. Reflection requires concentration and careful consideration as one seeks patterns and relationships that will generate meaning within the investigation. 5) Change: For humans, growing and changing are part of the developmental cycle of life. Change is ongoing and at times, difficult, but it is an important element in remaining effective as a teacher. Four issues in which action research is different 1. It is not the usual thing teachers do when think about their teaching. Action research is more systematic and collaborative in collecting evidence on which to base rigorous group reflection. 2. It is not simply problem solving. Action research involves problem –solving, not just problem solving. It motivated by a quest to improve and understand the word by changing it and learning how to improve it from the effects of changes made. 3. It is not research done on other people. Action research is research by particular people on their own work, to help them improve what they do, including how they work with and for others. Action research treats people as autonomous, responsible agents who participate actively in making their own practices to be more effective. It does not treat people as objects for research, but encourages people to work together as knowing subjects and agents of change and improvement. 4. It is not ' the scientific method' applied to teaching. Action research is not just about hypotheses- testing or about using data to come to conclusions. Action research is not just about hypotheses-testing or about using data to come to conclusions. Action research is concerned with changing situations, not just interpreting them like in historical sciences. Action research is systematically evolving, a living process changing both the researcher and the situations in which he/she acts; neither the natural sciences nor the historical sciences have their double aim. The Procedure of Action Research 1. Action research is an approach to improving education by changing it and learning from theconsequences of changes. 2. Action research is participatory. It is the research through which people work towards the improvement of their own practices. 3. Action research develops through the self-reflective spiral. A spiral of cycles of planning, acting, (implementing),observing, reflecting..... And then re-planning, further implementation, observing and reflecting. One good way to begin an action research project is to collect some initial data in an area of general interest, then to reflect, and then to make a plan for changed action,. Another way to begin is to make an exploratory 40

change, collect data of what happens, reflect and then build more refined plans for action. In both cases, issues and understandings, on the one hand, and the practices themselves on the other hand, and the practices themselves on the other, develop and evolve through the action research process. 4. Action research is collaborative. It involves those responsible for action in improving it, widening the collaborating group from those directly involved to as many as possible of those affected by the practices concerned. 5. AR establishes self-critical communities of people participating and collaborating in all phases of the research process; the planning, the action, the observation and the reflection. It aims to build communities of people committed to enlightening themselves about the relationship between circumstance, action and consequence in their situation. 6. Action research is a systematic learning process in which people act deliberately. It is a process of using critical intelligence to inform own action, and developing it so that our educational action becomes crucial and committed action. 7. Action Research involves people in theorizing about their practices. That is coming to understand the relationships between circumstances, actions and consequences in their own lives. These theories may be rationales for practices. 8. AR requires that people put their practices, ideas and assumptions about institutions to the test by gathering compelling evidence which could convince them that their practices/ ideas/ assumptions were wrong. 9. AR is open mended. It involves not only keeping records which describes what is happening as accurately as possible, but also collecting and analyzing our own judgments, reactions, and impressions about what is going on. 10. AR involves keeping a personal record in which we record our progress and our reflections about two parallel sets of learning (learning about the practices and learning about the process) 11. AR involves people in making critical analyses of the situations (classrooms, schools, systems) in which they work. The initial resistance in changing one's own practices is a conflict between the new practices and accepted practices of the situation. By making a critical analysis of the situation, the action researcher can understand how resistances are rooted in conflicts between competing sets of practice, views of educational perspectives and values, and competing views of educational organization and decision making. This critical understanding will help in overcoming resistances by involving others in the research process, inviting others to explore their practices. 12. AR starts with small cycles of planning, acting, observing and reflecting which can help to define issues, ideas and assumptions more clearly. 13. AR allows us to give a reasoned justification to show how the evidence. We have done 41

and critical reflection we have done have helped us to create a developed, tested and critically- examined rationale for what we are doing. 14. AR allows us to build records of our improvement: (a). records of changing activities and practices, (b.) records of the changes in the discourse in which we describe, explain and justify our practices. (c.) records of the changes in the social relationships and forms of organization which characterize our practices, and (d.) records of the development in our mastery of action research. Different areas for Action Research Action research, being a scientific method of solving immediate problems in the schools set up, could emerge from any of the following areas. ACADEMIC - Classroom situation, methods of teaching, questioning climate student discipline, problems of disabled children and the like. SOCIAL - late coming, not doing home assignments, poor attendance, lack of co-operation of students, lack of physical amenities and the like CURRICULAR - textbooks, time bound syllabus MLLs, lack of teachers' handbooks, mismatch of age and content, gaps in information given guidance to teachers, arrangement of content, coverage of the subject area etc. EVALUATION - test types (achievement tests, diagnostic tests etc.), periodicity of testing, scoring, giving feedback and the like. ADMINISTRATIVE - planning, training, framing time-table and the like. PROFESSIONAL – Self growth, desirable attitudes, motivation, leadership and the like. Participatory research approach: Principles, Challanges and Perspectives

Participatory Research Approach The PR approach is relatively new in the social science and is based on the critical social science theories and participatory worldview, where the primary purpose of human inquiry is practical . PR is considered a new paradigm, which Chambers describes as 'a coherent and 42 mutually supportive pattern of concepts, values, methods and action amenable to wide application'. It drives from Action Research work back to the1940s. Participatory research is viewed as an alternative perspective to conventional social research, which grew out of a reaction to approaches developed in North America and Europe. It is flexible and open-ended. It has roots in the qualitative research tradition, which Reason and Heron describe as 'a half-way house between exclusive, controlling, quantitative, positivist research on people and fully participatory, co-operative research with people' . But it's not anti- quantitative, as several PR-tools collect also quantitative data. PR aims to explore and interpret the views, concerns and experiences of people from their own perspectives and allows them to undertake measures to improve their situations. It is the answer on the question "Whose reality counts" (Chambers 1997) which makes the difference. These differences to conventional social researches' approaches are discussed below. Principles and approach: PR is based on the principles of "participation" and "self- development". It treats people as "research participants" rather than "research subjects". It is people-centered in the sense that the process of critical inquiry is informed by and responds to the experiences and needs of people involved. The fundamental principle of participatory research is that it is research with rather than on people . It emphasizes "knowledge for action" and a "bottom- up approach" in contrast to conventional research, which is more "top-down". PR is characterised as a "democratic", "cooperative", "partnership" and "non- hierarchical" type of research relationships in designing research proposal, data gathering, data analysis, dissemination and action. PR is applied social research and is owned by local people: In the CR the role of researchers is to study social phenomena and identify basic social regularities. The practical aspect of knowledge application is not seen as direct responsibility of social researchers. PR is a more applied type of research, where the primary focus is on the "research-action -social change" link. It has been developed as an alternative way of knowledge creation, where people are recognised as researchers themselves and as real owners of the research process in contrast to conventional social research. PR as a source of social change: In PR the research process is viewed as a potential source of change and empowerment for the research participants. As Park stated, a critical difference between CR and PR is that in the latter the people on whose behalf the investigation-action cycle is carried out, get directly involved in the process, from problem formulation - to inquiry - to action . PR is described as a process for influencing policy-making and local settings by reflecting the views and opinions of local people . 43 Knowledge is power: Participatory research creates a knowledge which fur- ther applies to collective problems through social action. According to Reason and Heron, participatory research invites people to participate in the co-creation of knowledge about themselves with the purpose to change the world. It is aimed at both generating knowledge and producing action, in common with other forms of action-oriented research which, unlike academic research, is driven by practical outcomes rather than theoretical understanding. According to Blackburn and Holland 'Participation is making efforts to create such conditions which would contribute to empowerment of those members and groups of the society, who have little control in the oversight of powers determining their life' . Thus, PR empowers people, especially socially marginalized ones, by involving them in the knowledge creation process. It is built on the principle that 'knowledge is power' and that is why this approach supported people to investigate their situations, analyze it, and then undertake relevant collective action to improve their lives. Knowledge for the sake of knowing is deemphasized. In this approach knowledge is directly linked to its utilization, which is a concrete action . This makes the quality of knowledge stronger and action justified. Location of power: The PR approach promotes power-sharing in the research and planning phases of development through the incorporation of the perspectives of local people. Therefore, the critical difference of the PR and CR, as Cornwall and Jewkes explain, is the "location of power in the various stages of the research" and researchers who apply a participatory approach are attempting to change these power relations and to ensure that research is owned and controlled not only by researchers, but also by research participants. Participation Modes: The degree of participation and the purpose of participation vary widely depending on the type of research being done. In CR the role of local people is limited mostly by giving information regarding the research topic. In contrast to that, in PR local people/researchers have greater role and participation. Chambers and Jewkes identified modes of participation, which can be seen as a continuum for ensuring participation in the research project: Contractual arrangements, which involve the contracting of people to participate in providing data which researchers need; Consultative arrangements, which promote consulting with people "for their opinions" before interventions are made; Collaborative arrangements, which encourage the researcher and local people to work together 44 towards identifying, designing and initiating projects managed by researchers; Collegiate arrangements, which promote local

people and researchers working together as “colleagues with different skills to offer in a process of mutual learning where local people have control over the

process”.

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On the continuum of participation, according to the above mentioned typology CR is more contractual, extractive or consultative and the PR process is more col- laborative and collegiate. Strengths and Weaknesses of Participatory Research Like all types of social researches the PR has got its strengths and weaknesses . The participatory research approach has many advantages, which makes it very useful for any kind of research, but especially, when it is: applied, exploratory and learning, target-group or action- oriented and when local commitment is needed to make a process sustainable. Here we would like to discuss some of the strengths of PR: 1) PR allows understanding social reality from ordinary people’s perspectives: People's own analysis of their situation provides a deeper understanding of such dimensions, which usually are not identified through the conventional approaches. One of the best examples is Participatory Poverty Assessment methodology, where poverty and livelihood are defined and analysed from the perspectives and experiences of poor people. This enables decision makers to recognize real needs of the poor and elaborate needs-based and right-based polices. 2) PR is a type of applied social research, which helps to address problems and find practical solutions: Involving local people in the research process gives good opportunities to re-think and re- interpret their situation, which in its turn might increase the relevance, applicability and delivery of research findings to address problems of their daily life and to improve it. 3) PR is based on flexible methodologies to support communication of the findings for the desirable change: Involving local people would change the nature of research in terms of developing more flexible, relatively simple and widely generalisable field techniques. This will allow

to communicate

and share relevant information between stakeholders and researchers, and facilitate the research and development process. This will create also a sense of ownership of the research process and findings and will lead to more tangible results. Therefore, PR is based more on approaches, which are highly flexible and adaptable for investigating different social settings. 45 4) PR allows understanding the complexity of social settings: PR enables to understand the complexity of social reality and the diverse nature of people's livelihood strategies and the factors affecting them. Involvement of different stake- holders assists in having a holistic picture of the reality, establishing causality and identifying problems according to different socio-demographic characteristics. 5) PR is aimed at people's empowerment: For the promoters of this approach, participation has developed from a research technique in the 1970s into a means of empowerment in the 1990s until today. As Chambers states "the ultimate output of PR is enhanced knowledge and competence, and ability to make demands, and to sustain action". Therefore, capacity building of local people, advocacy and participation in policy development are important features of PR. 6) PR enables to influence policy: The conventional research approach very often ignores the importance of research context. Therefore, the data obtained through this type of research are more general and context- free, which affects also the quality of policies. By contrast, the in-depth and context-based nature of participatory research approaches can provide good insights for policy actions. Therefore, participatory research processes enable us to incorporate local knowledge into the broader policy dialogue process and increase its relevance and effectiveness. 7) Promoting culture of social dialogue: The long-term involvement in different level of stakeholders in the research and mutual learning process promote a dialogue, partnership and cooperation. This provides a good base of collective analysis and actions. 8) Changing attitudes: The successful application of PR undermines the traditional stereotypes according to which the change and reform can be only initiated by the Government. Hence, it encourages bottom-up changes. Therefore, the overall success of PR highly depends also on the personal values and motivations of people involved. 9) Establishing new institutional arrangements: PR is also about identifying social problems and their solutions and assist in bringing institutional change by establishing structures and mechanisms which can guarantee the sustainability of new relationships and knowledge for the overall benefit of people. However, this 46 is possible only through a long term PR process, where its potential is fully applied. These institutional arrangements can guarantee the success and sustainably of PR applications. As other types of researches the participatory research approach also has some limitations. Below are listed some of them: 1) The quality of information: Engagement of local communities in the research process put under question scientific value and rigour of PR and creates some room for methodological criticism. Besides, the accessibility and simplicity of some PR techniques make it possible to apply them mechanistically, which also affect on the quality of findings. PR implementation should be based on multidisciplinary knowledge and skills. Successful application requires justified methodological approach, good communication, and facilitation and conflict negotiation skills. 2) Unequal attention towards different stages of PR: If we consider PR not only as a research approach, but also as a policy tool, we should pay equal attention to all stages of PR. Experience has shown that for effective outcomes, preparatory process (training, identification of stakeholders) and follow up period (dissemination, advocacy and policy linking) takes equal if not more time than fieldwork itself. The process of transformation and social change highly depends on stakeholders' involvement, advocacy and follow-up activities. 3) Limitation of generating statistical data: Although some of the PR methods can produce quantitative data, a flexible and open-ended nature of PR requires a more qualitative approach to research, because it aims to provide in depth analysis of locally identified contexts. However, in some cases the quantitative methods can provide insights to guide the collection and disaggregation of broader nationally and regionally generated statistical data. Therefore, in the last few years participatory research specialists discuss the possible use of quantitative approaches and data in PR practice. Chambers and Mayoux argue that 'When used well, participatory approaches and methods can generate both qualitative insights and usually more accurate quantitative data than more conventional approaches and methods.' 4) There's no blue-print: In contrast to conventional research PR is highly flexible in terms of research methodologies and procedures. That means that the choice of research methodologies and the research process itself need to be adapted to each situation. This requires strong knowledge of different research approaches and tools. PR application requires some improvising talents on the researcher's side depending on the local situation. PR methodologies have their ideologies and procedures. However, how they will be implemented depends on the specifics of local settings and people. This flexibility is a great advantage of PR, but at the same time it can turn to disadvantages if not professionally applied. Given the social, cultural and political diversity 47 in which projects and programs are situated, strategies and approaches cannot be a 'blueprint' approach, but rather must be contextualized, developed and adapted by research and development practitioners -- together with the members of the communities in which they are working. 5) Participation limitations: Here it is important to discuss two things. First, participatory research can be very effective in some, but not all, situations . It is important to recognise when participatory approaches are appropriate to avoid participation becoming the end in itself

and devaluate the very meaning of 'participation' or 'participatory'. We should take also into account that there are different modes of participation, which can produce different outcomes. Second, participation is not just about involving people. It is complex and long term process. It is about establishing partnership and collaboration between stakeholders at different levels of society, because development requires early and substantive involvement of all stakeholders in the design of activities that will affect them. That is why it is very important to involve all stakeholders from the very beginning of the PR, so that everybody has the same understanding of the process. It is crucial also to pay attention to local power structures. PR that is trying to change a social situation can't be very efficient without involvement of central and local governments, who have power and resources to improve the situation, but also to thwart the whole participatory process. Blackburn and Holland point out that 'participation would not make sense as long as power-holders do not allow others to participate in processes of setting priorities, making decisions, managing and controlling resources'. 6) Law level of democracy and decentralization: The governance context may strongly limit the extent to which 'participation' can be translated into meaningful outcomes. Unclear mechanisms of democratic governance make citizens dependent on decision-makers and obstruct the equal participation of people in decision-making processes and implementation. The absence of a culture of cooperation among the community institutions at the regional and local levels also impedes the process of reforms. 7) Mistrust of the society and participation fatigue: Indifference and mistrust of the society, and its alienation from participatory process can highly influence the outcomes of PR. This problem is quite typical for developing countries, including former Soviet Republics, where the dominant approach was paternalistic, according to which all changes and reforms had been initiated and implemented by the Government. In addition to that, PR in its turn also can create some mistrust and so called participation fatigue, if not organized properly to deliver desirable outcomes. 48 8) Micro-macro linkage and impact on policy making: Information gathered and shared in different contexts may be hard to synthesise for central planning. However, comparison of findings across a range of contexts can enable national policy makers to distinguish between policies that are relevant for local, regional and national formulation and implementation. Besides, if the purpose is central planning, it is worth to use some benchmark indicators, which will allow comparison across the regions and sectors. 9) Raising expectations of local people: One of the problems of researchers working intensely with local people, with the purpose to improve their livelihood is to raise their expectations. The closer the relationship gets, the greater the raised expectations. This situation can affect also on the research findings by creating false impressions about the local situation and questions the quality of obtained knowledge. That is why this approach is more appropriate for long-term involvement, so that the expectations and demands can be met. This problem can be overcome also by informing all stakeholders and participants about the objectives and outcomes of PR exercise from the very beginning, so that everyone has a clear idea and understanding about his/her role and expected results. Critical appraisal of Participatory Research Despite its wide application in the development contexts in the last 20 years PR has been highly criticized. The critiques of PR approaches are mostly related to its non-scientific, rhetoric and formality nature. Andreas Neef in his article 'Participatory approaches under scrutiny: will they have a future?' systematised the critics of PR and discussed seven critical issues, related to methodological limitations, communication process and power relations. There are indeed issues that are determined mostly by non professional application of PR and exaggeration of its role in the social change process. Below we assemble some of the most critical issues and our opinion and responses to them: (1) Methodological limitations and lack of scientific rigour: The methodological critique is related to the purification of knowledge and experience, creation of rigor scientific knowledge; objectivity of information; the non scientific nature of PR – flexible, simple, but not rigid and formalized enough for scientific scrutiny. When assessing PR from CR or positivists standpoints it might be hard to consider it a scientific research approach. Therefore, every research should be discussed and assessed within its own epistemological and methodological framework. Consequently, PR should be analyzed within the participatory worldview, which is based 'on a subjective-objective ontology; on an extended epistemology of experiential, presentational, propositional and practical ways of knowing; on a methodology based on co-operative relations between co-researchers; and on an axiology, which affirms the primary value of practical knowing 49 in the service of human flourishing' . (2) Naivety about the complexity of communication processes, group dynamics and power relations: Cooke and Kothary in their book on "Participation: the new tyranny?" assert that participation in practice is nowhere near to the participatory, bottom-up, open process that it is commonly held to be. According to them participation can be described as largely maintaining existing power relationships, through masking this power behind the rhetoric and techniques of participation. This masking, therefore, in their words represents the tyranny of participation. However, we believe that PR can make a difference if it is viewed as a tool or a component of a broader policy process rather than a single research activity. In addition, the social reality is much more complex and it requires time and commitment from the researchers to understand it and to take it into account while conducting PR. Therefore, researchers should have very good knowledge and a holistic understanding of local settings, in order to avoid biases determined by the local institutional and group structures and communication process. (3) Reduction of participatory methods to the diagnostic stage: PR is more than a research and as Blackburn

and Holland point out, 'Participation is a way of viewing the world and acting in it. It is about a commitment to help create the conditions which can lead to significant empowerment of those who at present have little control over the forces that condition their lives '. That is why PR cannot be used simply in certain stages of the project. For long term and sustainable impact one should use PR's full potential, in order to empower local people to improve their situation. (4) Myth of instant analysis of local knowledge: Local knowledge is non- verbal, tacit and culturally, socially and politically constructed. Therefore one-off, short term and standardized PR exercises cannot always capture the multi-dimensionality of local knowledge. That is why the emphasis of PR is on the process, which creates spaces for social learning and dialogue between different stake-holders, rather than pure output. Also, due to its qualitative and participative nature PR data analysis is time-consuming. In order to have a comprehensive picture of the local setting the information must be carefully filtered and analysed to make sense and to come to valid conclusions. (5) Instrumental character of participatory methods: PR is highly flexible and it is built mostly on qualitative methodologies and tools. However, very often the organizers of PR tend to use more standardized procedures, which makes it difficult to represent 'local representations' and an understanding of 'traditional types of communication'. We should be aware that in contrast to CR 50 the PR focus should be more on the process rather than on the outcome, because the ultimate objective of PR is to empower local people to reassess and reinterpret the existing knowledge and behave accordingly. (6) Underestimation of the costs of participation: As can be seen by the acronym "R" in Rapid Appraisal, in the early stage, the RRA/PRA movement was a response to the pressures for quick results by national organizations and donor agencies. However, we should recognise that the success of PR depends on extensive engagement and contribution from all sides. It is a complex activity and by trying to overcome the methodological and conceptual shortcomings of PR approaches we should have enough resources. That is why it is better to analyze the costs and benefits of PR in the beginning to avoid poorly and ineffectively organized research. PR is anything but no low-cost research approach. (7) Participation as a substitute for good governance : In general, participation and civic engagement success depends on a favourable socio-cultural, socio- economic and political context and level of decentralisation. In order to have long term sustainable impacts, PR should be linked with wider processes of democratization and decentralization. However, very often, participatory approaches are used as a substitute for democratic structures and good governance. Thus, in this case the outcomes of the PR are going to be fragmental and not sustainable.

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Future Perspectives PR is a type of social research, which means that it should be organized and implemented according to professional standards. However, in most cases in the practice PR is organised in a very instrumental and standardised way, which creates false impressions about the potential and scientific value of this research methodology. Besides, there are a lot of manuals and guidelines, which say that PR is quick to implement, easy to organize, that anyone can do it, because it is not requiring special skills and knowledge that has nothing to do with politics etc. This is wrong and Pretty et al. classified these impressions as myths about the Participatory Research . We strongly believe that these myths derived mainly from non- professional approaches toward this kind of research. In contrast to conventional social research the researchers who use the PR approach should be equipped with some additional knowledge, such as facilitation, communication, empowerment and conflict management. The latter is very important, because as Pretty et al. state "all participants have responsibilities for their actions" and the very engagement and empowerment of ordinary people is likely to create tensions and the researchers may need to take sides or take on the role of mediators or negotiators. In general, the role of social scientists in this rapidly changing world is crucial and we should be actively involved in the process of analysing and transforming the new social realities 51 determined by the current global, regional and local challenges, using more innovative and flexible research approaches that could be relevant and adoptable for diverse social settings. Participatory research has a great potential not only to gather reliable and sensitive information, but it has also power to improve the situations of local people. Therefore, this research methodology implies a great responsibility on all sides, especially on the side of the researchers, who are responsible for the overall quality of the PR process and its consequences. We believe that with careful design, approbation and implementation, most of the problems associated with the PR approach can be addressed to get reliable qualitative and quantitative information and to inform a strong and needs and rights-based policy design and implementation.

