Social Spectrum

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Preface

Social science research also contributes to the understanding of the social, economic, and political institutions that potentially affect, either directly or indirectly, the whole biosocial reproductive system and family planning programs. At least as important as its specific theories and findings is the role of social science in testing how to adapt such knowledge to distinctive national and local cultural circumstances of family planning programs.

Social science is also in great demand in the business world, specifically in the aviation industry. They help the companies to understand their customers well by providing them information about the travel patterns, use of services, etc. Social science research can help the industries in gaining customer satisfaction by giving them useful insights into customer behaviors. This can lead to business growth and higher profitability of the firms.

A hypothesis is a research statement about relationships between variables that is testable and that can be accepted or rejected based on the evidence. Therefore, you can only develop hypotheses that are quantifiable. To design a study to test your hypothesis, you use quantitative research methods. Hypotheses are divided into two categories: research hypotheses and null hypotheses.

The range of social scientific methods has also broadly expanded. Social researchers draw upon a variety of qualitative and quantitative techniques. The linguistic and cultural turns of the mid-twentieth century led to increasingly interpretative, hermeneutic, and philosophic approaches to the analysis of society. Conversely, recent decades have seen the rise of new analytically, mathematically and computationally rigorous techniques, such as agent-based modelling and social network analysis. Sociological reasoning predates the foundation of the discipline.

Research in social sciences, as in other fields is a search for knowledge. It provides assistance in making reasonable decisions. Acknowledge of the research process is essential both for these who take an active role in the conduct of research and for those who desire to keep abreast of the new knowledge being contributed by others through research.

Social scientists employ a range of methods in order to analyse a vast breadth of social phenomena; from census survey data derived from millions of individuals, to the in-depth analysis of a single agents' social experiences; from monitoring what is happening on contemporary streets, to the investigation of ancient historical documents. The methods rooted in classical sociology and statistics have formed the basis for research in other disciplines, such as political science, media studies, and market research.

Social research is the scientific study of society. More specifically, social research examines a society's attitudes, assumptions, beliefs, trends, stratifications and rules. The scope of social research can be small or large, ranging from the self or a single individual to spanning an entire race or country. Popular topics of social research include poverty, racism, class issues, sexuality, voting behaviour, gender constructs, policing and criminal behaviour.

This book re-examines the concept of research methodologyand social science in the Indian and abroad context and attempts to integrate participatory and rights-based concerns.

—Author

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1

Nature and Significance of Social Research

SOCIAL SCIENCE RESEARCH

Social research refers to research conducted by social scientists. Social research methods may be divided into two broad categories:

- Quantitative designs approach social phenomena through quantifiable evidence, and often rely on statistical analysis of many cases (or across intentionally designed treatments in an experiment) to create valid and reliable general claims
- Qualitative designs emphasize understanding of social phenomena through direct observation, communication with participants, or analysis of texts, and may stress contextual and subjective accuracy over generality.

Social scientists employ a range of methods in order to analyse a vast breadth of social phenomena; from census survey data derived from millions of individuals, to the in-depth analysis of a single agents' social experiences; from monitoring what is happening on contemporary streets, to the investigation of ancient historical documents. The methods rooted in classical sociology and statistics have formed the basis for research in other disciplines, such as political science, media studies, and market research.

Methodology

Social scientists are divided into camps of support for particular research techniques. These disputes relate to the historical core of social theory (positivism and antipositivism; structure and agency). While very different in many aspects, both qualitative and quantitative approaches involve a systematic interaction between theory and data. The choice of method often depends largely on what the researcher intends to investigate.

For example, a researcher concerned with drawing a statistical generalization across an entire population may administer a survey questionnaire to a representitive sample population. By contrast, a researcher who seeks full contextual understanding of an individuals' social actions may choose ethnographic participant observation or open-ended interviews. Studies will commonly combine, or 'triangulate', quantitative *and* qualitative methods as part of a 'multi-strategy' design. For instance, a quantitative study may be performed to gain statistical patterns or a target sample, and then combined with a qualitative interview to determine the play of agency.

An extreme form of ethnographic participant observation is practiced when a group of social scientists (1) build and occupy an experimental community, (2) observe and record their own behaviours, (3) experimentally test possible solutions to their personal and social problems, (4) deliberately adopt experimentally validated solutions, and (5) publish reports about the evolution of their culture.

Sampling

Typically a population is very large, making a census or a complete enumeration of all the values in that population infeasible. A 'sample' thus forms a manageable subset of a population.

In positivist research, statistics derived from a sample are analysed in order to draw inferences regarding the population as a whole. The process of collecting information from a sample is referred to as 'sampling'. Sampling methods may be either 'random' (random sampling, systematic sampling, stratified sampling, cluster sampling) or non-random/nonprobability (convenience sampling, purposive sampling, snowball sampling). The most common reason for sampling is to obtain information about a population. Sampling is quicker and cheaper than a complete census of a population.

CHARACTERISTICS OF SOCIAL SCIENCE RESEARCH

Followings are the main Characteristics of Social Research

Accuracy & Precision

Accuracy and precision are also the basic requirements for a research. A researcher brought its views must be accurate and precise to the problematic situation. For example someone says that the illiteracy or literacy rate is rural areas is 100%. This statement is invalid and does not accurate to the rural areas. Instead of it he should say that the rural areas, s people are 50%, 60% or 80% illiterate. This would be acceptable.

Verifiability

Another characteristic of research is the researcher must verify the data. It must be subject for verifiability and testability. For example; the statement, "criminality is due to illiteracy among the people". This proposition would be regarded as scientific fact because it verifies the observation that the ration of criminals among literate people is less as compared to illiterate.

Evidence of Facts

Research knowledge should be based on facts second hand information or hearing and say reports should not be added to the research study. It must have is original facts for which it is necessary.

Objectivity

Objectivity means that the reality must be shown in a research. Scientific research must have its real thing is and it must be clear from self or personal bias, prejudice, feelings of like and dislike etc.

Reliability & Validity

Truth is the canon of research. The research study must be true and valid to a great extent. No outwards information or self-created objects are included to a research study. The error should be finished.

Qualification

Qualification is the personal experience and skill of a researcher. The complete study of a problematic situation is possible when the researcher is qualified and known well about the existing problem.

Measurability

Various instruments, devices and scientific techniques are used for measuring and undertaking a problem for testing. Accurate measurement is required for researcher to measure the data collected from a problematic phenomenon.

Recording and Reporting

Every term should be defined and illustrate clearly. The procedure must be described in detail and the report should be written by the researcher to clarify the situation.

Centers around a Problem

The research must be focused on a point. It means that the study must be confined to a specific place and existing of a particular problem.

Original Works

Social research is clear from duplicate or copied information. It must have the original work not on the work done by other.

Actually research starts from the point when the already existing knowledge ends.

PURPOSE OF SOCIAL SCIENCE RESEARCH

Social science deals with the study of society and the relationship among individuals within a society. It includes business, sociology, commerce, demography, etc. Social science research provides authentic information to the people that are scientifically proven so that end users can rely upon it. It also helps us in finding the solutions to different social problems. It focuses on the fact that if we are able to find the root cause of any problem, we can find a more effective solution to it.

Social science is involved everywhere starting from the healthcare sector to the business world. It also contributes to social welfare, formulation of theories, development of methodology, social planning, prediction, and control.

Social scientists are involved with solving many of the world's biggest issues like cybersecurity, finding a cause of various new diseases, and evolving new strategies for defense challenges faced by the countries. Various countries also take help from social researchers in order to deal with the day-to-day challenges faced by them. If we consider the field of medicine, social scientists work closely with different organizations. For finding the cause of any new disease, studying the environmental conditions is equally important as studying the cause and pathogen responsible for the disease.

Social science is also in great demand in the business world, specifically in the aviation industry. They help the companies to understand their customers well by providing them information about the travel patterns, use of services, etc. Social science research can help the industries in gaining customer satisfaction by giving them useful insights into customer behaviors. This can lead to business growth and higher profitability of the firms.

Businesses are always interested in knowing more about their customers. Knowing the customers well ease their several purposes. If they know the behaviors of the customers, they can design the products accordingly. It decreases their marketing efforts and even if it is required, it can be strategically planned in the required manner. It not only decreases the overall cost but also provides a better profitability. The brand name of the company gets higher visualization in the market. Technology can serve the purpose of increasing profits but social science research can add a flavor of value to it.

MOTIVATION FORCES OF SOCIAL SCIENCE RESEARCH

Stimulation of Respondent

As the researcher depends upon the respondents for collection of data for the attainment of the research objectives, one of the most important tasks of the researcher is to inspire and stimulate the respondents with zeal to help for the accomplishment of research goals. In other words the motivation of the respondents plays a significant role for the success of any kind of research.

Human motives are based on certain needs which may be primary or secondary and vary in their intensity according to situation and time. The researcher must study these needs, try to understand their intensity and have the responsibility to satisfy them in order to stimulate the respondents for research work.

Motivation means any idea, need, emotion or organic state that prompts a man to an action. Motivation is an internal factor that integrates a man's behaviour. As the motive is within the individual, it is necessary to study the needs, emotions etc. in order to motivate him to co-operate in the research work.

The following are the important inducing factors which influence the respondent's behaviour and induce him for the best performance to meet the need of research:

(i) The research should be directed towards the solution of respondent's problem.

(ii) The nature of the problem or topic must have social relevance.

(iii) The researcher should clearly spell the goals of research.

(iv) The respondents must be informed about the matters concerning objectives of the research. The more a person knows about its subject matter, the more interest and concern he will develop.

(v) Respondents can be motivated to involve in research if they get continuous recognition for their efforts. Respondents provide valuable information and suggestion for the success of research work. If the researcher has a praise of words for the respondents' cooperation, it motivates the respondents more and more to be involved in the research process. Thus recognition tends to motivate the respondents to provide required information for research.

Stimulation of Researcher

The success of a research work, to a great extent, depends upon the motivation of the researcher as well.

The following are some of the factors which stimulate a researcher to conduct research effectively:

(i) The researcher must have a concrete and complete knowledge of the subject under study. He must be capable of removing the doubts of the respondents regarding the study.

(ii) He must have a personal interest in the study undertaken.

(iii) The researcher must have sufficient knowledge about the respondents.

(iv) The researcher must have the idea of the tools of research.

A Sense or Participation

Participation in a research activity does not mean simply the involvement of the respondents in giving information on a topic or problem. In real sense, participation is an individual's mental and emotional involvement in research solutions that encourage him to contribute to research and to share the responsibility for it. From utilitarian point of view the main goal of research is to understand social life and attempt on social welfare. However it cannot be done without the active participation of the people involved in the process of social research.

Any social research, whether it is meant for the development of a specific section of society or for the overall development of the entire society, requires participation of people. Research does not only mean involvement of the researcher but it also requires the conscious participation of the respondents.

The respondents involve themselves in thinking, identifying the needs, fixing priorities of the needs, providing valuable information, implementing and evaluating critically various research programmes. Thus it involves the participation of both the researcher and the respondents.

Growth of Knowledge

Interest for increasing knowledge motivates people to do research in their own field. Research adds to the existing knowledge in a systematic way. The quest for knowledge is therefore an important motivating factor in social research. Discovering the truth always forces man to undertake research in own society.

Quest for Progress

Research has proved to be a significant and powerful tool in bringing social progress. Without scientific social research there would be very little progress. The results of social research will provide us with the possible means to bring solution to different social problems. Research opens new avenues and provides a better alternative to us. It enhances the efficiency of all the agencies and organisations engaged in the development of society. So the quest for progress is also another motivating factor of social research.

ASSUMPTIONS OF SOCIAL SCIENCE RESEARCH

In social science, research scholars construct views about social entities on the basis of different philosophical assumptions such as:

- Ontological assumption- It includes different views about the nature of reality in the social world
- Epistemological assumption- Determine what they consider valid knowledge for the purpose of research
- Rhetorical assumptions- Relate to the method of Dissertation Writing
- Axiological assumption

Further ontological and epistemological assumptions explain how research scholars understand reality and obtain knowledge about the social world. Since the present study was value-laden where it focused to understand how entrepreneurial characteristics such as creativity and risk-taking influence Indian entrepreneurs in introducing innovative products and also participated in the research process, it upholds the interpretive philosophy that relates to rhetorical assumptions. Further the present study used an informal style and personal voice, and accepted qualitative words and limited definitions.

SUBJECT MATTER OF SOCIAL SCIENCE RESEARCH

Social sciences help to explain how society works, exploring everything from the triggers of economic growth and causes of unemployment to what makes people happy. This information is vital and can be used for many purposes. Among other things, it helps to shape corporate strategies and government policies.

Social science as a field of study is separate from the natural sciences, which cover topics such as physics, biology, and chemistry. Social science examines the relationships between individuals and societies, as well as the development and operation of societies, rather than studying the physical world.

These academic disciplines rely more heavily on interpretation and qualitative research methodologies.

The social sciences include:

- Anthropology
- Economics
- Political science
- Sociology
- Social psychology

History is also sometimes regarded as a branch of social science, although many historians often consider the subject to share closer links to the humanities. Both humanities and social sciences study human beings. What separates them is the technique applied: humanities are viewed as more philosophical and less scientific. Law, too, has some ties to social sciences, as does geography. In the U.S., early education of social sciences begins in elementary school and progresses throughout middle and high school with an emphasis on core social sciences such as economics and political science. At the collegiate level, more specialized disciplines are offered.

SOURCES OF DATA FOR SOCIAL SCIENCE RESEARCH

Primary Sources

A primary source is an original document that contains firsthand information about a topic or an event. Primary sources exist on a spectrum and different fields of study may use different types of primary source documents. For example, the field of History may use diary entries and letters as primary source evidence, while the Sciences may use a publication of original research as a primary source. Being an interdisciplinary program, ISS courses and topics will require a range of understandings and approaches to primary sources. Here are some common examples of primary source documents:

- Historical documents (letters, pamphlets, political tracts, manifestos)

- Data and Research Results (scientific article presenting original findings, statistics)
- Original works of art
- Video footage & photographs
- Works of literature
- Interview transcripts
- Eyewitness accounts, newspapers articles & autobiographies
- Blogs articles, tweets and other social media entries
- Lab notebooks and case studies

Secondary Sources

A secondary source is an interpretation, analysis, discussion or evaluation of an event or issue that is based on primary source evidence. Secondary sources list, summarize, compare, and evaluate information and studies so as to draw conclusions or present on the current state of knowledge on a topic. Secondary sources are often in the form of scholarly discourse or reviews. Secondary sources are useful to introducing a topic and providing historical or broader context. Common examples of secondary sources are:

- Biographies
- Indexes, Abstracts, Bibliographies
- Journal articles
- Literary criticism
- Monographs written about the topic
- Reviews of books, movies, musical recordings, works of arts, etc
- Newsletters and professional news sources.

UTILITY OF SOCIAL SCIENCE RESEARCH

Utility of Social Research

To the question "what use is social research?" one may reply "of what use is a new-born child?" in the manner of

Benjamin Franklin who replied thus, when asked the utility of his findings about the relationship between thunderclouds and electricity.

This means that new knowledge like the new-born baby, holds great potential of worth and maturity. Also like the new-born child, it gives us pleasure. It gives us satisfaction of knowing the unknown.

This points to a value that the scientist is committed to, i.e., the self-justifying goodness of' new knowledge' about anything big or small. "Social research is persistently opening our eyes to the social reality, simplifying the mysterious within the seemingly common place in social life and shattering its garments of make-believe by which pious hands have hidden their uglier features.

The obvious function of research is to add new knowledge to its existing store, but its power of cleansing our minds of cliches and removing the rubbish of inapplicable theory are equally notable. Scientific research is a cumulative process. It is also a rejective process, especially in social sciences … understanding can be (advanced) not only by gains in knowledge but also by discarding outworn assumptions."

A social researcher is interested in the discovery and interpretation of social processes, patterns of behaviour, similarities and dissimilarities that apply to typical social phenomena and social systems, generally.

That is the social researcher is concerned with types and classes of social situation, persons or groups of which the unit he is studying at the time, is a specimen or an instance. His facts are selected and related according to their intrinsic nature and the susceptibility to organization into a logical system.

This search for knowledge has a definite relation to people's basic needs and welfare. The social scientist assumes that all knowledge is potentially useful in the end. It must be remembered, however that science and society have a two way relationship. There is a give and take between science and social conditions. Science helps to create social conditions; social conditions recharge the accumulators of science.

In concrete developmental parlance the major possibilities of utilizing social science research may be identified as under:

(a) Social research may afford valuable background data to be capitalized by social planners for assessing the existing state of affairs; particularly the magnitude, complexity and ramifications of the problem they are expected to grapple with; the critical may be illuminated by analytical studies.

The observed and hidden dimensions of the problem thrown up by such studying may be expected to proffer certain measure of foresight to planners to deal with the problem effectively.

(b) Such social science exercise may provide a basis for testing the validity of certain assumptions that our planners are prone to make in laying down their short-term and long-term goals. These researches conceivably, may help the planner to anticipate the consequences and cost of alternative strategies which may be pressed into operation for achieving the settled goals.

(c) Social science researches may bring into sharp focus the varied influences and factors that contribute to the failure of certain projects. Hence the policy planners may stand forewarned about these.

(d) If social science research finding becomes a part of public knowledge, a general awareness about the situation and challenges, as also, the desired policy to meet them squarely may result.

This would prepare people for accepting a particular policy and for exerting popular pressure for reformulation of amending current policies, or rejecting of modifying them. Let us now consider the utility of social research, especially, for a developing country like ours.

DIFFICULTIES IN SOCIAL SCIENCE RESEARCH

The social sciences, like the physical or biological sciences, are intellectual subjects, directed primarily toward understanding, rather than action. It would of course be a curious kind of "understanding" that had no implications for action, and this is perhaps especially true for the social sciences. Nevertheless, there is a difference between enlarging one's understanding of human behavior and society on the one hand and trying to solve a social problem on the other. The social sciences are distinct from social problem solving, but each can contribute to the other.

During the last few years there has been a significant change in popular attitudes and expectations in the United States regarding social change and social problems. A renewed determination to ameliorate certain long-standing, as well as recently developed, ills of the society has arisen along with a sense of power and confidence in its ability to do so.

In looking for ways in which to implement this desire for self-control, for directed rather than accidental improvement, a good many leaders of society have begun to turn, increasingly expectant, to the social sciences. Some have asked what the social sciences can contribute to the venture. Others have assumed that these sciences have a great deal to contribute to a better society and that they need only to be force-fed (the recommended diet varies from prescriber to prescriber) in order to grow faster and to make their contribution larger.

The social sciences do have a contribution to make to social practice, but not so large a contribution as they will make if helped to develop properly. At this point in history, the magnitude of major social problems exceeds the capacity of social scientists to solve them.

Such expectations have been entertained before. In the latter part of the nineteenth century and the first decade or so of the twentieth, social scientists of the day offered advice to the progressive political and social movements of the times.

As David Truman has pointed out, these political scientists and sociologists operated not only from a weak position in the political structure, but also with an almost total lack of theoretical sophistication, quite nonrigorous methods, and few facts about the systems on which they were advising. They were intellectually premature and too ready to claim relevance. Their efforts fell far short of expectations, both their own and expectations of those who, from outside the disciplines, had called upon them.

Social scientists had another try during the early years of the New Deal when economists especially, but sociologists and political scientists too, were invited into government and other institutions to develop programs, plans, and social devices for dealing with the Great Depression. The novel thinking of agricultural economists and the resultant development of institutions for what was then known as "farm relief" were considerably more successful than the efforts of the social reformers of the early 1900s had been.

One reason for the relatively greater success of the applied economics of the New Deal was that there had been developing in the United States a considerable sophistication in economics as a discipline, together with a good empirical base of data that had been accumulated over the prior decades. In comparison with today's data base, that of the 1930s was poor and small; but it was a vast improvement over the virtual data vacuum of 1900. Another reason for the relative success was probably the degree of desperation that gripped the country and led to a willingness to try the somewhat radical measures that were proposed by economists; partly because people were willing to try the measures, they were successful. Still another opportunity for the social sciences came during World War II when psychologists and anthropologists especially made significant contributions to the prosecution of the war and the government of occupied territories.

Social scientists are currently being offered a fourth opportunity to display what they have to offer toward the solution of what is now a fairly well-standardized, if incomplete, list of problems: poverty, racial segregation and discrimination, urban decay and the strangulation of transportation, human and mechanical pollution of the environment, and a perceived increase in the incidence of crimes of violence. Will social scientists succeed better this time in living up to the expectations that face them? What can and should be done to make possible greater success?

There are several purely scientific difficulties in applying social science successfully to the solution of social problems. Limitations of space prevent their adequate discussion here. Their importance is such that they must at least be mentioned, however, and they require persistent scientific effort in order to improve the capacity of the social science disciplines to cope with social problems. There are three major scientific issues: so-called "Hawthorne effects" or changes in behavior which result from the fact that individuals are subjects in an experimental study; the inadequacies of existing data about social problems and individual behavior and the defects of indirect data; and finally the manipulability of social factors that are variables in social scientific analyses of problems. These are difficult scientific problems, but not impossible of solution. Furthermore, much headway can be made in applying social science without fully solving them.

QUALITIES OF A GOOD RESEARCHER

Friendly with Respondents. A good researcher must have the quality to become friendly with respondents. It should have to talk to them in the same language in which the responding are answering and make happy made.

Least Discouragement. If the people are not co-operate to give correct data, the researcher should not be discouraged and face the difficulties, it would be called a good researcher.

Free From Prejudice. A researcher would be good if he has no prejudice or bias study about a problematic situation but he is capable of providing clear information's.

Capacity of Depth Information. A researcher should have the capacity to collect more and more information in little time.

Accuracy. A researcher would be said to be good, if he is accurate in his views. His ideas must be accurate one.

Truthful. A researcher must have to be truthful. Its idea would be free from false reports and saying information.

SOCIAL RESEARCH IN DEVELOPING COUNTRIES

Social science research has made important contributions to population policy and to the effectiveness of family planning programs. Social science concepts, theories, and methods potentially are relevant to all aspects of reproductive behavior, including actual fertility, proximate variables, and desired family size. Social science research also contributes to the understanding of the social, economic, and political institutions that potentially affect, either directly or indirectly, the whole biosocial reproductive system and family planning programs. At least as important as its specific theories and findings is the role of social science in testing how to adapt such knowledge to distinctive national and local cultural circumstances of family planning programs.

Before addressing the two major questions with which the paper is concerned, it will be useful to consider the empirical utility of the typology of basic and applied research for measuring social science research benefits. One reason for doing this is that while there is a well developed body of knowledge about measuring the benefits of applied research, there is a consensus that measuring the benefits of basic or pure research (which is largely a public good) is much harder. In part, it is more difficult because 3 identifying the amount of basic research inputs, the immediate changes in the stock of useful knowledge that results from those inputs, and the effects of these changes in the stock of useful knowledge on economic welfare all present extremely difficult problems of measurement or estimation. In particular, if the effects of basic research are to be identified separately from the effects of applied research, then there should be some sensible method of determining what constitutes basic and applied research that can be used to produce effective measurements of the investments in each type of research.

However, for the last few years, social scientists, with the exception of economists, have played a peripheral role in agricultural development planning. Program design and the implementation of development plans have been conducted mainly by technical scientists. In most cases, social scientists have been invited to justify the decisions of the technical scientists after the selection and the designing of the projects.

Such development projects have usually had unanticipated consequences because of this lack of input from social scientists. At present there is a growing concern by international funding agencies and other research institutes to involve social scientists not only in the evaluation and appraisal of development projects, but also in the planning and formulation of these projects. The rationale behind this is that social scientists can contribute to the understanding of social, political, and economic problems in a society and help to plan development projects in such a way that they address basic developmental needs.

SOCIAL RESEARCH IN INDIA

Social science research in India has had a chequered history. In India the development of social science research is directly an outcome of the processes of modern education, the setting-up of universities and the academic interests of Indian intellectuals in writing issues concerning the people of the country during the colonial period. In the pre-independence phase social science research was mostly university centric and after the independence of India many institutes of research came up which have also contributed towards the development of social science research.

Today social science research in India has grown manifold and as of 2014, there are 677 universities in India with more than 500 departments of social sciences as per the latest statistics from the website of India's HRD ministry. Some NGOs and policy research initiatives have also produced specific development focused research products but generally do not have longer term interest in research and the quality of their research is not yet established. Generally speaking, the Social Sciences like Sociology, Economics, Anthropology, History, Psychology, Political Science etc cannot be kept within the limitations of demarcated boundaries. This is because; every human activity is a multifaceted activity. Therefore the Social Sciences overlap other disciplines and also relates to Natural and Human Sciences along with the Arts. In totality, Social Sciences study the structure and properties of human groups, the way of individuals interact with one another and within other environmental groups. When we talk about Social Science Research, it means, research conducted by social scientists following a systematic plan. Social Science Research refers to any scientific study of human action and interaction focusing on elements of thought and behavior that are in some sense social3 . Social scientists employ a range of methods in order to analyze a vast breadth of social phenomena. Social Science Research concerned with a systematic investigation of the behavior of man in society with the aim of formulating a body of relevant theory. Social scientists also attempt to explain some aspect of human action and interaction, and the social world, through their research.

Social Science Research in India: An overview: The fourth review committee (March 2007) of The Indian Council of Social Science Research , New Delhi 4 claimed that social science research is chiefly driven by two forces: (a) interest in knowledge about the functioning of society in its diverse social, cultural, political and economic aspects, and in understanding the factors that shape them; and (b) the practical needs of policy makers and managers in government, civil society and the private sector for reliable information and professional analysis. According to the committee, in the pre-Independence period, the scale and scope of both these was quite limited: universities and other academic institutions, the main canters of scholarly research at that time, were relatively few. The requirements of information and analyses for government were also quite limited. The post Independence period witnessed a vastly expanded role for government in engineering economic development and social change. It also saw the rapid growth of modern industrial and commercial enterprises. Political controversies and public interest in issues relating to public policy and their social implications generated an economy and society. All this led to a rapid increase in the demand for both information and research on developmental issues. The fifties and sixties saw an unprecedented effort at expanding and restructuring the statistical system, and in promoting research. Several new universities with departments for teaching and research in different social science disciplines were established. The Planning Commission initially played a leading role in (a) involving social scientists (mostly economists) from the university system in preparing plans, monitoring their implementation and impact; and (b) encouraging and supporting research by scholars in universities through a large number of projects on diverse subjects. Government departments began to show increasing interest in establishing or expanding specialized institutes under their control. They also began sponsoring research projects in universities and funding units in existing universities and institutions to conduct research on specified subjects. The number of university departments and research institutions in the field of social sciences has since grown manifold.

CONCLUSION

The conclusion is intended to help the reader understand why your research should matter to them after they have finished reading the paper. A conclusion is not merely a summary of the main topics covered or a re-statement of your research problem but a synthesis of key points and, if applicable, where you recommend new areas for future research. For most essays, one well-developed paragraph is sufficient for a conclusion, although in some cases, a two or three paragraph conclusion may be required.

If social researchers are to be effective in understanding people, they need to be detached from common sense (the perspective of the person on the street). However, they should not be so detached that they fall into the trap of imposing their own categories upon the object without regard for the experience of those involved (the perspective of the expert).

A good researcher requires the intention to be involved in research and immediately thereafter to show a dedicated interest to do the best research possible. From there we must accumulate the knowledge needed to advance the current ideas already existent in the research world. The intention of this writing is to introduce there qualities that consider essential for a good researcher to succeed. A good teacher researcher should investigate their questions with their students systematically documenting what happens. A good researcher should evaluating performance and present findings to others.

2

Concepts of Social Science Research

DEFINITION OF CONCEPTS

Concepts may remain theoretical or the researcher may attempt to transform them into measurable variables of one sort or another. This approach to conceptualisation is known as operationalism.

Definitive and Sensitizing Concepts

Definitive concepts are are defined in a fairly narrow, precise and clear manner. They give very clear prescriptions of what to look for in a research situation. Definitive concepts are to be distinguished from sensitizing concepts, which are less explicitly defined and give a general sense of reference and guidance in collecting data and analysing it. Secondary sources, such as articles, novels, diaries, are valuable sources of sensitizing concepts. The distinction between definitive and sensitizing concepts is in some way indicative of distinctive and contrasting methodologies in social science research. Blumer, to whom the distinction is attributable, has argued that concepts in the social sciences are essentially sensitizing and that the search for definitive concepts is misplaced.

Objectives of Social Research

Social Research is a scientific approach of adding to the knowledge about society and social phenomena. Knowledge to be meaningful should have a definite purpose and direction. The growth of knowledge is closely linked to the methods and approaches used in research investigation. Hence the social science research must be guided by certain laid down objectives enumerated below:

- Development of Knowledge: As we know 'science' is the systematic body of knowledge which is recorded and preserved. The main object of any research is to add to the knowledge. As we have seen earlier, research is a process to obtain knowledge. Similarly social research is an organized and scientific effort to acquire further knowledge about the problem in question. Thus social science helps us to obtain and add to the knowledge of social phenomena. This is one of the most important objectives of social research.
- Scientific Study of Social Life: Social research is an attempt to acquire knowledge about the social phenomena. Man being the part of a society, social research studies human being as an individual, human behavior and collects data about various aspects of the social life of man and formulates law in this regards. Once the law is formulated, then the scientific study tries to establish the interrelationship between these facts. Thus, the scientific study of social life is the base of the sociological development which is considered as the second best objective of social research.
- Welfare of Humanity: The ultimate objective of the social science study is often and always to enhance the welfare of humanity. No scientific research makes only for the sake of study. The welfare of humanity is the most common objective in social science research.
- Classification of facts: According to Prof. P.V.Young, social research aims to clarify facts. The classification of facts plays important role in any scientific research.
- Social control and Prediction: "The ultimate object of many research undertaking is to make it possible, to

predict the behavior of particular type of individuals under the specified conditions. In social research we generally study of the social phenomena, events and the factors that govern and guide them."

REASONS FOR LACK OF CLARITY IN CONCEPTS

Social science research stem fundamentally from the lack of a developmentalist culture, which manifests itself by researchers' inadequate interest and participation in continuing professional development. Yet institutional research leaders also have a key role in increasing research capacity. They need to be specific about precisely what sort of development they want to occur: what specific skills need to be developed, and what kinds of output they are encouraging. These will be incorporated into their visions of institutional research activity and achievement, which must be communicated clearly to those for whose development they are responsible. What is proposed is a model of institutionally-based professional development centred around the notion of 'extended' professionality, and from which developmentalist research cultures are likely to emerge.