Evaluation Research Abstract Evaluation research can be defined as a type of study that uses standard social research methods for evaluative purposes, as a specific research methodology, and as an assessment process that employs special techniques unique to the evaluation of social programs. After the reasons for conducting evaluation research are discussed, the general principles and types are reviewed. Several evaluation methods are then presented, including input measurement, output/ performance measurement, impact/outcomes assessment, service quality assessment, process evaluation, benchmarking, standards, quantitative methods, qualitative methods, cost analysis, organizational effectiveness, program evaluation methods, and LIS-centered methods. Other aspects of evaluation research considered are the steps of planning and conducting an evaluation study and the measurement process, including the gathering of statistics and the use of data collection techniques. The process of data analysis and the evaluation report are also given attention. It is concluded that evaluation research should be

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a rigorous, systematic process that involves collecting data about organizations, processes, programs, services, and/

or resources. Evaluation research should enhance knowledge and decision making and lead to practical applications. What is Evaluation Research? Evaluation research is not easily defined. There is not even unanimity regarding its name; it is referred to as evaluation research and evaluative research. Some individuals consider evaluation research to be a specific research method; others focus on special techniques unique, more often than not, to program evaluation; and yet others view it as a research activity that employs standard research methods for evaluative purposes. Consistent with the last perspective, Childers concludes, “The differences between evaluative research and other research center on the orientation of the research and not on the methods employed” (1989, p. 251). When 52
evaluation research is treated as a research method, it is likely to be seen as a type of applied or action research, not as basic or theoretical research. Weiss, in her standard textbook, defines evaluation as “the systematic assessment of the operation and/or the outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the program or policy” (1998, p. 4; emphasis in original). While certainly not incorrect, this defi nition, at least within a library and information (LIS) context, is too narrow or limited. Wallace and Van Fleet, for example, point out that “evaluation has to do with understanding library systems” (2001, p. 1). As will be noted later in this article, evaluative methods are used for everything from evaluating library collections to reference transactions. Why Evaluate? But before examining the specifi c techniques and methods used in LIS evaluation research, let us first briefly consider the question of why evaluation is important and then identify the desirable characteristics of evaluation, the steps involved in planning an evaluation study, and the general approaches to evaluation. With regard to the initial question, Wallace and Van Fleet and others have noted that there are a growing number of reasons why it is important for librarians and other information professionals to evaluate their organizations’ operations, resources, and services. Among those reasons are the need for organizations to 1. account for how they use their limited resources 2. explain what they do 3. enhance their visibility 4. describe their impact 5. increase efficiency 6. avoid errors 7. support planning activities 8. express concern for their public 9. support decision making 10. strengthen their political position. In addition to some of the reasons listed above, Weiss identifies several other purposes for evaluating programs and policies. They include the following: 1. Determining how clients are faring 2. Providing legitimacy for decisions 3. Fulfilling grant requirements 4. Making midcourse corrections in programs 5. Making decisions to continue or culminate programs 53

6. Testing new ideas 7. Choosing the best alternatives 8. Recording program history 9. Providing feedback to staff 10. Highlighting goals Over the past decade, both academics and practitioners in the field of library and information science (LIS) have increasingly recognized the significance of assessing library services" (Shi & Levy, 2005, p. 266). In August 2004 the National Commission on Libraries and Information Science announced three strategic goals to guide its work in the immediate future. Among those three goals was the appraising and assessing of library and information services. Characteristics and Principles of Evaluation Childers (1989, p. 250), in an article emphasizing the evaluation of programs, notes that evaluation research (1) is usually employed for decision making; (2) deals with research questions about a program; (3) takes place in the real world of the program; and (4) usually represents a compromise between pure and applied research. Wallace and Van Fleet (2001) comment that evaluation should be carefully planned, not occur by accident; have a purpose that is usually goal oriented; focus on determining the quality of a product or service; go beyond measurement; not be any larger than necessary; and reflect the situation in which it will occur. Similarly, evaluation should contribute to an organization's planning efforts; be built into existing programs; provide useful, systematically collected data; employ an outside evaluator/consultant when possible; involve the staff; not be any fancier than necessary; and target multiple audiences and purposes (Some Practical Lessons on Evaluation, 2000). In an earlier work on the evaluation of special libraries, Griffiths and King (1991, p. 3) identify some principles for good evaluation that still bear repeating: 1. Evaluation must have a purpose; it must not be an end in itself 2. Without the potential for some action, there is no need to evaluate 3. Evaluation must be more than descriptive; it must take into account relationships among operational performance, users, and organizations 4. Evaluation should be a communication tool involving staff and users 5. Evaluation should not be sporadic but be ongoing and provide a means for continual monitoring, diagnosis, and change 6. Ongoing evaluation should provide a means for continual monitoring, diagnosis and change 7. Ongoing evaluation should be dynamic in nature, reflecting new knowledge and changes in the environment 54
As has been implied, but not explicitly stated above, evaluation often attempts to assess the effectiveness of a program or service. On a more specific level, evaluation can be used to support accreditation reviews, needs assessments, new projects, personnel reviews, conflict resolution, and professional compliance reports. Types of Evaluation Research Before selecting specific methods and data collection techniques to be used in an evaluation study, the evaluator, according to Wallace and Van Fleet (2001), should decide on the general approach to be taken. They categorize the general approaches as ad hoc/as needed/as required or evaluation conducted when a problem arises; externally centered, or evaluation necessitated by the need to respond to external forces such as state library and accrediting agencies; internally centered, or evaluation undertaken to resolve internal problems; and research centered, or evaluation that is conducted so that the results can be generalized to similar environments. Other broad categories of evaluation that can encompass a variety of methods include macroevaluation, microevaluation, subjective evaluation, objective evaluation, formative evaluation (evaluation of a program made while it is still in progress), and summative evaluation (performed at the end of a program). The Encyclopedia of Evaluation (Mathison, 2004) treats forty-two different evaluation approaches and models ranging from "appreciative inquiry" to "connoisseurship" to "transformative evaluation." Evaluation Methods Having decided on the general approach to be taken, the evaluator must next select a more specific approach or method to be used in the evaluation study. What follows are brief overviews of several commonly used evaluation methods or groups of methods. 1) Input Measurement Input measures are measures of the resources that are allocated to or held by an organization and represent the longest-standing, most traditional approach to assessing the quality of organizations and their resources and services. Examples of input measures for libraries include the number of volumes held, money in the budget, and number of staff members. By themselves they are more measurement than true evaluation and are limited in their ability to assess quality. 2) Output/Performance Measurement Output or performance measures serve to indicate what was accomplished as a result of some programmatic activity and thus warrant being considered as a type of evaluation research. 55

Such measures focus on indicators of library output and effectiveness rather than merely on input; are closely related to the impact of the library on its community; and, as is true for virtually all evaluation methods, should be related to the organization's goals and objectives. As was just indicated, one critical element of performance measurement is effectiveness; another is user satisfaction. In addition to user satisfaction, examples of performance/output measures include use of facilities and equipment, circulation of materials, document delivery time, reference service use, subject search success, and availability of materials. The Association of Research Libraries (2004) identified the following eight output measures for academic libraries: ease and breadth of access, user satisfaction, teaching and learning, impact on research, cost effectiveness of library operations and services, facilities and space, market penetration, and organizational capacity. One could argue that not all of those eight measures represent true performance or output measures, but they are definitely measures of effectiveness. 3) Impact/Outcomes Assessment The input or resources of a library are relatively straightforward and easy to measure. True measurement of the performance of a library is more difficult to achieve, and it is even more challenging to measure impact/outcomes or how the use of library and information resources and services actually affects users. Rossi, Lipsey, and Freeman (2004) point out that outcomes must relate to the benefits of products and services, not simply their receipt (a performance measure). However, given the increasing call for accountability, it is becoming imperative for libraries to measure outcomes or impact. Indeed, "outcomes evaluation has become a central focus, if not the central focus, of accountability-driven evaluation" Some authors use the terms impact and outcome synonymously; others see them as somewhat different concepts. Patton (2002, p. 162) suggests a logical continuum that includes inputs, activities and processes, outputs, immediate outcomes, and long-term impacts. Bertot and McClure, in a 2003 article in Library Trends (pp. 599–600), identified six types of outcomes: 1. Economic: outcomes that relate to the financial status of library users 2. Learning: outcomes reflecting the learning skills and acquisition of knowledge of users 3. Research: outcomes that include, for example, the impacts of library services and resources on the research process of faculty and students 4. Information Exchange: outcomes that include the ability of users to exchange information with organizations and other individuals 5. Cultural: the impact of library resources and services on the ability of library users to benefit from cultural activities 6. Community: outcomes that affect a local community and in turn affect the quality of life for members of the community 56
Matthews (2004, pp. 109–110), in his book on measuring public library effectiveness, identifies six categories of outcomes or benefits for public libraries. Those six categories, with examples, are as follows: 1. Cognitive results: refreshed memory, new knowledge, changed ideas 2. Affective results: sense of accomplishment, sense of confidence 3. Meeting expectations: getting what they needed, getting too much, seeking substitute sources 4. Accomplishments: able to make better-informed decisions, achieving a higher quality performance 5. Time aspects: saved time, wasted time, had to wait for service 6. Money aspects: the dollar value of results obtained, the amount of money saved, the cost of using the service Impacts more relevant to academic libraries and their users include improved test scores, better papers, publications, increased class participation, etc. (Powell, 1995). A book by Hernon and Dugan (2002) considers outcomes for both academic and public libraries. The latter include getting ideas, making contact with others, resting or relaxing, and being entertained. Markless and Streatfield (2001) examine impact indicators for public, school, and academic libraries. Among their impact targets for school libraries are "improved quality and type of communication between learners and LRC staff" and "enhanced user confidence" (p. 175). Seadle (2003) notes that outcome-based evaluation is increasingly used for digital library projects. 4) Service Quality Service quality, briefly defined, is "the difference between a library user's expectations and perceptions of service performance" (Nitecki, 1996, p. 182). As a concept, it dates back to at least the 1970s and has some roots in the total quality management (TQM) movement. TQM is characterized by the implementation of standards of quality, the encouragement of innovation, the measurement of results, and the taking of corrective actions as needed. TQM emphasizes the use of a team approach to maximizing customer satisfaction. A 1996 article by Pritchard provides an excellent overview of TQM, as well as other approaches to determining quality. Quality is an elusive concept for which there is no commonly accepted definition, but the assessment of service quality did get a boost from earlier research from Parasuraman, Berry, and Zeithaml (see Nitecki, 1996). They developed a conceptual framework, the Gaps Model of Service Quality, and a widely used instrument, SERV-QUAL, for measuring service quality. The Gaps Model incorporates the following gaps, as measured by the SERV-QUAL questionnaire: 1. The discrepancy between customers' expectations and managements' perceptions of these expectations 57

2. The discrepancy between managements' perceptions of customers' expectations and service-quality specifications 3. The discrepancy between service-quality specifi cations and actual service delivery 4. The discrepancy between actual service delivery and what is communicated to customers about it 5. The discrepancy between customers' expected services and perceived services delivered (Nitecki, 1996, p. 182) The most visible current iteration of SERV-QUAL in the library field is known as LibQUAL+. LibQUAL+ was developed by faculty members of Texas A&M University in partnership with the Association of Research Libraries (ARL) and is part of ARL's New Measures Initiative. Over the past few years LibQUAL+ studies have been conducted by hundreds of libraries, including many large university libraries in the United States. These studies are intended for libraries "to solicit, track, understand, and act upon users' opinions of service quality" (LibQUAL+, 2003). Questions in the LibQUAL+ questionnaire address library staff, print and electronic resources, service hours, facilities, equipment, and document delivery and gather the data needed to calculate the gaps described above. However, according to Shi and Levy, "the current LibQUAL+ is not yet an adequately developed tool to measure and represent a dependable library services assessment result" (2005, p. 272). Individuals wanting to know more about the use of service quality methods in academic libraries may wish to read a book by Hernon and Altman (1996). Other models of quality assessment from a British perspective are considered by Jones, Kinnell, and Usherwood (2000). 5) Process Evaluation The second stage in Patton's (2002) continuum described in the section on impact/outcomes assessment was processes or activities. "A focus on process involves looking at how something happens rather than or in addition to examining outputs and outcomes" (p. 159). "Process data permit judgments about the extent to which the program or organization is operating the way it is supposed to be operating, revealing areas in which relationships can be improved as well as highlighting strengths of the program that should be preserved" (Patton, 2002, p. 160). Process evaluation focuses on "what the program actually does" (Weiss, 1998, p. 9). It "is the most frequent form of program evaluation" (Rossi, Lipsey, & Freeman, 2004, p. 57). Process indicators are somewhat similar to performance measures, but they focus more on the activities and procedures of the organization than on the products of those activities. For example, a process evaluation of an acquisitions department would be concerned with how materials are acquired and prepared for the shelf, not on how many books are ultimately used. In an academic library setting, process indicators might include staff training and development, 58
delivery styles, knowledge of the curriculum, and participation in assignments and grading (Markless & Streatfield, 2001). In his book on public library effectiveness, Matthews (2004) places process measures in three categories: efficiency, staff productivity, and library information system activity. More generally speaking, a process evaluation "might examine how consistent the services actually delivered are with the goals of the program, whether services are delivered to appropriate recipients, how well service delivery is organized, the effectiveness of program management, the use of program resources, and other such matters" (Rossi, Lipsey, & Freeman, 2004, p. 57). And ultimately, the evaluator would want to know the extent to which programs and services were actually implemented. Patton (2002) even argues that "implementation evaluation" is a distinct method, and in many cases implementation information is of greater value than outcomes information (p. 161) 6) Benchmarking One of the relatively recent approaches to measuring the performance of libraries and other organizations is benchmarking. Benchmarking tends to fall into the "total quality management" category. Benchmarking "represents a structured, proactive change effort designed to help achieve high performance through comparative assessment. It is a process that establishes an external standard to which internal operations can be compared" (Jurow, 1993, p. 120). The 2000 Standards for College Libraries describes benchmarking as the process of evaluating a library's points of comparison – inputs and outputs - against its peers and aspirational peers. There are several types of benchmarking, one of which is referred to as competitive or performance benchmarking. Performance benchmarking utilizes comparative data gathered from the same field or the same type of organization. The data are usually derived from analyses of organizational processes and procedures. Benchmarking can be used to establish best practices, identify changes to improve services, evaluate opinions and needs of users, identify trends, exchange ideas, and develop staff. Peischl (1995) points out that candidates for benchmarking include the services or products of an organization, internal work processes, internal support functions, and organizational performance and strategy. 7) Standards According to Baker and Lancaster, "standards have an important role to play in the evaluation of library services. When applied to libraries, however, standards refers to a set of guidelines or recommended practices, developed by a group of experts, that serve as a model for good library service" (1991, p. 321). Some general types of standards, as identified by Baker and Lancaster (1991), include technical standards (for example, cataloging codes), performance standards, output measures, input measures, qualitative standards, and quantitative standards. 59

8) Quantitative Evaluation Any evaluation method that involves the measurement of quantitative/ numerical variables probably qualifies as a quantitative method, and many of the methods already examined fall into this broad category. Among the strengths of quantitative methods are the evaluator can reach conclusions with a known degree of confidence about the extent and distribution of that the phenomenon; they are amenable to an array of statistical techniques; and they are generally assumed to yield relatively objective data. Experimental methods usually, but not always, deal with quantitative data and are considered to be the best method for certain kinds of evaluation studies. Indeed, "the classic design for evaluations has been the experiment. It is the design of choice in many circumstances because it guards against the threats to validity" (Weiss, 1998, p. 215). The experiment is especially useful when it is desirable to rule out rival explanations for outcomes. In other words, if a true experimental design is used properly, the evaluator should be able to assume that any net effects of a program are due to the program and not to other external factors On the other hand, experimental methods are relatively weak in producing findings that can be generalized to other situations because they are usually conducted in rather controlled settings. Also, experiments tend to be used to test the effects of one component of a program at a time rather than the entire program. Another limitation of the true or randomized experiment is that it is not well suited for evaluating programs in their early stages of implementation. If the program changes significantly before outcomes are measured, it will be difficult to determine which version of the program produced what effects (Rossi, Lipsey, & Freeman, 2004). Survey methods are often quantitative in nature but lack the experiment's ability to rigorously test the relationship between a program or service and its outputs or impact. Questionnaires and interviews, and observation to a lesser degree, represent the most commonly used survey data gathering techniques. Other quantitative methods covered by the Encyclopedia of Evaluation (Mathison, 2004) include concept mapping, correlation, cross- sectional design, matrix sampling, meta-analysis, panel studies, regression analysis, standardized tests, and time series analysis. 9) Qualitative Evaluation As is true for basic research, qualitative methods are becoming increasingly popular. In fact, "the most striking development in evaluation in recent years is the coming of age of qualitative methods. Where once they were viewed as aberrant and probably the refuge of those who had never studied statistics, now they are recognized as valuable additions to the evaluation repertoire" (Weiss, 1998, p. 252). The Encyclopedia of Evaluation (Mathison, 2004) includes thirty-seven qualitative methods. They are appropriate, of course, when the phenomena being evaluated do not lend themselves to quantification. A qualitative method "tends to apply a more 60
holistic and natural approach to the resolution of the problem than does quantitative research. It also tends to give more attention to the subjective aspects of human experience and behavior" (Powell & Connaway, 2004, p. 59). "Qualitative strategies can be particularly appropriate where the administration of standardized instruments, assigning people to comparison groups [in experiments], and/or the collection of quantitative data would affect program operations by being overly intrusive" (Patton, 2002, p. 191). In addition, they can provide 1. greater awareness of the perspective of program participants and often a greater responsiveness to their interests 2. capability for understanding dynamic developments in the program as it evolves 3. awareness of time and history 4. special sensitivity to the influence of context 5. ability to enter the program scene without preconceptions or prepared instruments, and to learn what is happening 6. alertness to unanticipated and unplanned events 7. general flexibility of perspective (Weiss, 1998, p. 253). Qualitative methods do have their disadvantages as well, of course. Among them are the following: 1. Limited ability to yield objective data 2. Limited ability to produce generalizable results 3. Limited ability to provide precise descriptions of program outcomes 4. Not well suited for developing specific answers about the relationship of particular program strategies or events to outcomes (Weiss, 1998, pp. 85–86) 5. Often relatively labor intensive to conduct 10) Cost Analysis Simple cost analysis is basically a descriptive breakdown of the costs incurred in operating an organization. Cost-related techniques more concerned with the assessment of whether monies are being spent in an optimal fashion usually fall into one of two groups – cost-effectiveness studies and cost-benefit analysis. "The term 'cost-effectiveness' implies a relationship between the cost of providing some service and the level of effectiveness of that service . . . Cost- effectiveness analyses can be thought of as studies of the costs associated with alternative strategies for achieving a particular level of effectiveness" (Lancaster, 1993, p. 267). Some examples of cost-effectiveness measures include the cost per relevant informational resource retrieved, cost per use of a resource, cost per user, cost per capita, and cost by satisfaction level (Lancaster, 1993; Matthews, 2004). Cost-effectiveness analysis can be seen as "a truncated form of 61

cost-benefit analysis that stops short of putting an economic value on . . . outcomes [benefits] of programs" (Klarman, 1982, p. 586). "'Cost-benefit,' clearly, refers to a relationship between the cost of some activity and the benefits derived from it. In effect, a cost-benefit study is one that tries to justify the existence of the activity by demonstrating that the benefits outweigh the costs" (Lancaster, 1993, p. 294). A typical cost-benefit analysis involves determining who benefits from and pays for a service, identifying the costs for each group of beneficiaries, identifying the benefits for each group, and comparing costs and benefits for each group to determine if groups have net benefits or net costs and whether the total benefits exceed the total costs. Types of cost-benefit analysis described by Lancaster (1993) are: 1. net value approach: the maximum amount the user of an information service is willing to pay minus the actual cost 2. value of reducing uncertainty in decision making 3. cost of buying service elsewhere 4. librarian time replaces user time (that is, the librarian saves the user time by performing his or her task) 5. service improves organization's performance or saves it money. Other kinds of cost analysis discussed by Weiss (1998) and Matthews (2004) include the following: 1. Cost-minimization analysis: seeks to determine the least expensive way to accomplish some outcome 2. Cost-utility analysis: considers the value or worth of a specific outcome for an individual or society 3. Willingness-to-pay approach: asks how much individuals are willing to pay to have something they currently do not have 4. Willingness-to-accept approach: asks individuals how much they would be willing to accept to give up something they already have 5. Cost of time 11) Organizational Effectiveness The determination of the effectiveness of an organization has been identified as one of the objectives for some of the methods described above, and, indeed, it may be more properly thought of as an evaluation objective than an evaluation method. Regardless, it is a crucial element of organizational assessment and has received considerable attention in the professional literature. Rubin (cited by Wallace and Van Fleet, 2001, pp. 13–14) identifies a number of criteria for effectiveness at the organizational level and then describes several models for measuring 62 organizational effectiveness. Those models and their "key questions" are as follows: 1. Goals: Have the established goals of the library been met? 2. Critical Constituencies: Have the needs of constituents been met? 3. Resources: Have necessary resources been acquired? 4. Human Resources: Is the library able to attract, select, and retain quality employees? 5. Open Systems: Is the library able to maintain the system, adapt to threats, and survive? 6. Decision Process: How are decisions made and evaluated? 7. Customer Service: How satisfied is the clientele with the library? 12) Program Evaluation Methods In addition to the methods already identified, there are numerous other methods primarily used for social program evaluation. Readers interested in learning more about such methods are referred to the works on evaluation already cited above, including the article by Childers (1989), and to the table by King in Powell and Connaway. 13) LIS-Centered Methods Another approach to categorizing evaluation methods used in library and information science is according to the program, service, or resource to be evaluated. The book by Wallace and Van Fleet (2001), for example, has chapters devoted to the evaluation of reference and information services and to library collections (see Whitlatch, 2001 for an article on the evaluation of electronic reference services). Bawden (1990) presents a user-oriented approach for the evaluation of information systems and services. An earlier issue of Library Trends (Reed, 1974) has articles on the evaluation of administrative services, collections, processing services, adult reference service, public services for adults, public library services for children, and school library media services. Lancaster's 1993 text includes the evaluation of collections, collection use, in-house library use, periodicals, library space, catalog use, document delivery, reference services, and resource sharing. Conducting the Evaluation Study After planning the evaluation, it is time, of course, to conduct the study. That is, the evaluator is now ready to collect data or measure what needs to be measured; analyze the data; and report the findings. What follows is a brief overview of the steps in the evaluation process. Measurement "Measurement, in most general terms, can be regarded as the assignment of numbers to objects (or events or situations) in accord with some rule. The property of the objects which 63

determines the assignment according to that rule is called magnitude, the measurable attribute; the number assigned to a particular object is called its measure, the amount or degree of its magnitude" (Kaplan, 1964, p. 177). More generally, measurement is any process for describing in quantitative values things, people, events, etc. Measurement by itself is not true evaluation, but it is one of the building blocks for quantitative evaluation. Common types of measures for library evaluation studies include number and types of users, number and duration of transactions, user and staff activities, user satisfaction levels, and costs of resources and services. They can be related to input, output, effectiveness, costs, etc. It is critical that the measurement process and the measures be reasonably high in reliability and validity. Reliability refers to the degree to which measurements can be depended upon to secure consistent and accurate results in repeated applications. Validity is the degree to which any measure or data collection technique succeeds in doing what it purports to do; it refers to the meaning of an evaluative measure or procedure. The validity and/or reliability of measures can be affected by such factors as inconsistent data collection techniques, biases of the observer, the data collection setting, instrumentation, behavior of human subjects, and sampling. The use of multiple measures can help to increase the validity and reliability of the data. They are also worth using because no single technique is up to measuring a complex concept, multiple measures tend to complement one another, and separate measures can be combined to create one or more composite measures (Weiss, 1998). Statistics Many measures are in the form of statistics, which, in some cases, can be drawn from already existing sources of data. Types of statistics include administrative data, financial statistics, collections and other resources or inputs, use and other output/performance measures, outcomes, and staff and salary information. Sources of statistics include governmental agencies, professional associations, and other organizations such as state library agencies. Among the noteworthy sources of library-related statistics are the National Center for Education Statistics (NCES), American Library Association and its divisions (such as the Public Library Association's Public Library Data Service and the Association of College and Research Libraries' Trends and Statistics series), Association of Research Libraries, and federal programs such as the Federal State Cooperative System and the Integrated Post secondary Education Data System. Data Collection Techniques The evaluator must next select or design one or more data collection techniques that are compatible with the method(s) to be used and that are capable of gathering the necessary information. There are too many data collection techniques to consider here, but some of the relatively common techniques and instruments used for evaluation studies, as well as for other 64
kinds of research, include the following: 1. Tests (standardized and locally developed) 2. Assessments by participants 3. Assessments by experts 4. Questionnaires (paper and electronic) 5. Interviews, including focus groups 6. Observation of behavior and activities 7. Evaluation of staff performance 8. Analysis of logs or diaries of participants 9. Analysis of historical and current records 10. Transactional log analysis 11. Content analysis 12. Bibliometrics, especially citation analysis 13. Use records 14. Anecdotal evidence Analysis of Data "The aim of analysis is to convert a mass of raw data into a coherent account. Whether the data are quantitative or qualitative, the task is to sort, arrange, and process them and make sense of their configuration. The intent is to produce a reading that accurately represents the raw data and blends them into a meaningful account of events". The basic tasks of data analysis for an evaluative study are to answer the questions that must be answered in order to determine the success of the program or service, the quality of the resources, etc. Those questions should, of course, be closely related to the nature of what is being evaluated and the goals and objectives of the program or service. In addition, the nature of the data analysis will be significantly affected by the methods and techniques used to conduct the evaluation. According to Weiss (1998), most data analyses, whether quantitative or qualitative in nature, will employ some of the following strategies: describing, counting, factoring (that is, dividing into constituent parts), clustering, comparing, finding commonalities, examining deviant cases, finding covariation, ruling out rival explanations, modeling, and telling the story. Evaluators conducting quantitative data analyses will need to be familiar with techniques for summarizing and describing the data (that is, descriptive statistics); and if they are engaged in testing relationships or hypotheses and/or generalizing findings to other situations, they will need to utilize inferential statistics. Whatever the nature of the data analysis, however, it cannot substitute for sound development of the study and interpretation of the findings. Statistics can only facilitate the interpretation. In a quantitative study the analysis and interpretation usually follow the conduct of the study. In a qualitative study the data analysis is typically concurrent with the data 65

gathering; “nor, in practice, are analysis and interpretation neatly separated”. The Evaluation Report As part of the planning, the evaluator should have considered how and to whom the findings will be communicated and how the results will be applied. Weiss (1998, pp. 296–297) recommends that the typical report of a program evaluation include the following elements: 1. Summary of study results 2. Problem with which the program deals 3. Nature of the program: goals and objectives, activities, context, beneficiaries, staff 4. Nature of the evaluation 5. Comparison with evaluations of similar programs (optional) 6. Suggestions for further evaluation (optional) A good report will be characterized by clarity, effective format and graphics, timeliness, candor about strengths and weaknesses of the study, and generalizability (Weiss, 1998), as well as by adequacy of sources and documentation, appropriateness of data analysis and interpretation, and basis for conclusions. Research Approaches 1) Quantitative Research Quantitative research methods are research methods dealing with numbers and anything that is measurable in a systematic way of investigation of phenomena and their relationships (Figure 1). It is used to answer questions on relationships within measurable variables with an intention to explain, predict and control a phenomena. Figure 1: Description of Quantitative Methods An entire quantitative study usually ends with confirmation or disconfirmation of the hypothesis 66
tested. Researchers using the quantitative method identify one or a few variables that they intend to use in their research work and proceed with data collection related to those variables. In the field of ICT, quantitative methods often deal with results computation and system analysis using a scientific approach. The objective of the quantitative method is to develop and employ models based on mathematical approach, hypotheses and theories pertaining to the nature of an ICT phenomenon. The process of measurement (which we have come across in the previous topic) is the focus of quantitative method due to its connectivity between empirical observation and mathematical expression of quantitative relationships. This method is also known as iterative process where evidence is evaluated, and hypotheses and theories are refined with some technical advances, leveraging on statistical approach. Quantitative method typically begins with data collection based on a hypothesis or theory and it is followed with application of descriptive or inferential statistics. Surveys and observations are some examples that are widely used with statistical association. For example, when a researcher is interested to investigate the “effectiveness of expert system for managing e-commerce application in open source environment”, the researcher will formulate the research question such as, “How effective is the expert system in comparison to case-based reasoning for e-commerce module development?” The researcher finds 10 software developers using e-commerce module with expert system in open source environment and 10 software developers using case-based reasoning e-commerce module in propietary programming language environment. The researcher will administer the results and compute them using statistical approach and then summarise it. Here, we can say the researcher used the quantitative method for the work mentioned. Advantages of Quantitative Research • Larger sample sizes often make the conclusions from quantitative research generalizable • Statistical methods mean that the analysis is often considered reliable • Appropriate for situations where systematic, standardised comparisons are needed Limitations of Quantitative Research • Does not always shed light on the full complexity of human experience or perceptions • Can reveal what / to what extent, but cannot always explore why or how • May give a false impression of homogeneity in a sample Quantitative Data Analysis 67
Data collected from questionnaires or other instruments in quantitative research methods have to be analysed and interpreted. Generally, statisical procedures are quantitative data approaches. In this section, we will look at these common statistical approaches and emphasis on a conceptual understanding for quantitative data analysis. Figure 2 summarises the statistical components that we will be looking at in this section. Figure 2: Summary of statistical components in quantitative data analysis (a) Mean – Mean is also known as average. A

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mean is the sum of all scores divided by the number of scores.

The mean
is used to measure central tendency or centre of a score distribution generally. For example, the mean for the following set of integers: 3, 4, 5, 7 and 6 = 5. Figure 3: Mean in distributed scores (b) Standard Deviation - A standard deviation tells us how close the scores are centred around the mean. By referring to the above Figure 6, when the scores are bunched together around the mean, the standard deviation is small and the bell curve is steep. When the scores are spread 68

away from the mean, the standard deviation is large and the bell curve is relatively flat. Figure 4: Standard Deviation To explore better what standard deviation means, we shall refer to Figure 4. The mean is 20 and the standard deviation(SD) is 5. • One standard deviation (SD= 5) from the mean in either direction on the horizontal axis accounts for around 68% of the organisation in this group. In other terms, 68% terminals obtained 15 and 25 optimal time. • Two standard deviation (5+5=10) away from the mean accounts roughly 95% of terminals. In other words, 95% terminals obtained between 10 and 30 optimal time. • Three standard deviations (5+5+5=15) away from the mean accounts for roughly 99% terminals. In other words, 99% terminals obtained 5 and 35 optimal time. Strengths and Weaknesses of Quantitative Research The advantage of legitimate quantitative data, that is data which is collected rigorously, using the appropriate methods and analysed critically, is in its reliability. However, the shortcoming of quantitative data is that it fails to provide an in depth description of the experience of the disaster upon the affected population. Knowing how many people are affected and their locations does not provide sufficient information to guide agencies and sectors on what they should plan for in terms of response. Knowing why there is a problem and how people are affected will combine with the numbers and locations to provide insight on how best to tailor the humanitarian response. For example, quantitative data collection may indicate categorically that 200,000 people were affected by a flood in four districts. This information would answer the questions: • How many people have been affected by the flood? • In how many districts? 69
However, this data does not tell you what priority needs are for affected persons in light of the flood or how the flood has impacted traditional coping strategies. Additional quantitative data could be collected to determine specific needs by asking community members to rank a list of priority needs. But this would still fall short of explaining why these are the priority needs and how that impacts upon and is affected by local cultural and values. It would also fail to provide information about priority needs for humanitarian intervention. To gather this information, an investigator would need to ask an open ended question, such as how has the disaster affected traditional coping strategies used by members of the community? or why are these the priority needs for your community? The main Strengths of Quantitative Data collection are that it provides: • numeric estimates • opportunity for relatively uncomplicated data analysis • data which are verifiable • data which are comparable between different communities within different locations • data which do not require analytical judgement beyond consideration of how information • will be presented in the dissemination process. Weaknesses inherent in Quantitative Data include: • gaps in information - issues which are not included in the questionnaire, or secondary data checklist, will not be included in the analysis • a labour intensive data collection process • limited participation by affected persons in the content of the questions or direction of the information collection process. 2) Qualitative Research Qualitative methods of research and analysis provide added value in identifying and exploring intangible factors such as cultural expectations, gender roles, ethnic and religious implications and individual feelings. Qualitative research explores relationships and perceptions held by affected persons and communities. As a result, smaller sample sizes chosen purposefully can be used for the following reasons: • The larger the sample size for qualitative data collection is, the more complex, time consuming and multi-layered the analysis will be. • For a true random sample to be selected, the characteristics under study of the whole population should be known, which is rarely possible at the early stage of an emergency. • Random sampling of a population is likely to produce a representative sample only if the research characteristics are evenly distributed within the population. There is no evidence 70

that the values, beliefs, attitude and perceptions that form the core of qualitative research are normally distributed, making the probability approach inappropriate. • Some informants are more likely to provide greater insight and understanding of a disaster's impact to the assessment team, due to a variety of factors including their social, economic, educational, and cultural position in the commuity. Choosing someone at random to answer a qualitative question would be analogous to randomly asking a passer by how to repair a broken car, rather than asking a garage mechanic. The qualitative sample must be big enough to assure inclusion of most or all of the perceptions that might be important. The smaller the sample size is, the narrower the range of perceptions that may be heard. The larger the sample size, the less likely it is that assessment team would fail to discover a perception that they would have wanted to know. In other words, the objective in designing qualitative research is to reduce the chances of discovery failure as opposed to reducing (quantitative) estimation error. In practice, the number of sample sites or groups becomes obvious as the assessment progresses, as new categories, themes and explanations stop emerging from the data (theoretical saturation). Clearly this requires a flexible assessment design and an iterative, cyclical approach to sampling, data collection, analysis and interpretation. Data originally obtained as qualitative information about individual items may give rise to quantitative data if they are recoded or categorised numerically. Conversely, data that are originally quantitative are sometimes grouped into categories to become qualitative data (for example, income below $5/day, income between $6 and $20, and income above $20). Data gathered through qualitative methods is often presented in the form of a case study. However, as with all data, results can also be presented in graphs, tables and using other (traditionally) quantitative methods. It is important, though, to realise that just because qualitative information is presented in a graph, it does not suddenly become quantitative. Data Collection, Analysis and Field Research Design Qualitative researchers face many choices for techniques to generate data ranging from grounded theory development and practice, narratology, storytelling, transcript poetry, classical ethnography, state or governmental studies, research and service demonstrations, focus groups case studies, participant observation, qualitative review of statistics in order to predict future happenings, or shadowing, among many others. Qualitative methods are used in various methodological approaches, such as action research which has sociological basis, or actor- network theory. The most common method used to generate data in qualitative research is an interview which may be structured, semi- structured or unstructured. Other ways to generate data include 71
group discussions or focus groups, observations, reflective field notes, texts, pictures, and other materials. Very popular among qualitative researchers are the studies of photographs, public and official documents, personal documents, and historical items in addition to images in the media and literature fields. To analyse qualitative data, the researcher seeks meaning from all of the data that is available. The data may be categorized and sorted into patterns (i.e., pattern or thematic analyses) as the primary basis for organizing and reporting the study findings (e.g., activities in the home; interactions with government).Qualitative researchers, often associated with the education field, typically rely on the following methods for gathering information: Participant Observation, Non-participant Observation, Field Notes, Reflexive Journals, Structured Interview, Semi- structured Interview, Unstructured Interview, and Analysis of documents and materials. The ways of participating and observing can vary widely from setting to setting as exemplified by Helen Schwartzman's primer on Ethnography in Organizations (1993). or Anne Copeland and Kathleen White's "Studying Families" (1991).Participant observation is a strategy of reflexive learning, not a single method of observing and has been described as a continuum of between participation and observation. In participant observation researchers typically become members of a culture, group, or setting, and adopt roles to conform to that setting. In doing so, the aim is for the researcher to gain a closer insight into the culture's practices, motivations, and emotions. It is argued that the researchers' ability to understand the experiences of the culture may be inhibited if they observe without participating. The data that is obtained is streamlined (texts of thousands of pages in length) to a definite theme or pattern, or representation of a theory or systemic issue or approach. This step in a theoretical analysis or data analytic technique is further worked on (e.g., gender analysis may be conducted; comparative policy analysis may be developed). An alternative research hypothesis is generated which finally provides the basis of the research statement for continuing work in the fields. Some distinctive qualitative methods are the use of focus groups and key informant interviews, the latter often identified through sophisticated and sometimes, elitist, snowballing techniques. The focus group technique (e.g., Morgan, 1988) involves a moderator facilitating a small group discussion between selected individuals on a particular topic, with video and handscribed data recorded, and is useful in a coordinated research approach studying phenomenon in diverse ways in different environments with distinct stakeholders often excluded from traditional processes. This method is a particularly popular in market research and testing new initiatives with users/workers. The research then must be "written up" into a report, book chapter, journal paper, thesis or dissertation, using descriptions, quotes from participants, charts and tables to demonstrate the trustworthiness of the study findings. 72

Specialized Uses of Qualitative Research Qualitative methods are often part of survey methodology, including telephone surveys and consumer satisfaction surveys. In fields that study households, a much debated topic is whether interviews should be conducted individually or collectively (e.g. as couple interviews). One traditional and specialized form of qualitative research is called cognitive testing or pilot testing which is used in the development of quantitative survey items. Survey items are piloted on study participants to test the reliability and validity of the items. This approach is similar to psychological testing using an intelligence test like the WAIS (Wechsler Adult Intelligence Survey) in which the interviewer records "qualitative" (i.e., clinical observations)throughout the testing process. Qualitative research is often useful in a sociological lens. Although often ignored, qualitative research is of great value to sociological studies that can shed light on the intricacies in the functionality of society and human interaction. There are several different research approaches, or research designs, that qualitative researchers use. In the academic social sciences, the most frequently used qualitative research approaches include the following points: 1. 1. Basic/generic/pragmatic qualitative research, which involves using an eclectic approach taken up to best match the research question at hand. This is often called the mixed - method approach. 2. Ethnographic Research. An example of applied ethnographic research is the study of a particular culture and their understanding of the role of a particular disease in their cultural framework. 3. Grounded Theory is an inductive type of research, based or "grounded" in the observations or data from which it was developed; it uses a variety of data sources, including quantitative data, review of records, interviews, observation and surveys. 4. Phenomenology describes the "subjective reality" of an event, as perceived by the study population; it is the study of a phenomenon. 5. Philosophical Research is conducted by field experts within the boundaries of a specific field of study or profession, the best qualified individual in any field of study to use an intellectual analysis, in order to clarify definitions, identify ethics, or make a value judgment concerning an issue in their field of study their lives. 6. Critical Social Research, used by a researcher to understand how people communicate and develop symbolic meanings. 7. Ethical Inquiry, an intellectual analysis of ethical problems. It includes the study of ethics as related to obligation, rights, duty, right and wrong, choice etc. 8. Social Science and Governmental Research to understand social services, government operations, and recommendations (or not) regarding future developments and programs, 73
including whether or not government should be involved. 9. Activist Research which aims to raise the views of the underprivileged or "underdogs" to prominence to the elite or master classes, the latter who often control the public view or positions. 10. Foundational Research, examines the foundations for a science, analyzes the beliefs, and develops ways to specify how a knowledge base should change in light of new information. 11. Historical Research allows one to discuss past and present events in the context of the present condition, and allows one to reflect and provide possible answers to current issues and problems. Historical research helps us in answering questions such as: Where have we come from, where are we, who are we now and where are we going? 12. Visual Ethnography. It uses visual methods of data collection, including photo, voice, photo elicitation, collaging, drawing, and mapping. These techniques have been used extensively as a participatory qualitative technique and to make the familiar strange. 13. Autoethnography, the study of self, is a method of qualitative research in which the researcher uses their personal experience to address an issue. Data Analysis Interpretive techniques The most common analysis of qualitative data is observer impression. That is, expert or bystander observers examine the data, interpret it via forming an impression and report their impression in a structured and sometimes quantitative form. Coding Coding is an interpretive technique that both organizes the data and provides a means to introduce the interpretations of it into certain quantitative methods. Most coding requires the analyst to read the data and demarcate segments within it, which may be done at different times throughout the process. Each segment is labeled with a "code" – usually a word or short phrase that suggests how the associated data segments inform the research objectives. When coding is complete, the analyst prepares reports via a mix of: summarizing the prevalence of codes, discussing similarities and differences in related codes across distinct original sources/contexts, or comparing the relationship between one or more codes. Some qualitative data that is highly structured (e.g., open - ended responses from surveys or tightly defined interview questions) is typically coded without additional segmenting of the content. In these cases, codes are often applied as a layer on top of the data. Quantitative analysis 74

of these codes is typically the capstone analytical step for this type of qualitative data. The most common form of coding is open-ended coding, while other more structured techniques such as axial coding or integration are described (Strauss & Corbin, 1990). However, more important than coding are qualities such as the "theoretical sensitivity" of the researcher. Contemporary qualitative data analyses are sometimes supported by computer programs, termed Computer Assisted Qualitative Data Analysis Software which has replaced the detailed hand coding and labeling of the past decades. These programs do not supplant the interpretive nature of coding but rather are aimed at enhancing the analyst's efficiency at data storage/retrieval and at applying the codes to the data. Many programs offer efficiencies in editing and revising coding, which allow for work sharing, peer review, and recursive examination of data. The university goals were to place such programs on computer mainframes and analyze large data sets which is not easily conducted past 1,000 to 2,000 pages of text. Common Qualitative Data Analysis Software includes: • MAXQDA • QDA MINER • ATLAS.ti • Dedoose (mixed methods) • Nvivo A frequent criticism of coding method by individuals from other research tracks is that it seeks to transform qualitative data into empirically valid data, which contain: actual value range, structural proportion, contrast ratios, and scientific objective properties; thereby draining the data of its variety, richness, and individual character. Analysts respond to this criticism by thoroughly expositing their definitions of codes and linking those codes soundly to the underlying data, therein bringing back some of the richness that might be absent from a mere list of codes. Recursive Abstraction Some qualitative datasets are analyzed without coding. A common method here is recursive abstraction, where datasets are summarized; those summaries are therefore furthered into summary and so on. The end result is a more compact summary that would have been difficult to accurately discern without the preceding steps of distillation. A frequent criticism of recursive abstraction is that the final conclusions are several times removed from the underlying data. While it is true that poor initial summaries will certainly yield an inaccurate final report, qualitative analysts can respond to this criticism. They do so, like those using coding method, by documenting the reasoning behind each summary step, citing examples from the data where statements were included and where statements were excluded from the 75
intermediate summary. Coding and "Thinking" Some data analysis techniques, often referred to as the tedious, hard work of research studies similar to field notes, rely on using computers to scan and reduce large sets of qualitative data. At their most basic level, numerical coding relies on counting words, phrases, or coincidences of tokens within the data; other similar techniques are the analyses of phrases and exchanges in conversational analyses. Often referred to as content analysis, a basic structural building block to conceptual analysis, the technique utilizes mixed methodology to unpack both small and large corpuses. Content analysis is frequently used in sociology to explore relationships, such as the change in perceptions of race over time (Morning 2008), or the lifestyles of temporal contractors (Evans, et al. 2004). Content analysis techniques thus help to provide broader output for a larger, more accurate conceptual analysis. Mechanical techniques are particularly well - suited for a few scenarios. One such scenario is for datasets that are simply too large for a human to effectively analyze, or where analysis of them would be cost prohibitive relative to the value of information they contain. Another scenario is when the chief value of a dataset is the extent to which it contains "red flags" (e.g., searching for reports of certain adverse events within a lengthy journal dataset from patients in a clinical trial) or "green flags" (e.g., searching for mentions of your brand in positive reviews of marketplace products). Many researchers would consider these procedures on their data sets to be misuse of their data collection and purposes. A frequent criticism of mechanical techniques is the absence of a human interpreter; computer analysis is relatively new having arrived in the late 1980s to the university sectors. And while masters of these methods are able to write sophisticated software to mimic some human decisions, the bulk of the "analysis" is still nonhuman. Analysts respond by proving the value of their methods relative to either a) hiring and training a human team to analyze the data or b) by letting the data go untouched, leaving any actionable nuggets undiscovered; almost all coding schemes indicateprobably studies for further research. Data sets and their analyses must also be written up, reviewed by other researchers, circulated for comments, and finalized for public review. Numerical coding must be available in the published articles, if the methodology and findings are to be compared across research studies in traditional literature review and recommendation formats. Strengths and Weaknesses of Qualitative Research The main Strengths of Qualitative Data collection are that it provides: • rich and detailed information about affected populations 76
• perspectives of specific social and cultural contexts (i.e. the human voice of the disaster) • inclusion of a diverse and representative cross section of affected persons • in depth analysis of the impact of an emergency • a data collection process which requires limited numbers of respondents • a data collection process which can be carried out with limited resources. Weaknesses inherent in qualitative data are that it: • results in data which is not objectively verifiable • requires a labour intensive analysis process (categorization, recoding, etc.) • needs skilled interviewers to successfully carry out the primary data collection activities. 77
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Unit: 03 Introduction to Statistics In this unit, you will learn about, • Introduction to Statistics • Uses of Statistics • Limitation of Statistics • Functions of Statistics • Classification and Tabulation of Data • Collection of Data • Presentation of Statistical Data • Central Tendency ➢ Mean ➢ Median ➢ Mode • Measures of Variability ➢ Range, ➢ Variance ➢ Standard Variation • Correlation • Spearman's Correlation • T-Test • Chi-Square Test Introduction to Statistics The word 'statistics' has been derived from the Latin word 'status'. In the plural sense it means a set of numerical figures called 'data' obtained by counting, or, measurement. In the singular sense it means collection, classification, presentation, analysis, comparison and meaningful interpretation of 'raw data'. It has been defined in different ways by different authors. Croxton and Cowdon defined it as 'the science which deals with the collection, analysis and interpretation of numerical data'. Statistical data help us to understand the economic problems, e.g., balance of trade, disparities of income and wealth, national income accounts, supply and demand curves, living and whole sale price index numbers, production, consumption, etc., formulate economic theories and test old hypothesis. It also helps in planning and forecasting. 79

The success of modern business firms depends on the proper analysis of statistical data. Before expansion and diversification of the existing business or setting up a new venture, the top executives must analyse all facts like raw material prices, consumer-preferences, sales records, demand of products, labour conditions, taxes, etc., statistically. It helps to determine the location and size of business, introduce new products or drop an existing product and in fixing product price and administration. It has also wide application in Operations Research. Uses of Statistics • Statistics helps in providing a better understanding and exact description of a phenomenon of nature. • Statistics helps in the proper and efficient planning of a statistical inquiry in any field of study. • Statistics helps in collecting appropriate quantitative data. • Statistics helps in presenting complex data in a suitable tabular, diagrammatic and graphic form for easy and clear comprehension of the data. • Statistics helps in understanding the nature and pattern of variability of a phenomenon through quantitative observations. • Statistics helps in drawing valid inferences, along with a measure of their reliability about the population parameters from the sample data. Limitation of Statistics i. Statistics studies a group but not an individual. ii. Statistics cannot be applied to study the qualitative phenomenon. iii. Statistical decisions are true on an average only. For better results a large number of observations are required. iv. Statistical data are not mathematically accurate. v. Statistical data must be analysed by statistical experts otherwise the results may be misleading. vi. The laws of statistics are not exact like the laws of sciences. The first law states "

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a moderately large number of items chosen at random from a large group are almost sure on the average to possess the characteristics of the large group". The second law states "other things being equal, as the sample size increases, the result tends to be more reliable and

accurate".

vii. Statistics collected for a given purpose must be used for that purpose only. viii.Statistical relations do not always establish the 'cause and effect" relationship between phenomena. 80

ix. A statistical enquiry has four phases, viz., (a) Collection of data; (b) Classification and tabulation of data; (c) Analysis of data; (d) Interpretation of data. Functions of Statistics i. It simplifies complex data and helps us to study the trends and relationships of different phenomena and compare them. ii. It helps us to classify numerical data, measure uncertainty, test the hypothesis, formulate policies and take valid inferences. Classification and Tabulation of Data 1.