In the social sciences, the research problem establishes the means by which you must answer the "So What?" question. This question refers to a research problem surviving the relevancy test [the quality of a measurement procedure that provides repeatability and accuracy]. Note that answering the "So What?" question requires a commitment on your part to not only show that you have reviewed the literature, but that you have thoroughly considered the significance of the research problem and its implications applied to creating new knowledge and understanding.

Mixing and matching groups is a powerful technique for tackling system complexity by making algorithms much more scalable and resource efficient without sacrificing conceptual clarity. One may use highly tuned communication protocols for specific groups to reduce latency and energy costs.

CONCEPTS IN DIFFERENT FRAMEWORKS

Research in the social sciences is concerned with complex social behaviour, group dynamics and unique human settings. Researchers have different patterns of thought and modes of thinking. As such, they often use different words to explain phenomena, thereby causing conceptual confusion. This chapter explains how conceptual frameworks can help overcome such confusion by serving as visual organising tools and mental maps to direct and guide research. By using a descriptive approach, the article aims firstly to outline the necessity, purpose, nature and scope of conceptual frameworks in social science research and, secondly, to provide a 'how-to' guide on the design of such a framework by exploring a practical example.

Conceptual frameworks in social science research: A contextual and conceptual orientation

Social scientists are typically engaged with highly ambiguous sense-making designs. Social science research is not usually conducted under fixed laboratory conditions. Therefore, findings seldom neither conform neatly to expectations nor are linear or isolated easily. Social science research is concerned with complex social behaviour, group dynamics and unique human settings, such as culture, socio-economic status and educational background. In this regard, Erickson argued that 'human interaction is not rocket science – it is far more complicated …!' A critical component of human interaction is the study of verbal (language), and non-verbal and written engagement. Erickson argued that language has multiple formal and informal meanings and is 'astonishingly complex'.

In scientific writing, scholars ascribe particular meaning to words, as Wilson explained, 'the conceptual equipment of people differs'. This realisation also leads Hornby to point out that defining concepts is 'not an innocent exercise'. People use different words to explain phenomena or describe emotions; they have different patterns of thought and modes of thinking.

Such a variety may cause conceptual confusion. For example, the question arises about the difference between words such as 'concepts', 'constructs' and 'variables' often used in social science research. Therefore, it is necessary to clarify the meaning of 'concept' briefly compared to other words often used in scholarly work. Such clarification is critical to grasp the meaning of concepts as used within conceptual frameworks. Clarification of concepts is furthermore essential as accentuated by qualitative schools of thought, such as interpretivism and constructionism.

According to Lauffer, the term 'concept' refers to 'a mental image or abstraction of a phenomenon'. In its broadest sense, a concept summarises ideas or observations about the characteristics of a mental image about a phenomenon.

Maree (2012:34) stressed the importance of clarifying concepts derived from the title of a study by means of a thorough literature review. Silverman (2005:9) and Leggett (2011:3), in turn, stated that the notion that 'concept' has progressive levels of abstraction. Concepts such as 'table', 'window' and 'door' have extremely low levels of abstraction and are thus relatively simple to define. However, concepts with a high degree of abstraction such as 'personality' are difficult to visualise and define. Such abstract concepts are typically referred to as 'constructs'. Examples of constructs are 'leadership', 'ethics', 'democracy', 'welfare', 'performance', 'motivation' and 'anxiety'.

A clear definition of the above-mentioned constructs is not possible without a particular theoretical disposition. Constructs are thus heavily theory-laden. A definition of the construct 'religion', for example, is only possible if particular theoretical attributes are clarified, such as doctrines, scriptures, rituals and hermeneutics, which combinedly constitute a specific religion.

The definition of 'religion' is also highly case-dependent; in other words, its meaning depends on the societal context. Such a set-up includes cultures, belief systems, traditions, values and norms that characterise followers of a particular religion.

In light of such complexity, Miles and Huberman referred to constructs as 'intellectual bins' that define and show the interrelationship between the key concepts.

Conceptualisation entails building the level of sophistication to define concepts – from elementary to comprehensive. The level of sophistication is reached by indicating how different scholars add characteristics, elements, dimensions and attributes to a concept. The researcher should finalise the development of key concepts with a comprehensive working definition that will be applicable to the particular study. Conceptualisation is thus broader than mere definition and should produce an agreed-upon meaning (i.e. through adequate scholarly consensus) for concepts guiding a study. It should be evident that conceptualisation essentially does not concern questions of facts, value, meaning of words or its definition. The focus is rather about the usage of words in particular settings. As Ravitch and Riggan argued, 'The definition is far more important than the label'.

ORIGIN OF CONCEPTS

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists.

The concept of 'social studies' is of recent origin. Social studies originated and developed in order to be considered as the part of school curriculum. The wide spread use of social studies started in America since 1916. Its use in India can be traced back to the formulation of Gandhiji's Basic Education in 1937.

Social studies is a single and composite instructional area which draws its contents from many social sciences like history, geography, political science, economics, etc. Social studies doesn't combine social science subjects in unrelated way rather it meaningfully integrates them for the purpose of helping the learners understand woman's/man's relationship with the society/ environment in which she/he lives. Developing the competencies relating to healthy social living is the main aim of social studies learning. Social studies is concerned with the practical aspects of the society. Let us study the definitions of James High and John V. Michael's on social studies.

LEVEL OF EXPLANATION OF CONCEPTS

Social Science Core Concepts

Imagine you're a teacher and you're teaching your students about issues leading up to the American Civil War. If you haven't laid a foundation discussing race and racial issues, your students will have very little context for understanding your lecture. Or, say you're discussing the Russian Revolution of 1917, but you haven't explained social class and class conflict. Again, your students will have a difficult time grasping the material because they don't understand the underlying, foundational issues at play.

The social sciences is a broad designation used to refer to the academic disciplines of history, government/civics, economics, political science, sociology, and other areas. Basically, the term refers to areas of human and social interactions. Within the social sciences there are some foundational concepts that guide us as we examine them.

Race, gender, class, culture, technology, and other concepts are relevant to all the social sciences disciplines and exert tremendous influence on the ''movement'' or activity within these disciplines. For example, issues surrounding race were a major reason for the outbreak of the American Civil War, and class conflict led directly to the French Revolution and the Russian Revolution of 1917. In order to have a solid grasp of the social sciences, we need to understand these core concepts. Let's look at them.

PROCEDURE FOR DEFINITION OF CONCEPTS

Concepts

A concept is an abstraction representing an object, a property of an object, or a certain phenomenon. Concepts serve a number of important functions in social science research: 1) they are the foundation of communication; 2) they introduce a point of view-a way of looking at empirical phenomena; 3) they are means for classification and generalization; and 4) they serve as components of theories and thus of explanations and predictions.

Definitions

Clarity and precision in the usage of concepts are achieved by definitions. Two types of definitions are important in social science research: conceptual definitions and operational definitions. Conceptual definitions consist of primitive and derived terms. Primitive terms are those on which there is a consensus over their meaning; usually their meaning is conveyed by indicating examples. Derived terms are those that can be defined by the use of primitive terms. Operational definitions refer to sets of procedures that describe the activities one should perform in order to establish empirically the existence or degree of existence of a phenomenon described by a concept. Concepts have both conceptual and operational components; the problem faced by the social scientist involves the integration of these two levels.

CONCEPTS AND COMMUNICATION

Communication studies or communication science is an academic discipline that deals with processes of human communication and behavior, patterns of communication in interpersonal relationships, social interactions and communication in different cultures. Communication is commonly defined as giving, receiving or exchanging ideas, information, signals or messages through appropriate media, enabling individuals or groups to persuade, to seek information, to give information or to express emotions effectively. Communication studies is a social science that uses various methods of empirical investigation and critical analysis to develop a body of knowledge that encompasses a range of topics, from face-to-face conversation at a level of individual agency and interaction to social and cultural communication systems at a macro level.

Scholarly communication theorists focus primarily on refining the theoretical understanding of communication, examining statistics in order to help substantiate claims. The range of social scientific methods to study communication has been expanding. Communication researchers draw upon a variety of qualitative and quantitative techniques. The linguistic and cultural turns of the mid-20th century led to increasingly interpretative, hermeneutic, and philosophic approaches towards the analysis of communication. Conversely, the end of the 1990s and the beginning of the 2000s have seen the rise of new analytically, mathematically, and computationally rigorous techniques.

As a field of study, communication is applied to journalism, business, mass media, public relations, marketing, news and television broadcasting, interpersonal and intercultural communication, education, public administration—and beyond. As all spheres of human activity and conveyance are affected by the interplay between social communication structure and individual agency, communication studies has gradually expanded its focus to other domains, such as health, medicine, economy, military and penal institutions, the Internet, social capital, and the role of communicative activity in the development of scientific knowledge.

Communication Defined

In its simplest form, the term communication refers to the process by which one person transmits information (new knowledge) to another person (or persons). A number of communication models exist, but common elements delineated by Claude Shannon and Warren Weaver (1949) link them: a sender, a receiver, a channel, the message itself, and some effect or impact resulting from the message exchange (including feedback).

Feedback, a crucial part of the communication process, represents the response to a received message (not necessarily to the message intended to be sent, but to its interpretation). While an element in the overall process, feedback's transmission duplicates the communication process it responds to, and thus involves sending and receiving, as well as media, and it can be impacted by communication barriers. Feedback, in turn, may lead to a response. Mechanistic approaches like the classic Shannon-Weaver model are appealing in their simplicity in explaining the communication process, but they do not reflect communication's complexity, especially in terms of perception (which reflects the application of past events as well as the context in which the message is being received). Perception, in fact, accounts for much of the complexity of the communication process.

Perception

The sender (often) and the receiver always use perception to make sense of the message passing in the communication interchange. The perceiver processes the message's signs, its tangible factors, to determine the meaning (intended or not intended). These signs include what is seen, heard, felt, tasted, or smelled. The receiver then uses the mental filters of past experience to sort the signs and apply the meanings gained from similar past sensory experiences. Meaning derives from that past experience as one makes sense of the present through that experience.

The sender of a message may intend one meaning for what is sent, but the experiences the sender draws on in assigning that intended meaning may be only partly shared with the receiver. The meaning derived is thus imperfectly shared between the parties if at all. Few (if any) messages represent a pure transfer of identical meaning. While spoken communication is usually interpreted by the receiver almost immediately and often in a close spatial context (mass media and telephonic messages are obvious spatial exceptions), written communication is likely to be received and interpreted after some time lag and at a spatial distance. The context in which it is received will most likely have changed through time, and these changes may affect the perception of the message. Additionally, in any communication interchange, the very experience of receiving the message alters the receiver's perception and will affect the next message that comes through. Perception is a dynamic, ongoing process, as communication theorist C. Glenn Pearce noted, and the sender and receiver's own perceptual filters change constantly as a result of the interaction.

Communication And Intent

Even when unintentional, communication can still occur. A hapless job interviewee might make a poor first impression with unpolished shoes, a weak handshake, or slouching posture (elements of nonverbal communication). The interviewee likely intends to signal competence, but the outcome differs from that intended. Of course, much communication is intentional. The more effective sender learns skills to help achieve the intended results, but perception is still a major factor. Yet, if what one applies to interpret a message varies widely from the sender's intent, common meaning may not be achieved, especially in communication between cultures.

Communication Barriers

Communication barriers, elements external to the message, also complicate the process. Barriers can be as simple as physical noise or can derive from intrapersonal, interpersonal and even organizational sources. These barriers are inevitable and communicators (senders and receivers) need to work to overcome them (where possible) to enhance communication effectiveness.

Steven Golen's (1990) research into communication barriers has revealed their myriad sources and the challenges communicators face in overcoming them.

Some barriers are easier to overcome. Physical noise, for example, can be overcome by isolation or simple muting. However, the intrapersonal barrier of defensiveness is more challenging in calling for one's self-awareness and empathy. An organizational barrier like the serial transmission effect (the tendency for messages to change in passing through an organization's levels) calls for objective message management skills.

The goal of a message is to transmit information, knowledge the receiver does not already know. Shannon noted that the entropy rate, the amount of information the sender wishes to transmit, cannot exceed the channel capacity without creating uncorrectable transmission errors. Keeping the sender's entropy rate below channel capacity greatly reduces errors and enhances information transfer and helps combat communication barriers. Redundancy is another useful element in communication.

RECONCEPTUALISATION

So far, the word *concept* has come up quite a bit, and it is important to be sure we have a shared understanding of that term. A concept is the notion or image that we conjure up when we think of some cluster of related observations or ideas. For example, masculinity is a concept. What do you think of when you hear that word? Presumably, you imagine some set of behaviors and perhaps even a particular style of self-presentation. Of course, we can't necessarily assume that everyone conjures up the same set of ideas or images when they hear the word *masculinity*. While there are many possible ways to define the term and some may be more common or have more support than others, there is no universal definition of masculinity. What counts as masculine may shift over time, from culture to culture, and even from individual to individual. This is why defining our concepts is so important.

CONCLUSION

The conclusion is intended to help the reader understand why your research should matter to them after they have finished reading the paper. A conclusion is not merely a summary of the main topics covered or a re-statement of your research problem, but a synthesis of key points and, if applicable, where you recommend new areas for future research. For most college-level research papers, one or two well-developed paragraphs is sufficient for a conclusion, although in some cases, three or more paragraphs may be required.

The social sciences rest on two major components: theory and empirical research. There is a controversy about which of these components should come first. According to one school of thought, developed by Karl Popper, theory should come first, followed by research. Robert Merton and others have argued for a research then-theory argument, with empirical research suggesting new problems for theory, calling for new theoretical formulations, leading to the refinement of existing theories, and serving the function of verification.

3

Stages in Research Process

There are a variety of approaches to research in any field of investigation, irrespective of whether it is applied research or basic research. Each particular research study will be unique in some ways because of the particular time, setting, environment, and place in which it is being undertaken.

Nevertheless, all research endeavors share a common goal of furthering our understanding of the problem and thus all traverse through certain basic stages, forming a process called the research process.

An understanding of the research process is necessary to effectively carry out research and sequencing of the stages inherent in the process.

SELECTION OF A RESEARCH PROBLEM

There are some suggestion for the graduate students and researchers which are drawn from the different areas of education, social sciences as well as psychology. There are two factors in the selection of topic external and personal. External criteria involves how the topic is important for the field, availability of both data and data collection methods and the administration is cooperative or not. Personal Criteria means researcher own interest, time and cost. Criteria for selection of research problem depends on the following characteristics.

Personal Inclination. The chief motivation in the way of selecting research problem is the personal inclination of the researcher. If a researcher has personal interest in the topic, he would select that problem for his research work.

Resources Availability. During the selection, a researcher will see to the resources available. If these resources like money, time, accommodation and transport are available to the selection place, then the selection of the problem is easy.

Relative Importance. The importance and the problem also play a vital role in the selection of research problem. If the problem is relatively important, then the researcher tends towards the selection of the problem.

Researcher Knowledge. The researcher knowledge should play a vital role in the selection of the research problem. The wisdom and experience of an investigator is required for well collection of the research data. He can bitterly select a problem.

Practicality: Practicality is also responsible for the selection. The practical usefulness of the problem is the main motivation for a researcher to attend it.

Time-lines of the Problem. some problems take little time for its solution while others take more time. So, it depends on the time in which we have to complete his research work.

Data Availability. If the desired data is available to the researcher, then the problem would be selected.

Urgency. Urgency is a pinpoint in the way of the selection of research problem. Urgent problem must be given priority because the immediate solution can benefit the people.

Feasibility. Feasibility is also an important factor for the selection of the research problem. The researcher qualification, training and experience should match the problem.

Area Culture. The culture of the area for which a researcher conducts his research is also responsible for the selection of research problem.

Characteristic of Research Problem

Any research is a difficult task to achieve and research needs to do a great effort. Selection of research topic is the first step to success.

1. Research topic must be very clear and easy to understand. It should not distract people.
2. If a topic is well define is the only way to successful research. The topic should not create doubt and double impression.
3. Easy language is a key to success. Use technical words if necessary otherwise focus of simplicity.
4. Research title should be according to the rules of titling. There are different rules of titling, a researcher must aware before writing a research title.
5. While selecting a research topic current importance of a researcher should also be considered. Topic should not be obsolete and it should have great importance in the current day.

COMPONENTS OF FORMULATION OF A RESEARCH PROBLEM

Components of Research Problem Formulation

Research always stated from the words "what and why" and then the selection of suitable answers for these words. According to Morton, the important research components are the following three.

1. What a person wants to know?
2. Why a person wants to know?
3. Possible answers for these questions.

Conditions for Problem Formulation

Some of the important conditions for problem formulation are as under.

1. Knowledge about the selected area
2. Knowledge about the problem
3. Critical mind of the researcher

4. Availability of the resources
5. Research equipment & tools
6. Analysis experience
7. Findings and report writing

Research Proposal Process of Problem Formulation

Following are the main steps to take in the formulation of a research proposal.

1. Title of the problem
2. Statement of the problem
3. Overview of literature
4. Conceptual Framework
5. Objectives of the study
6. Hypothesis designing
7. Scope and universe
8. Tools of data collection
9. Methodology
10. Time Budgeting
11. Cost estimation
12. Research Report

Formulating your research problem with ease

Formulating your research problem enables you to make a purpose of your study clear to yourself and target readers. Focus your paper on providing relevant data to address it. A problem statement is an effective and essential tool to keep you on track with research and evaluate it. How can you formulate a powerful research problem? Consider 5 ways to formulate the research problem:

1. Specify your research objectives;
2. Review its context or environment;
3. Explore its nature;

4. Determine variable relationships;
5. Anticipate the possible consequences of alternative approaches.

Specific research objectives

A clear statement that defines all objectives can help you conduct and develop effective and meaningful research. They should be manageable to bring you success. A few goals will help you keep your study relevant. This statement also helps professors evaluation the questions your research project answers and different methods that you use to address them.

Review the context of your research problem

It's necessary to work hard to define and test all kinds of environmental variables to make your project successful. Why do you need to do that? This step can help you define if the important findings of your study will deliver enough data to be worth considering. Identify specific environmental variables that may potentially affect your research and start formulating effective methods to control all of them.

Why explore the nature of your research problem?

Research problems may range from simple to complex, and everything depends on a range of variables and their relationships. Some of them can be directly relevant to specific research questions, while others are completely unimportant for your project.

ROLE OF VALUES IN THE SELECTION OF A RESEARCH PROBLEM

A research problem is a statement about an area of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in scholarly literature, in theory, or in practice that points to the need for meaningful understanding and deliberate investigation. In some social science disciplines the research problem is typically posed in the form of a question. A research problem does not state how to do something, offer a vague or broad proposition, or present a value question.

SIZE OF THE PROBLEM

Math is not the only activity that requires problem solving; we're constantly problem solving socially when communicating with others, working in groups, doing homework, self-regulating, etc. Along the way, we encounter problems of different sizes that can cause negative emotions. We teach that it's expected to match the size of our reaction to the *size of the problem* (though this concept should be taught differently to different ages). For example, small problems warrant small reactions or none at all—however, this often requires emotional regulation—and that is easier said than done! In fact, some kids and adults get stuck focusing on their negative emotions instead of solving the problem—which can cause even more problems. Join Michelle Garcia Winner as she cracks open problem solving and emotional responses and shares developmentally based strategies to help individuals navigate it all. Plus, discover which Social Thinking materials will help you teach social problem solving across the ages!

Factors That Affect Sample Size

The purpose of estimating the appropriate sample size is to produce studies capable of detecting clinically relevant differences. Bearing this point in mind, there are different formulas to calculate sample size. These formulas comprise several aspects which are listed below. Most sample size calculators available on the web have limited validity because they use a single formula - which is usually not divulged - to generate sample sizes for the studies.

The first aspect is the type of variable being studied. For example, it should be determined if the variable is categorical like the Angle classification (Class I, II or III), or continuous like the length of the dental arch (usually measured in millimeters).

It is then necessary to determine the relationship between the groups that will be evaluated and the statistical analysis that will be employed. Are we going to evaluate groups that are independent, i.e., the measurements of one group do not influence the other? Are they dependent groups like the measurements taken before and after treatment? Are we going to use a split-mouth design, whereby treatment is performed on one quadrant and a different therapy on another quadrant? Will we be using t-test or chi-square test? All these questions lead to different sample size calculation formulas.

Subsequently, we have to answer the question concerning which results we envisage if a standard treatment is performed. What is the mean value or the expected ratio? The answer to this question is usually obtained from the literature or by means of pilot studies. It is also important to determine what is the smallest magnitude of the effect and the extent to which it is clinically relevant. For example, how many degrees of difference in the ANB angle can be considered relevant? It is vital that we address this issue. The smaller the difference that we wish to identify, the greater the number of cases in a study. If researchers wish to detect a difference as small as 0.1° in an ANB angle, they will probably need thousands of patients in their study. If this value rises to 1°, the number of cases required falls drastically.

Finally, it is essential that the researcher determine the level of significance and the type II error, which is the probability of not rejecting the null hypothesis, although the hypothesis is actually false, which the study will accept as reasonable.

With this information in hand, we will apply the appropriate formula according to the study design in question, and determine the sample size. Today, this calculation is typically carried out with the aid of a computer program. For example, Pocock's formula for continuous variables is frequently used in our specialty. It is used in studies where one wishes to examine the difference between data means with normal distribution and equal-size, independent groups.

The Problem of Sample Size

We shall now consider one of the trickiest problems relating to sampling, viz., the problem of sample size. "What should be the adequate size of the sample in relation to the size of population?" "How big ought to be a sample?" are questions often asked by research students. Xo decisive answer to this question can be given.

This is because the question of size can be answered only when we are sampling elements for the population in such a manner that each element has the same chance of being included in the sample, i.e., when we are adopting the probability design of sampling.

Only the probability design makes possible the formulation of representative sampling plans. Hence, makes it possible of the formulation of representative sampling plans.

Hence, the question, "how large the sample should be in order to be representative of the population of a designated size?" presupposes the probability sampling procedure. Failing this procedure, representativeness of the sample howsoever large can only be a matter of hope and conjecture.

The general misconceptions in regard to the size of the sample is that the size of the universe from which the sample is drawn determines the number of cases needed to yield an adequate or representative sample of that universe.

We shall do well to note right away that the emphasis should be placed not upon the number of cases in the universe but on their number in the sample.

The Mathematics of Sample-size

The basic practical question "How to determine the sample-size which will yield the desired degree of precision as stipulated by the researcher for a given study?" The sampling problem is, of course, the same in all studies, i.e., to estimate or predict something about the population on the basis of knowledge of something about the sample.

The researcher must know what kind of statistics on the sample will serve the purpose, e.g., percentages, averages, standard deviation, etc., for such an estimation. This is important because different kinds of statistics are useful depending on the desired degrees of precision in sample returns which in turn are afforded by different sample-sizes.

Averages and percentages are the more commonly desired statistics, we shall therefore deal specifically with the question of sample-sizes corresponding to the desired degrees of precision in respect of averages and percentages.

Since the sample drawn by the researcher is only one of the many possible samples of the universe that he might have happened to choose, he needs to know how much reliance he can place on the sample as the representative of the 'universe' about which he wants to know something or with reference to which he wishes to generalize.

He needs to know how large the sample should be to give him a satisfactory level of precision. This calculation is possible by recourse to mathematics since in random sampling (probability sampling design) where every item in the universe has a specifiable probability of inclusion in the sample, the precision of prediction or estimate is related to the square root of the number of items in the sample.

Before proceeding with the calculation of the requisite size of the sample for a given study, it is necessary in practice, to secure some preliminary information about the population or universe.

If the researcher intends to use the sample to make an estimate of the average measure of particular characteristic in the universe, he needs to have some preliminary estimate to the standard deviation (dispersion) in the distribution of the values of items in the universe with respect to the given characteristic.

The researcher who comes to know the range of values (the spread) in respect of a particular characteristic in the universe can get a preliminary estimate of the standard deviation by dividing this range by 6, since the standard deviation of the (finite) universe may for all practical purposes be taken to be around 1/6 of the full range of variation.

In other words, the range of dispersion of a distribution may be taken to comprise 6 standard deviation units. The preliminary information about the universe may be had by means of a pilot study, results of past surveys, from reports published by statistical bureaus, reckoning of experts in the field, etc.

The researcher, before proceeding to calculate the size of the sample, must decide the expected level of precision of the estimates. This expectation is based, in the main, on the purpose of the study.

ORGANISATIONAL VS. INDIVIDUAL RESEARCH

Social science tells us about the world beyond our immediate experience, and can help explain how our own society works - from the causes of unemployment or what helps economic growth, to how and why people vote, or what makes people happy. It provides vital information for governments and policymakers, local authorities, non-governmental organisations and others.

Organizational research and research on bureaucracy were once synonymous or nearly so, as the bureaucratic model was believed descriptive of all organizations, for-profit, non-profit, and governmental. Case studies of bureaucracy written during the 1950s and 1960s encompassed government agencies and industrial firms alike as evidenced by titles like Gouldner's (1954) *Patterns of Industrial Bureaucracy*. Early quantitative research on organizations, such as the work originating at Aston University and the University of Chicago, focused mainly on relations among elements of organizational structure (size, hierarchy, administrative ratio, formalization, centralization, etc.) that flowed from the bureaucratic model implicitly if not explicitly. As attention shifted to external causes of organizational outcomes, however, the bureaucratic model has become less relevant to organizational theory. Thus, for example, the key causal variable in resource dependence models of organizations is control of strategic resources, which is more germane to businesses than to government bureaus. The key dependent variables in organizational population ecology are births and deaths of organizations, which are infrequent in the public sector. The new institutional theory of organizations has downplayed Weber's notion of bureaucracy as rational administration and has substituted for it the notion that all organizations, bureaucratic and nonbureaucratic alike but especially the former, pursue social approval or legitimation by appearing to be rational rather than actual efficiency outcomes. Almost alone among major organizational theorists, Philip Selznick argues that the problem of bureaucracy remains a central issue in organizational theory: '… the ideal of an effective, fair, and responsive bureaucracy remains elusive. Our society desperately needs organized ways of dealing with social problems; we cannot rely solely on market strategies. Yet the specter of bureaucracy still haunts and repels, still saps public confidence and weakens support for collective action'.

The notion of self-organization

The notion of self-organization has been more robustly articulated since its inclusion within the complexity framework, however, it should not be thought of as a subordinate concept. Self-organization has been a pervasive idea in scientific thought, with a longstanding subject of inquiry in different fields of knowledge. The relation between self-organization and complexity should be seen more as one of cross-fertilization. The work of Nicolis and Prigogine (1977) on dissipative structures, for example, provided some of the philosophical foundations that allowed transferring the complexity framework, which had remained within the domain of physical systems, to biological systems, and, later, to social systems as well. In turn, it was the production on these latter fields which partly led to the realization that complexity should not be studied only in terms of structures, but also of processes. References to the notion of self-organization can be traced back to foundational classical and modern thinkers, such as Heraclitus, Descartes (1968) and Kant (1952). Current accounts of self-organization, however, commonly refer to Ashby's (1947) work in cybernetics as the contemporary precursor. Although in the early decades of the twentieth century different authors in the natural, biological and social sciences focused on self-organizing dynamics, Ashby is acknowledged as the first one using explicitly the concept 'self-organization' in a somewhat similar manner to contemporary accounts, among other things, because of its strong emphasis on the mereological character of self-organizing dynamics in complex systems. The further advancement of the concept and its inclusion into the complexity framework took a few more decades and were fostered by additional theoretical-methodological and technological developments, especially advances in computing.

Because of the overarching nature of complexity science, there is an overabundance of definitions of self-organization. A monolithic definition is unlikely, as well as undesirable. Gilbert et al. (2015) suggest there are four factors that are common across definitions: pattern formation, autonomy, robustness and resilience, and dynamics.

The first factor is associated with the product of the process of self-organization. The literature on self-organization contemplates several kinds of patterns and ways to measure them; in social science, many of the patterns of interest are usually designated by nominalized verbs (e.g. cooperation, segregation, stratification, normalization, etc). Autonomy deals with the controlling force or mechanism behind the process. As the prefix 'self' suggest, the concept deals with processes without coordination or central control. Price setting is one paradigmatic example of a self-organizing process in the social domain, for it emerges from the interaction between offer and demand.

Robustness and resilience are used to suggest self-organizing dynamics display a level of stability over time and space that makes their identification possible. Robustness refers to a system's ability to resist change whereas resilience allows for change but refers to the system's ability to endure despite this change. In social science, robustness and resilience often require subjective criteria, associated with the role given to the different intervening factors. Take, for example, the case of a political system that experiences a coup. Robustness and resilience could be linked to the regime's ability to appease civil unrest or to the revolutionary forces' ability to overthrow the regime without significantly changing the normative framework. The two concepts need not match every time. If the revolutionary forces succeed, the system might be considered to lack robustness, for political discomfort was not channelled through official mechanisms, eventually altering the regular operation of the system; yet resilient, because it does not totally dispense with prior political and social institutions.

Finally, dynamics refers to the processual part of the phenomenon. A self-organizing system will have variables and relations that vary in time; the analysis of the system is done considering this variability instead of focusing on the individual states. A well-known theoretical-methodological limitation in social science is accounting for spatio-temporal dynamics, this is the reason why new methodological approaches, such as agent-based modeling, have gained relevance in the study of self-organization in the social science domain.

DETERMINANTS OF INDIVIDUAL RESEARCH

Earlier researchers like Turkeli, suggested that 'the factors which determine the productivity of scientists are admittedly complex and perhaps not amenable to real scientific analysis2. The present investigation was designed with the sole purpose of confronting such a complex problem. Nearly 200 variables influencing research productivity were collected through relevant literature, analysis of biographies of great scientists, and discussion with eminent scientists. Finally, through a critical examination, 80 variables were selected for the use of Q-sort technique. The sample for the study consisted of a cross section of scientists ranging from Fellows of Indian National Science Academy to young agricultural scientists. Mailed questionnaires and personal interview methods were used for collecting data. Out of a total of 912 respondents, reply was obtained from 325. On the basis of Q-sorted data, 26 variables were selected for further analysis and they were subjected to principal component factor analysis.

The results indicated eleven factors affecting research productivity of scientists. They were: persistence, resource adequacy, access to literature, initiative, intelligence, creativity, learning capability, stimulative leadership, concern for advancement, external orientation, and professional commitment.

DEVELOPING THE IDEAS THROUGH EXPERIENCE SURVEY

A research design can be defined as the preparation of conditions, for the collection and analysis of data in such a manner, which aims at combining relevance to the research purpose with economy in procedure. In other words, the design arrangement of a research project is commonly known as the "research design". Besides, the decisions like what, where, when, how, etc., in regard to a research study, creates a research design. In fact, the research design is the conceptual structure within which a research is conducted. Moreover, it comprises the outline for the collection, measurement and analysis of data. Hence, the design carries a blueprint of what the researcher will do, from composing the hypothesis and its operational implications to the final analysis of data.