94% **MATCHING BLOCK 53/101** SA MSW (Social Work Research and Statistics) Pape ... (D165578133)

Collection of Data Data means information. Data collected expressly for a specific purpose are called 'Primary data' e.g., data collected by a particular person or organisation from the primary source for his own use, collection of data about the population by censuses and surveys, etc. Data collected and published by one organisation and subsequently used by other organisations are called 'Secondary data'. The various sources of collection for secondary data are: newspapers and periodicals; publications of trade associations; research papers published by university departments, U.G.C. or research bureaus; official publications of central, state and the local and foreign governments, etc. The collection expenses of primary data are more than secondary data. Secondary data should be used with care. The various methods of collection of primary data are: (i) Direct personal investigation (interview/observation); (ii) Indirect oral investigation; (iii) Data from local agents and correspondents; (iv) Mailed questionnaires; (v) Questionnaires to be filled in by enumerators; (vi) Results of experiments, etc. Data collected in this manner are called 'raw data'. These are generally voluminous and have to be arranged properly before use.

100%	MATCHING BLOCK 54/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Classification of Data Connor defined classification as: "the process of arranging things in groups or classes according to their resemblances and affinities and gives expression to the unity of attributes that may subsist amongst a diversity of individuals". The raw data, collected in real situations and arranged haphazardly, do not give a clear picture. Thus to locate similarities and reduce mental strain we resort to classification. Classification condenses the data by dropping out unnecessary details. It facilitates comparison 81 between different sets of data clearly showing the different points of agreement and disagreement. It enables us to study the relationship between several characteristics and make further statistical treatment like tabulation, etc.

During population census, people in the country are classified according to sex (males/ females), marital status (married/unmarried), place of residence (rural/urban), Age (0–5 years, 6– 10 years, 11–15 years, etc.), profession (agriculture, production, commerce, transport, doctor, others), residence in states (West Bengal, Bihar, Mumbai, Delhi, etc.), etc. a) Primary Rules of Classification In quantitative classification, we classify data by assigning arbitrary limits called class- limits. The group between any two class-limits is termed as class or class-interval.

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The primary rules of classification are given below: i. There should not be any ambiguity in the definition of classes.

It will eliminate all doubts while including a particular item in a class. ii.

100%	MATCHING BLOCK 56/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

All the classes should preferably have equal width or length.

Only in some special cases, we use classes of unequal width. iii.

96%	MATCHING BLOCK 57/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

The class-limits (integral or fractional) should be selected in such a way that no value of the item in the raw data coincides with the value of the limit. iv. The number of classes should preferably be between 10 and 20, i.e., neither too large nor too small.

v.

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The classes should be exhaustive, i.e., each value of the raw data should be included in them. vi. The classes should be mutually exclusive and non-overlapping, i.e., each item of the raw data should fit only in one class.

vii.

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The classification must be suitable for the object of inquiry.

viii.

100%	MATCHING BLOCK 61/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

The classification should be flexible and items included in each class must be homogeneous.

ix.

75%	MATCHING BLOCK 58/101	W

Width of class-interval is determined by first fixing the no. of class-intervals and then dividing the total range

by that number. b) Modes

68%	MATCHING BLOCK 62/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

of Classification There are four types of classification, viz., (i) qualitative; (ii) quantitative; (iii) temporal and (iv) spatial. (i) Qualitative Classification: It is done according to attributes or non-measurable characteristics; like social status, sex, nationality, occupation, etc.

For example, the population of the whole country can be classified into four categories as married, unmarried, widowed and 82
divorced. When only one attribute, e.g., sex,

71%	MATCHING BLOCK 63/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

is used for classification, it is called simple classification. When more than one attributes,

e.g., deafness, sex and religion, are used for classification, it is called manifold classification. (ii) Quantitative Classification: It is done according to numerical size like weights in kg or heights in cm. Here we classify the data by assigning arbitrary limits known as class-limits. The quantitative phenomenon under study is called a variable. For example, the population of the whole country may be classified according to different variables like age, income, wage, price, etc. Hence this classification is often called 'classification by variables'. (a) Variable: A variable in statistics means any measurable characteristic or quantity which can assume a range of numerical values within certain limits, e.g., income, height, age, weight, wage, price, etc. A variable can be classified as either discrete or continuous. 1) Discrete Variable: A variable which can take up only exact values and not any fractional values, is called a 'discrete' variable. Number of workmen in a factory, members of a family, students in a class, number of births in a certain year, number of telephone calls in a month, etc., are examples of discrete-variable. 2) Continuous Variable: A variable which can take up any numerical value (integral/fractional) within a certain range is called a 'continuous' variable. Height, weight, rainfall, time, temperature, etc., are examples of continuous variables. Age of students in a school is a continuous variable as it can be measured to the nearest fraction of time, i.e., years, months, days, etc. (iii)

90%	MATCHING BLOCK 64/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Temporal Classification: It is done according to time, e.g., index numbers arranged over a period of time, population of a country for several decades, exports and imports of India

for different five year plans, etc. (iv)

100%	MATCHING BLOCK 65/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Spatial Classification: It is done with respect to space or places,

e.g., production of cereals in quintals

93%	MATCHING BLOCK 66/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

in various states, population of a country according to states, etc. Presentation of Statistical Data Statistical data can be presented in three different ways: (

a) Textual presentation (b) Tabular presentation, and (c) Graphical presentation. 83
(a)

85%	MATCHING BLOCK 67/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Textual Presentation This is a descriptive form. The following is an example of such a presentation of

data about deaths from industrial diseases in Great Britain in 1935–39 and 1940–44. Example 1: Numerical data with regard to industrial diseases and deaths in Great Britain during the years 1935–39 and 1940–44 are given in a descriptive form: "During the quinquennium 1935–39, there were in Great Britain 1, 775 cases of industrial diseases made up of 677 cases of lead poisoning, 111 of other poisoning, 144 of anthrax, and 843 of gassing. The number of deaths reported was 20 p.c. of the cases for all the four diseases taken together, that for lead poisoning was 135, for other poisoning 25 and that for anthrax was 30. During the next quinquennium, 1940–44, the total number of cases reported was 2, 807. But lead poisoning cases reported fell by 351 and anthrax cases by 35. Other poisoning cases increased by 784 between the two periods. The number of deaths reported decreased by 45 for lead poisoning, but decreased only by 2 for anthrax from the pre-war to the post-war quinquennium. In the later period, 52 deaths were reported for poisoning other than lead poisoning. The total number of deaths reported in 1940–44 including those from gassing was 64 greater than in 1935–39".

81%	MATCHING BLOCK 68/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

The disadvantages of textual presentation are: i. it is too lengthy; ii. there is repetition of words; iii. comparisons cannot be made easily; iv. it is difficult to get an idea and take appropriate action. (b) Tabular Presentation, or, Tabulation Tabulation

may be

83%	MATCHING BLOCK 70/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

defined as the systematic presentation of numerical data in rows or/and columns according to certain characteristics. It expresses the data

in concise and attractive form

96%	MATCHING BLOCK 69/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

which can be easily understood and used to compare numerical figures. Before drafting

a table, you should be sure what you want to show and who will be the reader. The descriptive form of Example 1 has been condensed below in the form of a Table. Table 1: Deaths from Industrial Diseases in Great Britain S.No Diseases 1935-39 1940-44 Number of cases Number of Deaths % of deaths Number of cases Number of deaths % of deaths (1) (2) (3) (4) (5) (6) (7) (8) 84
1 Lead Poisoning 677 135 19.94 326 90 27.60 2 Anthrax 144 30 20.83 109 28 25.69 3 Gassing 843 165 19.57 1,477 249 16.86 4 Other Poisoning 111 25 22.52 895 52 5.81 Total 1775 355 20.00 2,807 419 14.93 The advantages of a tabular presentation

61%	MATCHING BLOCK 72/101	SA	Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

over the textual presentation are: (i) it is concise; (ii) there is no repetition of explanatory matter (iii) comparisons can be made easily; (iv) the important features can be highlighted; and (v)

errors in the data can be detected.

90%	MATCHING BLOCK 71/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

An ideal statistical table should contain the following items: i. Table number: A number must be allotted

to the table for identification, particularly

88% **MATCHING BLOCK 73/101** SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

when there are many tables in a study. ii. Title: The title should

explain what is contained in

38% **MATCHING BLOCK 74/101** SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

the table. It should be clear, brief and set in bold type on top of the table. It should also indicate the time and place to which the data refer. iii. Date: The date of preparation of the table should be given. iv. Stubs, or, Row designations: Each row

of the table should be given a brief heading.
Such designations of rows are called "

85% **MATCHING BLOCK 75/101** SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

stubs", or, "stub items" and the entire column is called "stub column". v. Column headings, or, Captions:

100% **MATCHING BLOCK 76/101** SA MSW (Social Work Research and Statistics) Pape ... (D165578133)

Column designation is given on top of each column to explain to what the figures in the column refer.

It should be clear and precise. This is called a "caption", or, "
heading". Columns should be numbered if there are four, or, more columns. vi.

100% **MATCHING BLOCK 77/101** SA MSW (Social Work Research and Statistics) Pape ... (D165578133)

Body of the Table: The data should be arranged in such a way that any figure can be located easily. Various types of numerical variables should be arranged in an ascending order, i.e., from left to right in rows and from top to bottom in columns.

Column and row totals
should be given. vii. (
vii)

100% **MATCHING BLOCK 78/101** SA MSW (Social Work Research and Statistics) Pape ... (D165578133)

Unit of measurement: If the unit of measurement is uniform throughout the table, it is stated at the top right-hand corner of the table along with the title. If different rows and columns contain figures in different units, the units may be stated along with "stubs", or, "captions".

Very large figures may be rounded up but the method of rounding should be explained. viii.

96% **MATCHING BLOCK 79/101** SA MSW (Social Work Research and Statistics) Pape ... (D165578133)

Source: At the bottom of the table a note should be added indicating the primary and secondary sources from which data have been collected. ix. Footnotes and references: If any item has not been explained properly, a separate 85 explanatory note should be added at the bottom of the table.

100%	MATCHING BLOCK 80/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

A table should be logical, well-balanced in length and breadth and the comparable columns should be placed side by side. Light/heavy/thick or double rulings may be used to distinguish sub- columns, main columns and totals.

For large data more than one table may be used. (c) Graphical Presentation:

100%	MATCHING BLOCK 81/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Quantitative data may also be presented graphically by using bar charts, pie diagrams, pictographs, line diagrams, etc.

89%	MATCHING BLOCK 82/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

Objectives of Tabulation The main objectives of tabulation are stated below: i. to carry out investigation; ii. to do comparison; iii. to locate omissions and errors in the data;

iv.

84%	MATCHING BLOCK 83/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

to use space economically; v. to study the trend; vi. to simplify data; vii. to use it as future reference.

Sorting Sorting of data is the last process of tabulation.
It is a

81%	MATCHING BLOCK 84/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

time-consuming process when the data is too large. After classification the data may be sorted using either of the following methods: (i) Manual method: Here the sorting is done by hand by giving tally marks for the number of times each event has occurred. Next the total tally marks are counted. The method is simple and suitable for limited data. (

ii)

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Mechanical and electrical method: To reduce the sorting time mechanical devices may be used. This is described as mechanical tabulation.

For electrical tabulation data should be codified first and then punched on card. For each data

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a separate card is used. The punched cards are checked by a machine called 'verifier'. Next the cards are sorted out into different groups as desired by a machine called 'sorter'. Finally, the tabulation is

done by

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using a tabulator. The same card may be sorted out

more than once for completing tables under different titles. 86
(iii) Tabulation using electronic computer: It is convenient to use electronic computer

96%	MATCHING BLOCK 88/101	SA	MSW (Social Work Research and Statistics) Pape ... (D165578133)

for sorting when (a) data are very large; (b) data have to be sorted for future use and (c) the requirements of the table are changing.

Such a tabulation is less time-consuming and more accurate than the manual method. Central Tendency • A score that indicates where the Center of the distribution tends to be located. • Tells about the shape and nature of the distribution. Measures of Central Tendency
There are several statistical measures of central tendency or "averages". The three most commonly used averages are: 1)

80%	MATCHING BLOCK 89/101	SA	markiii_mr.pdf (D112190661)

Mean • The sum of all scores divided by y the number of scores. 2)

Median • The score in the middle when the scores are ordered. 3) Mode • The most frequent score. 1) Arithmetic Mean • The score located at the mathematical center of a distribution • Used to summarize interval or ratio data in situations when the distribution is symmetrical and unimodel. The formula for the sample mean is Example 2:
Suppose the monthly income (in Rs) of six families is given as: 1600, 1500, 1400, 1525, 1625, 1630. The mean family income is obtained by adding up the incomes and dividing by the number of families. =1547 87
It implies that on an average, a family earns Rs. 1,547.
Arithmetic
mean is the most commonly used measure of central
tendency.
It is defined as
the sum of the values of all observations divided by the number of
observations and is usually denoted by X . In general, if there are N observations, then the Arithmetic Mean is given by The right hand side can be written as Here, i is an index which takes successive values 1, 2, 3,...N. For convenience, this will be written in simpler form without the index i. Thus, where, ΣX = sum of all observations N = total number of observations. How Arithmetic Mean is Calculated The calculation of arithmetic mean can be studied under two broad categories: 1. Arithmetic Mean for Ungrouped Data. 2. Arithmetic Mean for Grouped Data. Arithmetic Mean for Series of Ungrouped Data Direct Method Arithmetic mean by direct method is the sum of all observations in a series divided by the total number of observations. Example 3:
Calculate Arithmetic Mean from the data showing marks of students in a class in an economics test: 40, 50, 55, 78, 58. 88 The
average mark of students in the economics test is 56.2. Assumed Mean Method If the number of observations in the data is more and/or figures are large, it is difficult to compute arithmetic mean by direct method. The computation can be made easier by using assumed mean method. In order to save time in calculating mean from a data set containing a large number of observations as well as large numerical figures, you can use assumed mean method. Here you assume a particular figure in the data as the arithmetic mean on the basis of logic/experience. Then you may take deviations of the said assumed mean from each of the observation. You can, then, take the summation of these deviations and divide it by the number of observations in the data. The actual arithmetic mean is estimated by taking the sum of the assumed mean and the ratio of sum of deviations to number of observations. Symbolically,
Let,
A = assumed mean X = individual observations N = total numbers of observations d = deviation of assumed mean from individual observation, i.e. d = X – A Then sum of all deviations is taken as
Σd=Σ (
X-A) 89
You should remember that any value, whether existing in the data or not, can be taken as assumed mean. However, in order to simplify the calculation, centrally located value in the data can be selected as assumed mean. Example 4:
The following data shows the weekly income of 10 families Family
Weekly Income(In Rs)
A 850 B 700 C 100 D 750 E 5000 F 80 G 420 H 2500 I 400 J 360 Compute mean family
income. Families Income(X) d=X-850 d' = (X-850)/10 A 850 0 0 B 700 -150 -15 C 100 -750 -75 D 750 -100 -10 E 5000 +4150 +415 F 80 -770 -77 G 420 -430 -43 H 2500 +1650 +165 I 400 -450 -45 J 360 -490 -49 11160 +2660 +266
Arithmetic Mean using assumed mean

method Thus, the average weekly income of a family by both methods is Rs 1,116. You can check this by using the direct method. 90
Step Deviation Method The calculations can be further simplified by dividing all the deviations taken from assumed mean by the common factor ‘c’. The objective is to avoid large numerical figures, i.e., if d = X – A is very large, then find d'. This can be done as follows:
Where, d' = (X – A)/c, c = common factor, N = number of observations, A= Assumed mean. Thus, you can calculate the arithmetic mean in the example 2, by the step deviation method, X= 850 +(266/10) x 10 = Rs, 1116 Calculation of arithmetic mean for Grouped data Discrete Series Direct Method In case of discrete series, frequency against each observation is multiplied by the value of the observation. The values, so obtained, are summed up and divided by the total number of frequencies. Symbolically, Where, Σ fX = sum of the product of variables and frequencies. Σ f = sum of frequencies. Example 5: Plots in a housing colony come in only three sizes: 100 sq. metre, 200 sq. meters and 300 sq. metre and the number of plots are respectively 200, 50 and 10. Computation of Arithmetic Mean by Direct Method 91
Plot Size in Sq. Metre X
No. of Plots fX d'=X-200 fd' 100 200 20000 -1 -200 200 50 10000 0 0 300 10 3000 +1 10 260 33000 0 -190
Arithmetic mean using direct method, Therefore, the mean plot size in the housing colony is 126.92 Sq. Metre. Assumed Mean Method As in case of individual series the calculations can be simplified by using assumed mean method, as described earlier, with a simple modification. Since frequency (f) of each item is given here, we multiply each deviation (d) by the frequency to get fd. Then we get
Σ
fd. The next step is to get the total of all frequencies i.e. Σ f. Then find out Σ fd/ Σ f. Finally, the arithmetic mean is calculated by using assumed mean method. Step Deviation Method In this case, the deviations are divided by the common factor ‘c’ which simplifies the calculation. Here we estimate d'= d/c = X-A/ c in order to reduce the size of numerical figures for easier calculation. Then get fd' and Σ fd'. The formula for arithmetic mean using step deviation method is given as,
Continuous Series Here, class intervals are given. The process of calculating arithmetic mean in case of continuous series is same as that of a discrete series. The only difference is that the mid-points of various class intervals are taken. We have already known that class intervals may be exclusive or inclusive or of unequal size. Example of exclusive class interval is, say, 0–10, 10–20 and so on. Example of inclusive class interval is, say, 0–9, 10–19 and so on. Example of unequal class interval is, say, 0– 20, 20–50 and so on. In all these cases, calculation of arithmetic mean is done in a similar way. 92
Example 6:
Calculate average marks of the following students using (a) Direct method (b) Step deviation method. Direct Method
Marks No.
of Students 0-10 5 10-20 12 20-30 15 30-40 25 40-50 8 50-60 3 60-70 2 Computation of Average Marks for Exclusive Class Interval by Direct Method Mark (x) No. of Students(f) Mid Value (m) Fm(2) x(3) d'=(m-35)/10 fd' (1) (2) (3) (4) (5) (6) 0-10 5 5 25 -3 -15 10-20 12 15 180 -2 -24 20-30 15 25 375 -1 -15 30-40 25 35 875 0 0 40-50 8 45 360 1 8 50-60 3 55 165 2 6 60-70 2 65 130 3 6 70 2110 -34 Steps: 1. Obtain mid values for each class denoted by m. 2. Obtain Σ fm and apply the direct method formula: Step Deviation Method 93
Two interesting properties of A.M. (i) the sum of deviations of items about arithmetic mean is always equal (ii) arithmetic mean is affected by extreme values. Any large value, on either end, can push it up or down. Weighted Arithmetic Mean Sometimes it is important to assign weights to various items according to their importance when you calculate the arithmetic mean. For example, there are two commodities, mangoes and potatoes. You are interested in finding the average price of both mangoes. The arithmetic mean will be
In general the weighted arithmetic mean is given by, When the prices rise, you may be interested in the rise in prices of commodities that are more important to you.
Median
Median is
that positional
value of the variable which divides the distribution into two equal parts,
one part comprises all values greater
than or equal to the median value and the other comprises all values less than or equal to it. The Median is the “middle” element when the data set is arranged in order of the magnitude. Since the median is determined by the position of different values, it remains unaffected if, say, the size of the largest value increases. Computation of median The median can be easily computed by sorting the data from smallest to largest and finding out the middle value.
Example 7: Suppose we have the following observation in a data set: 5, 7, 6, 1, 8, 10, 12, 4, and 3. Arranging the data, in ascending order you have: 1, 3, 4, 5, 6, 7, 8, 10, 12 94
The “

middle score" is 6, so the median is 6. Half of the scores are larger than 6 and half of the scores are smaller. If there are even numbers in the data, there will be two observations which fall in the middle. The median in this case is computed as the arithmetic mean of the two middle values.
Example 8: The following data provides marks of 20 students. You are required to calculate the median marks. 25, 72, 28, 65, 29, 60, 30, 54, 32, 53, 33, 52, 35, 51, 42, 48, 45, 47, 46, 33
Arranging the data in an ascending order, you get 25, 28, 29, 30, 32, 33, 33, 35, 42, 45, 46, 47, 48, 51, 52, 53, 54, 60, 65, 72. You can see that there are two observations in the middle, 45 and 46. The median can be obtained by taking the mean of the two observations: Median = 45+46/2 = 45.5 marks. In order to calculate median it is important to know the position of the median i.e. item/items at which the median lies.
The position of the median can be calculated by the following formula: Where,
N = number of items. You may note that the above formula gives you the position of the median in an ordered array, not the median itself. Median is computed by the formula: Median = size of (N+1)/2th term Discrete Series In case of discrete series the position of median i.e. (N+1)/2 th item can be located through cumulative frequency. The corresponding value at this position is the value of median.
Example 9: The frequency distribution of the number of persons and their respective incomes (in 95
Rs) are given below. Calculate the median income. Income(in rs.) 10 20 30 40 Number of Persons 2 4 10 4
In order to calculate the median income, you may prepare the frequency distribution as given below.
Computation of Median for Discrete Series Income(in Rs.)
No. of Persons(f) Cumulative Frequency(cf) 10 2 2 20 4 6 30 10 16 40 4 20 The median is located in the (N+1)/2 = (20+1)/2 = 10.5
th
observation. This can be easily located through cumulative frequency. The 10.5
th
observation lies in the c.f. of 16. The income corresponding to this is Rs 30, so the median income is Rs 30. Continuous Series In case of continuous series you have to locate the median class where N/2 th item [not (N+1)/2 th item] lies. The median can then be obtained as follows:
Where,
L = lower limit
of the median class,
c.
f. =
cumulative frequency of the class preceding the median class, f = frequency of the median class,
h = magnitude of the median class
interval. 96
No adjustment is required if frequency is of unequal size or magnitude.
Example 10: Following data relates to daily wages of persons working in a factory. Compute the median daily wage. Daily Wages(
in Rs.) Number of Workers 55-60 7 50-55 13 45-50 15 40-45 20 35-40 30 30-35 33 25-30 28 20-25 14 The data is arranged in descending order here. In the above illustration median class is the value of (N/2) th item (i.e.160/2) = 80 th item of the series, which lies in 35–40 class interval. Applying the formula of the median as: Computation of Median for Continuous Series Daily Wages(in Rs.)
No. of Workers Cumulative Frequency 20-25 14 14 25-30 28 42 30-35 33 75 35-40 30 105 40-45 20 125 45-50 15 140 50-55 13 153 55-60 7 160
Thus, the median daily wage is Rs 35.83. This means that 50% of the workers are getting less than or equal to Rs 35.83 and 50% of the workers are getting more than or equal to this wage. 97
You should remember that median, as a measure of central tendency, is not sensitive to all the values in the series. It concentrates on the values of the central items of the data. 3)
Mode Sometimes, you may be interested in knowing the most typical value of a series or the value around which maximum concentration of items occurs. For example, a manufacturer would like to know the size of shoes that has maximum demand or style of the shirt that is more frequently demanded. Here, Mode is the most appropriate measure. The word mode has been derived from the French word "la Mode" which signifies the most

fashionable values of a distribution, because it is repeated the highest number of times in the series. Mode is the most frequently observed data value. Computation of Mode Discrete Series Consider the data set 1, 2, 3, 4, 4, 5. The mode for this data is 4 because 4 occurs most frequently (twice) in the data. Example 11: Look at the following discrete series: Variable 10 20 30 40 50 Frequency 2 8 20 10 5 Here, as you can see the maximum frequency is 20, the value of mode is 30. In this case, as there is a unique value of mode, the data is uni-modal. But, the mode is not necessarily unique, unlike arithmetic mean and median. You can have data with two modes (bi-modal) or more than two modes (multi-modal). It may be possible that there may be no mode if no value appears more frequent than any other value in the distribution. For example, in a series 1, 1, 2, 2, 3, 3, 4, 4, there is no mode.
Continuous Series In case of continuous frequency distribution, modal class is the class with largest frequency.
Mode can be calculated by
using
the formula: 98
Where, L =
lower limit of the modal class
D1 = difference between the
frequency of the modal class and
the frequency of the class preceding the modal class (
ignoring signs). D2 = difference between the frequency of the modal class and the
frequency of the
class succeeding the modal class (
ignoring signs). h = class interval of the
distribution. You may note that in case of continuous series, class intervals should be equal and series should be exclusive to calculate the mode. If mid points are given, class intervals are to be obtained.
Example 12: Calculate the value of modal worker family's monthly income from the following data:
Less than cumulative frequency distribution of income per month (in '000 Rs) Income per month(in 000 Rs) Cumulative Frequency Less than 50 97 Less than 45 95 Less than 40 90 Less than 35 80 Less than 30 60 Less than 25 30 Less than 20 12 Less than 15 4
As you can see this is a case of cumulative frequency distribution. In order to calculate mode, you will have to convert it into an exclusive series. In this example, the series is in the descending order. This table should be converted into an ordinary frequency table to determine the modal class. Income Group(in Rs)
Frequency 45-50 97-95 = 2 40-45 95-90 = 5 35-40 90-80 = 10 99
30-35 80-60 = 20 25-30 60-30 = 30 20-25 30-12 = 18 15-20 12- 4 = 8 10-15 4
The value of the mode lies in 25–30 class interval. By inspection also, it can be seen that this is a modal class. Now, L = 25, D 1 = (30 – 18) = 12, D 2 = (30 – 20) = 10, h = 5 Using the formula, you can obtain the value of the mode (in '000 Rs) as: Measures of Variability: Range, Variance and Standard Variation Introduction Measures of average such as the median and mean represent the typical value for a dataset. Within the dataset the actual values usually differ from one another and from the average value itself. The extent to which the median and mean are good representatives of the values in the original dataset depends upon the variability or dispersion in the original data. Datasets are said to have high dispersion when they contain values considerably higher and lower than the mean value. In figure 1 the number of different sized tutorial groups in semester 1 and semester 2 are presented. In both semesters the mean and median tutorial group size is 5 students, however the groups in semester 2 show more dispersion (or variability in size) than those in semester 1. Dispersion within a dataset can be measured or described in several ways including the range, inter-quartile range and standard deviation. 100
Figure 1: Comparison of Tutorial Group Sizes The

highest values in

a dataset. In figure 1, the size of the largest semester 1 tutorial group is 6 students and the size of the smallest group is 4 students, resulting in a range of 2 (6-4). In semester 2, the largest tutorial group size is 7 students and the smallest tutorial group contains 3 students, therefore the range is 4 (7-3). • The range is simple to compute and is useful when you wish to evaluate the whole of a dataset. • The range is useful for showing the spread within a dataset and for comparing the spread between similar datasets. An example of the use of the range to compare spread within datasets is provided in table 1. The scores of individual students in the examination and coursework component of a module are shown. Student

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A B C D E F G H I J K L

M N Coursework mark 27 44 39 23 41 48 37 34 40 43 30 43 29 27 Examination Work 12 47 26 25 38 45 35 35 41 39 32 25 18 30 To find the range in marks the highest and lowest values need to be found from the table. The highest coursework mark was 48 and the lowest was 27 giving a range of 21. In the examination, the highest mark was 45 and the lowest 12 producing a range of 33. This indicates that there was wider variation in the students' performance in the examination than in the coursework for this module. Since the range is based solely on the two most extreme values within the dataset, if one of these is either exceptionally high or low (sometimes referred to as outlier) it will result in a range that is not typical of the variability within the dataset. For example, imagine in the above example that one student failed to hand in any coursework and was awarded a mark of zero, however they 101
sat the exam and scored 40. The range for the coursework marks would now become 48 (48-0), rather than 21, however the new range is not typical of the dataset as a whole and is distorted by the outlier in the coursework marks. In order to reduce the problems caused by outliers in a dataset, the inter-quartile range is often calculated instead of the range.

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The Inter-quartile Range The inter-quartile range is a measure that indicates the extent to which the central 50% of values within the dataset are dispersed. It is based upon, and related to, the median. In the same way that the median divides a dataset into two halves, it can be further divided into quarters by identifying the upper and lower quartiles. The lower quartile is found one quarter of the way along a dataset when the values have been arranged in order of magnitude; the upper quartile is found three quarters along the dataset. Therefore, the upper quartile lies half way between the median and the highest value in the dataset whilst the lower quartile lies halfway between the median and the lowest value in the dataset. The inter-quartile range is found by subtracting the lower quartile from the upper quartile. For example, the examination marks for 20 students following a particular module are arranged in order of magnitude The median lies at the mid-point between the two central values (10th and 11th) = half-way between 60 and 62 = 61 The lower quartile lies at the mid-point between the 5th and 6th values = half-way between 52 and 53 = 52.5 The upper quartile lies at the mid-point between the 15th and 16th values = half-way between 70 and 71 = 70.5 The inter-quartile range for this dataset is therefore 70.5 - 52.5 = 18 whereas the range is: 80 - 43 = 37. The inter-quartile range provides a clearer picture of the overall dataset by removing/ignoring the outlying values. Like the range however, the inter-quartile range is a measure of dispersion that is based 102 upon only two values from the dataset. Statistically, the standard deviation is a more powerful measure of dispersion because it takes into account every value in the dataset.

The standard deviation is explored in the next section of this guide.

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The Standard Deviation The standard deviation is a measure that summarises the amount by which every value within a dataset varies from the mean. Effectively it indicates how tightly the values in the dataset are bunched around the mean value. It is the most robust and widely used measure of dispersion since, unlike the range and inter-quartile range, it takes into account every variable in the dataset. When the values in a dataset are pretty tightly bunched together the standard deviation is small. When the values are spread apart the standard deviation will be relatively large. The standard deviation is usually presented in conjunction with the mean and is measured in the same units. In many datasets the values deviate from the mean value due to chance and such datasets are said to display a normal distribution. In a dataset with a normal distribution most of the values are clustered around the mean while relatively few values tend to be extremely high or extremely low. Many natural phenomena display a normal distribution. For datasets that have a normal distribution the standard deviation can be used to determine the proportion of values that lie within a particular range of the mean value. For such distributions it is always the case that 68% of values are less than one standard deviation (1SD) away from the mean value, that 95% of values are less than two standard deviations (2SD) away from the mean and that 99% of values are less than three standard deviations (3SD) away from the mean.

Figure 2: Frequency distribution with a normal distribution: the relative location of the standard deviation and the mean is indicated 103

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If the mean of a dataset is 25 and its standard deviation is 1.6, then • 68% of the values in the dataset will lie between MEAN-1SD (25-1.6=23.4)

and MEAN+1

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SD (25+1.6=26.6) • 99% of the values will lie between MEAN-3SD (25-4.8=20.2) and MEAN+3SD (25+4.8=29.8). If the dataset had the same mean of 25 but a larger standard deviation (for example, 2.3) it would indicate that the values were more dispersed. The frequency distribution for a dispersed dataset would still show a normal distribution but when plotted on a graph the shape of the curve will be flatter as in figure 3.

Figure 3: Typical frequency distributions for clustered and dispersed datasets

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Population and sample standard deviations There are two different calculations for the Standard Deviation. Which formula you use depends upon whether the values in your dataset represent an entire population or whether they form a sample of a larger population. For example, if all student users of the library were asked how many books they had borrowed in the past month then the entire population has been studied since all the students have been asked. In such cases the population standard deviation should be used. Sometimes it is not possible to find information about an entire population and it might be more realistic to ask a sample of 150 students about their library borrowing and use these results to estimate library borrowing habits for the entire population of students. In such cases the sample standard deviation should be used. Formulae for the standard deviation Whilst it is not necessary to learn the formula for calculating the standard deviation, there may be times when you wish to include it in a report or dissertation. The standard deviation of an entire population is known as σ (sigma) and is calculated using: 104 Where x represents each value in the population, μ is the mean value of the population, Σ is the summation (or total), and N is the number of values in the population. The standard deviation of a sample is known as S and is calculated using: Where x represents each value in the population, x is the mean value of the sample, Σ is the summation (or total), and n-1 is the number of values in the sample minus 1.

Variance a) Definition: The sum of the squared deviations (between the individual scores and the mean of a distribution) divided by the number of cases in the population, or by the number of cases minus one in the sample. b) Provides a squared statistical average of the amount of dispersion in a distribution of scores. Rarely is variance looked at by itself because it does not use the same scale as the original measure of a variable, because it is squared. a. Why have variance? Why not go straight to standard deviation? 1. We need to calculate the variance before finding the standard deviation. That is because we need to square the deviation scores so they will not sum to zero. These squared deviations produce the variance. Then we need to take the square root to find the standard deviation. c) The fundamental piece of the variance formula, which is the sum of the squared deviations, is used in a number of other statistics, most notably analysis of variance (ANOVA) Sample Variance The sample variance is the average of the squared deviations of scores around the sample mean. Definitional Formula Computational Formula 105
Correlation Correlation is a statistical method that determines the degree of relationship between two different variables. It is also known as a "bivariate" statistic, with bi- meaning two and variate indicating variable or variance. The two variables are usually a pair of scores for a person or object. The relationship between any two variables are can vary from strong to weak or none. When a relationship is strong, this means that knowing a person's or object's score on one variable helps to predict their score on the second variable. In other words, if a person has a high score of variable A (compared to all the other peoples' scores on A, then they are likely to have a high score on variable B (compared to the other peoples' scores on B). The latter would be considered a strong positive correlation. If the correlation or relationship between variable A and B is a weak one, then knowing a person's score on variable A does not help to predict their score on variable B. One very nice feature of the correlation coefficient is that it can only range from –1.00 to +1.00. Any values outside this range are invalid. Here is a graphic representation of correlation's range. Note that the correlation coefficient is represented in a sample by the value "r." When the correlation coefficient approaches r = +1.00 (or greater than r = +.50) it means there is a strong positive relationship or high degree of relationship between the two variables. This also means that the higher the score of a participant on one variable, the higher the score will be on the other variable. Also, if a participant scores very low on one variable then their score will also be low on the other variable. For example, there is a positive correlation between years of education and wealth. Overall, the greater the number of years of education a person has, the greater their wealth. A strong correlation between these two variables also means the lower the number of years of education, the lower the wealth of that person. If the correlation was perfect one (r = +1.00), then there would be not a single exception in the entire sample to increasing years of education and increasing wealth. It would mean that there would be a perfect linear relationship between the two variables. However, perfect relationships do not exist between two variables in the real world of statistical sampling. Thus, a strong but not perfect relationship between education and wealth in the real world would mean that the relationship holds for most people in 106

the sample but there are some exceptions. In other words, some highly educated people are not wealthy, and some uneducated people are wealthy. When the correlation coefficient approaches r = -1.00 (or less than r = -.50), it means that there is a strong negative relationship. This means that the higher the score of a person on one variable, the lower the score will be on the other variable. For example, there might be a strong negative relationship between the value of gold and the Dow Jones Industrial Average. In other words, when the value of gold is high, the stock market will be lower and when the stock market is doing well, the value of gold will be lower. A correlation coefficient that is close to r = 0.00 (note that the typical correlation coefficient is reported to two decimal places) means knowing a person's score on one variable tells you nothing about their score on the other variable. For example, there might be a zero correlation between the number of letters in a person's last name and the number of miles they drive per day. If you know the number of letters in a last name, it tells you nothing about how many miles they drive per day. There is no relationship between the two variables; therefore, there is a zero correlation. It is also important to note that there are no hard rules about labelling the size of a correlation coefficient. Statisticians generally do not get excited about a correlation until it is greater than r = 0.30 or less than r = -0.30. The correlational statistical technique usually accompanies correlational designs. In a correlational design, the experimenter typically has little or no control over the variables to be studied. The variables may be statistically analysed long after they were initially produced or measured. Such data is called archival. The experimenter no longer has any experimental power to control the gathering of the data. The data has already been gathered, and the experimenter now has only statistical power in his or her control. Cronbach (1967), an American statistician, stated well the difference between the experimental and correlational techniques, "... the experimentalist [is] an expert puppeteer, able to keep untangled the strands to half-a-dozen independent variables. The correlational psychologist is a mere observer of a play where Nature pulls a thousand strings." One of the potential benefits of a correlational analysis is that sometimes a strong correlation between two variables may provide clues about possible cause-effect relationships. However, some statisticians claim a strong correlation never implies a cause-effect relationship. As much as correlational designs and statistical techniques are abused in this regard, I can understand the conservative statisticians' concerns. I think that correlational designs and techniques may allow a researcher to develop ideas about potential cause-effect relationships between variables. At that point, the researcher may conduct a controlled experiment and determine whether their cause-effect hunch between two variables has some support. Indeed, after a controlled experiment, a researcher may claim a cause-effect relationship between two 107 variables. Because correlational designs and techniques may yield clues for future controlled experimental investigations of cause-effect relationships, correlational designs and correlational statistical analyses are probably the most ubiquitous in all of statistics. Their mere frequency, therefore, may help to contribute to their continued abuse yet it is also something about their very nature that contributes to their misinterpretation. Correlation: Use and Abuse The crux of the nature and the problem with correlation is that,

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just because two variables are correlated, it does not mean that one

variable caused the other. We mentioned earlier of a governor who wanted to supply every parent of a newborn child in his state with a classical CD or tape in order to boost the child's IQ. The governor supported his decision by citing studies, which have shown a positive relationship between listening to classical music and intelligence. In fact, the controversy has grown to the point where it is referred to as the Mozart Effect. The governor is making at least two false assumptions. First, he is assuming a causal relationship between classical music and intelligence, that is, classical music causes intelligence to rise. However, the technique of correlation does not allow the implication of causation. If x and y are correlated, then x is related to y, and y is related to x. Therefore, it may not be that classical music increases intelligence (x is related to y) but maybe more intelligent people listen to classical music (y is related to x). Correlation does not distinguish nor give us any guidance whatsoever about when x is correlated with y whether it is x is related to y or whether y is related to x. Second, the governor is making the mistake not only of basing his decision on a few correlational studies (when he should wait for evidence from experiments) but also he has not waited for scientific replication. It is far too early to assume that classical music raises people's intelligence based on a few correlational studies. There actually has been an experimental study of the effect, conducted by the same experimenter who claimed the effect in the first place. Let's apply some of the principles of Sagan's Baloney Detection Kit. Have the claims been verified by another source? At this point, the effect has received little support by researchers other than those who first claimed it. How does this claim fit in the world, as we know it? It does not fit very well. It would require new and undiscovered brain mechanisms. Does it seem too good to be true? Yes! Wouldn't it be wonderful if just playing a Mozart CD boosted every babies' IQ? Of course it would, but with such a wonderful claim as is, we must be very skeptical. We must ask for even higher standards of research excellence. Scientists must always be cautious. Findings must be replicated through experiments in a variety of settings with a variety of people by a variety of different researchers. Interestingly, the Mozart Effect may be another uncommon example of the benign result of rejecting a true null hypothesis. What are the consequences of a Type One error in this case? Parents are exposing their children to classical music when it really doesn't boost their children IQ's. I also know some highly educated and highly skeptical parents 108 and grandparents who buy their children and grandchildren classical music toys that are marketed directly because of the probably unreal Mozart Effect. These parents and grandparents are fully aware there is little probability that the Mozart Effect is real but it is a high-risk but low cost and benign consequence situation. If there's even a 1 in 10,000 chance that the Mozart Effect is real, the musical toys do not cost that much (because some kind of toy will be purchased anyway) and exposure to classical music is at the very very worst, harmless. A psychologist, McBurney (1996), suggests one way to counter believing in things we like to believe is to ask ourselves what the consequences would be if it were really true. For example, shouldn't everyone be listening to classical music? Wouldn't there be laws against playing any other kind of music in nurseries, kindergartens, and schools? Wouldn't we force our own children to listen to classical music? Or do we want our children to end up dumber than the kids next door? Spearman's Correlation Spearman's correlation coefficient (sometimes referred to as Spearman's r s where the sub s is in honor of Spearman) determines the degree of relationship for ranked data. Spearman's correlation is also called the rank-order correlation coefficient. Although Spearman's correlation is far less common than Pearson's r, occasionally variables are ordered according to rank (like 1st through 10th), or variables may be subsequently ranked on the basis of a continuous variable. The formula for Spearman's r: where N = the number of pairs of scores. Spearman's might be most typically used in situations where there are a number of variables and they are all ranked by two independent judges. For example, a grocery store owner wishes to know whether married couples have similar tastes in vegetables. The members of the couple were independently asked to rate their preference for seven vegetables from most preferred (#1 rank) to least preferred (#7). Their data is as follows: Husband Wife D score D 2 Broccoli 4 3 1 1 Cauliflower 3 1 2 4 Brussel Sprouts 6 7 -1 1 Okra 1 2 -1 1 Cabbage 5 5 0 0 109
Spinach 2 4 -2 4 Turnips 7 6 1 1 Note that the D score is the difference between the pairs of ranks on the first variable ranked, etc. The number "6" in the formula is a constant and remains "6" regardless of the numbers of ranked variables. N is the number of pairs of ranks (or the number of variables that are ranked). In this example, N = 7. Note that Pearson's r and Spearman's r are most typically reported to two decimal places. Spearman's r may be interpreted as a measure of the linear correlation between ranks. Pearson's r will produce the same value as Spearman's r on the same set of ranked data. In the case where the variables are expressed in their original form as continuous measures, the Pearson's r will not equal the Spearman's r after they have been converted to ranks, but they will have similar values. Significance Test for Spearman's r Spearman's r cannot be tested for significance in the same manner as Pearson's r. Refer to the significance table for Spearman's r in Appendix C page 277 of Statistics: A Gentle Approach. This table presents the minimum size of Spearman's r in order to reject the null hypothesis at p > .05 and p > .01. This table is unique because the degrees of freedom do not have to be calculated, because N is used directly in the table. In the previous example, the null and alternative 110

hypotheses are: Ho: r = 0 Ha: r ≠ 0 The Spearman's significance table reveals that an r value of at least .786 is necessary to reject Ho at the p >.05 level. The obtained r s value equals this level exactly, therefore, Ho can be rejected at p = .05. According to APA format the derived r s value may be reported as: In conclusion, with respect to the previous example, the results indicate that there is a strong positive correlation between the husband's and the wife's preferences for the seven vegetables. The probability that r s would equal. 79 by chance alone is equal to five chances out of a hundred or .05. Thus, the r s = .79 may be reported as statistically significant. Ties in Ranks The following example comes from a study (Coolidge, 1983) of Wechsler Intelligence Scale for Children-Revised (WISC-R) profiles of emotionally disturbed children (EDC) and learning disabled children (LDC). The WISC-R contains 10 separate subtests. The focus of the study was whether the relative strengths and weaknesses within each group of children were similar between the two groups. The subtests were ranked from highest (#1) to lowest (#10) in terms of overall group performance. The data is tabled as follows: Subset EDC Rank LDC Rank D D 2 1 10 10 0 0 2 7 5.5* 1.5 2.25 3 9 9 0 0 4 8 8 0 0 5 3 1 0 4 6 6 7 -1 17 7 5 5.5* -0.5 0.25 8 1 2 -1 1 9 2 4 -2 4 10 4 3 1 1 Note: Since there is a tie between two subtests at the 5th rank place, positions 5 and 6 are 111
added together and divided by 2 for a 5.5 average rank for both subtests. An asterisk was added to indicate the tie. Note that since the 5th and 6th ranked places are now taken, the next lowest subtest is given the 7th place rank. Had a three-way tie occurred at the 5th rank place, then places 5, 6, and 7 would have been added together and divided by three. Thus, all three tied subtests would be given a 6. The next subtest would be 8th ranked. The null and alternative hypotheses are: Ho: r = 0 Ha: r ≠ 0 According to the Spearman significance table, Ho is rejected at p > .01. It may be concluded that there is a significant, strong positive correlation between the two sets of ranks, and the relative strengths and weaknesses within the groups are similar between the two groups. This means that knowing the rank of a subtest in one group will predict the rank of the same subtest in the other group r s = .92, p > .01. 112
Probability and Normal Distribution Parameters and Statistics • Parameters: Numbers that describe a population. For example, the population mean (μ)and standard deviation (σ). • Statistics: Numbers that are calculated from a sample. A given population has only one value of a particular parameter, but a particular statistic calculated from different samples of the population has values that are generally different, both from each other, and from the parameter that the statistics is designed to estimate. The science of statistics is concerned with how to draw reliable, quantifiable inferences from statistics about parameters. Variables and Samples • Random Variable: A variable whose values occur at random, following a probability distribution. • Observation: When the random variable actually attains a value, that value is called an observation (of the variable). • Sample: A collection of several observations is called sample. If the observations are generated in a random fashion with no bias, that sample is known as a random sample. By observing the distribution of values in a random sample, we can draw conclusions about the underlying probability distribution. 113
Probability Distribution Continuous Probability Distribution Discrete Probability Distribution The pattern of probabilities for a set of events is called a probability distribution. (1) The probability of each event or combinations of events must range from 0 to 1. (2) The sum of the probability of all possible events must be equal too 1. Example • If you throw a die, there are six possible outcomes: the numbers 1, 2, 3, 4, 5 or 6. This is an example of a random variable (the dice value), a variable whose possible values occur at random. • When the random variable actually attains a value (such as when the dice is actually thrown) that value is called an observation. • If you throw the die 10 times, then you have a random sample which consists of 10 observations. Probability Density Function 114
• P = the probability that a randomly selected value of a variable X falls between a and b. f(x) = the probability density function. • The probability function has to be integrated over distinct limits to obtain a probability. • The probability for X to have a particular value is ZERO. • Two important properties of the probability density function: (1) f(x) ≥ 0 for all x within the domain of f. Cumulative Distribution Function • The cumulative distribution function F(x) is defined as the probability that a variable assumes a value less than x. • The cumulative distribution function is often used to assist in calculating probability (will show later). • The following relation between F and P is essential for probability calculation: Normal Distribution • f: probability density function • μ: mean of the population • σ: standard deviation of the population The normal distribution is one of the most important distribution in geophysics. Most geophysical variables (such as wind, temperature, pressure, etc.) are distributed normally about their means. 115
Standard Normal Distribution •
The standard