Develop the question wording

Survey questions can be classified into three forms, i.e. closed, open-ended and open response-option questions. So far only the first of these, i.e. closed questions has been discussed. This type of questioning has a number of important advantages;

- It provides the respondent with an easy method of indicating his answer - he does not have to think about how to articulate his answer.
- It 'prompts' the respondent so that the respondent has to rely less on memory in answering a question.
- Responses can be easily classified, making analysis very straightforward.
- It permits the respondent to specify the answer categories most suitable for their purposes.

Disadvantages are also present when using such questions

They do not allow the respondent the opportunity to give a different response to those suggested.

They 'suggest' answers that respondents may not have considered before.

With open-ended questions the respondent is asked to give a reply to a question in his/her own words. No answers are suggested.

Example: "What do you like most about this implement?"

Open-ended questions have a number of advantages when utilised in a questionnaire:

- They allow the respondent to answer in his own words, with no influence by any specific alternatives suggested by the interviewer.
- They often reveal the issues which are most important to the respondent, and this may reveal findings which were not originally anticipated when the survey was initiated.
- Respondents can 'qualify' their answers or emphasise the strength of their opinions.

However, open-ended questions also have inherent problems which means they must be treated with considerable caution. For example:

- Respondents may find it difficult to 'articulate' their responses i.e. to properly and fully explain their attitudes or motivations.
- Respondents may not give a full answer simply because they may forget to mention important points. Some respondents need prompting or reminding of the types of answer they could give.
- Data collected is in the form of verbatim comments - it has to be coded and reduced to manageable categories. This can be time consuming for analysis and there are numerous opportunities for error in recording and interpreting the answers given on the part of interviewers.
- Respondents will tend to answer open questions in different 'dimensions'. For example, the question: "When did you purchase your tractor?", could elicit one of several responses, viz:
  1. "A short while ago".
  2. "Last year".
  3. "When I sold my last tractor".
  4. "When I bought the farm".

Such responses need to be probed further unless the researcher is to be confronted with responses that cannot be aggregated or compared.

It has been suggested that the open response-option questions largely eliminate the disadvantages of both the afore-mentioned types of question.

An open response-option is a form of question which is both open-ended and includes specific response-options as well. For example,

What features of this implement do you like?

- Performance
- Quality
- Price

- Weight
- Others mentioned:

The advantages of this type of question are twofold:

- The researcher can avoid the potential problems of poor memory or poor articulation by then subsequently being able to prompt the respondent into considering particular response options.
- Recording during interview is relatively straightforward.

CONCLUSION

The importance of research problem lies in the fact that the entire research efforts which began with the articulation and formulation of research problem from the research topic led to further development of the research problem into questions, objectives and hypotheses that were tested to eventually arrive at results and findings, which compared with the objectives of the research (study) provide bases for conclusion and recommendations.

4

Hypothesis

A hypothesis is a research statement about relationships between variables that is testable and that can be accepted or rejected based on the evidence. Therefore, you can only develop hypotheses that are quantifiable. To design a study to test your hypothesis, you use quantitative research methods. Hypotheses are divided into two categories: research hypotheses and null hypotheses. The research hypothesis asserts that there is a relationship between the variables, and the null hypothesis claims that the relationship between the variables can be rejected. In other words, the null hypothesis is what the researcher is attempting to reject. For example, we may have a null hypothesis that no difference exists between a treatment group and a nontreatment group after intervention. If this is rejected, then the research hypothesis that the treatment group will be different from the nontreatment group after intervention (e.g., less sick or more educated) is supported. Hypotheses are typically abbreviated as Ho (null hypothesis), Ha (research hypothesis), and H1, H2, H3 (a number is used when there is more than one research hypothesis).

Imagine that you are working at an emergency shelter with a consumer named Joe. Joe is in need of permanent housing (he has been living on the streets for the past two years). While you are collecting assessment history with Joe, he discloses that he has a long history of drug abuse. One initial hypothesis may be “A history of substance abuse is related to not having stable housing." In further discussions with Joe, you explore this hypothesis with him, and he confirms that his substance abuse has interfered with his ability to seek and keep a job—a strong factor in his being homeless. You then decide to design a research study to determine if this relationship between substance abuse and homelessness exists beyond your client. You can also test a second hypothesis that looks at the relationship between substance abuse and unemployment.

Adopting a Sceptical Approach to Explanations

The need for research design stems from a sceptical approach to research and a view that scientific knowledge must always be provisional. The purpose of research design is to reduce the ambiguity of much research evidence. We can always find some evidence consistent with almost any theory. However, we should be sceptical of the evidence, and rather than seeking evidence that is consistent with our theory we should seek evidence that provides a compelling test of the theory. There are two related strategies for doing this: eliminating rival explanations of the evidence and deliberately seeking evidence that could disprove the theory.

A hypothesis (plural hypotheses) is a proposed explanation for a phenomenon. For a hypothesis to be a scientific hypothesis, the scientific method requires that one can test it. Scientists generally base scientific hypotheses on previous observations that cannot satisfactorily be explained with the available scientific theories. Even though the words "hypothesis" and "theory" are often used synonymously, a scientific hypothesis is not the same as a scientific theory. A working hypothesis is a provisionally accepted hypothesis proposed for further research, in a process beginning with an educated guess or thought.

A different meaning of the term *hypothesis* is used in formal logic, to denote the antecedent of a proposition; thus in the proposition "If P, then Q", P denotes the hypothesis (or antecedent); Q can be called a consequent. P is the assumption in a (possibly counterfactual) *What If* question. The adjective *hypothetical*, meaning "having the nature of a hypothesis", or "being assumed to exist as an immediate consequence of a hypothesis", can refer to any of these meanings of the term "hypothesis".

Uses

In Plato's *Meno* (86e–87b), Socrates dissects virtue with a method used by mathematicians, that of "investigating from a hypothesis." In this sense, 'hypothesis' refers to a clever idea or to a convenient mathematical approach that simplifies cumbersome calculations. Cardinal Bellarmine gave a famous example of this usage in the warning issued to Galileo in the early 17th century: that he must not treat the motion of the Earth as a reality, but merely as a hypothesis.

In common usage in the 21st century, a *hypothesis* refers to a provisional idea whose merit requires evaluation. For proper evaluation, the framer of a hypothesis needs to define specifics in operational terms. A hypothesis requires more work by the researcher in order to either confirm or disprove it. In due course, a confirmed hypothesis may become part of a theory or occasionally may grow to become a theory itself. Normally, scientific hypotheses have the form of a mathematical model. Sometimes, but not always, one can also formulate them as existential statements, stating that some particular instance of the phenomenon under examination has some characteristic and causal explanations, which have the general form of universal statements, stating that every instance of the phenomenon has a particular characteristic.

In entrepreneurial science, a hypothesis is used to formulate provisional ideas within a business setting. The formulated hypothesis is then evaluated where either the hypothesis is proven to be "true" or "false" through a verifiability- or falsifiability-oriented experiment.

Any useful hypothesis will enable predictions by reasoning (including deductive reasoning). It might predict the outcome of an experiment in a laboratory setting or the observation of a phenomenon in nature. The prediction may also invoke statistics and only talk about probabilities. Karl Popper, following others, has argued that a hypothesis must be falsifiable, and that one cannot regard a proposition or theory as scientific if it does not admit the possibility of being shown false. Other philosophers of science have rejected the criterion of falsifiability or supplemented it with other criteria, such as verifiability (e.g., verificationism) or coherence (e.g., confirmation holism). The scientific method involves experimentation, to test the ability of some hypothesis to adequately answer the question under investigation. In contrast, unfettered observation is not as likely to raise unexplained issues or open questions in science, as would the formulation of a crucial experiment to test the hypothesis. A thought experiment might also be used to test the hypothesis as well.

In framing a hypothesis, the investigator must not currently know the outcome of a test or that it remains reasonably under continuing investigation. Only in such cases does the experiment, test or study potentially increase the probability of showing the truth of a hypothesis. If the researcher already knows the outcome, it counts as a "consequence" — and the researcher should have already considered this while formulating the hypothesis. If one cannot assess the predictions by observation or by experience, the hypothesis needs to be tested by others providing observations. For example, a new technology or theory might make the necessary experiments feasible.

Scientific hypothesis

People refer to a trial solution to a problem as a hypothesis, often called an "educated guess" because it provides a suggested outcome based on the evidence. However, some scientists reject the term "educated guess" as incorrect. Experimenters may test and reject several hypotheses before solving the problem.

According to Schick and Vaughn, researchers weighing up alternative hypotheses may take into consideration:

- Testability
- Parsimony (as in the application of "Occam's razor", discouraging the postulation of excessive numbers of entities)
- Scope – the apparent application of the hypothesis to multiple cases of phenomena
- Fruitfulness – the prospect that a hypothesis may explain further phenomena in the future
- Conservatism – the degree of "fit" with existing recognized knowledge-systems.

Working hypothesis

A working hypothesis is a hypothesis that is provisionally accepted as a basis for further research in the hope that a tenable theory will be produced, even if the hypothesis ultimately fails. Like all hypotheses, a working hypothesis is constructed as a statement of expectations, which can be linked to the exploratory research purpose in empirical investigation. Working hypotheses are often used as a conceptual framework in qualitative research.

The provisional nature of working hypotheses makes them useful as an organizing device in applied research. Here they act like a useful guide to address problems that are still in a formative phase.

In recent years, philosophers of science have tried to integrate the various approaches to evaluating hypotheses, and the scientific method in general, to form a more complete system that integrates the individual concerns of each approach. Notably, Imre Lakatos and Paul Feyerabend, Karl Popper's colleague and student, respectively, have produced novel attempts at such a synthesis.

Hypotheses, concepts and Measurement

Concepts in Hempel's deductive-nomological model play a key role in the development and testing of hypotheses. Most formal hypotheses connect concepts by specifying the expected relationships between propositions. When a set of hypotheses are grouped together they become a type of conceptual framework. When a conceptual framework is complex and incorporates causality or explanation it is generally referred to as a theory. According to noted philosopher of science Carl Gustav Hempel "An adequate empirical interpretation turns a theoretical system into a testable theory: The hypothesis whose constituent terms have been interpreted become capable of test by reference to observable phenomena. Frequently the interpreted hypothesis will be derivative hypotheses of the theory; but their confirmation or disconfirmation by empirical data will then immediately strengthen or weaken also the primitive hypotheses from which they were derived."

Hempel provides a useful metaphor that describes the relationship between a conceptual framework and the framework as it is observed and perhaps tested (interpreted framework). "The whole system floats, as it were, above the plane of observation and is anchored to it by rules of interpretation. These might be viewed as strings which are not part of the network but link certain points of the latter with specific places in the plane of observation. By virtue of those interpretative connections, the network can function as a scientific theory." Hypotheses with concepts anchored in the plane of observation are ready to be tested. In "actual scientific practice the process of framing a theoretical structure and of interpreting it are not always sharply separated, since the intended interpretation usually guides the construction of the theoretician." It is, however, "possible and indeed desirable, for the purposes of logical clarification, to separate the two steps conceptually."

Statistical hypothesis Testing

When a possible correlation or similar relation between phenomena is investigated, such as whether a proposed remedy is effective in treating a disease, the hypothesis that a relation exists cannot be examined the same way one might examine a proposed new law of nature. In such an investigation, if the tested remedy shows no effect in a few cases, these do not necessarily falsify the hypothesis. Instead, statistical tests are used to determine how likely it is that the overall effect would be observed if the hypothesized relation does not exist. If that likelihood is sufficiently small (e.g., less than 1%), the existence of a relation may be assumed. Otherwise, any observed effect may be due to pure chance.

In statistical hypothesis testing, two hypotheses are compared. These are called the null hypothesis and the alternative hypothesis. The null hypothesis is the hypothesis that states that there is no relation between the phenomena whose relation is under investigation, or at least not of the form given by the alternative hypothesis.

The alternative hypothesis, as the name suggests, is the alternative to the null hypothesis: it states that there *is* some kind of relation. The alternative hypothesis may take several forms, depending on the nature of the hypothesized relation; in particular, it can be two-sided (for example: there is *some* effect, in a yet unknown direction) or one-sided (the direction of the hypothesized relation, positive or negative, is fixed in advance).

Conventional significance levels for testing hypotheses (acceptable probabilities of wrongly rejecting a true null hypothesis) are .10, .05, and .01. The significance level for deciding whether the null hypothesis is rejected and the alternative hypothesis is accepted must be determined in advance, before the observations are collected or inspected. If these criteria are determined later, when the data to be tested are already known, the test is invalid.

The above procedure is actually dependent on the number of the participants (units or sample size) that are included in the study. For instance, to avoid having the sample size be too small to reject a null hypothesis, it is recommended that one specify a sufficient sample size from the beginning. It is advisable to define a small, medium and large effect size for each of a number of important statistical tests which are used to test the hypotheses.

NATURE AND MEANING

Nature of Hypothesis

An hypothesis is a proposed explanation for an observable phenomenon. The term derives from the Greek, meaning "to put under" or "to suppose." For a hypothesis to be put forward as a scientific hypothesis, the scientific method requires that one can test it. Scientists generally base scientific hypotheses on previous observations that cannot satisfactorily be explained with the available scientific theories. Even though the words " hypothesis" and "theory" are often used synonymously in common and informal usage, a scientific hypothesis is not the same as a scientific theory. A working hypothesis is a provisionally accepted hypothesis. In a related but distinguishable usage, the term hypothesis is used for the antecedent of a proposition; thus in proposition "If P, then Q", P denotes the hypothesis; Q can be called a consequent. P is the assumption in a What If question. The adjective hypothetical, meaning "having the nature of a hypothesis," or "being assumed to exist as an immediate consequence of a hypothesis," can refer to any of these meanings of the term " hypothesis."

Uses

In its ancient usage, hypothesis also refers to a summary of the plot of a classical drama. In Plato's Meno, Socrates dissects virtue with a method used by mathematicians, that of "investigating from a hypothesis." In this sense, ' hypothesis' refers to a clever idea or to a convenient mathematical approach that simplifies cumbersome calculations. Cardinal Bellarmine gave a famous example of this usage in the warning issued to Galileo in the early 17th century: that he must not treat the motion of the Earth as a reality, but merely as a hypothesis. In common usage in the 21st century, a hypothesis refers to a provisional idea whose merit requires evaluation. For proper evaluation, the framer of a hypothesis needs to define specifics in operational terms. A hypothesis requires more work by the researcher in order to either confirm or disprove it. In due course, a confirmed hypothesis may become part of a theory or occasionally may grow to become a theory itself. Normally, scientific hypotheses have the form of a mathematical model.

Sometimes, but not always, one can also formulate them as existential statements, stating that some particular instance of the phenomenon under examination has some characteristic and causal explanations, which have the general form of universal statements, stating that every instance of the phenomenon has a particular characteristic. Any useful hypothesis will enable predictions by reasoning. It might predict the outcome of an experiment in a laboratory setting or the observation of a phenomenon in nature. The prediction may also invoke statistics and only talk about probabilities. Karl Popper, following others, has argued that a hypothesis must be falsifiable, and that one cannot regard a proposition or theory as scientific if it does not admit the possibility of being shown false. Other philosophers of science have rejected the criterion of falsifiability or supplemented it with other criteria, such as verifiability or coherence.

The scientific method involves experimentation on the basis of hypotheses to answer questions and explore observations. In framing a hypothesis, the investigator must not currently know the outcome of a test or that it remains reasonably under continuing investigation. Only in such cases does the experiment, test or study potentially increase the probability of showing the truth of a hypothesis. If the researcher already knows the outcome, it counts as a "consequence" — and the researcher should have already considered this while formulating the hypothesis. If one cannot assess the predictions by observation or by experience, the hypothesis classes as not yet useful, and must wait for others who might come afterward to make possible the needed observations. For example, a new technology or theory might make the necessary experiments feasible.

Scientific Hypothesis

People refer to a trial solution to a problem as a hypothesis — often called an "educated guess" — because it provides a suggested solution based on the evidence. Experimenters may test and reject several hypotheses before solving the problem. Schick and Vaughn, researchers weighing up alternative hypotheses may take into consideration:

- Testability
- Simplicity
- *Scope*: The apparent application of the hypothesis to multiple cases of phenomena
- *Fruitfulness*: The prospect that a hypothesis may explain further phenomena in the future
- *Conservatism*: The degree of "fit" with existing recognized knowledge-systems.

Evaluating Hypotheses

Karl Popper's formulation of hypothetico-deductive method, which he called the method of "conjectures and refutations", demands falsifiable hypotheses, framed in such a manner that the scientific community can prove them false. This view, a hypothesis cannot be "confirmed", because there is always the possibility that a future experiment will show that it is false. Hence, failing to falsify a hypothesis does not prove that hypothesis: it remains provisional. However, a hypothesis that has been rigorously tested and not falsified can form a reasonable basis for action, *i.e*, we can act as if it were true, until such time as it is falsified. Just because we've never observed rain falling upward, doesn't mean that we never will—however improbable, our theory of gravity may be falsified some day. Popper's view is not the only view on evaluating hypotheses. For example, some forms of empiricism hold that under a well-crafted, well-controlled experiment, a lack of falsification does count as verification, since such an experiment ranges over the full scope of possibilities in the problem domain. Should we ever discover some place where gravity did not function, and rain fell upward, this would not falsify our current theory of gravity– it would rather suggest an expansion of our theory to encompass some new force or previously undiscovered interaction of forces.

In other words, our initial theory as it stands is verified but incomplete. This situation shows the importance of having well-crafted, well-controlled experiments that range over the full scope of possibilities for applying the theory. In recent years philosophers of science have tried to integrate the various approaches to evaluating hypotheses, and the scientific method in general, to form a more complete system that integrates the individual concerns of each approach. Notably, Imre Lakatos and Paul Feyerabend, both former students of Popper, have produced novel attempts at such a synthesis.

Hypotheses, Concepts and Measurement

Concepts, as abstract units of meaning, play a key role in the development and testing of hypotheses. Concepts are the basic components of hypotheses. Most formal hypotheses connect concepts by specifying the expected relationships between concepts. For example, a simple relational hypothesis such as "education increases income" specifies a positive relationship between the concepts "education" and "income." This abstract or conceptual hypothesis cannot be tested. First, it must be operationalized or situated in the real world by rules of interpretation.

Consider again the simple hypothesis "Education increases Income." To test the hypothesis the abstract meaning of education and income must be derived or operationalized. The concepts should be measured. Education could be measured by "years of school completed" or "highest degree completed" etc. Income could be measured by "hourly rate of pay" or "yearly salary" etc. When a set of hypotheses are grouped together they become a type of conceptual framework. When a conceptual framework is complex and incorporates causality or explanation it is generally referred to as a theory. A philosopher of science Carl Gustav Hempel "An adequate empirical interpretation turns a theoretical system into a testable theory: The hypothesis whose constituent terms have been interpreted become capable of test by reference to observable phenomena. Frequently the interpreted hypothesis will be derivative hypotheses of the theory; but their confirmation or disconfirmation by empirical data will then immediately strengthen or weaken also the primitive hypotheses from which they were derived."

Hempel provides a useful metaphor that describes the relationship between a conceptual framework and the framework as it is observed and perhaps tested. "The whole system floats, as it were, the plane of observation and is anchored to it by rules of interpretation. These might be viewed as strings which are not part of the network but link certain points of the latter with specific places in the plane of observation. By virtue of those interpretative connections, the network can function as a scientific theory" Hypotheses with concepts anchored in the plane of observation are ready to be tested. In "actual scientific practice the process of framing a theoretical structure and of interpreting it are not always sharply separated, since the intended interpretation usually guides the construction of the theoretician." It is, however, "possible and indeed desirable, for the purposes of logical clarification, to separate the two steps conceptually."

ORIGIN OF HYPOTHESIS

Hypothesis, something supposed or taken for granted, with the object of following out its consequences.

In planning a course of action, one may consider various alternatives, working out each in detail. Although the word *hypothesis* is not typically used in this case, the procedure is virtually the same as that of an investigator of crime considering various suspects. Different methods may be used for deciding what the various alternatives may be, but what is fundamental is the consideration of a supposal as if it were true, without actually accepting it as true. One of the earliest uses of the word in this sense was in geometry. It is described by Plato in the *Meno*.

The most important modern use of a hypothesis is in relation to scientific investigation. A scientist is not merely concerned to accumulate such facts as can be discovered by observation: linkages must be discovered to connect those facts. An initial puzzle or problem provides the impetus, but clues must be used to ascertain which facts will help yield a solution. The best guide is a tentative hypothesis, which fits within the existing body of doctrine. It is so framed that, with its help, deductions can be made that under certain factual conditions ("initial conditions") certain other facts would be found if the hypothesis were correct.

The concepts involved in the hypothesis need not themselves refer to observable objects. However, the initial conditions should be able to be observed or to be produced experimentally, and the deduced facts should be able to be observed. William Harvey's research on circulation in animals demonstrates how greatly experimental observation can be helped by a fruitful hypothesis. While a hypothesis can be partially confirmed by showing that what is deduced from it with certain initial conditions is actually found under those conditions, it cannot be completely proved in this way. What would have to be shown is that no other hypothesis would serve. Hence, in assessing the soundness of a hypothesis, stress is laid on the range and variety of facts that can be brought under its scope. Again, it is important that it should be capable of being linked systematically with hypotheses which have been found fertile in other fields.

If the predictions derived from the hypothesis are not found to be true, the hypothesis may have to be given up or modified. The fault may lie, however, in some other principle forming part of the body of accepted doctrine which has been utilized in deducing consequences from the hypothesis. It may also lie in the fact that other conditions, hitherto unobserved, are present beside the initial conditions, affecting the result. Thus the hypothesis may be kept, pending further examination of facts or some remodeling of principles. A good illustration of this is to be found in the history of the corpuscular and the undulatory hypotheses about light.

SOURCES OF HYPOTHESIS

The derivation of a good hypothesis demands characteristic of experience and creativity. Though hypothesis should precede the gathering of data, a good hypothesis can come only from experience. Some degree of data gathering, the review of related literature, or a pilot study must precede the development and gradual refinement of the hypothesis. A good investigator must have not only an alert mind capable of deriving relevant hypothesis, but also a critical mind capable of rejecting faulty hypothesis. What is the source of hypotheses? They may be derived directly from the statement of the problem; they may be based on the research literature, or in some cases, such as in ethnographic research, they may (at least in part) be generated from data collection and analysis. The various sources of hypotheses may be:

- Review of similar studies in the area or of the studies on similar problems;
- Examination of data and records, if available, concerning the problem for possible trends, peculiarities and other clues;
- Discussions with colleagues and experts about the problem, its origin and the objectives in seeking a solution.
- Exploratory personal investigation which involves original field interviews on a limited scale with interested parties and individuals with a view to secure greater insight into the practical aspects of the problem.
- Intuition is often considered a reasonable source of research hypotheses — especially when it is the intuition of a well-known researcher or theoretician who “knows what is known”

- Rational Induction is often used to form "new hypotheses" by logically combining the empirical findings from separate areas of research
- Prior empirical research findings are perhaps the most common source of new research hypotheses, especially when carefully combined using rational induction
- Thus hypothesis are formulated as a result of prior thinking about the subject, examination of the available data and material including related studies and the council of experts.

TYPES OF HYPOTHESIS

Research hypothesis: When a prediction or a hypothesized relationship is to be tested by scientific methods, it is termed as research hypothesis. The research hypothesis is a predictive statement that relates an independent variable to a dependent variable. Usually a research hypothesis must contain, at least, one independent and one dependent variable. A research hypothesis must be stated in a testable form for its proper evaluation. As already stressed, this form should indicate a relationship between the variables in clear, concise, and understandable language. Research hypotheses are classified as being directional or non-directional.

Directional hypothesis: The hypotheses which stipulate the direction of the expected differences or relationships are terms as directional hypotheses. For example, the research hypothesis: "There will be a positive relationship between individual's attitude towards high caste Hindus and his socio-economic status," is a directional research hypothesis. This hypothesis stipulates that individuals with favourable attitude towards high cast Hindus will generally come from higher socio-economic Hindu families and therefore it does stipulate the direction of the relationship. Similarly, the hypothesis: "Adolescent boys with high IQ will exhibit low anxiety than adolescent boys with low IQ" is a directional research hypothesis because it stipulates the direction of the difference between groups.

Non-directional hypothesis: A research hypothesis which does not specify the direction of expected differences or relationships is a non-directional research hypothesis.

For example, the hypotheses: "There will be difference in the adaptability of fathers and mothers towards rearing of their children" or "There is a difference in the anxiety level of adolescent girls of high IQ and low IQ" are non-directional research hypotheses. Although these hypotheses stipulate there will be a difference, the direction of the difference is not specified. A research hypothesis can take either statistical form, declarative form, the null form, or the question form.

Statistical hypothesis: When it is time to test whether the data support or refute the research hypothesis, it needs to be translated into a statistical hypothesis.

A statistical hypothesis is given in statistical terms. Technically, in the context of inferential statistics, it is a statement about one or more parameters that are measures of the populations under study. Statistical hypotheses often are given in quantitative terms, for example: "The *mean* reading achievement of the population of third-grade students taught by Method A equals the *mean* reading achievement of the population taught by Method B."

Therefore we can say that statistical hypotheses are, concerned with populations under study. We use inferential statistics, to draw conclusions about population values even though we have access to only a sample of participants.

In order to use inferential statistics, we need to translate the research hypothesis into a testable form, which is called the null hypothesis. An alternative or declarative hypothesis indicates the situation corresponding to when the null hypothesis is not true. The stated hypothesis will differ depending on whether or not it is a directional research hypothesis.

Declarative hypothesis: When the researcher makes a positive statement about the outcome of the study, the hypothesis takes the declarative form. For example, the hypothesis: "The academic achievement of extroverts is significantly higher than that of the introverts," is stated in the declarative form.

In such a statement of hypothesis, the researcher makes a prediction based on his theoretical formulations of what should happen if the explanations of the behaviour he has given in his theory are correct.

Null hypothesis: In the null form, the researcher makes a statement that no relationship exists. The hypothesis, "There is no significant difference between the academic achievement of high school athletes and that of non athletes," is an example of null hypothesis.

Since null hypotheses can be tested statistically, they are often termed as statistical hypotheses.

They are also called the testing hypotheses when declarative hypotheses are tested statistically by converting them into null form. It states that even where it seems to hold good it is due to mere chance. It is for the researcher to reject the null hypothesis by showing that the outcome mentioned in the declarative hypothesis does occur and the quantum of it is such that it cannot be easily dismissed as having occurred by chance.

Question form hypothesis: In the question form hypothesis, a question is asked as to what the outcome will be instead of stating what outcome is expected. Suppose a researcher is interested in knowing whether programmed instruction has any relationship to test anxiety of children.

- The declarative form of the hypothesis might be: "Teaching children through the programmed instruction material will decrease their test anxiety".
- The null form would be: "teaching children through programmed instruction material will have no effect on their test anxiety.' This statement shows that no relationship exists between programmed instruction and test anxiety.

- The question form puts the statement in the form: "Will teaching children through programmed instruction decrease their test anxiety?"

FORMULATION OF HYPOTHESIS

Hypotheses are guesses or tentative generalizations, but these guesses are not merely accidents. Collection of factual information alone does not lead to successful formulation of hypotheses.

Hypotheses are the products of considerable speculation and imaginative guess work. They are based partly on known facts and explanations, and partly conceptual. There are no precise rules for formulating hypotheses and deducing consequences from them that can be empirically verified. However, there are certain necessary conditions that are conducive to their formulation. Some of them are:

- *Richness of background knowledge*. A researcher may deduce hypotheses inductively after making observations of behaviour, noticing trends or probable relationships. For example, a classroom teacher daily observes student behaviour. On the basis of his experience and his knowledge of behaviour in a school situation, the teacher may attempt to relate the behaviour of students to his own, to his teaching methods, to changes in the school environment, and so on. From these observed relationships, the teacher may inductively formulate a hypothesis that attempts to explain such relationships.

Background knowledge, however, is essential for perceiving relationships among the variables and to determine what findings other researchers have reported on the problem under study. New knowledge, new discoveries, and new inventions should always form continuity with the already existing corpus of knowledge and, therefore, it becomes all the more essential to be well versed with the already existing knowledge.

Hypotheses may be formulated correctly by persons who have rich experiences and academic background, but they can never be formulated by those who have poor background knowledge.

- *Versatility of intellect*: Hypotheses are also derived through deductive reasoning from a theory. Such hypotheses are called deductive hypotheses. A researcher may begin a study by selecting one of the theories in his own area of interest. After selecting the particular theory, the researcher proceeds to deduce a hypothesis from this theory through symbolic logic or mathematics. This is possible only when the researcher has a versatile intellect and can make use of it for restructuring his experiences. Creative imagination is the product of an adventure, sound attitude and agile intellect. In the hypotheses formulation, the researcher works on numerous paths. He has to take a consistent effort and develop certain habits and attitudes. Moreover, the researcher has to saturate himself with all possible information about the problem and then think liberally at it and proceed further in the conduct of the study.
- *Analogy and other practices*. Analogies also lead the researcher to clues that he might find useful in the formulation of hypotheses and for finding solutions to problems. For example, suppose a new situation resembles an old situation in regard to a factor X. If the researcher knows from previous experience that the old situation is related to other factors Y and Z as well as to X, he reasons that perhaps a new situation is also related to Y and Z. The researcher, however, should use analogies with caution as they are not fool proof tools for finding solutions to problems. At times, conversations and consultations with colleagues and expert from different fields are also helpful in formulating important and useful hypotheses.

Characteristics of a Good Hypothesis

Hypothesis must possess the following characteristics:

i) Hypothesis should be clear and precise. If the hypothesis is not clear and precise, the inferences drawn on its basis cannot be taken as reliable.

ii) Hypothesis should be capable of being tested. Some prior study may be done by researcher in order to make hypothesis a testable one. A hypothesis "is testable if other deductions can be made from it which, in turn, can be confirmed or disproved by observation."

iii) Hypothesis should state relationship between variables, if it happens to be a relational hypothesis.

iv) Hypothesis should be limited in scope and must be specific. A researcher must remember that narrower hypotheses are generally more testable and he should develop such hypotheses.

v) Hypothesis should be stated as far as possible in most simple terms so that the same is easily understandable by all concerned. But one must remember that simplicity of hypothesis has nothing to do with its significance.

vi) Hypothesis should be consistent with most known facts i.e. it must be consistent with a substantial body of established facts. In other words, it should be one which judges accept as being the most likely.

vii) *The hypotheses selected should be amenable to testing within a reasonable time*. The researcher should not select a problem which involves hypotheses that are not agreeable to testing within a reasonable and specified time. He must know that there are problems that cannot be solved for a long time to come. These are problems of immense difficulty that cannot be profitably studied because of the lack of essential techniques or measures.

viii) Hypothesis must explain the facts that gave rise to the need for explanation. This means that by using the hypothesis plus other known and accepted generalizations, one should be able to deduce the original problem condition. Thus hypothesis must actually explain what it claims to explain, it should have empirical reference.

PROBLEMS IN FORMULATING HYPOTHESIS

Scientific process or all empirical sciences are recognised by two inter-related concepts, namely; (a) context of discovery (getting an idea) and (b) context of justification (testing and results). Hypotheses are the mechanism and container of knowledge moving from the unknown to known. These elements form techniques and testing ground for scientific discovery. Hypotheses are tentative explanation and potential answer to a problem. Hypothesis gives the direction and helps the researcher interpret data. In this unit, you will be familiarised with the term hypothesis and its characteristics. It is, then, followed by the hypothesis formulation and types of hypothesis. Errors in hypothesis testing are also highlighted.

In the formulation of useful hypothesis, there are three difficulties :

1. Absence of clear theoretical Framework : Generally, theoretical knowledge is found as unclean and ambiguous which presents difficulty in understanding, therefore, useful hypotheses cannot be derived from these.
2. Lack of ability to utilize theoretical framework : There is a need of intelligence and observation ability to avail the theoretical knowledge so that through deduction, the formulation of hypothesis be done from theoretical knowledge but because of lack of this ability theoretical knowledge cannot be availed and there is difficulty in meeting useful hypotheses.
3. Lack of Acquaintance with available research techniques : Scientific research procedure is so complicated and vast that complete knowledge and its correct use is difficult and to formulate useful hypothesis, there is a hesitation and Worry in the minds that how to test them.

CRITERIA FOR JUDGING HYPOTHESIS

Meaning of Hypothesis

In order to make the problem explicit and in order to focus attention in its solution, it is essential to start with certain known theories. Research, in real terms, depends upon a continuous interplay of theory and facts, upon a continuous stimulation of facts by theory and theory by facts. Theory is initiated by facts and facts lead to the rejection or reformulation of existing theory. Facts may also redefine or clarify the theory.

Hampel has compared a scientific theory to a network in which the terms and concepts are represented by knots and definitions and hypothesis by threads connecting the knots. From certain observational data we derive an interpretative string to some points in the theoretical framework. Then we proceed through definitions and hypothesis to other points from which another interpretative string permits to the plane of observation.

Theory thus gives meaning to empirically observed facts and puts them systematically. Theory is also built upon facts and various facts put in a theoretically framework may be analyzed and interpreted in a logical manner. Grounded on old facts and with the help of theoretical framework, new facts are discovered. In the process, certain deductions are formulated which are called hypotheses.

Thus "after internalizing the problem, after turning back on experience for possible solutions, after observing relevant phenomena, the scientist may formulate a hypothesis." "A Hypothesis is a conjectural statement, a tentative proposition about relation between two or more phenomena or variables". It is a tentative generalization, the validity of which remains to be tested.

At its initial stage, a hypothesis may be an imagined idea or a hunch or a mere guess. It is in the form of a declarative sentence and always indicates relation of one or more variable(s) with other variable(s) in a general or specific way. It is mostly based on accumulated knowledge. A hypothesis is made to examine the correct explanation of a phenomenon through investigation, to observe facts on the basis of collected data. If on the basis of verification, the hypothesis is found to be valid, a theory is obtained. Thus, hypothesis a theory entertained in order to study the facts and find out the validity of the theory.

The etymological meaning of hypothesis, therefore, is a theory which is not full reasoned, derived out of the combination of two words 'hypo' and 'thesis' meaning 'less than' and 'reasoned theory of rational view point' respectively. Accordingly Mill defines hypothesis as "any supposition which we make (either without actual evidence or an evidence avowedly insufficient) in order to endeavor to deduce conclusions in accordance with facts which are known to be real, under the idea that if the conclusions to which the hypothesis leads are known truths, the hypothesis itself either must be or at least likely to be, true". Likewise, Goode and Hatt define it as "a proposition which can be put to test to determine validity".

P.V. Young says that a hypothesis "is provisional central idea which becomes the basis for fruitful investigation, known as working theory" Coffey defines hypothesis as "an attempt at explanation : a provisional supposition made in order to explain scientifically some facts or phenomena". Hypothesis is not a theory; rather hypotheses are linked and related to theory which is more elaborate in nature as compared to hypothesis.

Therefore William H. George, while distinguishing between theory and hypothesis, described theory as 'elaborate hypothesis'. Hypothesis is not a claim of truth, but a claim for truth and hence serves as a bridge in the process of investigation which begins with a problem and ends with resolution of the problem. In the words of Cohen and Nagel "a hypothesis directs our search for the order."

Criteria for Formulation of Hypothesis

There exist two criteria for formulation of a good hypothesis. First, it is a statement about the relations between variables.

Secondly it carries clear implications for testing the stated relations. Thus, these couple of criteria imply that the hypotheses comprise two or more variables which are measurable or potentially measurable and that they specify the way in which they are related. A statement which fails to meet these criteria is no scientific hypothesis in the true sense of the term. However, there are legitimate hypotheses, formulated in factor analytic studies.

The following examples may be cited in order to justify how the couple of criteria apply to hypotheses:

1. More intelligent persons will be less hostile than those of lower level of intelligence.
2. Group study contributes to higher grade achievement.

In the first hypothesis, we visualize a relation stated between one variable, 'intelligence', and another variable 'hostility.' Furthermore, measurement of these variables is also easily conceivable. In the second example, a relation has also been stated between the variables 'group study' and 'grade achievement.' There exists the possibility of the measurement of the variables are thus there is implication for testing the hypotheses. Thus both the criteria are satisfied. '

Types of Hypothesis

Hypotheses may be of various kinds. It may be crude or refined. A crude hypothesis is at the lower level of abstraction, indicating only the kind of data to be collected, not leading to higher theoretical research. On the contrary, the refined hypothesis appears to be more significant in research.

It may be in the form of describing something in a given instance, that a particular object, situation or event has certain characteristics. It may be in the form of counting the frequencies or of association among the variables. It may be in the form of causal relationship that a particular characteristic or occurrence is one of the causes determining the other.

On the basis of levels of abstraction, Goode and Hatt have distinguished three broad types of hypotheses.

First, there are the simple levels of hypotheses indicating merely the uniformity in social behaviour. They are the most exact and the least abstract, as they state the existence of presence of empirical uniformities. Often it is said that such hypotheses do not involve much verification or do not require testing at all and they merely add up facts. But it is not correct to say so. Even empirical researches describing certain facts need testing of hypotheses and testing may result in providing with an altogether different profile.

Secondly, there are complex ideal hypotheses at a higher level of abstraction. These are more complex and aim at testing the existence of logically derived relationships between empirical uniformities. They are in the form of generalization, and therefore are also a little abstract. But empirical relationships are important in their context. Such hypotheses are useful in developing tools of analysis and in providing constructs for further hypothesizing.

Thirdly, there are hypotheses which are very complex and quite abstract. They are concerned with the interrelations of multiple analytic variables. They lead to the formulation of a relationship between changes in one property and changes in another.

The above kinds of hypotheses may be explained in an example. On the basis of empirical data we may show statistical regularity by wealth, religion region, size of community culture, tradition, health etc. First, we may formulate hypotheses in a simple manner on the basis of statistical regularity. Secondly, in order to formulate a complex ideal hypothesis we may combine all the factors together. As regards the formulation of the third category of hypothesis, more abstraction is brought in.

Only one of the factors can be studied at a time, such as relationship between religion and fertility or wealth and fertility, and all other variables may be controlled. Obviously, it is a very abstract way of handling the problem, because people may be affected by a multiplicity of variables. Yet, we are interested in studying the cause and effect relationship of one factor at one time. Hence, this level of hypothesizing is not only more abstract, simultaneously it is more sophisticated and provides scope for further research.

PROOF OF HYPOTHESIS

While the term sounds like something from a science test, marketers intent on boosting their digital results are increasingly turning to scientific methods to squeeze a little more juice from their online campaigns.

If you want the most leads, revenue, and rate of return, here are the steps to follow. The scientific method just met the digital marketing world, and you're about to reap the rewards.

Here's how to use hypothesis testing to boost the results of all of your B2B marketing campaigns.

Hypothesis Testing

Just like you learned in science class, hypothesis testing is the process of making an observation, forming a question based on the information that you've gleaned, and then attempting to solve that problem using the scientific method.

That's the simplified version. The beauty of the scientific method is that it's gradual and deliberate and each phase is recorded – and your hypothesis continually altered – until you've come to a solid enough conclusion.

While using hypothesis testing and the scientific method to get more results from marketing is not a new phenomenon, you are at a distinct advantage over marketers of the past.

That's because you have a myriad of tools you can use to test and collect relevant data in order to prove (or disprove) the hypotheses you construct.

In this way, marketing can be akin to a science. Your job is to ask the right questions and then devise the proper tests to prove your theories.

The end result, of course, will be a web presence that your audience expects. It attracts leads *en masse* and churns out conversions while ramping up revenue and ROI. Sounds amazing, doesn't it? Here's how to start forming hypotheses to make all that happen for your B2B campaigns.

What a Hypothesis Is – And What it Isn't

A hypothesis is nothing more than a question based on a particular observation that you will then set out to prove.

For a question to be a hypothesis, it must be provable using actual data.

For instance, you can prove if altering a headline will increase conversions by up to 20%. You shouldn't form a hypothesis that states, "Will changing the title boost conversions?"

In other words, your hypotheses should be concrete, not vague. However, as you continually test and prove or disprove your hypothesis, you are encouraged to continually alter them and manipulate them until you come to valid and provable conclusions.

To form a proper hypothesis, you must develop an inherent curiosity about the minutiae of your web campaigns. You must be willing to dig into the details.

Here's a great example. Let's say that you have ten blog posts. Two are highly successful. They receive a ton of views, experience extended times on site, and they're shared on various social channels.

By all accounts, those blogs are certainly ones to emulate.You observe that the successful blogs have larger images and shorter paragraphs than the other, less successful posts.

Your hypothesis might then be to ask, "Will the other blogs receive just as much attention with larger images and better formatting?"

You can then run tests to gauge the accuracy of your hypothesis. By making the other blogs' images larger and paragraphs shorter, did more traffic arrive? Did more shares occur? That's hypothesis testing in a nutshell.

ROLE OF HYPOTHESIS IN SCIENCE

Scientific hypothesis, an idea that proposes a tentative explanation about a phenomenon or a narrow set of phenomena observed in the natural world. The two primary features of a scientific hypothesis are falsifiability and testability, which are reflected in an "If…then" statement summarizing the idea and in the ability to be supported or refuted through observation and experimentation. The notion of the scientific hypothesis as both falsifiable and testable was advanced in the mid-20th century by Austrian-born British philosopher Karl Popper.

The formulation and testing of a hypothesis is part of the scientific method, the approach scientists use when attempting to understand and test ideas about natural phenomena. The generation of a hypothesis frequently is described as a creative process and is based on existing scientific knowledge, intuition, or experience. Therefore, although scientific hypotheses commonly are described as educated guesses, they actually are more informed than a guess. In addition, scientists generally strive to develop simple hypotheses, since these are easier to test relative to hypotheses that involve many different variables and potential outcomes. Such complex hypotheses may be developed as scientific models.

Depending on the results of scientific evaluation, a hypothesis typically is either rejected as false or accepted as true. However, because a hypothesis inherently is falsifiable, even hypotheses supported by scientific evidence and accepted as true are susceptible to rejection later, when new evidence has become available. In some instances, rather than rejecting a hypothesis because it has been falsified by new evidence, scientists simply adapt the existing idea to accommodate the new information. In this sense a hypothesis is never incorrect but only incomplete.

The investigation of scientific hypotheses is an important component in the development of scientific theory. Hence, hypotheses differ fundamentally from theories; whereas the former is a specific tentative explanation and serves as the main tool by which scientists gather data, the latter is a broad general explanation that incorporates data from many different scientific investigations undertaken to explore hypotheses.

Countless hypotheses have been developed and tested throughout the history of science. Several examples include the idea that living organisms develop from nonliving matter, which formed the basis of spontaneous generation, a hypothesis that ultimately was disproved (first in 1668, with the experiments of Italian physician Francesco Redi, and later in 1859, with the experiments of French chemist and microbiologist Louis Pasteur); the concept proposed in the late 19th century that microorganisms cause certain diseases (now known as germ theory); and the notion that oceanic crust forms along submarine mountain zones and spreads laterally away from them (seafloor spreading hypothesis).

Hypothesis basics

A hypothesis is a suggested solution for an unexplained occurrence that does not fit into current accepted scientific theory. The basic idea of a hypothesis is that there is no pre-determined outcome. For a hypothesis to be termed a scientific hypothesis, it has to be something that can be supported or refuted through carefully crafted experimentation or observation. This is called falsifiability and testability, an idea that was advanced in the mid-20th century a British philosopher named Karl Popper, according to the Encyclopedia Britannica.

A key function in this step in the scientific method is deriving predictions from the hypotheses about the results of future experiments, and then performing those experiments to see whether they support the predictions.

A hypothesis is usually written in the form of an if/then statement, according to the University of California. This statement gives a possibility (if) and explains what may happen because of the possibility (then). The statement could also include "may."

Here are some examples of hypothesis statements:

- If garlic repels fleas, then a dog that is given garlic every day will not get fleas.
- Bacterial growth may be affected by moisture levels in the air.
- If sugar causes cavities, then people who eat a lot of candy may be more prone to cavities.
- If UV light can damage the eyes, then maybe UV light is a cause of blindness.

Testing a hypothesis

Notice that all of the statements, above, are testable. The primary trait of a hypothesis is that something can be tested and that those tests can be replicated, according to Midwestern State University.

An example of untestable statement is, "All people fall in love at least once." The definition of love is subjective. Also, it would be impossible to poll every human about their love life. An untestable statement can be reworded to make it testable, though. For example, the previous statement could be changed to, "If love is an important emotion, some may believe that everyone should fall in love at least once." With this statement, the researcher can poll a group of people to see how many believe people should fall in love at least once.

A hypothesis is often examined by multiple scientists to ensure the integrity and veracity of the experiment. This process can take years, and in many cases hypotheses do not go any further in the scientific method as it is difficult to gather sufficient supporting evidence.

"As a field biologist my favorite part of the scientific method is being in the field collecting the data," Jaime Tanner, a professor of biology at Marlboro College, told Live Science. "But what really makes that fun is knowing that you are trying to answer an interesting question, so the first step in identifying questions and generating possible answers (hypotheses) is also very important and is a creative process. Then once you collect the data you analyze it to see if your hypothesis is supported or not."

A null hypothesis is the name given to a hypothesis that is possibly false or has no effect. Often, during a test, the scientist will study another branch of the idea that may work, which is called an alternative hypothesis, according to the University of California, Berkeley.

During a test, the scientist may try to prove or disprove just the null hypothesis or test both the null and the alternative hypothesis. If a hypothesis specifies a certain direction, it is called one-tailed hypothesis. This means that the scientist believes that the outcome will be either with effect or without effect. When a hypothesis is created with no prediction to the outcome, it is called a two-tailed hypothesis because there are two possible outcomes. The outcome could be with effect or without effect, but until the testing is complete, there is no way of knowing which outcome it will be, according to the Web Center for Social Research Methods.

During testing, a scientist may come upon two types of errors. A Type I error is when the null hypothesis is rejected when it is true. A Type II error occurs when the null hypothesis is not rejected when it is false, according to the University of California, Berkeley.

Upon analysis of the results, a hypothesis can be rejected or modified, but it can never be proven to be correct 100 percent of the time. For example, relativity has been tested many times, so it is generally accepted as true, but there could be an instance, which has not been encountered, where it is not true. For example, a scientist can form a hypothesis that a certain type of tomato is red. During research, the scientist then finds that each tomato of this type is red. Though his findings confirm his hypothesis, there may be a tomato of that type somewhere in the world that isn't red. Thus, his hypothesis is true, but it may not be true 100 percent of the time.

5

Theory and Facts of Social Science

Beyond the intentions and meanings associated with behaviour, social scientists are also interested in mapping out the basic structures of society and the resources, social and otherwise, that underwrite these structures. They are also concerned with the unintended consequences of actions and relations.

In all of these investigations, social scientists go beyond deciphering the meaning and import of acts and relations to uncover their broader causes and effects. Indeed, depending on how broad and successful social science is in this task, causal explanations become integrated into theories of social life—theories that typically go far beyond the self-understandings of the agents involved. Examples include Keynesian or monetarist theories in economics, kinship theories in anthropology, and modernization theory in political science and sociology. Questions about the nature of social-scientific theorizing abound: for example, can theories in the social sciences involve genuine laws, and what makes a regularity into a law? Can the social sciences make warranted predictions about future actions or relationships? Should the social sciences ultimately aim at explanation in terms of individual actions or in terms of groups or group structures (i.e., should fundamental explanations in the social sciences be individualistic or holistic)?

To these sorts of questions, humanists have sometimes insisted that causality in the social sciences is different in kind than causality in the natural sciences. Others have tried to work out a middle road that combines the best of both the naturalist approach, with its focus on causality, and the humanist approach, which focuses on meaning. The methodological writings of the German sociologist Max Weber are a particularly vivid instance of this.

An important class of theories in the social sciences—so-called competence theories—constitute a distinctive type. Theories of this type explain human behaviour as arising from principles of rationality or from internalized systems of rules. Examples include game theory (including prisoner's dilemma games), Noam Chomsky's theory of transformational grammar, and Jürgen Habermas's theory of communicative competence. These examples are indicative of the ways in which theorizing in the social sciences may be fundamentally different from that in the natural sciences.

Meaningful actions involve rationality because they consist of following rules, procedures, principles, and the like. For example, in order to christen a ship, a speaker may need to act in accordance with linguistic rules that specify the circumstances in which an utterance of the form "I christen thee" counts as a christening of a ship. Or, again, principles of economic reasoning specify how much product to bring to market in order to maximize profit. An actor's competence is his mastery of the rules or norms of rationality that apply to a particular activity, and competence theories are those that seek to describe in detail what these rules and norms are. They proceed by discovering how an idealized actor who is perfectly rational or who has perfectly mastered the relevant rules would behave in various situations.

Another way in which theories in the social sciences are different from those in the natural sciences is that the entities being explained in the social sciences (i.e., human beings), unlike those being explained in the natural sciences, themselves possess their own theories about what they and others are doing. One might call these theories the agents' self-understanding or their ideology. Moreover, it is plausible to claim (though some theorists have denied this) that agents' ideology is an important element of any account of how they behave. But this raises the question of what is the relationship, in social-scientific theories, between, on the one hand, the ideology and self-understanding of the agents and, on the other, the theoretical constructs that social-scientific observers of their behaviour might propose. Does the former take precedence over the latter? Does the former constrain the latter? These are questions that philosophers of the natural sciences need not address, because the phenomena studied in the natural sciences are not the product of the ideology of that which is being studied. Indeed, the notion of ideology points to an activity crucial in the social sciences but one potentially in tension with its scientific aspirations, namely, critique.

EVOLUTION OF THEORIES

Evolution has shaped the human body, but it also shaped the human brain, so evolutionary principles are indispensable for understanding our psychology. Yet many students, teachers, and even social scientists struggle to see how our evolutionary history significantly shapes our cognition and behavior today. "Learning" and "culture" do not explain behavior so completely that turning to ideas from evolution is unnecessary. The lack of willingness to view human cognition and behavior as within the purview of evolutionary processes has prevented evolution from being fully integrated into the social science curriculum.

A deeper scientific understanding leads to the view that learning doesn't compete with evolution as an explanation for human psychology. Learning requires evolved psychological adaptations—general learning mechanisms or mechanisms which may be specific to a particular adaptive problem. Specialized learning mechanisms help us avoid eating toxic food, yet no one is born knowing which particular foods to avoid. Humans have also evolved an aversion to mating with their genetic kin but are not born knowing who their kin are. Solving these adaptive challenges requires evolved psychological learning mechanisms.

Human cognition and behavior is the product of the interaction of genetic and cultural evolution. Gene-culture co-evolution has allowed us to adapt to highly diverse ecologies and to produce cultural adaptations and innovations. It has also produced extraordinary cultural diversity. In fact, cultural variability is one of our species' most distinctive features. Humans display a wider repertoire of behaviors that vary more within and across groups than any other animal. Social learning enables cultural transmission, so the psychological mechanisms supporting it should be universal. These psychological mechanisms must also be highly responsive to diverse developmental contexts and cultural ecologies.

Take the conformity bias. It is a universal proclivity of all human psychology—even very young children imitate the behavior of others and conform to group norms. Yet beliefs about conformity vary substantially between populations. Adults in some populations are more likely to associate conformity with children's intelligence, whereas others view creative non-conformity as linked with intelligence. Psychological adaptations for social learning, such as conformity bias, develop in complex and diverse cultural ecologies that work in tandem to shape the human mind and generate cultural variation.

Truly satisfying explanations of human behavior requires identifying the components of human cognition that evolution designed to be sensitive to social or ecological conditions and information. For example, populations in which food resources show high variance (large game hunting is very much hit or miss) tend to evoke cooperative adaptations for group-wide sharing compared to those in which food variance is lower and more dependent on individual effort, like gathered foods. Recent discoveries in the field of cultural evolution have demonstrated that our technological complexity is the outcome of our species' capacity for cumulative culture. It has set our genus *Homo* on an evolutionary pathway remarkably distinct from the one traversed by any other species. In a paper last year, I proposed that this was a result of psychological adaptations being universal but sufficiently flexible for innovations to build on each other, supporting the acquisition of highly variable behavioral repertoires.

Applying evolutionary theory to social science has the potential to transform education and, through it, society. For example, evolutionary perspectives can help social scientists understand, and eventually address, common social problems. Schoolyard bullying provides one example. Without an evolutionary understanding of the phenomenon, interventions are likely to be ineffective, since they misdiagnose the causes of bullying. Bullying is not merely negative interpersonal behavior; it's goal-oriented and serves the social function of gaining status and prestige for the bully, which must be understood to combat it. For example, bullying often occurs in front of an audience, suggesting that social attention drives, and may reinforce, the behavior. A 2015 paper suggests most interventions don't work because they remove the rewards of bullying—increased social status—without offering any alternatives. The researchers recommend that the esteem bullies seek "should be borne in mind when engineering interventions" designed to either decrease a bully's social status or channel the bully's social motivations to better ends. A deep understanding of the evolved functions of bullying, in short, provides a fulcrum for potential remedies.

CLASSIFICATION OF THEORY

A simple typology of scientific theories is developed which asks of any theory the Who, What, Why, Where and When (5W) questions. These guide the identification respectively of the type of agency, 'action' (including attitudes), and decision-making process involved, the degree of generalizability of the theory, and the type of time path involved. This typology generally captures what commentators on particular theories think most important. It thus becomes a handy device for identifying the essence of different theories. Where most natural science theories, as well as evolutionary theories in both natural and social science, would fit in the typology is briefly examined. Then several key types of social theory - action theory, systems theory/ functionalism, psychoanalytic theory, symbolic interactionism, rational choice theory, and phenomenology - are placed within the typology. The typology aids in understanding both disagreements within theoretical 'camps' and similarities and differences across theories and theorists. Defining natural and social scientific theories in terms of efforts to engage the 5W questions overcomes many problems associated with existing definitions.

THEORY AND DEVELOPMENT OF SCIENCE

Do you want to know how scientific theories are developed? Well, we'll get into that in a moment. First, we need to make sure we understand what a scientific theory is and what it is not. In a casual discussion with a friend, you may say an idea you have is just a theory to imply that the idea may or may not be correct. In other words, it's speculation that you can't really back up with solid evidence.

However, the word theory has a significantly different meaning when it's used in science. A scientific theory is a tested and accepted explanation of why things happen; it is knowledge that has been through rigorous testing and found to be a reliable explanation of a phenomenon. It's not just a guess!

Starting with the Scientific Method

Now, let's talk about how scientific theories are created. Put simply, a scientific theory is created by following the scientific method. First, a scientist observes a phenomenon. Next, they research all known information about this phenomenon. Then, the scientist will develop a hypothesis, or a possible explanation of the phenomenon based on what they have observed and researched. The hypothesis will be tested and a conclusion will be reached stating that the hypothesis can either be disproved or cannot be disproved through testing.

Most likely, you have created a science project in school and have had some experience with the scientific method up to this point. What you might not realize is that this is only one piece of what takes place.

The development of a scientific theory (ESCHQ)

The most important, and most exciting, thing about science and scientific theories is that they are not fixed. Hypotheses are formed and carefully tested, leading to scientific theories that explain those observations and predict results. The results are not made to fit the hypotheses. If new information comes to light with the use of better equipment, or the results of other experiments, this new information is used to improve and expand current theories. If a theory is found to have been incorrect it is changed to fit this new information. The data should never be made to fit the theory, if the data does not fit the theory then the theory is reworked or discarded. Although this changing of opinion is often taken for inconsistency, it is this very willingness to adapt that makes science useful, and allows new discoveries to be made.

Remember that the term theory has a different meaning in science. A scientific theory is not like your theory of about why you can only ever find one sock. A scientific theory is one that has been tested and proven through repeated experiment and data. Scientists are constantly testing the data available, as well as commonly held beliefs, and it is this constant testing that allows progress, and improved theories.

Gravity (ESCHR)

The theory of gravity has been slowly developing since the beginning of the 16th century. Galileo Galilei is credited with some of the earliest work. At the time it was widely believed that heavier objects accelerated faster toward the earth than light objects did. Galileo had a hypothesis that this was not true, and performed experiments to prove this.

Galileo's work allowed Sir Isaac Newton to hypothesise not only a theory of gravity on earth, but that gravity is what held the planets in their orbits. Newton's theory was used by John Couch Adams and Urbain Le Verrier to predict the planet Neptune in the solar system and this prediction was proved experimentally when Neptune was discovered by Johann Gottfried Galle.

Although a large majority of gravitational motion could be explained by Newton's theory of gravity, there were things that did not fit. But although a newer theory that better fit the facts was eventually proved by Albert Einstein, Newton's gravitational theroy is still successfully used in many applications where the masses, speeds and energies are not too large.

Thermodynamics (ESCHS)

The principles of the three rules of thermodynamics describe how energy works, on all size levels (from the workings of the Earth's core, to a car engine). The basis for these three rules started as far back as 1650 with Otto von Guericke. He had a hypothesis that a vacuum pump could be made, and proved this by making one. In 1656 Robert Boyle and Robert Hooke used this information and built an air pump.

METHODS OF JUSTIFICATION

Justification (also called epistemic justification) is a concept in epistemology used to describe beliefs that one has good reason for holding. Epistemologists are concerned with various epistemic features of belief, which include the ideas of warrant (a proper justification for holding a belief), knowledge, rationality, and probability, among others. Loosely speaking, justification is the reason that someone holds a rationally admissible belief (although the term is also sometimes applied to other propositional attitudes such as doubt).

Debates surrounding epistemic justification often involve the *structure* of justification, including whether there are foundational justified beliefs or whether mere coherence is sufficient for a system of beliefs to qualify as justified. Another major subject of debate is the sources of justification, which might include perceptual experience (the evidence of the senses), reason, and authoritative testimony, among others.

Justification and knowledge

"Justification" involves the reasons why someone holds a belief that one *should* hold based on one's current evidence. Justification is a property of beliefs insofar as they are held blamelessly. In other words, a justified belief is a belief that a person is entitled to hold.

According to Edmund Gettier, many figures in the history of philosophy have treated "justified true belief" as constituting knowledge. It is particularly associated with a theory discussed in Plato's dialogues *Meno* and *Theaetetus*. While in fact Plato seems to disavow justified true belief as constituting knowledge at the end of *Theaetetus*, the claim that Plato unquestioningly accepted this view of knowledge stuck.

The subject of justification has played a major role in the value of knowledge as "justified true belief". Some contemporary epistemologists, such as Jonathan Kvanvig assert that justification isn't necessary in getting to the truth and avoiding errors. Kvanvig attempts to show that knowledge is no more valuable than true belief, and in the process dismissed the necessity of justification due to justification not being connected to the truth.

Conceptions of justification

William P. Alston identifies two conceptions of justification. One conception is "deontological" justification, which holds that justification evaluates the obligation and responsibility of a person having only true beliefs. This conception implies, for instance, that a person who has made his best effort but is incapable of concluding the correct belief from his evidence is still justified. The deontological conception of justification corresponds to epistemic internalism. Another conception is "truth-conducive" justification, which holds that justification is based on having sufficient evidence or reasons that entails that the belief is at least likely to be true. The truth-conductive conception of justification corresponds to epistemic externalism.

Theories of justification

There are several different views as to what entails justification, mostly focusing on the question "How sure do we need to be that our beliefs correspond to the actual world?" Different theories of justification require different conditions before a belief can be considered justified. Theories of justification generally include other aspects of epistemology, such as knowledge.

SCIENTIFIC THEORY

A scientific theory is an explanation of an aspect of the natural world and universe that can be repeatedly tested and verified in accordance with the scientific method, using accepted protocols of observation, measurement, and evaluation of results. Where possible, theories are tested under controlled conditions in an experiment. In circumstances not amenable to experimental testing, theories are evaluated through principles of abductive reasoning. Established scientific theories have withstood rigorous scrutiny and embody scientific knowledge.

A scientific theory differs from a scientific fact or scientific law in that a theory explains "why" or "how": a fact is a simple, basic observation, whereas a law is a statement (often a mathematical equation) about a relationship between facts. For example, Newton's Law of Gravity is a mathematical equation that can be used to predict the attraction between bodies, but it is not a theory to explain *how* gravity works. Stephen Jay Gould wrote that "...facts and theories are different things, not rungs in a hierarchy of increasing certainty. Facts are the world's data. Theories are structures of ideas that explain and interpret facts."

The meaning of the term *scientific theory* (often contracted to *theory* for brevity) as used in the disciplines of science is significantly different from the common vernacular usage of *theory*. In everyday speech, *theory* can imply an explanation that represents an unsubstantiated and speculative guess, whereas in science it describes an explanation that has been tested and is widely accepted as valid.