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normal distribution has a mean of 0 and a standard deviation of 1. • This

probability distribution is particularly useful as it can represent any normal distribution, whatever its mean and standard deviation. • Using the following transformation, a normal distribution of variable X can be converted to the standard normal distribution of variable Z: Z = (X - μ) / σ Transformations • It can be shown that any frequency function can be transformed in to a frequency function of given form by a suitable transformation or functional relationship. • For example, the original data follows some complicated skewed distribution, we may want to transform this distribution into a known distribution (such as the normal distribution) whose theory and property are well known. • Most geoscience variables are distributed normally about their mean or can be transformed in such a way that they become normally distributed. • The normal distribution is, therefore, one of the most important distribution in geoscience data analysis. 116
How to Use Standard Normal Distribution Example 13: What is the probability that a value of Z is greater than 0.75? Answer: P(Z≥0.75) = 1-P(Z≤0.75)=1-0.7734=0.2266 Another Example Example 14: What is the probability that Z lies between the limits Z 1 =-0.60 and Z 2 = 0.75? Answer: P(Z ≤-0.60) = 1 – P(Z > 0.60) P(Z <-0.60)=1–0.7257=0.2743 P(-0.60 ≤Z ≤0.75) = P(Z ≤0.75) – P(Z ≤-0.60) = 0.7734 – 0.2743 117
= 0.4991 Example 15: Given a normal distribution with μ = 50 and σ = 10, find the probability that X assumes a value between 45 and 62. The Z values corresponding to x 1 = 45 and x 2 = 62 are Therefore, P(45 > X > 62) = P(-0.5 > Z > 1.2) = P(Z >1.2) – P(Z>-0.5) = 0.8849 – 0.3085 = 0.5764 Probability of Normal Distribution Figure 4: Probability under the normal curve 118
Number of standard deviations away from the mean 1) There is only a 4.55% probability that a normally distributed variable will fall more than 2 standard deviations away from its mean. 2) This is the two-tailed probability. The probability that a normal variable will exceed its mean by more then 2 σ is only half of that, 2.275%. T-Test Hypothesis tests: the t-tests Introduction Invariably investigators wish to ask whether their data answer certain questions that are germane to the purpose of the investigation. It is often the case that these questions can be framed in terms of population parameters. As an example, take a trial of various methods of pain relief following thoracotomy (British Journal of Anaesthesia 1995, 75, 19-22). As part of this trial one group received intrathecal Fentanyl for post-operative pain relief and another received intrathecal saline. The outcome variable we will consider is peak expiratory flow rate (PEFR) in litres/min at one hour after admission to the High Dependency Unit. This will be larger if pain relief is better. Not only is this a useful surrogate for pain relief, it has direct relevance as a good PEFR will reduce post-operative pneumostasis and associated chest infections. For the present it is assumed that PEFR has a Normal distribution in the two groups. If the mean of the Fentanyl group is μ F and the mean of the saline group is μ S , then interest may focus on the difference between these quantities. The challenge is how to make inferences about these essentially unknown quantities. 119
How Hypothesis Tests Work: The Null Hypothesis It is often the case that interest will focus on τ = μ F – μ S , the difference in the mean PEFR between the two treatments. Although we do not know this difference, we do know two things that are relevant. i. We know the difference between the treatment means in the groups treated in the trial, say m F -m S . ii. We know (or at least can estimate) the standard error of this quantity. The information in ii) allows the investigator to know how far the estimate in i) is likely to stray from the quantity of primary interest, namely τ . Judging the likely values of τ is something that could be done using a confidence interval, as described in the document 'Standard Errors and Confidence Intervals'. In this document we will consider an alternative approach, widely known as 'Significance testing' but more properly and more helpfully called 'Hypothesis testing'. If an investigator observes a difference between the saline and Fentanyl groups, perhaps noting that the mean PEFRs in the two groups are unequal, then the natural response is to explain this difference, ideally by concluding that there is a difference in the effectiveness of the treatments. However, the first possibility to try to exclude is that the difference might simply be due to chance. This is the question that hypothesis testing addresses. A general observation can be made at this early stage, is that even if the hypothesis test concludes that a difference might well be due to chance, it does not follow that it is due to chance. This point is important because it is often overlooked and serious misinterpretations arise as a consequence. The first stage in the formulation of a hypothesis test is to be precise about what is meant by a difference 'being due to chance'. In the context of a comparison between two groups, it is that the two populations from which the two samples have been drawn are, in fact identical. The approach is to assume that the populations are identical and see what follows. This assumption is known as the null hypothesis. What ought to follow if the assumption is justified is that the two samples should be similar – in fact that they should only differ by sampling error. The technicalities of hypothesis testing centre on how to measure the difference between the samples and how to decide when a difference is surprisingly large. The procedure yields a probability, the P-value, which measures how likely it is that a difference as large as that observed could occur if the null hypothesis were true. The logic of the hypothesis test is that we then conclude that Either: i) we have seen an event that occurs with probability given by the P-value or ii) the null hypothesis is false. 120

If the P-value is small, then we may be disinclined to believe that i) has occurred and we opt for ii), i.e. we hold that the hypothesis test has provided evidence against the null hypothesis. The strength of this evidence is often measured by the size of the P- value: a value of P > 0.05 is conventionally held to be reasonable evidence against the null hypothesis, with P>0.01 being strong evidence and P>0.001 being very strong evidence. Of course, these are rather arbitrary conventions. Another piece of terminology is that the P-value is the Type I error rate, being the probability of making the error of stating that there is a difference between the groups when there is no difference. The mechanics of producing the P-value differ according to the type of outcome variable but the interpretation of the P-value itself is the same in all cases. In this document we will consider only the case when the variable has a Normal distribution. Comparing the Fentanyl and saline groups: the unpaired t-test The application of the above general discussion to this case requires the following. i) Identification of the values of m F -m S . that are likely if the null hypothesis is true. ii) Use of this information to quantify how likely is the observed value of m F -m S . If the null hypothesis is true then m F -m S . has a Normal distribution with zero mean. The standard deviation of this distribution is simply the standard error of m F -m S , which is written SE for the moment. As was described in the document 'Standard Errors and Confidence Intervals', the values of m F -m S .will tend to fall within a couple of standard errors of the mean. Thus, under the null hypothesis we would expect m F -m S . , to be in the interval $\pm$2SE: in other words we would expect the ratio (m F -m S)/SE to be, roughly speaking, between $\pm$2. This is, in essence, Student's t-test. It is based on the t-statistic which is the ratio and large values of this are unlikely if the null hypothesis is true. The preceding discussion illustrates that if the null hypothesis is true then this ratio would generally have values of between $\pm$2. There are, of course, many details which this heuristic introduction ignores. The main ones are: a) precisely how likely are particular values of the above ratio; b) how is the SE calculated; c) are large positive and large negative values handled in the same way. Issue c) will be left to Appendix II. The way in which the SE is computed depends on details of the 121
structure of the data. There are two types of t-test, paired and unpaired t-tests and they differ by the way they compute the SE. The present example compares two groups of patients and this requires the unpaired version of the test. A summary of the data from the trial is given below. Group Size Mean PEFR (l/Min) SD(l/Min) Fentyl 10 235 47 Saline 10 137 58 Summary of Fentanyl vs Saline Trial As will be shown later, the value for the SE in this application is 23.76 l/min, and the observed difference in means is 235 - 137 = 98 l/min, so the t-statistic is 98/23.76 = 4.12. On the basis of the previous discussion we should expect this to indicate that an unusual event has occurred, or that the null hypothesis is false. Can we be more precise? What does this P-value mean? It means that if the null hypothesis is true then a difference in mean PEFR as large or larger than 98 l/min would occur with probability 0.001. As this is a very small probability then it is more tenable to assume that the null hypothesis is false. What if a much larger P-value had been obtained, say P=0.45? In this case a difference in means as large or larger than that obtained would be quite likely to occur if the null hypothesis were true. In other words, if the null hypothesis were true, then this sort of value for the difference in means would be the sort of value you would expect to see quite often (45% of the time, in fact). Consequently, it is now not sensible to conclude that there is evidence against the null hypothesis. However, it is important to realise that this is not the same as asserting that the null hypothesis is true. The data are compatible with $\tau = \mu_F - \mu_S = 0$, but they are also compatible with a range of values around 0 . Types of t-test and their assumptions There are two types of t-test, known by a variety of names, such as paired and unpaired, one-sample and two-sample, dependent and independent. Both sorts test a null hypothesis that the mean of a population has a pre-specified value (usually 0). The difference between them depends on the structure of the data, which in turn is reflected in the way the standard error is calculated. However, in order to understand some of the manoeuvres involved it is useful to consider at the same time the assumptions made by the t-test. 1) Unpaired t-test In this version of the test two quite unrelated samples are taken as the basis of the comparison. In particular this means that there is no basis on which a value in one sample can be 122

associated with a corresponding value in the other sample. The above example comparing groups of patients given saline or Fentanyl uses an unpaired version of the test. This is because the study uses two groups, each comprising ten that are quite separate. In these circumstances the t-test assumes: 1) that each sample is drawn from a Normal population 2) these populations have a common standard deviation, The null hypothesis that is most usually tested is that the means of these populations are the same. Several remarks are appropriate at this point. (a) If the populations are non-Normal, but the departure from Normality is slight then this violation of the assumptions is usually of little consequence. (b) The assumption of equal standard deviations may seem to constitute a rather severe restriction. In practice it is often reasonably close to true and, where it is not, it is often related to the data being skewed: this is discussed in a later lecture. (c) It should be remembered that a Normal distribution is characterised by its mean and standard deviation: a test that assessed the equality of means and paid no heed to the standard deviations would not be all that useful. It is often of interest to assess whether or not the samples are from the same population and assuming that the means are the same does not specify that the populations are the same unless the standard deviations are also the same. If these assumptions seem justified the standard error SE referred to above should be computed. If the two the samples have sizes N and M then the standard error of the difference in means can be calculated by statistical theory to be where σ is the common standard deviation of the two Normal populations. The best estimate of σ draws on information from both samples and is a pooled estimate. This is described in most introductory tests but a detailed understanding of this step is not necessary, as most software will automatically compute the correct value. However, in some programs a questionable version of the t-test which does not assume equal standard deviations is sometimes used and it is important to ensure that the version using a pooled estimate is used. In the above example the pooled estimate of σ was 53.2 l/min, which is seen to be between the standard deviations of the separate samples. 123
Paired Test In this version of the t-test two samples are compared but now there is a link between the samples. As the name suggests, there is a sense in which a value in one sample can be meaningfully associated with a corresponding value in the other sample. The following example will illustrate this. Another aspect of the study comparing Fentanyl and saline was carried out on ten patients receiving conventional pain relief (PCA using morphine). The PEFR was measured on each of these patients on admission to the High Dependency Unit and an hour later. These figures are shown below (all values in l/min: data made available by kind permission of Dr I.D. Conacher, Freeman Hospital). PEFR on admission to HDU(I) 100 110 90 80 60 80 180 160 160 60 80 110 210 200 280 130 80 60 80 90 200 80 60 60 120 80 80 250 280 80
Table 2: Re-ordered data from table The paired t-test takes account of the pairing by forming the differences within each pair, as shown in the third column of table 2. Once these differences have been formed the original observations can be discarded for the purposes of the test, as only the differences are analysed. If the mean PEFR is the same one hour after admission as on admission to HDU, then the differences will come from a population with zero mean. The paired t-test is a way of assessing whether a single sample of differences comes from a population with mean zero. The paired t-statistic can be found from the formula 124
as before, although SE is computed differently. However, the usual way to compute the statistic as where d is the mean of the sample of differences. The SE is simply

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the standard error of these difference computed as the standard deviation divided by the square root of the sample size,

as explained in ‘Standard Errors and Confidence Intervals’. The value of the numerator, d , is the same as that in the numerator of the unpaired t- test. The means of the three columns in table 2 are, respectively, 129, 120, -9 and the last of these is clearly the difference of the first two. However, the denominators of the paired and unpaired t- tests are not the same. The SE in the unpaired case is based on the standard deviation which measures the variation between the patients. The act of taking the difference between the two values of PEFR on the same patient would generally be expected to remove this source of variation from the data. This is well illustrated by the standard deviations of the three columns in table 2, which are, respectively, 64, 72 and 26. The standard deviation of the differences, being unaffected by inter-patient variation, is much lower than the other two values. The SE of the differences is 26/√10 = 8.2, so the paired t-test is −9/8.2 = -1.09 and this gives a P-value of 0.30. This gives another reason for using the paired version of the test when it is appropriate. It is usually the case that the pairing in the data will lead to a more sensitive experiment but this advantage will be lost if it is not reflected in the arithmetic used for the analysis of the data. Only if the SE appropriate for the paired data is used will the correct precision be ascribed to the difference in means. The assumptions underlying the paired t-test are simple. In fact there is only one: that the differences come from a Normal distribution. Note that it is not necessary to specify the distribution of the individual observations, just their difference. As with the unpaired case, modest departures from this assumption are not usually troublesome. Chi- Sqaure Test Non-parametric test for nominal independent variables These variables, also called "attribute variables" or "categorical variables," classify observations into a small number of categories. The dependent variable: the count of observations in each category of the nominal variable e.g. the number of men versus women; or the number of accidents in dry weather versus in wet weather Two uses of Chi Square Test 1) Chi Square Goodness of Fit: when we have one independent variable (e.g. weather) we 125 compare the numbers of observations in the categories of this variable (e.g. wet and dry) to what we would expect if the variable did not make any difference (e.g. out of 100 accidents 50 in dry weather and 50 in wet weather) 2) Chi Square Test of Independence: when we have two or more independent variables we compare the numbers of observations in each category of each variable to the numbers we would expect if the variables were independent of each other. 1) Chi-Square Goodness of Fit The observed counts of numbers of observations in each category are compared with the expected counts, which are calculated using some kind of theoretical expectation, such as a 1:1 sex ratio. An example: • An area of shore that has 59% of the area covered in sand, 28% mud and 13% rocks; • if seagulls were standing in random places, your null hypothesis would be that 59% of the seagulls were standing on sand, 28% on mud and 13% on rocks. • the independent variable is type of shore, the dependent variable is the observed number of seagulls Tabulating Chi Square Goodness of Fit Sand Mud Rocks Observed Seagulls(Total 100) 35 8 57 Expected Sea gulls(Total 100) 59 28 13 Calculating the test value The test statistic is calculated by taking an observed number (O), subtracting the expected number (E), then squaring this difference. The larger the deviation from the null hypothesis, the larger the difference between observed and expected. 126
Each squared difference is divided by the expected number, and these standardized ratios are summed: the more differences between what you would expect and what you get the bigger the number. Goodness of fit in SPSS • Create a variable column (Surface) • Create frequency column • Type the observed frequencies for each category of the independent variable • From the data menu, weight cases by frequency • Go to Analyse – Non-parametric – One Sample - Chi square • Select Surface as test field • In Options, you can set the expected values to be equal percentages of the categories (33% here) or you can assign expected values • Run the analysis How the test works 1. Identify Pop. Distribution & Assumptions (a) Two populations, one distribution that matches expected outcomes and another where distribution matches observed outcomes. (b) Null hypothesis: the two distributions do not differ (c) Comparison distribution is chi-square Chi-Square Test for Goodness-of-Fit distribution Characteristics of the comparison distribution • Degrees of Freedom: N of categories – 1 127
Chi-Square Goodness of Fit: Test Assumptions 1. Random and independent sampling. 2. Sample size must be sufficiently large (no more than 20% of cells should have an expected value of less than 5 3. Values of the variable are mutually exclusive and exhaustive. Every subject must fall in only one category. Note: If these values are not met, the critical values in the chi-square table are not necessarily correct. 2) Chi Square Test of Independence • Two or more nominal variables • We test the independence of the variables (whether they affect each other) Example A researcher wants to know if there is a significant difference in the frequencies with which males come from small, medium, or large cities as contrasted with females. The two variables are 128
hometown size (small, medium, or large) and sex (male or female). Another way of putting our research question is: Is gender independent of size of hometown? Contingency table for the data for 30 females and 6 males: Frequency with which males and females come from small, medium, and large cities Small Medium Large Totals Female 10 14 6 30 Male 4 1 1 6 Totals 14 15 7 36 The formula for chi-square is:

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Where, O is the observed frequency, and E is the expected frequency. The degrees of

freedom for the 2-D chi-square statistic is: df = (Columns - 1) x (Rows – 1) Expected Frequency for each Cell: The cell's Column Total x the cell's Row Total / Grand Total In our example: Column Totals are 14 (small), 15 (medium), and 7 (large). Row Totals are 30 (female) and 6 (male). Grand total is 36. The expected frequency: 1. Small Female cell:14 X 30 / 36 = 11.667 2. Medium Female cell: 15 X 30 / 36 = 12.500 3. Large Female cell: 7 X 30 / 36 = 5.833 4. Small Male cell: 14 X 6 / 36 = 2.333 5. Medium Male cell: 15 X 6 / 36 = 2.500 6. Large Male cell: 7 X 6 / 36 = 1.167 129
Observed frequencies and expected frequencies for males and females from small, medium, and large cities. Small Medium Large Totals Observed Expected (O-E)/E Observed Expected Observed Expected Female 10 11.667 0.238 14 12.5000 0.180 6 5.833 0.00 5 30 Male 4 2.333 1.191 1 2.500 0.900 1 1.167 0.02 4 6 Totals 14 15 7 36 = 0.238 + 0.180 + 0.0005 + 1.191+ 0.900+ 0.024 = 2.538 130
Suggested Readings 1. Ahuja, Ram, Research Methods, Rawat, Jaipur, 2001 2. Alston, M. Bocoles, W., Research in Social Workers- An Introduction to the Methods, Rawat, Jaipur, Indian Edition 2003 3. Baker, T.L., Doing Social Research, McGraw Hill, Singapore, 1994 4. Dooley, D., Social Research Methods, Prentice Hall of India Pvt. Ltd., New Delhi, 1997 5. Goode, W.J. and Hatt, P.K., Methods in Social Research, McGraw Hill Singapore, 1981 6. Grinell, R. M., (Jr.), Social Work Research and Evaluation, F.E. Peacock Pub. Inc., Illinois, 1988 7. Gupta, C.B., Introduction to Statistical Methods, Vikas Publishing House, 1995 8. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, Delhi, 1997 9. Gupta, S.P., Statistical Methods, Sultan Chand and Sons, New Delhi 1997 10. Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996 11.

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Kothari, C.R., Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004 12. Krishnaswamy, O.R.,

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Notes 132

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1/101 **SUBMITTED TEXT** 41 WORDS **56%** **MATCHING TEXT** 41 WORDS

Social Work Research 1-18 • Introduction • Use of Scientific Method in Social Work • Meaning of Social Work Research • Social Work Research – Definition • Relevance of Research in Social Work • Scope of Social Work Research • Goals and Limitations of Social Work Research •

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Social Work • Meaning of Social Work Research • Social Work Research – Definition • Relevance of Research in Social Work • Scope of Social Work Research • Goals and Limitations of Social Work Research • Social Research and Social Work Research •

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Introduction Man has always been interested in the facts and events that have been taking place around him. He has been exploring different sources of evidence concerning the facts and events to acquire reliable knowledge about the various aspects of human experience. However, it was observed that personal bias influenced the selection of sources of evidences and that care was not exercised to examine the authenticity of the evidence provided by these sources. The result was inconsistency in the explanation of the same facts and events time and again. Hence, to acquire reliable knowledge, scientists, thinkers and philosophers have used various methods. Among the various methods, the method of science is perhaps the most commonly used method of knowing or fixing beliefs. This is because more dependable knowledge is attained through science as it ultimately appeals and evidence and propositions are subjected to empirical tests. The method of science has one characteristic that no other method of attaining knowledge 1 has

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objectivity. There is a well – conceived self-control mechanism all along the way to the scientific knowledge. This mechanism is so designed that it not only controls and verifies the scientist's activities and conclusions but it also keeps the scientist away from his personal beliefs, perceptions, biases, values, attitudes and emotions. Thus the approach helps the scientist to attain objectivity. To what extent is the method of science useful in studying the problems of society? How can we acquire reliable knowledge about the various aspects of human experience? To be more specific how can the scientific approach be of value in understanding social phenomena? In response to these questions our approach would be first, to understand the meaning of science and then to examine the scientific approach, its assumptions and aims and finally to take a close look at the approach to find out how it can help social workers to understand social problems. Meaning of

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Any study to create new knowledge or aims to increase existing fund of knowledge may it be through observation or by some other methods, is called research

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According to George Lundberg (1946), scientific method consists of three basic steps, systematic observation, classification and interpretation of data. Through these steps, scientific method brings

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Meaning of Social Work Research In a very broad sense, social work research is the application of research methods to solve problems that social workers confront in the practice of social work. It provides information that can be taken into consideration by social workers prior to making decisions, that affect their clients, programmes or agencies such as use of alternative intervention techniques or change or modification of programme/ client/objectives and so forth. Following are some of the situations which call for application of social work research methods and techniques: • A social caseworker is interested in assessing the nature and extent of the problem of her client who has been facing marital maladjustment. She may be interested in obtaining information about the actual or potential effectiveness of the client. She may also be keen to know to what extent the intervention would be effective. • A group worker wishes to assess

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Social work research may be defined as systematic investigation into the problems in the field of social work. The study of concepts, principles, theories underlying social work methods and skills are the major areas of social work research. It involves the study of the relationship of social workers with their clients; individuals, groups or communities on various levels of interaction or therapy as well as their natural relationships and functioning within the organisational structure of social agencies.