The strength of a scientific theory is related to the diversity of phenomena it can explain and its simplicity. As additional scientific evidence is gathered, a scientific theory may be modified and ultimately rejected if it cannot be made to fit the new findings; in such circumstances, a more accurate theory is then required. Some theories are so well-established that they are unlikely ever to be fundamentally changed (for example, scientific theories such as evolution, heliocentric theory, cell theory, theory of plate tectonics, germ theory of disease, etc.). In certain cases, a scientific theory or scientific law that fails to fit all data can still be useful (due to its simplicity) as an approximation under specific conditions. An example is Newton's laws of motion, which are a highly accurate approximation to special relativity at velocities that are small relative to the speed of light.

Scientific theories are testable and make falsifiable predictions. They describe the causes of a particular natural phenomenon and are used to explain and predict aspects of the physical universe or specific areas of inquiry (for example, electricity, chemistry, and astronomy). As with other forms of scientific knowledge, scientific theories are both deductive and inductive, aiming for predictive and explanatory power. Scientists use theories to further scientific knowledge, as well as to facilitate advances in technology or medicine.

Types

Albert Einstein described two types of scientific theories:

"Constructive theories" and "principle theories". Constructive theories are constructive models for phenomena: for example, kinetic theory. Principle theories are empirical generalisations such as Newton's laws of motion.

Characteristics

Essential criteria

Typically for any theory to be accepted within most academia there is one simple criterion. The essential criterion is that the theory must be observable and repeatable. The aforementioned criterion is essential to prevent fraud and perpetuate science itself. The defining characteristic of all scientific knowledge, including theories, is the ability to make falsifiable or testable predictions. The relevance and specificity of those predictions determine how potentially useful the theory is. A would-be theory that makes no observable predictions is not a scientific theory at all. Predictions not sufficiently specific to be tested are similarly not useful. In both cases, the term "theory" is not applicable.

A body of descriptions of knowledge can be called a theory if it fulfills the following criteria:

- It makes falsifiable predictions with consistent accuracy across a broad area of scientific inquiry (such as mechanics).
- It is well-supported by many independent strands of evidence, rather than a single foundation.
- It is consistent with preexisting experimental results and at least as accurate in its predictions as are any preexisting theories.

These qualities are certainly true of such established theories as special and general relativity, quantum mechanics, plate tectonics, the modern evolutionary synthesis, etc.

Other criteria

In addition, scientists prefer to work with a theory that meets the following qualities:

- It can be subjected to minor adaptations to account for new data that do not fit it perfectly, as they are discovered, thus increasing its predictive capability over time.
- It is among the most parsimonious explanations, economical in the use of proposed entities or explanatory steps as per Occam's razor. This is because for each accepted explanation of a phenomenon, there may be an extremely large, perhaps even incomprehensible, number of possible and more complex alternatives, because one can always burden failing explanations with *ad hoc* hypotheses to prevent them from being falsified; therefore, simpler theories are preferable to more complex ones because they are more testable.

Definitions from scientific organizations

The United States National Academy of Sciences defines scientific theories as follows:

The formal scientific definition of theory is quite different from the everyday meaning of the word. It refers to a comprehensive explanation of some aspect of nature that is supported by a vast body of evidence. Many scientific theories are so well established that no new evidence is likely to alter them substantially. For example, no new evidence will demonstrate that the Earth does not orbit around the sun (heliocentric theory), or that living things are not made of cells (cell theory), that matter is not composed of atoms, or that the surface of the Earth is not divided into solid plates that have moved over geological timescales (the theory of plate tectonics)...One of the most useful properties of scientific theories is that they can be used to make predictions about natural events or phenomena that have not yet been observed.

From the American Association for the Advancement of Science:

A scientific theory is a well-substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment. Such fact-supported theories are not "guesses" but reliable accounts of the real world. The theory of biological evolution is more than "just a theory". It is as factual an explanation of the universe as the atomic theory of matter or the germ theory of disease. Our understanding of gravity is still a work in progress. But the phenomenon of gravity, like evolution, is an accepted fact.

Note that the term *theory* would not be appropriate for describing untested but intricate hypotheses or even scientific models.

Formation

The scientific method involves the proposal and testing of hypotheses, by deriving predictions from the hypotheses about the results of future experiments, then performing those experiments to see whether the predictions are valid. This provides evidence either for or against the hypothesis. When enough experimental results have been gathered in a particular area of inquiry, scientists may propose an explanatory framework that accounts for as many of these as possible. This explanation is also tested, and if it fulfills the necessary criteria, then the explanation becomes a theory. This can take many years, as it can be difficult or complicated to gather sufficient evidence.

Once all of the criteria have been met, it will be widely accepted by scientists as the best available explanation of at least some phenomena. It will have made predictions of phenomena that previous theories could not explain or could not predict accurately, and it will have resisted attempts at falsification. The strength of the evidence is evaluated by the scientific community, and the most important experiments will have been replicated by multiple independent groups.

Theories do not have to be perfectly accurate to be scientifically useful. For example, the predictions made by classical mechanics are known to be inaccurate in the relatistivic realm, but they are almost exactly correct at the comparatively low velocities of common human experience. In chemistry, there are many acid-base theories providing highly divergent explanations of the underlying nature of acidic and basic compounds, but they are very useful for predicting their chemical behavior. Like all knowledge in science, no theory can ever be completely certain, since it is possible that future experiments might conflict with the theory's predictions. However, theories supported by the scientific consensus have the highest level of certainty of any scientific knowledge; for example, that all objects are subject to gravity or that life on Earth evolved from a common ancestor.

Acceptance of a theory does not require that all of its major predictions be tested, if it is already supported by sufficiently strong evidence. For example, certain tests may be unfeasible or technically difficult. As a result, theories may make predictions that have not yet been confirmed or proven incorrect; in this case, the predicted results may be described informally with the term "theoretical". These predictions can be tested at a later time, and if they are incorrect, this may lead to the revision or rejection of the theory.

Modification and improvement

If experimental results contrary to a theory's predictions are observed, scientists first evaluate whether the experimental design was sound, and if so they confirm the results by independent replication. A search for potential improvements to the theory then begins. Solutions may require minor or major changes to the theory, or none at all if a satisfactory explanation is found within the theory's existing framework. Over time, as successive modifications build on top of each other, theories consistently improve and greater predictive accuracy is achieved. Since each new version of a theory (or a completely new theory) must have more predictive and explanatory power than the last, scientific knowledge consistently becomes more accurate over time.

If modifications to the theory or other explanations seem to be insufficient to account for the new results, then a new theory may be required. Since scientific knowledge is usually durable, this occurs much less commonly than modification. Furthermore, until such a theory is proposed and accepted, the previous theory will be retained. This is because it is still the best available explanation for many other phenomena, as verified by its predictive power in other contexts. For example, it has been known since 1859 that the observed perihelion precession of Mercury violates Newtonian mechanics, but the theory remained the best explanation available until relativity was supported by sufficient evidence. Also, while new theories may be proposed by a single person or by many, the cycle of modifications eventually incorporates contributions from many different scientists.

After the changes, the accepted theory will explain more phenomena and have greater predictive power (if it did not, the changes would not be adopted); this new explanation will then be open to further replacement or modification. If a theory does not require modification despite repeated tests, this implies that the theory is very accurate. This also means that accepted theories continue to accumulate evidence over time, and the length of time that a theory (or any of its principles) remains accepted often indicates the strength of its supporting evidence.

Unification

In some cases, two or more theories may be replaced by a single theory that explains the previous theories as approximations or special cases, analogous to the way a theory is a unifying explanation for many confirmed hypotheses; this is referred to as *unification* of theories. For example, electricity and magnetism are now known to be two aspects of the same phenomenon, referred to as electromagnetism.

When the predictions of different theories appear to contradict each other, this is also resolved by either further evidence or unification. For example, physical theories in the

19th century implied that the Sun could not have been burning long enough to allow certain geological changes as well as the evolution of life. This was resolved by the discovery of nuclear fusion, the main energy source of the Sun. Contradictions can also be explained as the result of theories approximating more fundamental (non-contradictory) phenomena. For example, atomic theory is an approximation of quantum mechanics. Current theories describe three separate fundamental phenomena of which all other theories are approximations; the potential unification of these is sometimes called the Theory of Everything.

Example: Relativity

In 1905, Albert Einstein published the principle of special relativity, which soon became a theory. Special relativity predicted the alignment of the Newtonian principle of Galilean invariance, also termed *Galilean relativity*, with the electromagnetic field. By omitting from special relativity the luminiferous aether, Einstein stated that time dilation and length contraction measured in an object in relative motion is inertial—that is, the object exhibits constant velocity, which is speed with direction, when measured by its observer. He thereby duplicated the Lorentz transformation and the Lorentz contraction that had been hypothesized to resolve experimental riddles and inserted into electrodynamic theory as dynamical consequences of the aether's properties. An elegant theory, special relativity yielded its own consequences, such as the equivalence of mass and energy transforming into one another and the resolution of the paradox that an excitation of the electromagnetic field could be viewed in one reference frame as electricity, but in another as magnetism.

Einstein sought to generalize the invariance principle to all reference frames, whether inertial or accelerating. Rejecting Newtonian gravitation—a central force acting instantly at a distance—Einstein presumed a gravitational field. In 1907, Einstein's equivalence principle implied that a free fall within a uniform gravitational field is equivalent to inertial motion. By extending special relativity's effects into three dimensions, general relativity extended length contraction into space contraction, conceiving of 4D space-time as the gravitational field that alters geometrically and sets all local objects' pathways. Even massless energy exerts gravitational motion on local objects by "curving" the geometrical "surface" of 4D space-time. Yet unless the energy is vast, its relativistic effects of contracting space and slowing time are negligible when merely predicting motion. Although general relativity is embraced as the more explanatory theory via *scientific realism*, Newton's theory remains successful as merely a predictive theory via *instrumentalism*. To calculate trajectories, engineers and NASA still uses Newton's equations, which are simpler to operate.

Theories and laws

Both scientific laws and scientific theories are produced from the scientific method through the formation and testing of hypotheses, and can predict the behavior of the natural world. Both are typically well-supported by observations and/or experimental evidence. However, scientific laws are descriptive accounts of how nature will behave under certain conditions. Scientific theories are broader in scope, and give overarching explanations of how nature works and why it exhibits certain characteristics. Theories are supported by evidence from many different sources, and may contain one or several laws.

A common misconception is that scientific theories are rudimentary ideas that will eventually graduate into scientific laws when enough data and evidence have been accumulated. A theory does not change into a scientific law with the accumulation of new or better evidence. A theory will always remain a theory; a law will always remain a law. Both theories and laws could potentially be falsified by countervailing evidence.

Theories and laws are also distinct from hypotheses. Unlike hypotheses, theories and laws may be simply referred to as scientific fact. However, in science, theories are different from facts even when they are well supported. For example, evolution is both a theory and a fact.

About theories

Theories as axioms

The logical positivists thought of scientific theories as statements in a formal language. First-order logic is an example of a formal language. The logical positivists envisaged a similar scientific language. In addition to scientific theories, the language also included observation sentences ("the sun rises in the east"), definitions, and mathematical statements. The phenomena explained by the theories, if they could not be directly observed by the senses (for example, atoms and radio waves), were treated as theoretical concepts. In this view, theories function as axioms: predicted observations are derived from the theories much like theorems are derived in Euclidean geometry. However, the predictions are then tested against reality to verify the theories, and the "axioms" can be revised as a direct result.

The phrase "the received view of theories" is used to describe this approach. Terms commonly associated with it are "linguistic" (because theories are components of a language) and "syntactic" (because a language has rules about how symbols can be strung together). Problems in defining this kind of language precisely, e.g., are objects seen in microscopes observed or are they theoretical objects, led to the effective demise of logical positivism in the 1970s.

Theories as models

The semantic view of theories, which identifies scientific theories with models rather than propositions, has replaced the received view as the dominant position in theory formulation in the philosophy of science. A model is a logical framework intended to represent reality (a "model of reality"), similar to the way that a map is a graphical model that represents the territory of a city or country. In this approach, theories are a specific category of models that fulfill the necessary criteria. One can use language to describe a model; however, the theory is the model (or a collection of similar models), and not the description of the model. A model of the solar system, for example, might consist of abstract objects that represent the sun and the planets. These objects have associated properties, e.g., positions, velocities, and masses. The model parameters, e.g., Newton's Law of Gravitation, determine how the positions and velocities change with time. This model can then be tested to see whether it accurately predicts future observations; astronomers can verify that the positions of the model's objects over time match the actual positions of the planets. For most planets, the Newtonian model's predictions are accurate; for Mercury, it is slightly inaccurate and the model of general relativity must be used instead.

The word "semantic" refers to the way that a model represents the real world. The representation (literally, "re-presentation") describes particular aspects of a phenomenon or the manner of interaction among a set of phenomena. For instance, a scale model of a house or of a solar system is clearly not an actual house or an actual solar system; the aspects of an actual house or an actual solar system represented in a scale model are, only in certain limited ways, representative of the actual entity. A scale model of a house is not a house; but to someone who wants to *learn about* houses, analogous to a scientist who wants to understand reality, a sufficiently detailed scale model may suffice.

Differences between theory and model

Several commentators have stated that the distinguishing characteristic of theories is that they are explanatory as well as descriptive, while models are only descriptive (although still predictive in a more limited sense). Philosopher Stephen Pepper also distinguished between theories and models, and said in 1948 that general models and theories are predicated on a "root" metaphor that constrains how scientists theorize and model a phenomenon and thus arrive at testable hypotheses.

Engineering practice makes a distinction between "mathematical models" and "physical models"; the cost of fabricating a physical model can be minimized by first creating a mathematical model using a computer software package, such as a computer aided design tool. The component parts are each themselves modelled, and the fabrication tolerances are specified. An exploded view drawing is used to lay out the fabrication sequence. Simulation packages for displaying each of the subassemblies allow the parts to be rotated, magnified, in realistic detail. Software packages for creating the bill of materials for construction allows subcontractors to specialize in assembly processes, which spreads the cost of manufacturing machinery among multiple customers.

Assumptions in formulating theories

An assumption (or axiom) is a statement that is accepted without evidence. For example, assumptions can be used as premises in a logical argument. Isaac Asimov described assumptions as follows:

...it is incorrect to speak of an assumption as either true or false, since there is no way of proving it to be either (If there were, it would no longer be an assumption). It is better to consider assumptions as either useful or useless, depending on whether deductions made from them corresponded to reality...Since we must start somewhere, we must have assumptions, but at least let us have as few assumptions as possible.

Certain assumptions are necessary for all empirical claims (e.g. the assumption that reality exists). However, theories do not generally make assumptions in the conventional sense (statements accepted without evidence). While assumptions are often incorporated during the formation of new theories, these are either supported by evidence (such as from previously existing theories) or the evidence is produced in the course of validating the theory. This may be as simple as observing that the theory makes accurate predictions, which is evidence that any assumptions made at the outset are correct or approximately correct under the conditions tested.

Conventional assumptions, without evidence, may be used if the theory is only intended to apply when the assumption is valid (or approximately valid). For example, the special theory of relativity assumes an inertial frame of reference. The theory makes accurate predictions when the assumption is valid, and does not make accurate predictions when the assumption is not valid. Such assumptions are often the point with which older theories are succeeded by new ones (the general theory of relativity works in non-inertial reference frames as well).

The term "assumption" is actually broader than its standard use, etymologically speaking. The Oxford English Dictionary (OED) and online Wiktionary indicate its Latin source as *assumere* ("accept, to take to oneself, adopt, usurp"), which is a conjunction of *ad-* ("to, towards, at") and *sumere* (to take). The root survives, with shifted meanings, in the Italian *assumere* and Spanish *sumir*. The first sense of "assume" in the OED is "to take unto (oneself), receive, accept, adopt".

The term was originally employed in religious contexts as in "to receive up into heaven", especially "the reception of the Virgin Mary into heaven, with body preserved from corruption", (1297 CE) but it was also simply used to refer to "receive into association" or "adopt into partnership". Moreover, other senses of assumere included (i) "investing oneself with (an attribute)", (ii) "to undertake" (especially in Law), (iii) "to take to oneself in appearance only, to pretend to possess", and (iv) "to suppose a thing to be" (all senses from OED entry on "assume"; the OED entry for "assumption" is almost perfectly symmetrical in senses). Thus, "assumption" connotes other associations than the contemporary standard sense of "that which is assumed or taken for granted; a supposition, postulate" (only the 11th of 12 senses of "assumption", and the 10th of 11 senses of "assume").

Descriptions

From philosophers of science

Karl Popper described the characteristics of a scientific theory as follows:

1. It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations.
2. Confirmations should count only if they are the result of risky predictions; that is to say, if, unenlightened by the theory in question, we should have expected an event which was incompatible with the theory—an event which would have refuted the theory.
3. Every "good" scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is.
4. A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.
5. Every genuine test of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability; but there are degrees of testability: some theories are more testable, more exposed to refutation, than others; they take, as it were, greater risks.
6. Confirming evidence should not count except when it is the result of a genuine test of the theory; and this means that it can be presented as a serious but unsuccessful attempt to falsify the theory. (I now speak in such cases of "corroborating evidence".)
7. Some genuinely testable theories, when found to be false, might still be upheld by their admirers—for example by introducing post hoc (after the fact) some auxiliary hypothesis or assumption, or by reinterpreting the theory post hoc in such a way that it escapes refutation. Such a procedure is always possible, but it rescues the theory from refutation only at the price of

destroying, or at least lowering, its scientific status, by tampering with evidence. The temptation to tamper can be minimized by first taking the time to write down the testing protocol before embarking on the scientific work.

Popper summarized these statements by saying that the central criterion of the scientific status of a theory is its "falsifiability, or refutability, or testability". Echoing this, Stephen Hawking states, "A theory is a good theory if it satisfies two requirements: It must accurately describe a large class of observations on the basis of a model that contains only a few arbitrary elements, and it must make definite predictions about the results of future observations." He also discusses the "unprovable but falsifiable" nature of theories, which is a necessary consequence of inductive logic, and that "you can disprove a theory by finding even a single observation that disagrees with the predictions of the theory".

Several philosophers and historians of science have, however, argued that Popper's definition of theory as a set of falsifiable statements is wrong because, as Philip Kitcher has pointed out, if one took a strictly Popperian view of "theory", observations of Uranus when first discovered in 1781 would have "falsified" Newton's celestial mechanics. Rather, people suggested that another planet influenced Uranus' orbit—and this prediction was indeed eventually confirmed.

Kitcher agrees with Popper that "There is surely something right in the idea that a science can succeed only if it can fail." He also says that scientific theories include statements that cannot be falsified, and that good theories must also be creative. He insists we view scientific theories as an "elaborate collection of statements", some of which are not falsifiable, while others—those he calls "auxiliary hypotheses", are.

According to Kitcher, good scientific theories must have three features:

1. Unity: "A science should be unified…. Good theories consist of just one problem-solving strategy, or a small

family of problem-solving strategies, that can be applied to a wide range of problems."

2. Fecundity: "A great scientific theory, like Newton's, opens up new areas of research.... Because a theory presents a new way of looking at the world, it can lead us to ask new questions, and so to embark on new and fruitful lines of inquiry.... Typically, a flourishing science is incomplete. At any time, it raises more questions than it can currently answer. But incompleteness is not vice. On the contrary, incompleteness is the mother of fecundity.... A good theory should be productive; it should raise new questions and presume those questions can be answered without giving up its problem-solving strategies."
3. Auxiliary hypotheses that are independently testable: "An auxiliary hypothesis ought to be testable independently of the particular problem it is introduced to solve, independently of the theory it is designed to save." (For example, the evidence for the existence of Neptune is independent of the anomalies in Uranus's orbit.)

Like other definitions of theories, including Popper's, Kitcher makes it clear that a theory must include statements that have observational consequences. But, like the observation of irregularities in the orbit of Uranus, falsification is only one possible consequence of observation. The production of new hypotheses is another possible and equally important result.

Analogies and metaphors

The concept of a scientific theory has also been described using analogies and metaphors. For instance, the logical empiricist Carl Gustav Hempel likened the structure of a scientific theory to a "complex spatial network:"

Its terms are represented by the knots, while the threads connecting the latter correspond, in part, to the definitions and, in part, to the fundamental and derivative hypotheses included in the theory. The whole system floats, as it were, above the plane of observation and is anchored to it by the rules of interpretation. These might be viewed as strings which are not part of the network but link certain points of the latter with specific places in the plane of observation. By virtue of these interpretive connections, the network can function as a scientific theory: From certain observational data, we may ascend, via an interpretive string, to some point in the theoretical network, thence proceed, via definitions and hypotheses, to other points, from which another interpretive string permits a descent to the plane of observation.

Michael Polanyi made an analogy between a theory and a map:

A theory is something other than myself. It may be set out on paper as a system of rules, and it is the more truly a theory the more completely it can be put down in such terms. Mathematical theory reaches the highest perfection in this respect. But even a geographical map fully embodies in itself a set of strict rules for finding one's way through a region of otherwise uncharted experience. Indeed, all theory may be regarded as a kind of map extended over space and time.

A scientific theory can also be thought of as a book that captures the fundamental information about the world, a book that must be researched, written, and shared. In 1623, Galileo Galilei wrote:

Philosophy [i.e. physics] is written in this grand book—I mean the universe—which stands continually open to our gaze, but it cannot be understood unless one first learns to comprehend the language and interpret the characters in which it is written. It is written in the language of mathematics, and its characters are triangles, circles, and other geometrical figures, without which it is humanly impossible to understand a single word of it; without these, one is wandering around in a dark labyrinth.

The book metaphor could also be applied in the following passage, by the contemporary philosopher of science Ian Hacking:

I myself prefer an Argentine fantasy. God did not write a Book of Nature of the sort that the old Europeans imagined. He wrote a Borgesian library, each book of which is as brief as possible, yet each book of which is inconsistent with every other. No book is redundant. For every book there is some humanly accessible bit of Nature such that that book, and no other, makes possible the comprehension, prediction and influencing of what is going on…Leibniz said that God chose a world which maximized the variety of phenomena while choosing the simplest laws. Exactly so: but the best way to maximize phenomena and have simplest laws is to have the laws inconsistent with each other, each applying to this or that but none applying to all.

In physics

In physics, the term *theory* is generally used for a mathematical framework—derived from a small set of basic postulates (usually symmetries—like equality of locations in space or in time, or identity of electrons, etc.)—that is capable of producing experimental predictions for a given category of physical systems. A good example is classical electromagnetism, which encompasses results derived from gauge symmetry (sometimes called gauge invariance) in a form of a few equations called Maxwell's equations. The specific mathematical aspects of classical electromagnetic theory are termed "laws of electromagnetism," reflecting the level of consistent and reproducible evidence that supports them. Within electromagnetic theory generally, there are numerous hypotheses about how electromagnetism applies to specific situations. Many of these hypotheses are already considered to be adequately tested, with new ones always in the making and perhaps untested. An example of the latter might be the radiation reaction force. As of 2009, its effects on the periodic motion of charges are detectable in synchrotrons, but only as *averaged* effects over time. Some researchers are now considering experiments that could observe these effects at the instantaneous level (i.e. not averaged over time).

PLACE OF THEORY IN RESEARCH

The use of theory in science is an ongoing debate in the production of knowledge. Related to qualitative research methods, a variety of approaches have been set forth in the literature using the terms conceptual framework, theoretical framework, paradigm, and epistemology. While these approaches are helpful in their own context, we summarize and distill them in order to build upon the case that a balanced and centered use of the theoretical framework can bolster the qualitative approach. Our project builds on the arguments that epistemology and methodological rigor are essential by adding the notion that the influence of theory permeates almost every aspect of the study—even if the author does not recognize this influence. Compilers of methodological approaches have referred to the use of theory as analogous to a coat closet in which different items can be housed or a lens through which the literature and data in the study are viewed. In this chapter, we offer an evaluative quadrant for determining the appropriate use of theory in qualitative research and a diagram of the qualitative project that points to the central role of a theoretical framework.

PLACE OF FACTS

No definitive date can be given for the birth of social science—its emergence is in fact due to a large number of circumstances spanning centuries and some of its rudimentary ideas can be traced to multiple origins, some dating as far back as Plato. It is generally accepted that an important era in the emergence of contemporary social science began with the Enlightenment and its emphasis on rationality, logic, and methodology as applied to the empirical world. There are scholars, however, such as Lynn McDonald, who contend that the foundation of social science should be traced back to the sixth century (McDonald 1993). Maurice Duverger (1961) has argued that the social sciences, despite early roots in Grecian inquiries into the nature of man, did not emerge as a distinct form of research until the eighteenth century, when social philosophy bearing a "philosophical attitude" gave way to a new scientific emphasis. This shift from social philosophy to social science was given impetus by the emergence of positivism as a widely accepted mode of knowledge. First articulated by August Comte and best described in his 1848 work *A General View of Positivism*, positivism moved almost entirely away from metaphysical speculation and instead focused on the scientific method's ability to produce facts and falsifiable statements about the empirical world.

CONCLUSION

Theory provides significant guidelines and trails for the conduct of research by pointing to areas that are most likely to be fruitful, that is, areas in which meaningful relationships among variables are likely to be found. If the variables come to be selected such that no relationships between them obtain, the research will be sterile no matter how meticulous the subsequent observations and inferences.

A theoretic system narrows down the range of facts to be studied. Theory provides the researcher with a definite view point a direction which goes a long way toward helping him enquire into relationships between certain variables selected from among an almost infinite array of variables.

As Oppenheimer puts it, "in order for us to understand anything we have to fail to perceive a great deal that is there. Knowledge is purchased at the expense of what might have been seen and learned and was not...it is a condition of knowledge that somehow or the other we pick the clues which give us insight into what we have to find out about the world."

As a storehouse of meaningful hypotheses a fruitful theory suggests potential problems for study and thus ignites new investigative studies.

In fact, a theory can be judged productive (to the extent it can spark off a number of questions. A productive theory suggests potential problems, fruitful hypotheses and provides new perspectives. Einstein and Infield observe, "It is never possible to introduce only observable quantities in a theory. It is the theory which decides what can be observed."Only thus can the task of science be reduced to manageability.

Besides suggesting fruitful approaches to phenomena in the general area with which it is concerned, theory also provides leads for research in a different way, viz., by suggesting other kinds of phenomena that may perhaps be understood or explained in the same general terms. Take the example of Cohen's theory of 'delinquent sub-culture'.

6

The Design of Research

Research design refers to the overall strategy utilized to carry out research that defines a succinct and logical plan to tackle established research question(s) through the collection, interpretation, analysis, and discussion of data.

The methodologies and methods incorporated in the design of a research study will depend on the standpoint of the researcher over their beliefs in the nature of knowledge and reality, often shaped by the disciplinary areas the researcher belongs to.

The design of a study defines the study type (descriptive, correlational, semi-experimental, experimental, review, meta-analytic) and sub-type (e.g., descriptive-longitudinal case study), research problem, hypotheses, independent and dependent variables, experimental design, and, if applicable, data collection methods and a statistical analysis plan. A research design is a framework that has been created to find answers to research questions.

Design types and sub-types

There are many ways to classify research designs. Nonetheless, the list below offers a number of useful distinctions between possible research designs. A research design is an arrangement of conditions or collection.

- Descriptive (e.g., case-study, naturalistic observation, survey)

- Correlational (e.g., case-control study, observational study)
- Experimental (e.g., field experiment, controlled experiment, quasi-experiment)
- Review (literature review, systematic review)
- Meta-analytic (meta-analysis)

Sometimes a distinction is made between "fixed" and "flexible" designs. In some cases, these types coincide with quantitative and qualitative research designs respectively, though this need not be the case. In fixed designs, the design of the study is fixed before the main stage of data collection takes place. Fixed designs are normally theory-driven; otherwise, it is impossible to know in advance which variables need to be controlled and measured. Often, these variables are measured quantitatively. Flexible designs allow for more freedom during the data collection process. One reason for using a flexible research design can be that the variable of interest is not quantitatively measurable, such as culture. In other cases, the theory might not be available before one starts the research.

Grouping

The choice of how to group participants depends on the research hypothesis and on how the participants are sampled. In a typical experimental study, there will be at least one "experimental" condition (e.g., "treatment") and one "control" condition ("no treatment"), but the appropriate method of grouping may depend on factors such as the duration of measurement phase and participant characteristics:

- Cohort study
- Cross-sectional study
- Cross-sequential study
- Longitudinal study

Confirmatory versus exploratory research

Confirmatory research tests *a priori* hypotheses — outcome predictions that are made before the measurement phase begins.

Such *a priori* hypotheses are usually derived from a theory or the results of previous studies. The advantage of confirmatory research is that the result is more meaningful, in the sense that it is much harder to claim that a certain result is generalizable beyond the data set. The reason for this is that in confirmatory research, one ideally strives to reduce the probability of falsely reporting a coincidental result as meaningful. This probability is known as á-level or the probability of a type I error.

Exploratory research, on the other hand, seeks to generate *a posteriori* hypotheses by examining a data-set and looking for potential relations between variables. It is also possible to have an idea about a relation between variables but to lack knowledge of the direction and strength of the relation. If the researcher does not have any specific hypotheses beforehand, the study is exploratory with respect to the variables in question (although it might be confirmatory for others). The advantage of exploratory research is that it is easier to make new discoveries due to the less stringent methodological restrictions. Here, the researcher does not want to miss a potentially interesting relation and therefore aims to minimize the probability of rejecting a *real* effect or relation; this probability is sometimes referred to as â and the associated error is of type II. In other words, if the researcher simply wants to see whether some measured variables could be related, he would want to increase the chances of finding a significant result by lowering the threshold of what is deemed to be *significant*.

State problems versus process problems

A distinction can be made between state problems and process problems. State problems aim to answer what the state of a phenomenon is at a given time, while process problems deal with the change of phenomena over time. Examples of state problems are the level of mathematical skills of sixteen-year-old children, the computer skills of the elderly, the depression level of a person, etc. Examples of process problems are the development of mathematical skills from puberty to adulthood, the change in computer skills when people get older, and how depression symptoms change during therapy.

State problems are easier to measure than process problems. State problems just require one measurement of the phenomena of interest, while process problems always require multiple measurements. Research designs such as repeated measurements and longitudinal study are needed to address process problems.

Examples of fixed designs

Experimental research designs

In an experimental design, the researcher actively tries to change the situation, circumstances, or experience of participants (manipulation), which may lead to a change in behaviour or outcomes for the participants of the study. The researcher randomly assigns participants to different conditions, measures the variables of interest and tries to control for confounding variables. Therefore, experiments are often highly fixed even before the data collection starts.