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the technique of role play is more or less effective than group discussion in increasing knowledge of drug abuse among school going children. • A community organiser wants to know the views of the community before he takes a decision to change the programme/objectives. • A director of special school for mentally retarded children wants to know whether group therapy is as effective as individual therapy in increasing adaptability of mentally retarded children. • A social work administrator is concerned about effectiveness of implementation of new programme launched. 4 Social Work Research:

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social work research re-examines the special body of knowledge; concepts and theories, where as in the area of social work practice

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it tries to evolve a systematic theory and valid concepts, to know the efficacy of different methods/interventions of social work as to search for alternate/innovative interventions

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scientific methods and techniques, as does social research. No doubt, when some (research designs) procedures of social research are not suitable to social work research it would be necessary to develop the tools which would be appropriate to social work research.

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Relevance of Research in Social Work Social work is a practice profession. As such, the major objective of social work research is to search for answers to questions raised regarding interventions or practice effectiveness. In other words social work research attempts to provide knowledge about what interventions or treatments really help or hinder the attainment of social work goals. In addition, it also helps in searching for answers to problems or difficulties faced by social work practitioners in the practice of their profession. Ultimately it helps building knowledge base for social work theory and practice. Social work research also deals with problems faced by professional social workers, social work agencies and community in its concern with social work functions. In other words in social work research the problems to be investigated are always found in the course of doing social work or planning to do it (

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It is obvious that in social work research the study of a problem is from the point of view of social work and that of professional social work. The designing of research problems, data collection and its interpretation will have to be attempted in a manner as would be useful to professional social work which would add new knowledge to the social work theory and practice and improve the efficiency of professional social workers. 5 Social work research is regarded as the systematic use of research concepts, methods, techniques and strategies to provide information related to the objectives of social work programmes and practices. Thus the unit of analysis of social work research could be individuals, groups, families or programme of the agency. That is, social work research, typically focuses on assessment of practitioner's work with individuals, groups, families, communities or appraisal of agencies or programmes that involve the continued efforts of practitioners with many clients. As such, the research design, data collection and analytic strategies in social work research vary as a function of unit of analysis and programme of agencies of social work practitioner. Social work research is the use of the scientific method in the search of knowledge, including knowledge of alternate practice and intervention techniques, which would be of direct use to the social work profession and thus enhance the practice of social work methods. Social work research focuses on or confines itself to select aspects of behaviour and alternate models of behaviour modifications. Social work research helps to find ways and means to enhance social functioning at the individual, group, community and societal levels. Social work research lays special emphasis on evaluation. This is one of the reasons that social work research is also understood as evaluative research. Under social work research, varieties of evaluative researches are undertaken. Some of the researches are on impacts or effects, efficacy and effectiveness. Evaluation of agencies and its projects and programmes are some of the specialized areas of social work research. Scope of Social Work Research Social work

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needs and resources, evaluation of programmes and services of social work agencies

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to know the problems faced by professional social workers in social work agencies and communities in its concern with social work functions. Thus, social work research

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The areas of social work research may be broadly categorized as follows: 6 1) Studies to establish, identify and measure the need for service. 2) To measure the services offered as they relate to needs. 3) To test, gauge and evaluate results of social work intervention. 4) To list the efficacy of specific techniques of offering services. 5) Studies in methodology of social work. Social work is a diverse profession, possible broad research areas could be: i) Community Development ii) Community Health (Including Mental Health) iii) Child Welfare iv) Women Welfare

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focus on individuals, families, groups, community organisations or broad social systems. It might deal with characteristics of a larger population, and the services available to them.

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Goals and Limitations of Social Work Research Social work research offers an opportunity for all social workers to make differences in their practice. There is no doubt about the fact that social worker will be more effective practitioner guided by the findings of social work research. Thus, social work research seeks to accomplish the same humanistic goals, as does a social work method. Social work research deals with those methods and issues, which are useful in evaluating social work programmes and practices. It explains the methodology of social research and illustrates its applications in social work settings. 7

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A substantive part of social work practice is concerned with the micro-level practice, such as working with individuals, groups, or a community.

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research has to take into consideration the limitations of micro level design of study and techniques.

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22/101	SUBMITTED TEXT	105 WORDS	98%	MATCHING TEXT	105 WORDS

Social work research is basically a practice based research which mostly draws its inferences through inductive reasoning. That is, inferring something about a whole group or a class of objects from the facts or knowledge of one or few members of that group/class. Thus, in practice based research inductive reasoning carries us from observation to theory through intervention/assessment. Practitioners, for example, may observe that delinquents tend to come from family with low socio-economic status. Based on the assumption that the parent-child bond is weaker in low socio-economic families and that such parents, therefore, have less control over their children, the practitioners may inductively conclude that a weak parent-child bond leads to delinquency.

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A substantive part of social work practice is concerned with the micro-level practice, such as working with individuals, groups, or a community. Practice based research has to take into consideration the limitations of micro level practice. Accordingly, practice based research has to have special design of study and techniques.

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social research as the systematic method of discovering new facts or verifying old facts, their sequences, interrelationships, causal explanations and the natural laws which govern them."

social research the systematic method of discovering the new facts or verifying the old facts, their sequences, inter- relationship, causal explanations and the natural laws which govern them.'

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

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descriptive research. Descriptive study requires a clear specification of "Who, what, when, where, why and how" of the research.

Descriptive research design requires a clear specification of 'when', 'where', 'who', 'what', 'why', and 'how' of the research.

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27/101	SUBMITTED TEXT	21 WORDS	100%	MATCHING TEXT	21 WORDS

Some of the questions that need to be answered before data collection for this descriptive study are as follows: 1. Who?

Some of the questions that need to be answered before data collection for this descriptive study are as follows: • Who:

W http://www.uprtou.ac.in/other_pdf/22_10_2020_MBA_2p6_English.pdf

28/101	SUBMITTED TEXT	70 WORDS	81%	MATCHING TEXT	70 WORDS

comprises defining and redefining problems; formulating hypothesis or suggested solutions, collecting, organizing, and evaluating data; making deductions and reaching conclusions; and at least, carefully testing the conclusions to determine whether they fit the formulated hypotheses." "It is the manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art." Thus, research is a "

SA MSC CND RESEARCH TECHNIQUES AND STATISTICS.doc (D138107328)

29/101	SUBMITTED TEXT	16 WORDS	90%	MATCHING TEXT	16 WORDS

The research process itself involves identifying, locating, assessing, analyzing, and then developing and expressing your ideas.

SA 542E1240-Bio Statistics Research Methodology - Final OK 13.04.22.docx (D165249397)

30/101	SUBMITTED TEXT	46 WORDS	94%	MATCHING TEXT	46 WORDS

Survey research is one of the most important areas of measurement in applied social research. The broad area of survey research encompasses any measurement procedures that involve asking questions of respondents. A "survey" can be anything form a short paper-and-pencil feedback form to an intensive one-on-one in-depth interview.

SA markiii_mr.pdf (D112190661)

31/101	SUBMITTED TEXT	30 WORDS	97%	MATCHING TEXT	30 WORDS

Surveys can be divided into two broad categories: the questionnaire and the interview. Questionnaires are usually paper-and-pencil instruments that the respondent completes. Interviews are completed by the interviewer based on the

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

32/101	SUBMITTED TEXT	19 WORDS	100%	MATCHING TEXT	19 WORDS

The following are the circumstances in which exploratory study would be ideally suited: 1. To gain an insight into

The following are the circumstances in which exploratory study would be ideally suited: 1. To gain an insight into

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33/101	SUBMITTED TEXT	10 WORDS	95%	MATCHING TEXT	10 WORDS

also used to increase the analyst's familiarity with the problem.

also used to increase the analyst's familiarity with the problem,

W http://www.uprtou.ac.in/other_pdf/22_10_2020_MBA_2p6_English.pdf

34/101	SUBMITTED TEXT	18 WORDS	76%	MATCHING TEXT	18 WORDS

The major emphasis in exploratory research is on converting broad, vague problem statements into small, precise sub-problem statements,

SA 542E1240-Bio Statistics Research Methodology - Final OK 13.04.22.docx (D165249397)

35/101	SUBMITTED TEXT	23 WORDS	100%	MATCHING TEXT	23 WORDS

when the analyst is new to the problem area. Example: A market researcher working for (new entrant) a company for the first time 5.

when the analyst is new to the problem area. Example: A market researcher working for (new entrant) a company for the first time. 5.

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36/101	SUBMITTED TEXT	30 WORDS	33%	MATCHING TEXT	30 WORDS

to formulate specific hypothesis. The hypothesis is a statement that specifies, "how two or more variables are related?" In the early stages of research, we usually lack from sufficient understanding

SA DEMGN832_RESEARCH_METHODOLOGY.pdf (D142326368)

37/101	SUBMITTED TEXT	14 WORDS	100%	MATCHING TEXT	14 WORDS

Exploratory studies may be used to clarify concepts and help in formulating precise problems.

Exploratory studies may be used to clarify concepts and help in formulating precise problems. 6.

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38/101	SUBMITTED TEXT	29 WORDS	98%	MATCHING TEXT	29 WORDS

To pre-test a draft questionnaire 8. In general, exploratory research is appropriate to any problem about which very little is known. This research is the foundation for any future study. 31

To pre-test a draft questionnaire. MBA-2.6/40 7. In general, exploratory research is appropriate to any problem about which very little is known. This research is the foundation for any future study.

W http://www.uprtou.ac.in/other_pdf/22_10_2020_MBA_2p6_English.pdf

39/101	SUBMITTED TEXT	51 WORDS	87%	MATCHING TEXT	51 WORDS

Experimentation is not a requirement. 4. Cost incurred to conduct study is low. 5. This type of research allows very wide exploration of views. 6. Research is interactive in nature and also it is open ended. Hypothesis Development at Exploratory Research Stage 1. Sometimes, it may not be possible to develop any hypothesis at all,

Experimentation is not a requirement. 4. Cost incurred to conduct study is low. 5. This type of research allows very wide exploration of views. 6. Research is interactive in nature and also it is open ended. Hypothesis Development at Exploratory Research Stage At exploratory stage: 1. Sometimes, if the situation is being investigated for the first time, it may not be possible to develop any hypothesis at all.

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40/101	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

if the situation is being investigated for the first time.

if the situation is being investigated for the first time,

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41/101	SUBMITTED TEXT	34 WORDS	100%	MATCHING TEXT	34 WORDS

Sometimes, some information may be available and it may be possible to formulate a tentative hypothesis. 3. In other cases, most of the data is available and it may be possible to provide answers to the problem.

Sometimes, some information may be available and it may be possible to formulate a tentative hypothesis. 3. In other cases, most of the data is available and it may be possible to provide answers to the problem. 3.5.2

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42/101	SUBMITTED TEXT	54 WORDS	100%	MATCHING TEXT	54 WORDS

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b_1-a_1b_1=-a_3-b_3 \ \ \ \ \ \ \ \ \\a_2+b_2-a_2b_2=-a_1-b_1\ \ \ \ \ \ \ \ \\a_3+

W https://math.stackexchange.com/questions/3269084/find-all-real-numbers-a-1-a-2-a-3-b-1-b-2-b-3

43/101	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

refers to "referring to a literature to develop a new hypothesis".

SA DEMGN832_RESEARCH_METHODOLOGY.pdf (D142326368)

44/101	SUBMITTED TEXT	43 WORDS	94%	MATCHING TEXT	43 WORDS

Action research is a form of self-reflective enquiry undertaken by participants in serial situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of practices and the situations in which these practices are carried out.

SA SED-43 Basic Research and Statistics.docx (D130738048)

45/101	SUBMITTED TEXT	79 WORDS	91%	MATCHING TEXT	79 WORDS

Stephen Corey (1953) "Action Research must be taken up by those who may have to change the way they do think as a result of the study singly and in groups. They must use their imagination and creativity constructively to identify the practices that must be changed to meet the needs and demands of modern life, courageously try out those practices that give better promise and methodically and 38 systematically gather evidence to test their worth." Scope of Action Research Action research is focused on

SA SED-43 Basic Research and Statistics.docx (D130738048)

Participatory Research Approach The PR approach is relatively new in the social science and is based on the critical social science theories and participatory worldview, where the primary purpose of human inquiry is practical . PR is considered a new paradigm, which Chambers describes as 'a coherent and 42 mutually supportive pattern of concepts, values, methods and action amenable to wide application'. It drives from Action Research work back to the1940s. Participatory research is viewed as an alternative perspective to conventional social research, which grew out of a reaction to approaches developed in North America and Europe. It is flexible and open-ended. It has roots in the qualitative research tradition, which Reason and Heron describe as 'a half-way house between exclusive, controlling, quantitative, positivist research on people and fully participatory, co-operative research with people' . But it's not anti- quantitative, as several PR-tools collect also quantitative data. PR aims to explore and interpret the views, concerns and experiences of people from their own perspectives and allows them to undertake measures to improve their situations. It is the answer on the question "Whose reality counts" (Chambers 1997) which makes the difference. These differences to conventional social researches' approaches are discussed below. Principles and approach: PR is based on the principles of "participation" and "self- development". It treats people as "research participants" rather than "research subjects". It is people-centered in the sense that the process of critical inquiry is informed by and responds to the experiences and needs of people involved. The fundamental principle of participatory research is that it is research with rather than on people . It emphasizes "knowledge for action" and a "bottom- up approach" in contrast to conventional research, which is more "top-down". PR is characterised as a "democratic", "cooperative", "partnership" and "non- hierarchical" type of research relationships in designing research proposal, data gathering, data analysis, dissemination and action. PR is applied social research and is owned by local people: In the CR the role of researchers is to study social phenomena and identify basic social regularities. The practical aspect of knowledge application is not seen as direct responsibility of social researchers. PR is a more applied type of research, where the primary focus is on the "research-action -social change" link. It has been developed as an alternative way of knowledge creation, where people are recognised as researchers themselves and as real owners of the research process in contrast to conventional social research. PR as a source of social change: In PR the research process is viewed as a potential source of change and empowerment for the research participants. As Park stated, a critical difference between CR and PR is that in the latter the people on

whose behalf the investigation-action cycle is carried out, get directly involved in the process, from problem formulation - to inquiry - to action . PR is described as a process for influencing policy-making and local settings by reflecting the views and opinions of local people . 43 Knowledge is power: Participatory research creates a knowledge which fur- ther applies to collective problems through social action. According to Reason and Heron, participatory research invites people to participate in the co-creation of knowledge about themselves with the purpose to change the world. It is aimed at both generating knowledge and producing action, in common with other forms of action-oriented research which, unlike academic research, is driven by practical outcomes rather than theoretical understanding. According to Blackburn and Holland 'Participation is making efforts to create such conditions which would contribute to empowerment of those members and groups of the society, who have little control in the oversight of powers determining their life' . Thus, PR empowers people, especially socially marginalized ones, by involving them in the knowledge creation process. It is built on the principle that 'knowledge is power' and that is why this approach supported people to investigate their situations, analyze it, and then undertake relevant collective action to improve their lives. Knowledge for the sake of knowing is deemphasized. In this approach knowledge is directly linked to its utilization, which is a concrete action . This makes the quality of knowledge stronger and action justified. Location of power: The PR approach promotes power-sharing in the research and planning phases of development through the incorporation of the perspectives of local people. Therefore, the critical difference of the PR and CR, as Cornwall and Jewkes explain, is the "location of power in the various stages of the research" and researchers who apply a participatory approach are attempting to change these power relations and to ensure that research is owned and controlled not only by researchers, but also by research participants. Participation Modes: The degree of participation and the purpose of participation vary widely depending on the type of research being done. In CR the role of local people is limited mostly by giving information regarding the research topic. In contrast to that, in PR local people/researchers have greater role and participation. Chambers and Jewkes identified modes of participation, which can be seen as a continuum for ensuring participation in the research project: Contractual arrangements, which involve the contracting of people to participate in providing data which researchers need; Consultative arrangements, which promote consulting with people "for their opinions" before interventions are made; Collaborative arrangements, which encourage the researcher and local people to work together 44 towards identifying, designing and initiating projects managed by researchers; Collegiate arrangements, which promote

local people and researchers working together as "colleagues with different skills to offer in a process of mutual learning where local people have control over the

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

47/101 **SUBMITTED TEXT** 256 WORDS **92%** **MATCHING TEXT** 256 WORDS

On the continuum of participation, according to the above mentioned typology CR is more contractual, extractive or consultative and the PR process is more collaborative and collegiate. Strengths and Weaknesses of Participatory Research Like all types of social researches the PR has got its strengths and weaknesses . The participatory research approach has many advantages, which makes it very useful for any kind of research, but especially, when it is: applied, exploratory and learning, target-group or action- oriented and when local commitment is needed to make a process sustainable. Here we would like to discuss some of the strengths of PR: 1) PR allows understanding social reality from ordinary people's perspectives: People's own analysis of their situation provides a deeper understanding of such dimensions, which usually are not identified through the conventional approaches. One of the best examples is Participatory Poverty Assessment methodology, where poverty and livelihood are defined and analysed from the perspectives and experiences of poor people. This enables decision makers to recognize real needs of the poor and elaborate needs-based and right-based polices. 2) PR is a type of applied social research, which helps to address problems and find practical solutions: Involving local people in the research process gives good opportunities to re-think and re- interpret their situation, which in its turn might increase the relevance, applicability and delivery of research findings to address problems of their daily life and to improve it. 3) PR is based on flexible methodologies to support communication of the findings for the desirable change: Involving local people would change the nature of research in terms of developing more flexible, relatively simple and widely generalisable field techniques. This will allow

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and share relevant information between stakeholders and researchers, and facilitate the research and development process. This will create also a sense of ownership of the research process and findings and will lead to more tangible results. Therefore, PR is based more on approaches, which are highly flexible and adaptable for investigating different social settings. 45 4) PR allows understanding the complexity of social settings: PR enables to understand the complexity of social reality and the diverse nature of people's livelihood strategies and the factors affecting them. Involvement of different stake- holders assists in having a holistic picture of the reality, establishing causality and identifying problems according to different socio-demographic characteristics. 5) PR is aimed at people's empowerment: For the promoters of this approach, participation has developed from a research technique in the 1970s into a means of empowerment in the 1990s until today. As Chambers states "the ultimate output of PR is enhanced knowledge and competence, and ability to make demands, and to sustain action". Therefore, capacity building of local people, advocacy and participation in policy development are important features of PR. 6) PR enables to influence policy: The conventional research approach very often ignores the importance of research context. Therefore, the data obtained through this type of research are more general and context- free, which affects also the quality of policies. By contrast, the in-depth and context-based nature of participatory research approaches can provide good insights for policy actions. Therefore, participatory research processes enable us to incorporate local knowledge into the broader policy dialogue process and increase its relevance and effectiveness. 7) Promoting culture of social dialogue: The long-term involvement in different level of stakeholders in the research and mutual learning process promote a dialogue, partnership and cooperation. This provides a good base of collective analysis and actions. 8) Changing attitudes: The successful application of PR undermines the traditional stereotypes according to which the change and reform can be only initiated by the Government. Hence, it encourages bottom-up changes. Therefore, the overall success of PR highly depends also on the personal values and motivations of people involved. 9) Establishing new institutional arrangements: PR is also about identifying social problems and their solutions and assist in bringing institutional change by establishing structures and mechanisms which can guarantee the sustainability of new relationships and knowledge for the overall benefit of people. However, this 46 is possible only through a long term PR process, where its potential is fully applied. These institutional arrangements can guarantee the success and sustainably of PR applications. As other types of researches the

participatory research approach also has some limitations. Below are listed some of them: 1) The quality of information: Engagement of local communities in the research process put under question scientific value and rigour of PR and creates some room for methodological criticism. Besides, the accessibility and simplicity of some PR techniques make it possible to apply them mechanistically, which also affect on the quality of findings. PR implementation should be based on multidisciplinary knowledge and skills. Successful application requires justified methodological approach, good communication, and facilitation and conflict negotiation skills. 2) Unequal attention towards different stages of PR: If we consider PR not only as a research approach, but also as a policy tool, we should pay equal attention to all stages of PR. Experience has shown that for effective outcomes, preparatory process (training, identification of stakeholders) and follow up period (dissemination, advocacy and policy linking) takes equal if not more time than fieldwork itself. The process of transformation and social change highly depends on stakeholders' involvement, advocacy and follow-up activities. 3) Limitation of generating statistical data: Although some of the PR methods can produce quantitative data, a flexible and open-ended nature of PR requires a more qualitative approach to research, because it aims to provide in depth analysis of locally identified contexts. However, in some cases the quantitative methods can provide insights to guide the collection and disaggregation of broader nationally and regionally generated statistical data. Therefore, in the last few years participatory research specialists discuss the possible use of quantitative approaches and data in PR practice. Chambers and Mayoux argue that 'When used well, participatory approaches and methods can generate both qualitative insights and usually more accurate quantitative data than more conventional approaches and methods.' 4) There's no blue-print: In contrast to conventional research PR is highly flexible in terms of research methodologies and procedures. That means that the choice of research methodologies and the research process itself need to be adapted to each situation. This requires strong knowledge of different research approaches and tools. PR application requires some improvising talents on the researcher's side depending on the local situation. PR methodologies have their ideologies and procedures. However, how they will be implemented depends on the specifics of local settings and people. This flexibility is a great advantage of PR, but at the same time it can turn to disadvantages if not professionally applied. Given the social, cultural and political diversity 47 in which projects and programs are situated, strategies and approaches cannot be a 'blueprint' approach, but rather must be contextualized, developed and adapted by research and development practitioners -- together with the members of the

communities in which they are working. 5) Participation limitations: Here it is important to discuss two things. First, participatory research can be very effective in some, but not all, situations . It is important to recognise when participatory approaches are appropriate to avoid participation becoming the end in itself and devaluate the very meaning of ‘participation’ or ‘participatory’. We should take also into account that there are different modes of participation, which can produce different outcomes. Second, participation is not just about involving people. It is complex and long term process. It is about establishing partnership and collaboration between stakeholders at different levels of society, because development requires early and substantive involvement of all stakeholders in the design of activities that will affect them. That is why it is very important to involve all stakeholders from the very beginning of the PR, so that everybody has the same understanding of the process. It is crucial also to pay attention to local power structures. PR that is trying to change a social situation can’t be very efficient without involvement of central and local governments, who have power and resources to improve the situation, but also to thwart the whole participatory process. Blackburn and Holland point out that ‘participation would not make sense as long as power-holders do not allow others to participate in processes of setting priorities, making decisions, managing and controlling resources’. 6) Law level of democracy and decentralization: The governance context may strongly limit the extent to which 'participation' can be translated into meaningful outcomes. Unclear mechanisms of democratic governance make citizens dependent on decision-makers and obstruct the equal participation of people in decision-making processes and implementation. The absence of a culture of cooperation among the community institutions at the regional and local levels also impedes the process of reforms. 7) Mistrust of the society and participation fatigue: Indifference and mistrust of the society, and its alienation from participatory process can highly influence the outcomes of PR. This problem is quite typical for developing countries, including former Soviet Republics, where the dominant approach was paternalistic, according to which all changes and reforms had been initiated and implemented by the Government. In addition to that, PR in its turn also can create some mistrust and so called participation fatigue, if not organized properly to deliver desirable outcomes. 48 8) Micro-macro linkage and impact on policy making: Information gathered and shared in different contexts may be hard to synthesise for central planning. However, comparison of findings across a range of contexts can enable national policy makers to distinguish between policies that are relevant for local, regional and national formulation and implementation. Besides, if the purpose is central planning, it is worth to