In a good experimental design, a few things are of great importance. First of all, it is necessary to think of the best way to operationalize the variables that will be measured, as well as which statistical methods would be most appropriate to answer the research question.

Thus, the researcher should consider what the expectations of the study are as well as how to analyse any potential results. Finally, in an experimental design, the researcher must think of the practical limitations including the availability of participants as well as how representative the participants are to the target population. It is important to consider each of these factors before beginning the experiment. Additionally, many researchers employ power analysis before they conduct an experiment, in order to determine how large the sample must be to find an effect of a given size with a given design at the desired probability of making a Type I or Type II error.

The researcher has an advantage of minimizing resources in experimental research designs.

Non-experimental research designs

Non-experimental research designs do not involve a manipulation of the situation, circumstances or experience of the participants. Non-experimental research designs can be broadly classified into three categories. First, in relational designs, a range of variables are measured. These designs are also called correlation studies because correlation data are most often used in the analysis. Since correlation does not imply causation, such studies simply identify co-movements of variables. Correlational designs are helpful in identifying the relation of one variable to another, and seeing the frequency of co-occurrence in two natural groups. The second type is comparative research. These designs compare two or more groups on one or more variable, such as the effect of gender on grades. The third type of non-experimental research is a longitudinal design. A longitudinal design examines variables such as performance exhibited by a group or groups over time.

Examples of flexible research designs

Case study

Famous case studies are for example the descriptions about the patients of Freud, who were thoroughly analysed and described.

Bell (1999) states “a case study approach is particularly appropriate for individual researchers because it gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale”.

Ethnographic study

This type of research is involved with a group, organization, culture, or community. Normally the researcher shares a lot of time with the group.

Grounded theory study

Grounded theory research is a systematic research process that works to develop "a process, and action or an interaction about a substantive topic".

MEANING

Neutrality: When you set up your study, you may have to make assumptions about the data you expect to collect. The results projected in the research should be free from bias and neutral. Understand opinions about the final evaluated scores and conclusions from multiple individuals and consider those who agree with the derived results.

Reliability: With regularly conducted research, the researcher involved expects similar results every time. Your design should indicate how to form research questions to ensure the standard of results. You'll only be able to reach the expected results if your design is reliable.

Validity: There are multiple measuring tools available. However, the only correct measuring tools are those which help a researcher in gauging results according to the objective of the research. The questionnaire developed from this design will then be valid.

Generalization: The outcome of your design should apply to a population and not just a restricted sample. A generalized design implies that your survey can be conducted on any part of a population with similar accuracy.

The above factors affect the way respondents answer the research questions and so all the above characteristics should be balanced in a good design.

A researcher must have a clear understanding of the various types of research design to select which model to implement for a study. Like research itself, the design of your study can be broadly classified into quantitative and qualitative.

Qualitative: Qualitative research determines relationships between collected data and observations based on mathematical calculations. Theories related to a naturally existing phenomenon can be proved or disproved using statistical methods. Researchers rely on qualitative research methods that conclude "why" a particular theory exists along with "what" respondents have to say about it.

Quantitative: Quantitative research is for cases where statistical conclusions to collect actionable insights are essential. Numbers provide a better perspective to make critical business decisions. Quantitative research methods are necessary for the growth of any organization. Insights drawn from hard numerical data and analysis prove to be highly effective when making decisions related to the future of the business.

You can further break down the types of research design into five categories:

1. Descriptive research design: In a descriptive design, a researcher is solely interested in describing the situation or case under their research study. It is a theory-based design method which is created by gathering, analyzing, and presenting collected data. This allows a researcher to provide insights into the why and how of research. Descriptive design helps others better understand the need for the research. If the problem statement is not clear, you can conduct exploratory research.
2. Experimental research design: Experimental research establishes a relationship between the cause and effect of a situation. It is a causal design where one observes the impact caused by the independent variable on the dependent variable. For example, one monitors the influence of an independent variable such as a price on a dependent variable such as customer satisfaction or brand loyalty. It is a highly practical research method as it contributes to solving a problem at hand. The independent variables are manipulated to monitor the change it has on the dependent variable. It is often used in social sciences to observe human behavior by analyzing two groups. Researchers can have participants change

their actions and study how the people around them react to gain a better understanding of social psychology.

3. Correlational research design: Correlational research is a non-experimental research technique that helps researchers establish a relationship between two closely connected variables. This type of research requires two different groups. There is no assumption while evaluating a relationship between two different variables, and statistical analysis techniques calculate the relationship between them.

   A correlation coefficient determines the correlation between two variables, whose value ranges between -1 and +1. If the correlation coefficient is towards +1, it indicates a positive relationship between the variables and -1 means a negative relationship between the two variables.

4. Diagnostic research design: In diagnostic design, the researcher is looking to evaluate the underlying cause of a specific topic or phenomenon. This method helps one learn more about the factors that create troublesome situations.

   This design has three parts of the research:

   - Inception of the issue
   - Diagnosis of the issue
   - Solution for the issue

5. Explanatory research design: Explanatory design uses a researcher's ideas and thoughts on a subject to further explore their theories. The research explains unexplored aspects of a subject and details about what, how, and why of research questions.

DEFINITION

Research design definition

Research design is the framework of research methods and techniques chosen by a researcher. The design allows researchers to hone in on research methods that are suitable for the subject matter and set up their studies up for success.

The design of a research topic explains the type of research (experimental, survey, correlational, semi-experimental, review) and also its sub-type (experimental design, research problem, descriptive case-study).

There are three main types of designs for research: Data collection, measurement, and analysis. The type of research problem an organization is facing will determine the research design and not vice-versa. The design phase of a study determines which tools to use and how they are used.

An impactful research usually creates a minimum bias in data and increases trust in the accuracy of collected data. A design that produces the least margin of error in experimental research is generally considered the desired outcome. The essential elements are:

1. Accurate purpose statement
2. Techniques to be implemented for collecting and analyzing research
3. The method applied for analyzing collected details
4. Type of research methodology
5. Probable objections for research
6. Settings for the research study
7. Timeline
8. Measurement of analysis

WHY RESEARCH DESIGN?

Research design is a plan to answer your research question. A research method is a strategy used to implement that plan. Research design and methods are different but closely related, because good research design ensures that the data you obtain will help you answer your research question more effectively.

It depends on your research goal. It depends on what subjects (and who) you want to study. Let's say you are interested in studying what makes people happy, or why some students are more conscious about recycling on campus. To answer these questions, you need to make a decision about how to collect your data. Most frequently used methods include:

1. Observation / Participant Observation
2. Surveys
3. Interviews
4. Focus Groups
5. Experiments
6. Secondary Data Analysis / Archival Study
7. Mixed Methods (combination of some of the above)

One particular method could be better suited to your research goal than others, because the data you collect from different methods will be different in quality and quantity. For instance, surveys are usually designed to produce relatively short answers, rather than the extensive responses expected in qualitative interviews.

CRITERIA OF A GOOD RESEARCH DESIGN

Throughout the design construction task, it is important to have in mind some endpoint, some criteria which we should try to achieve before finally accepting a design strategy. The criteria are only meant to be suggestive of the characteristics found in good research design. It is worth noting that all of these criteria point to the need to individually tailor research designs rather than accepting standard textbook strategies as is.

1. Theory-Grounded. Good research strategies reflect the theories which are being investigated. Where specific theoretical expectations can be hypothesized these are incorporated into the design. For example, where theory predicts a specific treatment effect on one measure but not on another, the inclusion of both in the design improves discriminant validity and demonstrates the predictive power of the theory.

2. Situational. Good research designs reflect the settings of the investigation. This was illustrated above where a particular need of teachers and administrators was explicitly addressed in the design strategy. Similarly, intergroup rivalry, demoralization, and competition might be assessed through the use of additional comparison groups who are not in direct contact with the original group.
3. Feasible. Good designs can be implemented. The sequence and timing of events are carefully thought out. Potential problems in measurement, adherence to assignment, database construction and the like, are anticipated. Where needed, additional groups or measurements are included in the design to explicitly correct for such problems.
4. Redundant. Good research designs have some flexibility built into them. Often, this flexibility results from duplication of essential design features. For example, multiple replications of a treatment help to insure that failure to implement the treatment in one setting will not invalidate the entire study.
5. Efficient. Good designs strike a balance between redundancy and the tendency to overdesign. Where it is reasonable, other, less costly, strategies for ruling out potential threats to validity are utilized.

This is by no means an exhaustive list of the criteria by which we can judge good research design nevertheless, goals of this sort help to guide the researcher toward a final design choice and emphasize important components which should be included. The development of a theory of research methodology for the social sciences has largely occurred over the past half century and most intensively within the past two decades. It is not surprising, in such a relatively recent effort, that an emphasis on a few standard research designs has occurred. Nevertheless, by moving away from the notion of "design selection" and towards an emphasis on design construction, there is much to be gained in our understanding of design principles and in the quality of our research.

Social Design

Social design has many definitions and the term is put to very different uses across the globe. Some definitions exist within the design world and refers to design in its traditional sense, meaning the shaping of products and services. Other definitions refer to social design as the creation of social reality; design of the social world.

Responsibility

Within the design world social design is sometimes defined as a design process that contributes to improving human well-being and livelihood. The agenda of social design is inspired by among others' Victor Papanek's idea that designers and creative professionals have a responsibility and are able to cause real change in the world through good design. Papanek writes about responsible design. Designers can contribute to designing more ecological products by carefully selecting the materials they use. Papanek also remarks on designing for people's needs rather than their wants. Responsible design includes many directions and one of these is design for the Third World. Designers have responsibility over the choices they make in design processes.

Social design thinking within the design world joins developing human and social capital with new products and processes that are profitable. Profitability and ownership of the processes are the cornerstones of sustainability that underpins human well-being. Another author that contributes to the development of this definition of social design is Victor Margolin. He writes in "*The Politics of the Artificial*" about the "designer's ability to envision and give form on material and immaterial products that can address human problems on broad scale and contribute to social well-being." This ideology is something that social design is built on. In this view social design is an activity that should not be framed with connotations of charity, aid donations, help etc. It is not voluntary work but it should be seen as professional contribution that plays a part in local economic development or livelihood.

Strategic Thinking

Another starting point for outlining social design is strategic thinking of design. Creating policies and implementing them on civil level. The two poles: tradition and the market economy can, in one of the models for social design, be placed in interaction, rather than in competition, with each other. An author that has to be mentioned here is Jacque Fresco and his Venus Project. He proposes that the future of the social systems needs to be designed by the scientific method. Social design can then be seen as a process that leads to human capabilities that in turn contributes to their well-being. As Amartya Sen writes, poverty is seen as deprivation of capabilities. By focussing on capabilities, rather than e.g. income, Amartya Sen suggests that development within various social aspects of life can contribute to general development. Understanding and using social design processes can contribute to the improvement of livelihood

Designing Systems

Another dimension of social design focuses on designing systems that join the elements of communication, new product development and the environment. It is argued that no single area of design is, by itself, sufficient to drive sustainable social development. What is needed is a system of design, one that encompasses all of the areas of design, towards an open system with multiple, self-adjusting and complementary actors that aim for a vision of a loosely defined common set of goals.

Outside the design world social design appears in a number of professional environments. There are a growing number of artists, especially in Scandinavia, that use the term social design to describe their work, though the work is exhibited within the art world. These are artist like FOS and Superflex. They come out of a tradition of social art that can be led back to the Futurists, the Dadaists and e.g. the German artist Joseph Beuys.

Social World

The term social design is also increasingly used to describe design of the social world. This definition implicates a perception of a man-made reality, which consequently can only be changed by man, and *is* changed by man all the time. In this view social design is inescapable, it is there whether people are aware of it or not. The social reality is created as a result of the sum of all our individual actions. There is an emerging discussion of this concept of social design, which encompasses all other definitions of the term.

TYPES OF RESEARCH DESIGN

What are the different major types of research designs? We can classify designs into a simple threefold classification by asking some key questions. First, does the design use random assignment to groups? If random assignment is used, we call the design a randomized experiment or true experiment. If random assignment is not used, then we have to ask a second question: Does the design use *either* multiple groups or multiple waves of measurement? If the answer is yes, we would label it a quasi-experimental design. If no, we would call it a non-experimental design.

This threefold classification is especially useful for describing the design with respect to internal validity. A randomized experiment generally is the strongest of the three designs when your interest is in establishing a cause-effect relationship. A non-experiment is generally the weakest in this respect. I have to hasten to add here, that I don’t mean that a non-experiment is the weakest of the three designs *overall*, but only with respect to internal validity or causal assessment. In fact, the simplest form of non-experiment is a one-shot survey design that consists of nothing but a single observation O. This is probably one of the most common forms of research and, for some research questions — especially descriptive ones — is clearly a strong design. When I say that the non-experiment is the weakest with respect to internal validity, all I mean is that it isn't a particularly good method for assessing the cause-effect relationship that you think might exist between a program and its outcomes. To illustrate the different types of designs, consider one of each in design notation. The first design is a posttest-only randomized experiment. You can tell it's a randomized experiment because it has an R at the beginning of each line, indicating random assignment.

The second design is a pre-post nonequivalent groups quasi-experiment. We know it's not a randomized experiment because random assignment wasn't used. And we know it's not a non-experiment because there are both multiple groups and multiple waves of measurement. That means it must be a quasi-experiment. We add the label "nonequivalent" because in this design we do not explicitly control the assignment and the groups may be nonequivalent or not similar to each other. Finally, we show a posttest-only nonexperimental design. You might use this design if you want to study the effects of a natural disaster like a flood or tornado and you want to do so by interviewing survivors. Notice that in this design, you don't have a comparison group (e.g., interview in a town down the road the road that didn't have the tornado to see what differences the tornado caused) and you don't have multiple waves of measurement (e.g., a pre-tornado level of how people in the ravaged town were doing before the disaster). Does it make sense to do the non-experimental study? Of course!

You could gain lots of valuable information by well-conducted post-disaster interviews. But you may have a hard time establishing which of the things you observed are due to the disaster rather than to other factors like the peculiarities of the town or pre-disaster characteristics.

Experimental Design

Experimental designs are often touted as the most "rigorous" of all research designs or, as the "gold standard" against which all other designs are judged. In one sense, they probably are. If you can implement an experimental design well (and that is a big "if" indeed), then the experiment is probably the strongest design with respect to internal validity. Why? Recall that internal validity is at the center of all causal or cause-effect inferences. When you want to determine whether some program or treatment *causes* some outcome or outcomes to occur, then you are interested in having strong internal validity. Essentially, you want to assess the proposition:

If X, then Y

or, in more colloquial terms:

If the program is given, then the outcome occurs.

Unfortunately, it's not enough just to show that when the program or treatment occurs the expected outcome also happens. That's because there may be lots of reasons, other than the program, for why you observed the outcome. To really show that there is a causal relationship, you have to simultaneously address the two propositions:

If X, then Y

and

If *not* X, then *not* Y.

Or, once again more colloquially:

If the program is given, then the outcome occurs

and

If the program is *not* given, then the outcome does *not* occur.

If you are able to provide evidence for both of these propositions, then you've in effect isolated the program from all of the other potential causes of the outcome. You've shown that when the program is present the outcome occurs and when it's not present, the outcome doesn't occur. That points to the causal effectiveness of the program.

Think of all this like a fork in the road. Down one path, you implement the program and observe the outcome. Down the other path, you don't implement the program and the outcome doesn't occur. But, how do we take *both* paths in the road in the same study? How can we be in two places at once? Ideally, what we want is to have the same conditions — the same people, context, time, and so on — and see whether when the program is given we get the outcome and when the program is not given we don't. Obviously, we can never achieve this hypothetical situation. If we give the program to a group of people, we can't simultaneously not give it! So, how do we get out of this apparent dilemma?

Perhaps we just need to think about the problem a little differently. What if we could create two groups or contexts that are as similar as we can possibly make them? If we could be confident that the two situations are comparable, then we could administer our program in one and not give the program in the other. And, if the two contexts are comparable, then this is like taking both forks in the road simultaneously! We can have our cake and eat it too, so to speak.

That's exactly what an experimental design tries to achieve. In the simplest type of experiment, we create two groups that are "equivalent" to each other. One group (the program or treatment group) gets the program and the other group (the comparison or control group) does not. In all other respects, the groups are treated the same. They have similar people, live in similar contexts, have similar backgrounds, and so on. Now, if we observe differences in outcomes between these two groups, then the differences must be due to the only thing that differs between them — that one got the program and the other didn't.

OK, so how do we create two groups that are "equivalent"? The approach used in experimental design is to assign people randomly from a common pool of people into the two groups.

The experiment relies on this idea of random assignment to groups as the basis for obtaining two groups that are similar. Then, we give one the program or treatment and we don't give it to the other. We observe the same outcomes in both groups.

The key to the success of the experiment is in the random assignment. In fact, even with random assignment we never expect that the groups we create will be exactly the same. How could they be, when they are made up of different people? We rely on the idea of probability and assume that the two groups are "probabilistically equivalent" or equivalent within known probabilistic ranges. So, if we randomly assign people to two groups, and we have enough people in our study to achieve the desired probabilistic equivalence, then we may consider the experiment to be strong in internal validity and we probably have a good shot at assessing whether the program causes the outcome(s).

But there are lots of things that can go wrong. We may not have a large enough sample. Or, we may have people who refuse to participate in our study or who drop out part way through. Or, we may be challenged successfully on ethical grounds (after all, in order to use this approach we have to deny the program to some people who might be equally deserving of it as others). Or, we may get resistance from the staff in our study who would like some of their "favourite" people to get the program. Or, they mayor might insist that her daughter be put into the new program in an educational study because it may mean she'll get better grades.

The bottom line here is that experimental design is intrusive and difficult to carry out in most real world contexts. And, because an experiment is often an intrusion, you are to some extent setting up an artificial situation so that you can assess your causal relationship with high internal validity. If so, then you are limiting the degree to which you can generalize your results to real contexts where you haven't set up an experiment. That is, you have reduced your external validity in order to achieve greater internal validity.

In the end, there is just no simple answer (no matter what anyone tells you!). If the situation is right, an experiment can be a very strong design to use. But it isn't automatically so. My own personal guess is that randomized experiments are probably appropriate in no more than 10% of the social research studies that attempt to assess causal relationships. Experimental design is a fairly complex subject in its own right. I've been discussing the simplest of experimental designs — a two-group program versus comparison group design. But there are lots of experimental design variations that attempt to accomplish different things or solve different problems. In this section you'll explore the basic design and then learn some of the principles behind the major variations.

Types of Research Studies and Designs

There are four major classifications of research designs. These include observational research, correlational research, true experiments, and quasi-experiments. Each of these will be discussed further below.

Observational research: There are many types of studies which could be defined as observational research including case studies, ethnographic studies, ethological studies, etc. The primary characteristic of each of these types of studies is that phenomena are being observed and recorded. Often times, the studies are qualitative in nature. For example, a psychological case study would entail extensive notes based on observations of and interviews with the client. These studies may also be qualitative in nature or include qualitative components in the research. For example, an ethological study of primate behavior in the wild may include measures of behavior durations ie. the amount of time an animal engaged in a specified behavior. This measure of time would be qualitative.

Surveys are often classified as a type of observational research. Correlational research: In general, correlational research examines the covariation of two or more variables. For example, the early research on cigarette smoking examine the covariation of cigarette smoking and a variety of lung diseases. These two variable, smoking and lung disease were found to covary together. Correlational research can be accomplished by a variety of techniques which include the collection of empirical data.

Often times, correlational research is considered type of observational research as nothing is manipulated by the experimenter or individual conducting the research. For example, the early studies on cigarette smoking did not manipulate how many cigarettes were smoked. The researcher only collected the data on the two variables. Nothing was controlled by the researchers.

It is important to not that correlational research is not causal research. In other words, we can not make statements concerning cause and effect on the basis of this type of research. There are two major reasons why we can not make cause and effect statements. First, we donÂ¹t know the direction of the cause. Second, a third variable may be involved of which we are not aware. An example may help clarify these points. In major clinical depressions, the neurotransmitters serotonin and/ or norepinephrine have been found to be depleted.

In other words, low levels of these two neurotransmitters have been found to be associated with increased levels of clinical depression. However, while we know that the two variables covary- a relationship exists- we do not know if a causal relationship exists.

Thus, it is unclear whether a depletion in serotonin/ norepinephrine cause depression or whether depression causes a depletion is neurotransmitter levels. This demonstrates the first problem with correlational research; we don't know the direction of the cause. Second, a third variable has been uncovered which may be affecting both of the variables under study. The number of receptors on the postsynaptic neuron has been found to be increased in depression. Thus, it is possible that the increased number of receptors on the postsynaptic neuron is actually responsible for the relationship between neurotransmitter levels and depression. As you can see from the discussion above, one can not make a simple cause and effect statement concerning neurotransmitter levels and depression based on correlational research. To reiterate, it is inappropriate in correlational research to make statements concerning cause and effect.

Correlational research is often conducted as exploratory or beginning research. Once variables have been identified and defined, experiments are conductable.

True Experiments: The true experiment is often thought of as a laboratory study. However, this is not always the case. A true experiment is defined as an experiment conducted where an effort is made to impose control over all other variables except the one under study. It is often easier to impose this sort of control in a laboratory setting. Thus, true experiments have often been erroneously identified as laboratory studies.

To understand the nature of the experiment, we must first define a few terms:

1. Experimental or treatment group- this is the group that receives the experimental treatment, manipulation, or is different from the control group on the variable under study.
2. Control group- this group is used to produce comparisons. The treatment of interest is deliberately withheld or manipulated to provide a baseline performance with which to compare the experimental or treatment group's performance.
3. Independent variable- this is the variable that the experimenter manipulates in a study. It can be any aspect of the environment that is empirically investigated for the purpose of examining its influence on the dependent variable.
4. Dependent variable- the variable that is measured in a study. The experimenter does not control this variable.

5. Random assignment- in a study, each subject has an equal probability of being selected for either the treatment or control group.
6. Double blind- neither the subject nor the experimenter knows whether the subject is in the treatment of the control condition.

Now that we have these terms defined, we can examine further the structure of the true experiment. First, every experiment must have at least two groups: an experimental and a control group. Each group will receive a level of the independent variable.

The dependent variable will be measured to determine if the independent variable has an effect. As stated previously, the control group will provide us with a baseline for comparison. All subjects should be randomly assigned to groups, be tested a simultaneously as possible, and the experiment should be conducted double blind. Perhaps an example will help clarify these points.

Wolfer and Visintainer (1975) examined the effects of systematic preparation and support on children who were scheduled for inpatient minor surgery.

The hypothesis was that such preparation would reduce the amount of psychological upset and increase the amount of cooperation among thee young patients. Eighty children were selected to participate in the study. Children were randomly assigned to either the treatment or the control condition.

During their hospitalization the treatment group received the special program and the control group did not. Care was take such that kids in the treatment and the control groups were not roomed together. Measures that were taken included heart rates before and after blood tests, ease of fluid intake, and self-report anxiety measures. The study demonstrated that the systematic preparation and support reduced the difficulties of being in the hospital for these kids. Let us examine now the features of the experiment described above. First, there was a treatment and control group. If we had had only the treatment group, we would have no way of knowing whether the reduced anxiety was due to the treatment or the weather, new hospital food, etc.

The control group provides us with the basis to make comparisons The independent variable in this study was the presence or absence of the systematic preparation program. The dependent variable consisted of the heart rates, fluid intake, and anxiety measures.

The scores on these measures were influenced by and depended on whether the child was in the treatment or control group. The children were randomly assigned to either group. If the "friendly" children had been placed in the treatment group we would have no way of knowing whether they were less anxious and more cooperative because of the treatment or because they were "friendly".

In theory, the random assignment should balance the number of "friendly" children between the two groups. The two groups were also tested at about the same time.

In other words, one group was not measured during the summer and the other during the winter. By testing the two groups as simultaneously as possible, we can rule out any bias due to time. Finally, the children were unaware that they were participants in an experiment (the parents had agreed to their children's participation in research and the program), thus making the study single blind. If the individuals who were responsible for the dependent measures were also unaware of whether the child was in the treatment or control group, then the experiment would have been double blind.

A special case of the true experiment is the clinical trial. A clinical trial is defined as a carefully designed experiment that seeks to determine the clinical efficacy of a new treatment or drug.

The design of a clinical trial is very similar to that of a true experiment. Once again, there are two groups: a treatment group (the group that receives the therapeutic agent) and a control group (the group that receives the placebo).

The control group is often called the placebo group. The independent variable in the clinical trial is the level of the therapeutic agent. Once again, subjects are randomly assigned to groups, they are tested simultaneously, and the experiment should be conducted double blind. In other words, neither the patient or the person administering the drug should know whether the patient is receiving the drug or the placebo.

Quasi-Experiments: Quasi-experiments are very similar to true experiments but use naturally formed or pre-existing groups. For example, if we wanted to compare young and old subjects on lung capacity, it is impossible to randomly assign subjects to either the young or old group (naturally formed groups).

Therefore, this can not be a true experiment. When one has naturally formed groups, the variable under study is a subject variable (in this case- age) as opposed to an independent variable.

As such, it also limits the conclusions we can draw from such an research study. If we were to conduct the quasi-experiment, we would find that the older group had less lung capacity as compared to the younger group.

We might conclude that old age thus results in less lung capacity. But other variables might also account for this result. It might be that repeated exposure to pollutants as opposed to age has caused the difference in lung capacity. It could also be a generational factor. Perhaps more of the older group smoked in their early years as compared to the younger group due to increased awareness of the hazards of cigarettes. The point is that there are many differences between the groups that we can not control that could account for differences in our dependent measures. Thus, we must be careful concerning making statement of causality with quasi-experimental designs.

Quasi-experiments may result from studying the differences between naturally formed groups (ie. young & old; men &

women). However, there are also instances when a researcher designs a study as a traditional experiment only to discover that random assignment to groups is restricted by outside factors.

The researcher is forced to divide groups according to some pre-existing criteria. For example, if a corporation wanted to test the effectiveness of a new wellness program, they might decide to implement their program at one site and use a comporable site (no wellness program) as a control. As the employees are not shuffled and randomly assigned to work at each site, the study has pre-existing groups.

After a few months of study, the researchers could then see if the wellness site had less absenteeism and lower health costs than the non-wellness site. The results are again restricted due to the quasi-correlational nature of the study. As the study has pre-existing groups, there may be other differences between those groups than just the presence or absence of a wellness program. For example, the wellness program may be in a significantly newer, more attractive building, or the manager from hell may work at the nonwellness program site. Either way, it a difference is found between the two sites it may or may not be due to the presence/absence of the wellness program.

To summarize, quasi-experiments may result from either studying naturally formed groups or use of pre-existing groups. When the study includes naturally formed groups, the variable under study is a subject variable. When a study uses pre-existing groups that are not naturally formed, the variable that is manipulated between the two groups is an independent variable (With the exception of no random assignment, the study looks similar in form to a true experiment). As no random assignment exists in a quasi-experiment, no causal statements can be made based on the results of the study.

Populations and Samples in Research Design

When conducting research, one must often use a sample of the population as opposed to using the entire population. Before we go further into the reasons why, let us first discuss what differentiates between a population and a sample.

A population can be defined as any set of persons/subjects having a common observable characteristic. For example, all individuals who reside in the United States make up a population. Also, all pregnant women make up a population. The characteristics of a population are called a parameter. A statistic can be defined as any subset of the population. The characteristics of a sample are called a statistic.

This brings us to the question of why sample. Why should we not use the population as the focus of study. There are at least four major reasons to sample. First, it is usually too costly to test the entire population. The United States government spends millions of dollars to conduct the U.S. Census every ten years.

While the U.S. government may have that kind of money, most researchers do not. The second reason to sample is that it may be impossible to test the entire population. For example, let us say that we wanted to test the 5-HIAA (a serotonergic metabolite) levels in the cerebrospinal fluid (CSF) of depressed individuals. There are far too many individuals who do not make it into the mental health system to even be identified as depressed, let alone to test their CSF.

The third reason to sample is that testing the entire population often produces error. Thus, sampling may be more accurate. Perhaps an example will help clarify this point. Say researchers wanted to examine the effectiveness of a new drug on Alzheimer's disease. One dependent variable that could be used is an Activities of Daily Living Checklist. In other words, it is a measure of functioning o a day to day basis. In this experiment, it would make sense to have as few of people rating the patients as possible. If one individual rates the entire sample, there will be some measure of consistency from one patient to the next. If many raters are used, this introduces a source of error. These raters may all use a slightly different criteria for judging Activities of Daily Living. Thus, as in this example, it would be problematic to study an entire population. The final reason to sample is that testing may be destructive. It makes no sense to lesion the lateral hypothalamus of all rats to determine if it has an effect on food intake. We can get that information from operating on a small sample of rats. Also, you probably would not want to buy a car that had the door slammed five hundred thousand time or had been crash tested. Rather, you probably would want to purchase the car that did not make it into either of those samples.

STEP IN PREPARING A RESEARCH DESIGN

Steps of Research Design

Formulation of the research problem

Necessity is the mother of all inventions, and accordingly, it is a problem which necessitates research. A general area of interest is selected by the researcher initially to indicate the problem.

The problem is evaluated by the program, which helps to shed new light on the facts and collecting of useful fact to plan social or even policy-making purposes. Social scientists involved their values as well as the social conditions which are prevalent in order to select the problem for the research.

It is suggested that this influence should be avoided as much as possible. The use of variation and topics of research because scientists also differ in their values and their preferences. This is the reason why the topics of the research very wide with different scientists.

The need for a specific problem is always fat by the scientist's sensor general topic fails twin sure that the ability to examine the data resides and the methods that are needed to adapt and organize them along with the formulation of the specific problem is always there.

This helps the researcher to sharpen his goal and to make it clear cut. The purpose of this is not only to guide the researcher but also to sharpen for narrow is questions like a pinpoint. For example, if a general topic of any industry or domain is compared with a pyramid base and the specific topic is exactly opposite to it which resembles the apex of the pyramid.

It is not an easy task to formulate a problem which has arisen out of a practical or theoretical situation. Even if it appears easy to do so, it is not the case, and in fact, it is more of a herculean task. Significant people by Charles Darwin have said that 'looking back it seems that seeing and understanding the problem is more difficult than solving them. ' since the problem itself poses a lot of difficulties and the same is experienced by the researchers, one should ensure that the formulation of the problem is done in such a way that it should be explained and put in an efficient way so that it justifies the saying that a problem well put is half solved.

There are three general questions which are considered as three important components that are involved in the process of problem formulation

1. What does one want to know?
2. Why?
3. What could be the probable answers to the originating questions?

There should be a rational base for the problems of the solution that is provided itself has a more rational base. The answers that are provided justify the concerns of the problem, which are theoretical or practical in nature.

The answers that are provided by the theoretical rationale in terms of enlargement or propagation of the existing ideas or theory. It helps to shed light on the consistency is which are observed in the existing theories and ensures them to examine those inconsistencies and determine their nature in terms of reality.

On the other hand, to bring desired values, the practical rationale should be able to justify the answers to the questions of the researcher. It is very crucial that the formation of the problem is done in an efficient way so that the solution is found in the same manner.

If there is a flaw in the problem, the solution itself will be full of flaws, and it won't be good research.

Literature review

The research is based on pastor knowledge, and the researcher should always make sure to take advantage of the north, which is already available or preserved earlier.

This not only helps the investigator to avoid replicating the hypothesis of earlier research but also enables him and provides evidence that he knows the current research which has already been done and can work on the untested and unknown field.

The literature review also means that the summary of writings how the earlier researchers and recognize the authority is in the particular area have been analyzed and summarised.

Books and libraries are the best places to find all human knowledge which is accumulated in the past. The published literature provides dear approaches which have been selected and helps the current researcher to study those approaches and take the baton from thereon.

The primary function of the literature review is that the research is given direction and information update related to the problem and the multiple ways that have already been tried to solve the problem and probably failed. This also helps the researcher to find his own hypothesis and save time doing what the earlier researchers had done.

The primary objectives of literature reviews are

1. To avoid the studies which are overlapping with each other
2. How to provide explanations ideas of the theory is which will be helpful in writing and defining the nature of the research problem.
3. To formulate hypothesis by being a fertile source for it.

4. To find out and suggest different methods in order to collect data and to explore different sources of data and techniques which are appropriate for the problem.
5. To study and analyze what the earlier researchers had done.
6. To ensure that the researcher is kept known of the current developments with regards to his area of activity.

Following are a few of the principles that the researcher has to follow for the review of the literature:

1. The researcher should ensure that he has obtained an overall view from a source which is general and which has materials which are likely to provide the nature along with the meaning of concept and variables.
2. After that, the researcher should also ensure that the reviewing that is conducted in the concerned field should review empirical researches.
3. A systematic manner is approached in order to review the library materials, and also it should be thorough in nature.
4. If at all he has mentioned any references, the researcher should ensure that it is mentioned in the bibliographic data.

Formation of Hypothesis in Research Design

The next step in the research is to formulate a hypothesis which will be tentative with nature and which would explain the nature of the problem. This explanation is tentative in nature refers to the statement of relation and relates two or more variables.

In order to formulate a hypothesis, the researcher collects information from multiple sources such as previous reports, existing theories, and literature which have worked with you on a similar problem.

Some of the studies test the hypothesis while others are formulating the hypothesis. The hypothesis for marketing studies are the ones which are exploratory studies since these end up with the formulation of hypothesis.

On the other hand, researches, which are hypothesis testing, start with a clearly defined and formulated hypothesis. The researcher has to state the definitions of concept so that they translate to the official and formal definitions and convey the nature of the problem into observables references.

In order to develop a hypothesis, it is essential to explain the nature of the relationship between two or more variables. If one of the variable influences the other in the first variable is called as independent while the second is termed as the dependent variable. A correlation exists when one variable changes and influences another variable. It is very crucial that the researcher separates the dependent and independent variables from each other.

Formulating a Research Design

Once the problem has been defined, and the literature review is completed after formatting of the hypothesis, the researcher then starts to work on the design of the research. The design of research must be a blueprint for the general collection.

It acts as a standard guidepost by providing answers to multiple questions. It also helps in carrying out research accurately, objective, the economically and validity and is therefore fail-proof.

The research designs vary according to their need and the purpose of the research as well as the point of view working procedure.

There are basically four categories of research design:

1. Exploration
2. Description
3. Diagnosis and
4. Experimentation

There are four parts of Research design according to the realizable working procedure.

1. Sampling design which is used to physically for sampling and selection of the units for the research purposes.
2. The observational design describes the method in which observations are to be collected.
3. The statistical design which describes the techniques statistically which are used in the analysis of data along with its interpretation.
4. The operational design which deals with the techniques by which entire research can be carried out. The handset has all the three designs which are mentioned above, such as observational statistical and sampling designs.

Defining the nature of the study

The nature of the study as the cause of the individual items which are under consideration in the field of study. Nature refers to the sum of units for individuals from which a sample is another east in order to find out results, and that analysis is applied to it.

The researcher also separates the target and server population in order to define the scope of the study. Target units are the one which is applied to the results of the research. On the other hand, survey units are the ones which are included in sampling and all the ones from which the sample is taken.

In most of the purposes, this distinction is not significant, and the entire population must be defined in clear terms.

Sample design

It is not possible under different circumstances to enumerate all of the atoms included in the universe because it requires the result of resources like Mani time and energy which is why the researcher decides to select a representative from the population known as a sample and the process is known as simple design.

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It is useful how to predetermine a sample before going for the entire research.

There are different types of samples which are as follows:

1. Probability samples
2. Purposive or judgment or subjective sampling
3. Mixed sampling.

The probability samples are the ones which are drawn from the universe which is according to the laws of chance and are based on on the proper scientific technique in which every sample in the unit has a predefined probability of being selected.

In case of Subjective or Purposive or judgment sampling, the units are purposefully our desperately drawn depending on the investigation objectives, and these include only the important ones which represent it the population completely.

These units are selected in mixed sampling according to fixed sampling rule for according to fixed sampling rule, which does not depend on chance.

Simple random sampling, stratified random sampling, complex random sampling, haphazard or convenience sampling, cluster and area sampling, judgment sampling, and quota sampling a few of the important types of sampling.

Administration of the tools of Data collection in Research Design

Appropriate data is required for any research work. Along with appropriateness, the data should also be adequate. Considering the financial and time and other resources which are available, the data may differ considerably.

Things like nature of the investigation, scope of the inquiry, objective and financial resources along with the desired degree of accuracy and the time which is available after of the things that the researcher has to take into consideration.

Apart from this, the ability and experience of the researcher also have very much importance in the data collection that is required. Journals newspapers reports published earlier and books are of the sources from which secondary data can be collected, and the primary data can be collected by survey or experimentation. In order to conduct a survey, the data is gathered by personal interviews observations making of the questionnaire on telephonic interviews and nowadays via the Internet.

Data analysis

After the collection of data is completed the investigator then has to analyze the collected data which involves operations like segregating the data into different categories and application of coding for deposition to the raw data that is collected.

Statistical conclusions were drawn after that. These operations are supervised very closely, and at the beginning, it is the researchers who have to classify some of the raw data into different categories based on similar purposes.

The coding is done in order to change the categories of data and make them tabulated and countable. After that, during the postcoding stage, the data which is collected is put into tabulated form, and this is done in the technical your manually with the devices such as computers.

If the data is very is ours than computers are used wisely in case of small data, manual mode is used. Standard statistical formulas and methods are applied in order to test the validity of the data by the researchers so that he arrives at some definite conclusion.

Hypothesis testing in Research Design

The studies do not always confirm the original hypothesis, and in many cases, the hypothesis may be refused, and the researcher in such cases mastery for a visit there results and conclusions. It is not possible in case of behavioral sciences to test multiple hypotheses.

The scientist can test the research hypothesis by making a sample for direct observation. On this observable basis, they determine if the hypothesis is consistent or not with the logical consequences, and that is why the indirect test of this hypothesis can be made.

The research hypothesis that is derived from the theory helps to provide an inconclusive test. A much stronger logical test is formed if the rejection of the null hypothesis. It is defined as a hypothesis of no difference, which is why the rejection of it results in the acceptance of the alternative hypothesis.

Various tests have been developed by statisticians like t-test, F-test, chi-square test in order to test the hypothesis. If there is no hypothesis, to begin with, then the generalizations are the only way to serve as the basis of hypothesis.

Interpretation and generalization

After the test of hypothesis is completed in Research Design, and the validity is confirmed, the researcher has reached a stage of generalization, which is generally seen as a real value to the research.

Only in case of hypothesis testing studies is this possible but thing hypothesis formulating studies where there is an absence of hypothesis the researcher has to you interpret his findings.

In other words, the theoretical framework may be used by the researcher in order to explain the findings of his research, which may raise new questions.

Preparing the report of the Research

The final product of all the research activity is the report which gives a written account of the entire journey along with the path to find new knowledge. This type requires a technical task, which is why writing research is not only but also tests patients and efforts on the part of the researcher.

The overall approach to the problem along with the analysis of the data and superior grasp over language all of it has to be used in case of preparing the report. The report has a foreword or the title page along with Preface, and list of tables and contents.

It may also contain a list of charts or illustrations. in the second section of the report; there will be an introduction to the research report along with the purpose of the study and statement of the problem.

Then the researcher will write about the hypothesis and the definitions along with the methodology by which the research is conducted. A section for secondary data analysis and primary data analysis is kept.

7

Methods of Data Collection-I

DEFINITION OF OBSERVATION

Observation is the active acquisition of information from a primary source. In living beings, observation employs the senses. In science, observation can also involve the perception and recording of data via the use of scientific instruments. The term may also refer to any data collected during the scientific activity. Observations can be qualitative, that is, only the absence or presence of a property is noted, or quantitative if a numerical value is attached to the observed phenomenon by counting or measuring.

Science

The scientific method requires observations of natural phenomena to formulate and test hypotheses. It consists of the following steps:

1. Ask a question about a natural phenomenon
2. Make observations of the phenomenon

Formulate a hypothesis that tentatively answers the question

1. Predict logical, observable consequences of the hypothesis that have not yet been investigated
2. Test the hypothesis' predictions by an experiment , observational study , field study , or simulation

3. Draw a conclusion from data gathered in the experiment, or revise the hypothesis or form a new one and repeat the process
4. Write a descriptive method of observation and the results or conclusions reached
5. Have peers with experience researching the same phenomenon evaluate the results

Observations play a role in the second and fifth steps of the scientific method. However, the need for reproducibility requires that observations by different observers can be comparable. Human sense impressions are subjective and qualitative, making them difficult to record or compare. The use of measurement developed to allow recording and comparison of observations made at different times and places, by different people. Measurement consists of using observation to compare the phenomenon being observed to a standard unit. The standard unit can be an artifact, process, or definition which can be duplicated or shared by all observers. In measurement the number of standard units which is equal to the observation is counted. Measurement reduces an observation to a number which can be recorded, and two observations which result in the same number are equal within the resolution of the process.

Human senses are limited and subject to errors in perception, such as optical illusions. Scientific instruments were developed to aid human abilities of observation, such as weighing scales, clocks, telescopes, microscopes, thermometers, cameras, and tape recorders, and also translate into perceptible form events that are unobservable by the senses, such as indicator dyes, voltmeters, spectrometers, infrared cameras, oscilloscopes, interferometers, geiger counters, and radio receivers.

One problem encountered throughout scientific fields is that the observation may affect the process being observed, resulting in a different outcome than if the process was unobserved. This is called the *observer effect*. For example, it is not normally possible to check the air pressure in an automobile tire without letting out some of the air, thereby changing the pressure. However, in most fields of science it is possible to reduce the effects of observation to insignificance by using better instruments.

Considered as a physical process itself, all forms of observation (human or instrumental) involve amplification and are thus thermodynamically irreversible processes, increasing entropy.

COMPONENTS OF OBSERVATION

Observation is a Systematic Method

Observation is not haphazard or unplanned. The length of the observation periods, the interval between them, the number of observations, the area or situation of observation and various techniques used for observation are carefully planned. Often there are systematic managements for controlling the situation if special factors are to be studied, for example study of honest behaviour, sportsman spirit, leadership qualities etc.

Observation is Specific

It is not just looking around for general aspects of human behaviour. Rather it is directed at those specific aspects of total situation which are assumed to be significant from the stand point of the purpose of the study. The layman may frequently overlook what is crucial while observing an event or phenomenon, but the scientific observer should look for some definite things which suit his purpose of study so as to economies his time, money and effort for observation.

Observation is Objective

Observation should be objective and free from bias as far as possible. It should generally be guided by a hypothesis. The observer must maintain ethical neutrality. He must consider hypothesis as something to be tested. But at the same time he must maintain a flexible attitude, so that he can deviate from his original plan when such deviation appears inevitable.

Observation is Quantitative

Although many important phenomena cannot be quantified, it becomes almost an imperative to use some means for quantifying observations in order to increase their precision and to facilitate their analysis. Even the quality should be converted into quantity, because qualitative data is subjective and quantitative one is objective and can further be interpreted in objective manner.

Observation is an Affair of Eyes

P.V. Young remarks that observation is a systematic and deliberate study through eye. An observer gathers the data which he has seen in his own eyes. Collecting information through eyes is probably the most trustworthy technique of data collection in social research.

Definite Aim

Observation must have some definite aims and objectives. It should be clearly defined before the beginning of the actual observation process. Without the proper aims and objectives observation will be unsystematic and expensive.

The Record of Observation is Made Immediately

During the observation period it is very difficult on the part of the observer to remember each and every element of observation. He may forget much important information. If we rely on memory the factor of forgetting will enter and affect the data of observation. Therefore the observer should record all important information's as soon as the observation is completed.

Observation is Verifiable

Observation result can be checked and verified. Observation must be verified with usual criteria of reliability, validity and usability. It may be possible to check the findings of the observation by comparing the results of different observers by repeating the study.

CHARACTERISTICS OF OBSERVATION

In addition to the above categories observations can also be either overt/disclosed (the participants know they are being studied) or covert/undisclosed (the research keeps their real identity a secret from the research subjects, acting as a genuine member of the group).

In general, observations are relatively cheap to carry out and few resources are needed by the researcher. However, they can often be very time consuming and longitudinal.

The researcher decides where the observation will take place, at what time, with which participants, in what circumstances and uses a standardized procedure. Participants are randomly allocated to each independent variable group.

Rather than writing a detailed description of all behavior observed, it is often easier to code behavior according to a previously agreed scale using a behavior schedule (i.e. conducting a structured observation).

The researcher systematically classifies the behavior they observe into distinct categories. Coding might involve numbers or letters to describe a characteristic, or use of a scale to measure behavior intensity.

The categories on the schedule are coded so that the data collected can be easily counted and turned into statistics.

AIDS OF OBSERVATION

Some researchers call self-reported research the Achillie's heal of survey data collection in terms of reliability.

The reason? Self-reported research is sometimes inaccurate and thwarted by a consumer's misguided perception.

For example, research states that some polls reported that 40% of Americans attended church every week. However, when Marlar and Hadaway (2005) examined actual church attendance records, they found the actual percentage was closer to fewer than 22% attendance every week. This is a prime example of self-reporting gone wrong.

Additionally, Seth Stephens-Davidowitz found that sometimes survey respondents outright lie about their perceptions on sensitive topics to present a better view of themselves.

Observational Research

Observation research is a qualitative research technique where researchers observe participants' ongoing behavior in a natural situation.

Depending on the type of observation research and the goal of the study, the market researcher will have varying levels of participation in the study. Sometimes the researcher will insert themselves into the environment, and other times, the researcher will not intervene in the setting and observe from a distance or in a laboratory setting.

The purpose of this type of research is to gather more reliable insights. In other words, researchers can capture data on what participants do as opposed to what they say they do.

When should a market researcher use observational research?

As a market researcher, you have several different research methodologies at your disposal, including surveys, interviews, observations, etc.

Using observational data is best when one of the following situations apply:

- You need to gather sensitive information, and you don't trust your participants will be honest with their self-reporting.
- You need to understand the how or what of a research question.
- The topic is new, and you need robust data to explain consumer behavior.
- When behavior in a natural setting is vital to your research question.

- When behavior in a controlled setting is critical to your research question.
- If you are concerned that self-reported data about behaviors will differ from actual actions, even if it's unintentional.
- When you need more information about a specific research question to formulate a more complete and accurate survey.

If any of these situations describe you or your current research state, then an observational study may be just what you need.

What are the three types of observational research?

When it comes to observational research, you have three different types of methodologies: controlled observations, naturalistic observations, and participant observations. Let's quickly look at what each type of observation includes, how they differ, and the strengths and weaknesses of each type of observation.

Controlled observation

Controlled observations are typically a structured observation that takes place in a psych lab. The researcher has a question in mind and controls many of the variables, including participants, observation location, time of the study, circumstances surrounding the research, and more.

During this type of study, the researcher will often create codes that represent different types of behaviors. That way, instead of writing a detailed report, they can classify behavior into different categories and analyze the data with more ease.

Advantages and limitations of controlled observation

The advantages of controlled observation include:

- You can make an observation schedule for your sampling, and have other market researchers use the same codes if they replicate the study. This helps test for reliability.

- The coded data is easy to analyze and quantify.
- Controlled studies aren't as time-consuming.

Limitations of a controlled observation include:

- It may be challenging to determine the validity of the study if participants know they are being watched.

Naturalistic observation

Naturalistic observation is another type of observation research method used by market researchers. This type of observation is when market researchers study the behaviors of participants in a natural surrounding.

There are typically no predetermined behavioral codes. Instead, the researcher will take rigorous notes and code the data later.

Advantages and limitations of naturalistic observation

Some advantages of naturalistic observation include:

- The study ensures validity when participants are in their natural setting.
- This type of study can generate new ideas and research questions.
- It opens researchers' minds to possibilities they might not have considered before.
- Researchers can collect authentic data and avoid any potential problems with self-reported data.

Some limitations include:

- You can't control different variables, making it difficult to replicate the study and test for reliability.
- It may be challenging to conduct this type of study on a wide scale.
- You have to use skilled researchers, so you don't risk missing critical behavioral data.
- You aren't able to manipulate any variables.

TYPES OF OBSERVATION

Participant observation

Participant observation was first introduced by Prof. Edward Winder Man. It means the activities of a group in which an observer himself participate and note the situation. He willingly mixes with the group and perform his activities as an observer not merely a participator who criticize the situation. In other words he takes place and share the activities with his group. For example when we study the rural and urban conditions of Asian people, we have to go there and watched what is going on. The best philosophy of participant observation is that we watch the phenomena not to ask. The actual behavior of the group can be observed only by participant observation not by any other method.

Merits

1. The observer is personally involved in group activities and shares their feelings and prejudices.
2. He participate himself and get insight into the behavior of the group.
3. It motivates and stimulates mutual relationship b/w the observer and observe.
4. He can get more information's with accuracy and precision.
5. The information's are recorded in front of the group people.

Demerits

1. The observer may develop emotional attachment to his group which will lose the objectivity of the study.
2. Cannot observe a certain phenomenon in a short time available to him.
3. Cannot cover a wide area through this method.

Non-Participant Observation

The non-participant observation has a lack of participation of the observer in his group activities. He either watch the phenomena from a distance or participate in the group but never in its activities. He only sit in the group but do not interest in the process.

The difference between participant & non-participant observation is that, in the former the observer himself take part in a group and become the member of that group also participate in their activities with full fledge while the latter refers to the less or no participation of the observer in his group, their membership and activities. He watch from a distance but do not have active eye sight that what is going on in the field of research.

Merits

1. Although observer himself never attach to the group but the objectivity maintained.
2. Less emotional involvement of the observer leads to accuracy and greater objectivity.
3. having secondary relationship with his group, so the information's are collected entirely.
4. Through non-participant observation the research remains very smooth.

Demerits

1. Do not have full knowledge about the group activities.
2. Cannot understand the whole phenomena.
3. Cannot get real and deep insight into the phenomena.

Controlled Observation

Here observer and observe or subject both are controlled. For systematic data collection control is imposed on both for accuracy and precision. When observation is pre-planned and definite, then it is termed as controlled observation. In control observation, mechanical devices are used for precision and standardized. So, control increase accuracy, reduce bias, ensure reliability and standardization. Some of the devices are as under.

1. Observational plan.
2. Observational schedule.
3. Mechanical appliances like, camera, maps, films, video, tape recorder etc.
4. Team of observers.
5. Socio Matric Scale.

Un-Controlled Observation

Uncontrolled observation takes place in natural setting without the influence of external or outside control. The observer does not plan in advance but this is related to day-to-day happenings and socio-cultural problems. It studies some of our life situations.

Structured and Un-Structured Observation

It this type careful information's are recorded in a standardized way. It is a planned observation of a phenomena and to follow certain patterns, rules and designs for the purpose what, how and when to observe, . Unstructured observation is opposite to structured. This is not systematic and un-planned observation. A researcher do not set a plan in advance but he get the information's freely. There is no rules to follow by the researcher.

General or Layman Observation

General or layman observation make by people in day-to-day happenings. They see many things daily but there is no objectivity of their study. For example a person see the children playing in a garden is general observation.

Scientific Observation

Scientific observation is based on some scientific rules and deliberate thinking. The observer must know what to observe. He have proper planning, objectivity, hypothesis and observation schedule in his study. Scientific observation is reliable and more standardized than general observation.

METHODS OF DATA COLLECTION-I

Data is one of the most valuable resources today's businesses have. The more information you have about your customers, the better you can understand their interests, wants and needs. This enhanced understanding helps you meet and exceed your customers' expectations and allows you to create messaging and products that appeal to them.

How do you collect this data? One of the most crucial tools for collecting — as well as organizing, analyzing and activating data — is the data management platform, or DMP. Your DMP can help facilitate all these steps and provide you with the tools you need to make the most of your data. There are various data-gathering methods you can use with the help of your DMP. Let's take a look at some of the most common data collection methods.

Data Collection Methods

Today businesses and organizations are connected to their clients, customers, users, employees, vendors, and sometimes even their competitors. Data can tell a story about any of these relationships, and with this information, organizations can improve almost any aspect of their operations.

Although data can be valuable, too much information is unwieldy, and the wrong data is useless. The right data collection method can mean the difference between useful insights and time-wasting misdirection.

Luckily, organizations have several tools at their disposal for primary data collection. The methods range from traditional and simple, such as a face-to-face interview, to more sophisticated ways to collect and analyze data.

Qualitative vs quantitative data collection methods

Some of the methods covered here are quantitative, dealing with something that can be counted. Others are qualitative, meaning that they consider factors other than numerical values.

In general, questionnaires, surveys, and documents and records are quantitative, while interviews, focus groups, observations, and oral histories are qualitative. There can also be crossover between the two methods.

Data analysis can take various formats. The method you choose depends on the subject matter of your research.

Quantitative methods, such as surveys, large-scale benchmarks, and prioritization, answer the question "How much?" But these methods can leave the question "Why?" unanswered. This is where qualitative data collection methods come into play.

Understanding qualitative data collection

Qualitative data collection looks at several factors to provide a depth of understanding to raw data. While qualitative methods involve the collection, analysis, and management of data, instead of counting responses or recording numeric data, this method aims to assess factors like the thoughts and feelings of research participants. Qualitative data collection methods go beyond recording events to create context.

With this enhanced view, researchers can

- Describe the environment. Understanding where observations take place can add meaning to recorded numbers.
- Identify the people involved in the study. If research is limited to a particular group of people, whether intentionally or as a function of demographics or other factors, this information can inform the results.
- Describe the content of the study. Sometimes, the specific activities involved in research and how messages about the study were delivered and received may illuminate facts about the study.
- Interact with study participants. Interactions between respondents and research staff can provide valuable information about the results.

- Be aware of external factors. Unanticipated events can affect research outcomes. Qualitative data collection methods allow researchers to identify these events and weave them into their results narrative, which is nearly impossible to do with just a quantitative approach.

Qualitative research methods

There are three commonly used qualitative data collection methods: ethnographic, theory grounded, and phenomenological.

Ethnography comes from anthropology, the study of human societies and cultures. Ethnography seeks to understand how people live their lives. Through this method, researchers veer away from the specific and practical questions that traditional market researchers use and instead observe the participants in a nondirected way. This approach is intended to reveal behaviors from a subject's perspective rather than from the view of the researchers.

Ethnography helps fill in the blanks when a participant may not be able to articulate their desires or the reasons for their decisions or behaviors. Instead of, or in addition to, asking why a participant acts a certain way, researchers use observation to understand the why behind these desires, decisions, or behaviors.

Grounded theory arose when sociological researchers sought to provide a level of legitimacy to qualitative research — to ground it in reality rather than assumptions. Before this method, qualitative data analysis was actually done before any quantitative data was collected, so it was disconnected from the collection and analysis process.

Grounded theory uses the following methods:

- Participant observation. Researchers immerse themselves in the daily lives of subjects. Another term for this is "fieldwork."
- Interviews. These can vary in formality from informal chats to structured interviews.

- Document and artifact collection. Grounded theory often is about more than observation and interviews. Researchers can learn about a group of people from looking at materials the group used. For example, a local community's laws may shed light on opinions and provide a clearer picture of residents' sentiments.

Sometimes, a person's true colors emerge only when they are genuinely put to the test. As such, phenomenology describes how people experience certain events or unique encounters. This method measures reactions to occurrences that are outside of the norm, so it's essential to understand the whole picture, not just facts and figures.

An example of phenomenology is studying the experiences of individuals involved in a natural disaster. To analyze data from such an event, the researcher must become familiar with the data; focus the analysis on the subject matter, time period, or other factors; and categorize the data.

Completing these tasks gives the researcher a framework for understanding how the natural disaster impacts people. Together, the understanding, focus, and organization help researchers identify patterns, make connections, interpret data, and explain findings.

Each of these qualitative data collection methods sheds light on factors that can be hidden in simple data analysis. Qualitative data is one way to add context and reality to raw numbers. Often, researchers find value in a hybrid approach, where qualitative data collection methods are used alongside quantitative ones.

EXPERIMENTAL METHOD

A systematic and scientific approach to research in which the researcher manipulates one or more variables, and controls and measures any change in other variables.

Experimental Research is often used where:

1. There is time priority in a causal relationship (cause precedes effect)

2. There is consistency in a causal relationship (a cause will always lead to the same effect)
3. The magnitude of the correlation is great.

The word experimental research has a range of definitions. In the strict sense, experimental research is what we call a true experiment. This is an experiment where the researcher manipulates one variable, and control/randomizes the rest of the variables. It has a control group, the subjects have been randomly assigned between the groups, and the researcher only tests one effect at a time. It is also important to know what variable(s) you want to test and measure.

A very wide definition of experimental research, or a quasi experiment, is research where the scientist actively influences something to observe the consequences. Most experiments tend to fall in between the strict and the wide definition.

A rule of thumb is that physical sciences, such as physics, chemistry and geology tend to define experiments more narrowly than social sciences, such as sociology and psychology, which conduct experiments closer to the wider definition.

Aims of Experimental Research

Experiments are conducted to be able to predict phenomenons. Typically, an experiment is constructed to be able to explain some kind of causation. Experimental research is important to society-it helps us to improve our everyday lives.

Identifying the Research Problem

After deciding the topic of interest, the researcher tries to define the research problem. This helps the researcher to focus on a more narrow research area to be able to study it appropriately.

The research problem is often operationalizationed, to define how to measure the research problem. The results will depend on the exact measurements that the researcher chooses and may be operationalized differently in another study to test the main conclusions of the study.

Defining the research problem helps you to formulate a research hypothesis, which is tested against the null hypothesis.

An ad hoc analysis is a hypothesis invented after testing is done, to try to explain why the contrary evidence. A poor ad hoc analysis may be seen as the researcher's inability to accept that his/her hypothesis is wrong, while a great ad hoc analysis may lead to more testing and possibly a significant discovery.

Constructing the Experiment

There are various aspects to remember when constructing an experiment. Planning ahead ensures that the experiment is carried out properly and that the results reflect the real world, in the best possible way.

Sampling Groups to Study

Sampling groups correctly is especially important when we have more than one condition in the experiment. One sample group often serves as a control group, whilst others are tested under the experimental conditions.

Deciding the sample groups can be done in using many different sampling techniques. Population sampling may chosen by a number of methods, such as randomization, "quasi-randomization" and pairing. Reducing sampling errors is vital for getting valid results from experiments. Researchers often adjust the sample size to minimize chances of random errors.

Here are some common sampling techniques:

- probability sampling
- non-probability sampling
- simple random sampling
- convenience sampling
- stratified sampling
- systematic sampling

- cluster sampling
- sequential sampling
- disproportonal sampling
- judgmental sampling
- snowball sampling
- quota sampling.

Creating the Design

The research design is chosen based on a range of factors. Important factors when choosing the design are feasibility, time, cost, ethics, measurement problems and what you would like to test. The design of the experiment is critical for the validity of the results.

HISTORICAL METHOD

The historical method comprises the techniques and guidelines by which historians use historical sources and other evidence to research and then to write history. There are various history guidelines commonly used by historians in their work, under the headings of external criticism, internal criticism, and synthesis. This includes lower criticism and sensual criticism. Though items may vary depending on the subject matter and researcher, the following concepts are usually part of most formal historical research:

- Identification of origin date
- Evidence of localization
- Recognition of authorship
- Analysis of data
- Identification of integrity
- Attribution of credibility.

Research Methods

The goal of the research process is to produce new knowledge. This process takes three main forms:

- Exploratory research, which structures and identifies new problems
- Constructive research, which develops solutions to a problem
- Empirical research, which tests the feasibility of a solution using empirical evidence.

Research can also fall into two distinct types:

- Primary research (collection of data that does not exist yet)
- Secondary research (summary, collation and/or synthesis of existing research).

In social sciences and later in other disciplines, the following two research methods can be applied, depending on the properties of the subject matter and on the objective of the research:

- Qualitative research (understanding of human behaviour and the reasons that govern such behaviour)
- Quantitative research (systematic empirical investigation of quantitative properties and phenomena and their relationships).

Research is often conducted using the hourglass model Structure of Research. The hourglass model starts with a broad spectrum for research, focusing in on the required information through the methodology of the project.

Publishing

Academic publishing describes a system that is necessary in order for academic scholars to peer review the work and make it available for a wider audience. The 'system', which is probably disorganized enough not to merit the title, varies widely by field, and is also always changing, if often slowly. Most academic work is published in journal article or book form. In publishing, STM publishing is an abbreviation for academic publications in science, technology, and medicine. Most established academic fields have their own journals and other outlets for publication, though many academic journals are somewhat interdisciplinary, and publish work from several distinct fields or subfields.

The kinds of publications that are accepted as contributions of knowledge or research vary greatly between fields; from the print to the electronic format. Business models are different in the electronic environment.

Since about the early 1990s, licensing of electronic resources, particularly journals, has been very common. Presently, a major trend, particularly with respect to scholarly journals, is open access. There are two main forms of open access: open access publishing, in which the articles or the whole journal is freely available from the time of publication, and self-archiving, where the author makes a copy of their own work freely available on the web.