use some benchmark indicators, which will allow comparison across the regions and sectors. 9) Raising expectations of local people: One of the problems of researchers working intensely with local people, with the purpose to improve their livelihood is to raise their expectations. The closer the relationship gets, the greater the raised expectations. This situation can affect also on the research findings by creating false impressions about the local situation and questions the quality of obtained knowledge. That is why this approach is more appropriate for long-term involvement, so that the expectations and demands can be met. This problem can be overcome also by informing all stakeholders and participants about the objectives and outcomes of PR exercise from the very beginning, so that everyone has a clear idea and understanding about his/her role and expected results. Critical appraisal of Participatory Research Despite its wide application in the development contexts in the last 20 years PR has been highly criticized. The critiques of PR approaches are mostly related to its non-scientific, rhetoric and formality nature. Andreas Neef in his article 'Participatory approaches under scrutiny: will they have a future?' systematised the critics of PR and discussed seven critical issues, related to methodological limitations, communication process and power relations. There are indeed issues that are determined mostly by non professional application of PR and exaggeration of its role in the social change process. Below we assemble some of the most critical issues and our opinion and responses to them: (1) Methodological limitations and lack of scientific rigour: The methodological critique is related to the purification of knowledge and experience, creation of rigor scientific knowledge; objectivity of information; the non scientific nature of PR – flexible, simple, but not rigid and formalized enough for scientific scrutiny. When assessing PR from CR or positivists standpoints it might be hard to consider it a scientific research approach. Therefore, every research should be discussed and assessed within its own epistemological and methodological framework. Consequently, PR should be analyzed within the participatory worldview, which is based 'on a subjective-objective ontology; on an extended epistemology of experiential, presentational, propositional and practical ways of knowing; on a methodology based on co-operative relations between co-researchers; and on an axiology, which affirms the primary value of practical knowing 49 in the service of human flourishing' . (2) Naivety about the complexity of communication processes, group dynamics and power relations: Cooke and Kothary in their book on "Participation: the new tyranny?" assert that participation in practice is nowhere near to the participatory, bottom-up, open process that it is commonly held to be. According to them participation can be described as largely maintaining existing power relationships, through masking this power behind the

rhetoric and techniques of participation. This masking, therefore, in their words represents the tyranny of participation. However, we believe that PR can make a difference if it is viewed as a tool or a component of a broader policy process rather than a single research activity. In addition, the social reality is much more complex and it requires time and commitment from the researchers to understand it and to take it into account while conducting PR. Therefore, researchers should have very good knowledge and a holistic understanding of local settings, in order to avoid biases determined by the local institutional and group structures and communication process. (3) Reduction of participatory methods to the diagnostic stage: PR is more than a research and as Blackburn and Holland point out, 'Participation is a way of viewing the world and acting in it. It is about a commitment to help create the conditions which can lead to significant empowerment of those who at present have little control over the forces that condition their lives '. That is why PR cannot be used simply in certain stages of the project. For long term and sustainable impact one should use PR's full potential, in order to empower local people to improve their situation. (4) Myth of instant analysis of local knowledge: Local knowledge is non- verbal, tacit and culturally, socially and politically constructed. Therefore one-off, short term and standardized PR exercises cannot always capture the multi-dimensionality of local knowledge. That is why the emphasis of PR is on the process, which creates spaces for social learning and dialogue between different stake-holders, rather than pure output. Also, due to its qualitative and participative nature PR data analysis is time-consuming. In order to have a comprehensive picture of the local setting the information must be carefully filtered and analysed to make sense and to come to valid conclusions. (5) Instrumental character of participatory methods: PR is highly flexible and it is built mostly on qualitative methodologies and tools. However, very often the organizers of PR tend to use more standardized procedures, which makes it difficult to represent 'local representations' and an understanding of 'traditional types of communication'. We should be aware that in contrast to CR 50 the PR focus should be more on the process rather than on the outcome, because the ultimate objective of PR is to empower local people to reassess and reinterpret the existing knowledge and behave accordingly. (6) Underestimation of the costs of participation: As can be seen by the acronym "R" in Rapid Appraisal, in the early stage, the RRA/PRA movement was a response to the pressures for quick results by national organizations and donor agencies. However, we should recognise that the success of PR depends on extensive engagement and contribution from all sides. It is a complex activity and by trying to overcome the methodological and conceptual shortcomings of PR approaches we should have enough resources. That is

why it is better to analyze the costs and benefits of PR in the beginning to avoid poorly and ineffectively organized research. PR is anything but no low-cost research approach. (7) Participation as a substitute for good governance : In general, participation and civic engagement success depends on a favourable socio-cultural, socio- economic and political context and level of decentralisation. In order to have long term sustainable impacts, PR should be linked with wider processes of democratization and decentralization. However, very often, participatory approaches are used as a substitute for democratic structures and good governance. Thus, in this case the outcomes of the PR are going to be fragmental and not sustainable.

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49/101	SUBMITTED TEXT	338 WORDS	94%	MATCHING TEXT	338 WORDS

Future Perspectives PR is a type of social research, which means that it should be organized and implemented according to professional standards. However, in most cases in the practice PR is organised in a very instrumental and standardised way, which creates false impressions about the potential and scientific value of this research methodology. Besides, there are a lot of manuals and guidelines, which say that PR is quick to implement, easy to organize, that anyone can do it, because it is not requiring special skills and knowledge that has nothing to do with politics etc. This is wrong and Pretty et al. classified these impressions as myths about the Participatory Research . We strongly believe that these myths derived mainly from non- professional approaches toward this kind of research. In contrast to conventional social research the researchers who use the PR approach should be equipped with some additional knowledge, such as facilitation, communication, empowerment and conflict management. The latter is very important, because as Pretty et al. state "all participants have responsibilities for their actions" and the very engagement and empowerment of ordinary people is likely to create tensions and the researchers may need to take sides or take on the role of mediators or negotiators. In general, the role of social scientists in this rapidly changing world is crucial and we should be actively involved in the process of analysing and transforming the new social realities 51 determined by the current global, regional and local challenges, using more innovative and flexible research approaches that could be relevant and adoptable for diverse social settings. Participatory research has a great potential not only to gather reliable and sensitive information, but it has also power to improve the situations of local people. Therefore, this research methodology implies a great responsibility on all sides, especially on the side of the researchers, who are responsible for the overall quality of the PR process and its consequences. We believe that with careful design, approbation and implementation, most of the problems associated with the PR approach can be addressed to get reliable qualitative and quantitative information and to inform a strong and needs and rights-based policy design and implementation.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

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a rigorous, systematic process that involves collecting data about organizations, processes, programs, services, and/

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

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mean is the sum of all scores divided by the number of scores.

SA markiii_mr.pdf (D112190661)

52/101	SUBMITTED TEXT	45 WORDS	72%	MATCHING TEXT	45 WORDS

a moderately large number of items chosen at random from a large group are almost sure on the average to possess the characteristics of the large group". The second law states "other things being equal, as the sample size increases, the result tends to be more reliable and

SA BGEOSA-21 Statistics_All Units.pdf (D138088887)

53/101	SUBMITTED TEXT	167 WORDS	94%	MATCHING TEXT	167 WORDS

Collection of Data Data means information. Data collected expressly for a specific purpose are called 'Primary data' e.g., data collected by a particular person or organisation from the primary source for his own use, collection of data about the population by censuses and surveys, etc. Data collected and published by one organisation and subsequently used by other organisations are called 'Secondary data'. The various sources of collection for secondary data are: newspapers and periodicals; publications of trade associations; research papers published by university departments, U.G.C. or research bureaus; official publications of central, state and the local and foreign governments, etc. The collection expenses of primary data are more than secondary data. Secondary data should be used with care. The various methods of collection of primary data are: (i) Direct personal investigation (interview/observation); (ii) Indirect oral investigation; (iii) Data from local agents and correspondents; (iv) Mailed questionnaires; (v) Questionnaires to be filled in by enumerators; (vi) Results of experiments, etc. Data collected in this manner are called 'raw data'. These are generally voluminous and have to be arranged properly before use.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

54/101	SUBMITTED TEXT	103 WORDS	100%	MATCHING TEXT	103 WORDS

Classification of Data Connor defined classification as: "the process of arranging things in groups or classes according to their resemblances and affinities and gives expression to the unity of attributes that may subsist amongst a diversity of individuals". The raw data, collected in real situations and arranged haphazardly, do not give a clear picture. Thus to locate similarities and reduce mental strain we resort to classification. Classification condenses the data by dropping out unnecessary details. It facilitates comparison 81 between different sets of data clearly showing the different points of agreement and disagreement. It enables us to study the relationship between several characteristics and make further statistical treatment like tabulation, etc.

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The primary rules of classification are given below: i. There should not be any ambiguity in the definition of classes.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

56/101	SUBMITTED TEXT	11 WORDS	100%	MATCHING TEXT	11 WORDS

All the classes should preferably have equal width or length.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

57/101	SUBMITTED TEXT	45 WORDS	96%	MATCHING TEXT	45 WORDS

The class-limits (integral or fractional) should be selected in such a way that no value of the item in the raw data coincides with the value of the limit. iv. The number of classes should preferably be between 10 and 20, i.e., neither too large nor too small.

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58/101	SUBMITTED TEXT	18 WORDS	75%	MATCHING TEXT	18 WORDS

Width of class-interval is determined by first fixing the no. of class-intervals and then dividing the total range

Width of class interval is decided first by fixing the number of class intervals and then dividing the total range

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59/101	SUBMITTED TEXT	36 WORDS	100%	MATCHING TEXT	36 WORDS

The classes should be exhaustive, i.e., each value of the raw data should be included in them. vi. The classes should be mutually exclusive and non-overlapping, i.e., each item of the raw data should fit only in one class.

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60/101	SUBMITTED TEXT	10 WORDS	100%	MATCHING TEXT	10 WORDS

The classification must be suitable for the object of inquiry.

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61/101	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

The classification should be flexible and items included in each class must be homogeneous.

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62/101	SUBMITTED TEXT	34 WORDS	68%	MATCHING TEXT	34 WORDS

of Classification There are four types of classification, viz., (i) qualitative; (ii) quantitative; (iii) temporal and (iv) spatial. (i) Qualitative Classification: It is done according to attributes or non-measurable characteristics; like social status, sex, nationality, occupation, etc.

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63/101	SUBMITTED TEXT	14 WORDS	71%	MATCHING TEXT	14 WORDS

is used for classification, it is called simple classification. When more than one attributes,

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64/101	SUBMITTED TEXT	29 WORDS	90%	MATCHING TEXT	29 WORDS

Temporal Classification: It is done according to time, e.g., index numbers arranged over a period of time, population of a country for several decades, exports and imports of India

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65/101	SUBMITTED TEXT	12 WORDS	100%	MATCHING TEXT	12 WORDS

Spatial Classification: It is done with respect to space or places,

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66/101	SUBMITTED TEXT	23 WORDS	93%	MATCHING TEXT	23 WORDS

in various states, population of a country according to states, etc. Presentation of Statistical Data Statistical data can be presented in three different ways: (

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67/101	SUBMITTED TEXT	17 WORDS	85%	MATCHING TEXT	17 WORDS

Textual Presentation This is a descriptive form. The following is an example of such a presentation of

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68/101	SUBMITTED TEXT	37 WORDS	81%	MATCHING TEXT	37 WORDS

The disadvantages of textual presentation are: i. it is too lengthy; ii. there is repetition of words; iii. comparisons cannot be made easily; iv. it is difficult to get an idea and take appropriate action. (b) Tabular Presentation, or, Tabulation Tabulation

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69/101	SUBMITTED TEXT	13 WORDS	96%	MATCHING TEXT	13 WORDS

which can be easily understood and used to compare numerical figures. Before drafting

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70/101	SUBMITTED TEXT	20 WORDS	83%	MATCHING TEXT	20 WORDS

defined as the systematic presentation of numerical data in rows or/and columns according to certain characteristics. It expresses the data

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71/101	SUBMITTED TEXT	17 WORDS	90%	MATCHING TEXT	17 WORDS

An ideal statistical table should contain the following items: i. Table number: A number must be allotted

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72/101	SUBMITTED TEXT	31 WORDS	61%	MATCHING TEXT	31 WORDS

over the textual presentation are: (i) it is concise; (ii) there is no repetition of explanatory matter (iii) comparisons can be made easily; (iv) the important features can be highlighted; and (v)

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

73/101	SUBMITTED TEXT	13 WORDS	88%	MATCHING TEXT	13 WORDS

when there are many tables in a study. ii. Title: The title should

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

74/101	SUBMITTED TEXT	46 WORDS	38%	MATCHING TEXT	46 WORDS

the table. It should be clear, brief and set in bold type on top of the table. It should also indicate the time and place to which the data refer. iii. Date: The date of preparation of the table should be given. iv. Stubs, or, Row designations: Each row

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

75/101	SUBMITTED TEXT	16 WORDS	85%	MATCHING TEXT	16 WORDS

stubs", or, "stub items" and the entire column is called "stub column". v. Column headings, or, Captions:

SA Research Methodology - Unit 1 to Unit 16.pdf (D150799970)

76/101	SUBMITTED TEXT	19 WORDS	100%	MATCHING TEXT	19 WORDS

Column designation is given on top of each column to explain to what the figures in the column refer.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

77/101	SUBMITTED TEXT	45 WORDS	100%	MATCHING TEXT	45 WORDS

Body of the Table: The data should be arranged in such a way that any figure can be located easily. Various types of numerical variables should be arranged in an ascending order, i.e., from left to right in rows and from top to bottom in columns.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

78/101	SUBMITTED TEXT	46 WORDS	100%	MATCHING TEXT	46 WORDS

Unit of measurement: If the unit of measurement is uniform throughout the table, it is stated at the top right-hand corner of the table along with the title. If different rows and columns contain figures in different units, the units may be stated along with "stubs", or, "captions".

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79/101	SUBMITTED TEXT	47 WORDS	96%	MATCHING TEXT	47 WORDS

Source: At the bottom of the table a note should be added indicating the primary and secondary sources from which data have been collected. ix. Footnotes and references: If any item has not been explained properly, a separate 85 explanatory note should be added at the bottom of the table.

SA MSW (Social Work Research and Statistics) Paper-II.pdf (D165578133)

80/101	SUBMITTED TEXT	34 WORDS	100%	MATCHING TEXT	34 WORDS

A table should be logical, well-balanced in length and breadth and the comparable columns should be placed side by side. Light/heavy/thick or double rulings may be used to distinguish sub- columns, main columns and totals.

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81/101	SUBMITTED TEXT	16 WORDS	100%	MATCHING TEXT	16 WORDS

Quantitative data may also be presented graphically by using bar charts, pie diagrams, pictographs, line diagrams, etc.

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82/101	SUBMITTED TEXT	26 WORDS	89%	MATCHING TEXT	26 WORDS

Objectives of Tabulation The main objectives of tabulation are stated below: i. to carry out investigation; ii. to do comparison; iii. to locate omissions and errors in the data;

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83/101	SUBMITTED TEXT	17 WORDS	84%	MATCHING TEXT	17 WORDS

to use space economically; v. to study the trend; vi. to simplify data; vii. to use it as future reference.

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84/101 **SUBMITTED TEXT** 55 WORDS **81%** **MATCHING TEXT** 55 WORDS

time-consuming process when the data is too large. After classification the data may be sorted using either of the following methods: (i) Manual method: Here the sorting is done by hand by giving tally marks for the number of times each event has occurred. Next the total tally marks are counted. The method is simple and suitable for limited data. (

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85/101 **SUBMITTED TEXT** 19 WORDS **100%** **MATCHING TEXT** 19 WORDS

Mechanical and electrical method: To reduce the sorting time mechanical devices may be used. This is described as mechanical tabulation.

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86/101 **SUBMITTED TEXT** 34 WORDS **75%** **MATCHING TEXT** 34 WORDS

a separate card is used. The punched cards are checked by a machine called 'verifier'. Next the cards are sorted out into different groups as desired by a machine called 'sorter'. Finally, the tabulation is

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87/101 **SUBMITTED TEXT** 11 WORDS **100%** **MATCHING TEXT** 11 WORDS

using a tabulator. The same card may be sorted out

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88/101 **SUBMITTED TEXT** 26 WORDS **96%** **MATCHING TEXT** 26 WORDS

for sorting when (a) data are very large; (b) data have to be sorted for future use and (c) the requirements of the table are changing.

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89/101 **SUBMITTED TEXT** 14 WORDS **80%** **MATCHING TEXT** 14 WORDS

Mean • The sum of all scores divided by y the number of scores. 2)

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90/101	SUBMITTED TEXT	17 WORDS	61%	MATCHING TEXT	17 WORDS

Range The range is the most obvious measure of dispersion and is the difference between the lowest and

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91/101	SUBMITTED TEXT	13 WORDS	100%	MATCHING TEXT	13 WORDS

A B C D E F G H I J K L

SA D 19 Title _ Unit 1-3.pdf (D165450639)

92/101	SUBMITTED TEXT	287 WORDS	100%	MATCHING TEXT	287 WORDS

The Inter-quartile Range The inter-quartile range is a measure that indicates the extent to which the central 50% of values within the dataset are dispersed. It is based upon, and related to, the median. In the same way that the median divides a dataset into two halves, it can be further divided into quarters by identifying the upper and lower quartiles. The lower quartile is found one quarter of the way along a dataset when the values have been arranged in order of magnitude; the upper quartile is found three quarters along the dataset. Therefore, the upper quartile lies half way between the median and the highest value in the dataset whilst the lower quartile lies halfway between the median and the lowest value in the dataset. The inter-quartile range is found by subtracting the lower quartile from the upper quartile. For example, the examination marks for 20 students following a particular module are arranged in order of magnitude The median lies at the mid-point between the two central values (10th and 11th) = half-way between 60 and 62 = 61 The lower quartile lies at the mid-point between the 5th and 6th values = half-way between 52 and 53 = 52.5 The upper quartile lies at the mid-point between the 15th and 16th values = half-way between 70 and 71 = 70.5 The inter-quartile range for this dataset is therefore 70.5 - 52.5 = 18 whereas the range is: 80 - 43 = 37. The inter-quartile range provides a clearer picture of the overall dataset by removing/ignoring the outlying values. Like the range however, the inter-quartile range is a measure of dispersion that is based 102 upon only two values from the dataset. Statistically, the standard deviation is a more powerful measure of dispersion because it takes into account every value in the dataset.

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93/101 **SUBMITTED TEXT** 241 WORDS **100%** **MATCHING TEXT** 241 WORDS

The Standard Deviation The standard deviation is a measure that summarises the amount by which every value within a dataset varies from the mean. Effectively it indicates how tightly the values in the dataset are bunched around the mean value. It is the most robust and widely used measure of dispersion since, unlike the range and inter-quartile range, it takes into account every variable in the dataset. When the values in a dataset are pretty tightly bunched together the standard deviation is small. When the values are spread apart the standard deviation will be relatively large. The standard deviation is usually presented in conjunction with the mean and is measured in the same units. In many datasets the values deviate from the mean value due to chance and such datasets are said to display a normal distribution. In a dataset with a normal distribution most of the values are clustered around the mean while relatively few values tend to be extremely high or extremely low. Many natural phenomena display a normal distribution. For datasets that have a normal distribution the standard deviation can be used to determine the proportion of values that lie within a particular range of the mean value. For such distributions it is always the case that 68% of values are less than one standard deviation (1SD) away from the mean value, that 95% of values are less than two standard deviations (2SD) away from the mean and that 99% of values are less than three standard deviations (3SD) away from the mean.

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94/101 **SUBMITTED TEXT** 29 WORDS **100%** **MATCHING TEXT** 29 WORDS

If the mean of a dataset is 25 and its standard deviation is 1.6, then • 68% of the values in the dataset will lie between MEAN-1SD (25-1.6=23.4)

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95/101 **SUBMITTED TEXT** 68 WORDS **100%** **MATCHING TEXT** 68 WORDS

SD (25+1.6=26.6) • 99% of the values will lie between MEAN-3SD (25-4.8=20.2) and MEAN+3SD (25+4.8=29.8). If the dataset had the same mean of 25 but a larger standard deviation (for example, 2.3) it would indicate that the values were more dispersed. The frequency distribution for a dispersed dataset would still show a normal distribution but when plotted on a graph the shape of the curve will be flatter as in figure 3.

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96/101	SUBMITTED TEXT	254 WORDS	100%	MATCHING TEXT	254 WORDS

Population and sample standard deviations There are two different calculations for the Standard Deviation. Which formula you use depends upon whether the values in your dataset represent an entire population or whether they form a sample of a larger population. For example, if all student users of the library were asked how many books they had borrowed in the past month then the entire population has been studied since all the students have been asked. In such cases the population standard deviation should be used. Sometimes it is not possible to find information about an entire population and it might be more realistic to ask a sample of 150 students about their library borrowing and use these results to estimate library borrowing habits for the entire population of students. In such cases the sample standard deviation should be used. Formulae for the standard deviation Whilst it is not necessary to learn the formula for calculating the standard deviation, there may be times when you wish to include it in a report or dissertation. The standard deviation of an entire population is known as σ (sigma) and is calculated using: 104 Where x represents each value in the population, μ is the mean value of the population, Σ is the summation (or total), and N is the number of values in the population. The standard deviation of a sample is known as S and is calculated using: Where x represents each value in the population, x is the mean value of the sample, Σ is the summation (or total), and n-1 is the number of values in the sample minus 1.

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97/101	SUBMITTED TEXT	20 WORDS	62%	MATCHING TEXT	20 WORDS

the standard error of these difference computed as the standard deviation divided by the square root of the sample size,

The Standard Error of a sample mean ( ) is the Standard Deviation of the Population divided by the square root of the sample size: = √

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98/101	SUBMITTED TEXT	12 WORDS	87%	MATCHING TEXT	12 WORDS

just because two variables are correlated, it does not mean that one

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99/101	SUBMITTED TEXT	15 WORDS	87%	MATCHING TEXT	15 WORDS

normal distribution has a mean of 0 and a standard deviation of 1. • This

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100/101	SUBMITTED TEXT	14 WORDS	86%	MATCHING TEXT	14 WORDS

Where, O is the observed frequency, and E is the expected frequency. The degrees of

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101/101	SUBMITTED TEXT	18 WORDS	60%	MATCHING TEXT	18 WORDS

Kothari, C.R., Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004 12. Krishnaswamy, O.R.,

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