Research Funding

Most funding for scientific research comes from two major sources: Corporate research and development departments; and government research councils such as the National Institutes of Health in the USA and the Medical Research Council in the UK.

These are managed primarily through universities and in some cases through military contractors. Many senior researchers (such as group leaders) spend a significant amount of their time applying for grants for research funds. These grants are necessary not only for researchers to carry out their research, but also as a source of merit.

Original Research

Original research is research that is not exclusively based on a summary, review or synthesis of earlier publications on the subject of research. This material is of a primary source character. The purpose of the original research is to produce new knowledge, rather than to present the existing knowledge in a new form (*e.g.*, summarized or classified).

Different Forms

Original research can take a number of forms, depending on the discipline it pertains to.

In experimental work, it typically involves direct or indirect observation of the researched subject, e.g., in the laboratory or in the field, documents the methodology, results, and conclusions of an experiment or set of experiments, or offers a novel interpretation of previous results.

In analytical work, there are typically some new (for example) mathematical results produced, or a new way of approaching an existing problem. In some subjects which do not typically carry out experimentation or analysis of this kind, the originality is in the particular way existing understanding is changed or re-interpreted based on the outcome of the work of the researcher.

The degree of originality of the research is among major criteria for articles to be published in academic journals and usually established by means of peer review. Graduate students are commonly required to perform original research as part of a dissertation.

Artistic Research

The controversial trend of artistic teaching becoming more academics-oriented is leading to artistic research being accepted as the primary mode of enquiry in art as in the case of other disciplines. One of the characteristics of artistic research is that it must accept subjectivity as opposed to the classical scientific methods. As such, it is similar to the social sciences in using qualitative research and intersubjectivity as tools to apply measurement and critical analysis. Artistic research has been defined by Dans och Cirkushögskolan (the University of Dance and Circus), Stockholm in the following manner-"Artistic research is to investigate and test with the purpose of gaining knowledge within and for our artistic disciplines. It is based on artistic practices, methods and criticality. Through presented documentation, the insights gained shall be placed in a context."

INTER-DISCIPLINARY APPROACH

Interdisciplinarity or interdisciplinary studies involves the combination of two or more academic disciplines into one activity (e.g., a research project). It draws knowledge from several other fields like sociology, anthropology, psychology, economics etc. It is about creating something by thinking across boundaries. It is related to an *interdiscipline* or an *interdisciplinary field,* which is an organizational unit that crosses traditional boundaries between academic disciplines or schools of thought, as new needs and professions emerge. Large engineering teams are usually interdisciplinary, as a power station or mobile phone or other project requires the melding of several specialties. However, the term "interdisciplinary" is sometimes confined to academic settings.

The term *interdisciplinary* is applied within education and training pedagogies to describe studies that use methods and insights of several established disciplines or traditional fields of study. Interdisciplinarity involves researchers, students, and teachers in the goals of connecting and integrating several academic schools of thought, professions, or technologies—along with their specific perspectives—in the pursuit of a common task. The epidemiology of HIV/AIDS or global warming requires understanding of diverse disciplines to solve complex problems. *Interdisciplinary* may be applied where the subject is felt to have been neglected or even misrepresented in the traditional disciplinary structure of research institutions, for example, women's studies or ethnic area studies. Interdisciplinarity can likewise be applied to complex subjects that can only be understood by combining the perspectives of two or more fields.

The adjective *interdisciplinary* is most often used in educational circles when researchers from two or more disciplines pool their approaches and modify them so that they are better suited to the problem at hand, including the case of the team-taught course where students are required to understand a given subject in terms of multiple traditional disciplines. For example, the subject of land use may appear differently when examined by different disciplines, for instance, biology, chemistry, economics, geography, and politics.

Development

Although "interdisciplinary" and "interdisciplinarity" are frequently viewed as twentieth century terms, the concept has historical antecedents, most notably Greek philosophy. Julie Thompson Klein attests that "the roots of the concepts lie in a number of ideas that resonate through modern discourse—the ideas of a unified science, general knowledge, synthesis and the integration of knowledge", while Giles Gunn says that Greek historians and dramatists took elements from other realms of knowledge (such as medicine or philosophy) to further understand their own material. The building of Roman roads required men who understood surveying, material science, logistics and several other disciplines. Any broadminded humanist project involves interdisciplinarity, and history shows a crowd of cases, as seventeenth-century Leibniz's task to create a system of universal justice, which required linguistics, economics, management, ethics, law philosophy, politics, and even sinology.

Interdisciplinary programs sometimes arise from a shared conviction that the traditional disciplines are unable or unwilling to address an important problem. For example, social science disciplines such as anthropology and sociology paid little attention to the social analysis of technology throughout most of the twentieth century. As a result, many social scientists with interests in technology have joined science, technology and society programs, which are typically staffed by scholars drawn from numerous disciplines. They may also arise from new research developments, such as nanotechnology, which cannot be addressed without combining the approaches of two or more disciplines. Examples include quantum information processing, an amalgamation of quantum physics and computer science, and bioinformatics, combining molecular biology with computer science. Sustainable development as a research area deals with problems requiring analysis and synthesis across economic, social and environmental spheres; often an integration of multiple social and natural science disciplines. Interdisciplinary research is also key to the study of health sciences, for example in studying optimal solutions to diseases. Some institutions of higher education offer accredited degree programs in Interdisciplinary Studies.

At another level, interdisciplinarity is seen as a remedy to the harmful effects of excessive specialization and isolation in information silos. On some views, however, interdisciplinarity is entirely indebted to those who specialize in one field of study—that is, without specialists, interdisciplinarians would have no information and no leading experts to consult.

Others place the focus of interdisciplinarity on the need to transcend disciplines, viewing excessive specialization as problematic both epistemologically and politically. When interdisciplinary collaboration or research results in new solutions to problems, much information is given back to the various disciplines involved. Therefore, both disciplinarians and interdisciplinarians may be seen in complementary relation to one another.

Barriers

Because most participants in interdisciplinary ventures were trained in traditional disciplines, they must learn to appreciate differences of perspectives and methods. For example, a discipline that places more emphasis on quantitative rigor may produce practitioners who are more scientific in their training than others; in turn, colleagues in "softer" disciplines who may associate quantitative approaches with difficulty grasp the broader dimensions of a problem and lower rigor in theoretical and qualitative argumentation.

An interdisciplinary program may not succeed if its members remain stuck in their disciplines (and in disciplinary attitudes). Those who lack experience in interdisciplinary collaborations may also not fully appreciate the intellectual contribution of colleagues from those discipline.

From the disciplinary perspective, however, much interdisciplinary work may be seen as "soft", lacking in rigor, or ideologically motivated; these beliefs place barriers in the career paths of those who choose interdisciplinary work. For example, interdisciplinary grant applications are often refereed by peer reviewers drawn from established disciplines; not surprisingly, interdisciplinary researchers may experience difficulty getting funding for their research.

In addition, untenured researchers know that, when they seek promotion and tenure, it is likely that some of the evaluators will lack commitment to interdisciplinarity. They may fear that making a commitment to interdisciplinary research will increase the risk of being denied tenure.

Interdisciplinary programs may also fail if they are not given sufficient autonomy. For example, interdisciplinary faculty are usually recruited to a joint appointment, with responsibilities in both an interdisciplinary program (such as women's studies) and a traditional discipline (such as history).

If the traditional discipline makes the tenure decisions, new interdisciplinary faculty will be hesitant to commit themselves fully to interdisciplinary work. Other barriers include the generally disciplinary orientation of most scholarly journals, leading to the perception, if not the fact, that interdisciplinary research is hard to publish.

In addition, since traditional budgetary practices at most universities channel resources through the disciplines, it becomes difficult to account for a given scholar or teacher's salary and time. During periods of budgetary contraction, the natural tendency to serve the primary constituency (i.e., students majoring in the traditional discipline) makes resources scarce for teaching and research comparatively far from the center of the discipline as traditionally understood. For these same reasons, the introduction of new interdisciplinary programs is often resisted because it is perceived as a competition for diminishing funds.

Due to these and other barriers, interdisciplinary research areas are strongly motivated to become disciplines themselves. If they succeed, they can establish their own research funding programs and make their own tenure and promotion decisions. In so doing, they lower the risk of entry. Examples of former interdisciplinary research areas that have become disciplines, many of them named for their parent disciplines, include neuroscience, cybernetics, biochemistry and biomedical engineering. These new fields are occasionally referred to as "interdisciplines".

On the other hand, even though interdisciplinary activities are now a focus of attention for institutions promoting learning and teaching, as well as organizational and social entities concerned with education, they are practically facing complex barriers, serious challenges and criticism. The most important obstacles and challenges faced by interdisciplinary activities in the past two decades can be divided into "professional", "organizational", and "cultural" obstacles.

Interdisciplinary studies and studies of interdisciplinarity

An initial distinction should be made between interdisciplinary studies, which can be found spread across the academy today, and the study of interdisciplinarity, which involves a much smaller group of researchers. The former is instantiated in thousands of research centers across the US and the world. The latter has one US organization, the Association for Interdisciplinary Studies (founded in 1979), two international organizations, the International Network of Inter- and Transdisciplinarity (founded in 2010) and the Philosophy of/as Interdisciplinarity Network (founded in 2009), and one research institute devoted to the theory and practice of interdisciplinarity, the Center for the Study of Interdisciplinarity at the University of North Texas (founded in 2008). As of 1 September 2014, the Center for the Study of Interdisciplinarity has ceased to exist. This is the result of administrative decisions at the University of North Texas.

An interdisciplinary study is an academic program or process seeking to synthesize broad perspectives, knowledge, skills, interconnections, and epistemology in an educational setting. Interdisciplinary programs may be founded in order to facilitate the study of subjects which have some coherence, but which cannot be adequately understood from a single disciplinary perspective (for example, women's studies or medieval studies). More rarely, and at a more advanced level, interdisciplinarity may itself become the focus of study, in a critique of institutionalized disciplines' ways of segmenting knowledge.

In contrast, studies of interdisciplinarity raise to self-consciousness questions about how interdisciplinarity works, the nature and history of disciplinarity, and the future of knowledge in post-industrial society. Researchers at the Center for the Study of Interdisciplinarity have made the distinction between philosophy 'of' and 'as' interdisciplinarity, the former identifying a new, discrete area within philosophy that raises epistemological and metaphysical questions about the status of interdisciplinary thinking, with the latter pointing toward a philosophical practice that is sometimes called 'field philosophy'.

Perhaps the most common complaint regarding interdisciplinary programs, by supporters and detractors alike, is the lack of synthesis—that is, students are provided with multiple disciplinary perspectives, but are not given effective guidance in resolving the conflicts and achieving a coherent view of the subject. Others have argued that the very idea of synthesis or integration of disciplines presupposes questionable politico-epistemic commitments. Critics of interdisciplinary programs feel that the ambition is simply unrealistic, given the knowledge and intellectual maturity of all but the exceptional undergraduate; some defenders concede the difficulty, but insist that cultivating interdisciplinarity as a habit of mind, even at that level, is both possible and essential to the education of informed and engaged citizens and leaders capable of analyzing, evaluating, and synthesizing information from multiple sources in order to render reasoned decisions.

While much has been written on the philosophy and promise of interdisciplinarity in academic programs and professional practice, social scientists are increasingly interrogating academic discourses on interdisciplinarity, as well as how interdisciplinarity actually works—and does not—in practice. Some have shown, for example, that some interdisciplinary enterprises that aim to serve society can produce deleterious outcomes for which no one can be held to account.

Politics of interdisciplinary studies

Since 1998, there has been an ascendancy in the value of interdisciplinary research and teaching and a growth in the number of bachelor's degrees awarded at U.S. universities classified as multi- or interdisciplinary studies. The number of interdisciplinary bachelor's degrees awarded annually rose from 7,000 in 1973 to 30,000 a year by 2005 according to data from the National Center of Educational Statistics (NECS).

In addition, educational leaders from the Boyer Commission to Carnegie's President Vartan Gregorian to Alan I. Leshner, CEO of the American Association for the Advancement of Science have advocated for interdisciplinary rather than disciplinary approaches to problem-solving in the 21st century.

This has been echoed by federal funding agencies, particularly the National Institutes of Health under the direction of Elias Zerhouni, who has advocated that grant proposals be framed more as interdisciplinary collaborative projects than single-researcher, single-discipline ones.

At the same time, many thriving longstanding bachelor's in interdisciplinary studies programs in existence for 30 or more years, have been closed down, in spite of healthy enrollment. Examples include Arizona International (formerly part of the University of Arizona), the School of Interdisciplinary Studies at Miami University, and the Department of

Interdisciplinary Studies at Wayne State University; others such as the Department of Interdisciplinary Studies at Appalachian State University, and George Mason University's New Century College, have been cut back.

Stuart Henry has seen this trend as part of the hegemony of the disciplines in their attempt to recolonize the experimental knowledge production of otherwise marginalized fields of inquiry. This is due to threat perceptions seemingly based on the ascendancy of interdisciplinary studies against traditional academia.

8

Methods of Data Collection-II

DOCUMENTARY SOURCES

After reading this chapter you will learn about the personal and official documents as sources of data.

Personal Documents

In its narrow sense, the personal document is a spontaneous first person description by an individual of his own actions, experiences and beliefs.

The wide range of personal documentary material comprises autobiographies, diaries and letters and other artistic and projective documents which describe the subject's experiences and his beliefs or which give an insight into his cultural background. 'Life history' as a personal document relates to a comprehensive autobiography.

But in common usage, a 'Life-history' may be almost any kind of biographical material. For Thomas and Znaniecki, the authors of 'The Polish Peasant', the personal document constituted a perfect type of sociological material.

Thomas and Znaniecki made vigorous use of the personal materials in their study of the Polish Peasants. Their stress on the use of such personal material subsequently proved to be something of a turning point in the development of social science. At the time of publication of 'The Polish Peasant' more than 60 years now, the social scientists were very keen on making their discipline comparable in objectivity to natural sciences. From this viewpoint, personal documents (being essentially subjective) were regarded as of low scientific value.

However, the sociological use of personal documents, thought to be out of the mainstream of development for a time, had not at any stage disappeared totally. Its persistence was partly due to the growing acceptance by social science of the whole range of psychological concepts and method.

The major thrust of the revelation by Sigmurid Freud that it was possible to conceptualize human beliefs and actions in terms of private and even unconscious motives and influences was that the subjective world is also accessible to and not beyond the scope of scientific investigation.

Blummer's criticism of the use of personal documents by the authors of 'The Polish Peasant' inaugurated a controversy. Subsequently, four authorities drawn from different social science fields, namely, G.W. Allport, L. Gottschalk, Clyde Kluckhohn and Robert Angell were invited to develop their views on the validity and limitations of personal documents as a tool of social science.

These authorities reached the conclusion that subject to necessary safeguards, the use of personal document was not only permissible but also indispensable. They have indeed made a lasting contribution to "social science in terms of systematically analysing the typical hazards attendant upon the use of personal documents.

Two crucial issues they raised pertain to:

(1) The methodological question of how far disortions enter in the course of translating private records, and

(2) The questions of how to gather and analyse the number of personal documents needed for the derivation of abstract principles or hypotheses.

All port identifies thirteen motives that might induce individuals to record details about themselves, viz., self-justification by special pleading, exhibitionism, desire for order, literary delight, securing personal perspective, relief from tension or catharsis, monetary gain, assignment to write a brief autobiography, assisting in therapy (for a psychiatric patient), confession as means to absolution, scientific interest,-public service and example (to achieve a reform or offer a model) and desire for immortality.

It is understandable that the individual's underlying motive is quite liable to influence the contents of the documents. Some authors, for example, may have a deliberate propagandist intention. Literary dishonesty may lead to suppression of unpalatable and un-dramatic sequences to form an aesthetically structured whole.

It must be remembered that "… every contributor is a prisoner of his own culture." It cannot be helped, therefore, that his thought processes are likely, by and large, to be determined by the society in which he lives.

We shall now discuss briefly the main forms of personal documents, namely, autobiographies, diaries and letters. Autobiographies which are written sometime after the occurrence of events recorded in them and intended for publication, may be expected to suffer from propagandist intentions, from a tendency to rationalize and from conscious stylization.

The prospective view, on the other hand, enables the writer to select and display such of his experiences and actions that subsequently come out to be significant features in his 'life history.'

Diaries are often the most revealing especially, when they are 'intimate journals.' This is so because they are less constricted by the fear of public showing and because they reveal with greatest clarity what experiences and actions seemed most significant at the time of their occurrence.

But the diaries may exaggerate the conflicts and dramatic phase of life maintaining silence about the long calm and happy periods. Often the diarist assumes that the reader knows the persons and situations which he fails to adequately describe. A shrewd diarist may with some ulterior motive write a diary which will easily fall into the outsiders' hands and in effect mislead them.

Letters are often used by researchers, as evidenced in the study of the Polish Peasant. The authors Thomas and Znaniecki analysed 754 letters exchanged between the Poles in the U.S.A. and those in Poland.

Letters often have some propagandist intention since they are designed by the writer to convey to the recipient some impressions more telling than mere facts. As with diaries, the letters often lack continuity and assume much of what any third party may be ignorant about.

We have seen how the personal documents by their very nature engender strong possibilities of distortion. It must be admitted that no internal test or screw exist for the analyst to correct such distortion.

The only satisfactory correctives are the external ones, such as the degree of correspondence with other sources of information or with observed behaviour and the success of predictions based on the original material. Gottschalk lists five kinds of circumstances which may predispose the investigator to believe that the informant's statement is truthful.

(a) When the truth of the statement is a matter of indifference to the witness, he is likely to be unbiased (this might possibly have impaired his observation or memory).

(b) When the statement is prejudicial to the informant or his interests, it is likely to be unusually truthful.

(c) When the facts at issue are so much the matters of common knowledge that the informant would be unlikely to be mistaken or lie about them.

(d) When the part of the statement of primary interest to the investigator is both incidental and intrinsically probable.

(e) When the informant makes statements which are contrary to his expectations and anticipations as assessed by the investigator's knowledge of his thought- patterns and preconceptions.

It may be remembered here that many of the personal documents are recorded not by the informant but by the investigator (as when the informant is illiterate). In the course of recording, the investigator himself may be responsible for introducing distortions.

The informants are likely to be 'blinkered' and 'polarized' by the investigator's own interests and line of approach. The informant is not only led to introduce topics which may barely be of any interest to him; he may even adopt attitudes and pretend to hold beliefs which he would not have expressed if only he had been free of investigator's Influence.

Let us now turn to consider how far the personal document material might serve as a basis for generalization. It is generally believed that people whose personal documents become available are the ones who tend to be suffering from frustrated emotional lives. Should this be fair surmise, generalisations based on personal documents would clearly refer to such people and not to the population as a whole.

One way of overcoming this limitation is to solicit the cooperation of a more representative cross-section of the population. The documents may be offered to be purchased. The offer of payment coupled with a promise of anonymity has been shown to induce the otherwise reluctant people to come out with personal documents. But such a practice may affect adversely their representativeness.

Even if the problem of typicality is solved, the problem of obtaining a sample of documents large enough to permit fine analysis still remains. In favourable circumstances, however, investigators have been able to obtain large samples (for example, Thomas and Znaniecki used a number of fragmentary autobiographies, large number of letters and a considerable collection of records, newspaper accounts, etc.). Thrasher in his study 'Gang' was able to supplement his main technique by persuading a number of gang members to write their life-stories.

The Public or Official Documents

Newspapers

Newspaper reports, where a reporter was present at the scene, might be thought of as valuable. But it has been shown too often how little reliance can be placed on them. We should recognize the pressures under which the newspaper correspondents work. Many of the correspondents may depend on their personal system of recording.

In many cases, the correspondent may highlight only the 'eye-catching' and the 'dramatic' parts of the total occurrence. Typically, newspapers work very fast. Latest news is always most desirable. Staleness is a taboo. Reports are controlled by available space and newspaper's policy. The popular press is often more concerned with entertaining than informing.

Public Records and Statistics

These are, on the face of things, the most satisfactory and reliable sources. For example, the verbatim parliamentary record of what is said possibly is the most trusted document one can find. More valuable than a written record is tape-recording which preserves not only what was said, but also how it was said.

An unedited sound film could be even better. Their reliability too is usually high. The inventory, balance sheet etc., are useful accessories to business transactions; there are penalties for false statements.

The Census Reports, the annual digests of statistics and statistical reports of various State departments and other national bodies produce a great deal of useful data for social scientists to work with.

Official statistics, although the data on which they are based may not be directly relevant to the researcher's interests, are in most instances designed to inform rather than deceive the readers. These are normally prepared by experts and this is a point in their favour.

The range of matter covered in available records and the treatment a subject receives in such records varies with the administrative needs of which they were collected.

Health statistics give birth and death rates, etc. Public and private economic organizations collect and publish data on wages, hours of work, productivity, absenteeism, strikes, etc. In addition, a small but steadily increasing body of data is being collected by various institutions like schools, hospitals, social service agencies, etc., on the psychological level proper.

Data collected in the course of such other activities have a number of advantages for social research in addition to that of economy. A major one is the fact that much information of this sort is collected periodically, making the establishment of trends over time possible. Another is that the gathering of information from such sources does not require the co-operation of the individuals about whom information is desired as does the use of techniques such as questionnaires, interviews, projective techniques and techniques such as questionnaire, interviews, projective techniques and techniques such as questionnaires, interviews, projective techniques and often observation.

Moreover, since such data are collected in the ordinary course of events, the measurement procedure is less likely to reveal the investigator's purpose or to change the behaviour in which he is interested.

K. M. Landis based his study entitled 'Segregation in Washington' exclusively on the analysis and interpretation of available statistical data, e.g., census reports, official health statistics, employment data, police statistics, etc. Similarly, Leo Srole in his study of 'Status and Prestige' (in the 'Yankee

City' series of investigations by Warner and Associates) utilized a rather unusual source of data relevant to his problem—the cemetery records.

It needs to be stressed that the statistical data require that the investigator is able to ask many different questions related to the research problem. If a research idea or hypothesis can be formulated in such manner that the available recorded material bears on the question, the use of such material becomes possible. The guiding principle for the use of such material becomes possible.

The guiding principle for the use of available statistic consists in keeping oneself flexible in respect of the form in which research questions are asked. Durkheim's study on suicide provides a classic example of how the superior flexibility of a genius resulted in the testing of a social theory by available statistics.

Durkheim started with the hypothesis that the causes of suicide are to be found in the social conditions. To test this theory, Durkheim studied critically the statistics on suicide in certain European countries.

Certain studies, such as Durkheim's, rely entirely on the analysis of data collected for purpose other than those of the particular study. In others, such data are used in conjunction with other procedures. Data regularly collected for other purpose may be used to measure the effects of an experimental treatment.

Thus, in the Hawthorne electrical studies, Roethlisberger and Dickson found that changes in such conditions as illumination, rest periods and hours of work could not account for a consistently rising rate of productivity in the experimental groups over a period of time.

They subsequently concluded that changes in social organization of work groups and their relationship to management were responsible for a rise in productivity.

Available statistics may be used for other purposes, in a study. They are frequently useful in selecting cases with specified characteristics for intensive study. Available records may also be used to supplement or to check information gathered specifically for the purposes of a given investigation.

For example, in a study of the psychological impact of long-term unemployment in an Austrian village (Jahoda, Lazarsfeld and Zeisl) the 'shock' effect of unemployment was checked against such records as the accounts of the local grocer.

The records of specific behaviour may be used as an indicator of some more general concept. A series of studies by Tryon illustrate this use of records. Tryon was concerned with the problem of identifying sub-cultural groups in more meaningful and reliable ways.

One of his hypotheses was that the residents of common demographic social area will experience certain common socially relevant situations and common psychological states elicited by those situations and will behave in certain common ways. As an evidence to test this hypothesis, Tryon used voting records. Voting for him was an indicator of social attitudes.

The investigator must take certain precautions even when using statistics which are generally considered reliable.

(a) The definitions of categories used in available statistical material do not so often coincide with those used in social research. In criminal statistics, for instance, the concept of 'crime' is operationally defined in a number of ways.

    A social scientist interested in family composition may be grossly misled if he proceeded on the basis of the operational definition of a household as used in the census reports. In view of such confusion, the use of available records may be more misleading than enlightening unless the precise definition on which the statistics are based is ascertained.

(b) To know merely what the original collector of available data (records) set out to gather is not enough; it is also necessary to enquire into his methods. Many records are collected with the intention of covering an entire 'population' and not just a sample.

Many obstacles stand in the way of realizing this ideal. It may also be that the informants from whom the original collector drew information were not willing to provide it. Income statistics based on individual tax declarations generally tend to be underestimates. This cannot but be the case.

(c) It is quite possible that the degree of inaccuracy in official statistics due to these reasons may be negligible from the point of view of the social scientist. But there are methodological errors that may lead to serious inaccuracies. This fact needs to be kept in mind especially when dealing with data collected over many years.

Kingsley Davis in 'The population of India and Pakistan' has pointed out that the olden rural statistics were kept by the village chowkidars to whom the most obvious and. intelligible cause of death was 'fever.' The increase of certain causes of death (other than fever) shown in later statistics is probably a reflection of the change in the techniques of reckoning.

Thus, to ignore how statistics are kept and for what purpose, is to misuse statistics badly. It is, of course, no criticism of the statistics themselves. Occasionally, it is possible to correct available records in the light of what is subsequently known about the methods by which they have been gathered.

In any case, the proper qualifications in respect of such data when used for research purpose can be made only if the social scientist is aware of the possible errors inherent in the particular method employed.

We close this discussion with the brilliant remarks on the subject by Professor Bowley: "It is never safe to take published statistics at their face value, without knowing their meaning and limitations, and it is always necessary to criticize arguments that are based on them unless one is able to trust implicitly the knowledge and good faith of the persons bringing them forward. It is extremely easy to falsify lessons which numerical statements should teach. The actual use or appreciation of statistics are ultimately a matter of intelligence, special knowledge and common sense."

Biographies

A glance along the borrower's registers of a public library will show that the common borrower enjoys reading about other people's lives. The biographer generally works on people of some fame, whatever their spheres of activity. Thus, a biography is more likely to be about some famous person, his outstanding success or the eye-catching personality.

The professional biographer depends on sensationalism for the sale of his work and as such he may try to make his book sensational, shocking and dramatic. There is a possibility that the biographer may be motivated by a concern with the defence of a dead person, such as biographies written by loving sons and daughters.

In yet another instance, biographer may have been commissioned by the family of a person. This latter type of biography must be carefully scrutinized since it is hardly likely to contain much criticism of its subject; it is rather likely to be replete with justifications and accentuation.

Historical Documents

Conventionally, historical documents deal with events of the past about which the main source of information is documentary, the participants being dead. This definition is by no means satisfactory since there is plenty of the present century alive in the minds of the living people.

Nevertheless, the historical document belongs to special category of its own since it enables us to appreciate the importance of the links between social sciences and history.

Much of sociological investigation is perfected with historical background. For example, community studies bring out the historical development of the given settlement, the study of organizational structure of the trade union can only gain a good perspective by tracing the developmental chain.

In all investigations such as these the sociologist must turn to documents to establish the sequence of events and try to understand the process that took place in the past.

The sociologist who dives into historical research, without seeking advice from the historian will only waste time and effort in seeking out correct sources and is likely to use the sources badly if he knows little about the way in which the documents were complied.

Case Histories

'Case-history' records are collected in the course of welfare work. The case-workers are firsthand observers of social behaviour. This material can be utilized by social scientist with great advantage.

It should be noted, however, that the case-workers tend to record their observation in an impressionistic way, their descriptions are subjective based on general personal experience with little concern for classification within an integrated conceptual framework.

Since there is likely, in case work, a bias toward the socially pathological (in the selection of cases) and as the case records have little uniformity, generalization is often difficult, On the other hand, it is in the nature of case-histories that they abound in richness and evocative quality.

There is no doubt that the data of the large and increasing body of case-workers with experience of various forms of pathology, can be utilized by the social scientists very fruitfully in their researches. Before the close of the discussion on documents, which afford a potent source of social science data, it is important to consider the question:

"How far can documentary evidence, even when properly selected and checked for authenticity, be used as proof?"

This is an issue of great importance, not only because a large part of social evidence is still entirely derived secondhand from documentary sources but also because there are reasons for supposing that the user of documents is often tempted to stretch his material to suit his imaginative thesis. He also has, to boot, unique opportunities for doing so.

It has been recognized generally that the documentary material by itself may never provide a deep insight into the motives and activities of other generations. It is also generally accepted that the ideal of objectivity, however possible for the natural scientist, is beyond the reach of any historian. This does not mean, of course, that the historical facts are a suspect.

As Carr points out, "… (the facts) have the same relation to history as bricks or steel or concrete have to architecture…. But they are not in themselves 'facts of history.' It is only the decision of the historian that they are significant for his purpose which makes them into the facts of history….' His choice and arrangement of these facts and juxtapositions of them which indicate his view of cause and effect, must be dictated by presuppositions and (these) will be closely related to the conclusion which he is seeking to establish…. History therefore is an interaction between the historian and the past of which he is writing. The facts help to mould the mind of the historian. But the mind of the historian also… helps to mould facts."

A question that poses itself is how the social scientists can exploit the documentary material and how they can overcome their prejudices while using them. The classical well-thumbed method is for the scientist to search his mind until he has exposed his own biases. Even if he cannot overcome them, at least he is able to make some allowance for them (Socrates).

But the psychologically naive belief that it is possible by introspection to unearth every secret interest and prejudice is no longer tenable.

The most persistent, 'obvious' and 'commonsense' of the individual's presuppositions may just be those which could be restricting his understanding and preventing him from realizing the significance of many of the facts available to him. If his access to the problem is by way of documents alone, these limitations are especially prone to detract from the richness of his results.

Even within the bounds of admissible ideas, the user of documents has ample scope for distortion so long as his conclusions are based on impressions and he wants us to take a lot of trust.

A more recent development which consists in, the direct use of quantitative methods on documents themselves, greatly reduces the possibility of impressionistic distortion. The technique is known as 'Content Analysis.'

OBSERVATION

Scientific knowledge is based on sensory observation of reality. Those aspects of reality that are definite certain self-evident and have independent existence are called "Facts". Since they have an independent existence of their own so they are amendable to sensory observation. However scientific investigation is not a search for isolated and random facts rather it is a guided enquiry to test the authenticity of definite propositions that form the starting point of gathering information. They are called "hypothesis". A hypothesis states what we are looking for. It formulates the logical relationship between different aspects of reality expressed in terms of scientific concepts. A good hypothesis should be scientific, simple and presented in a testable form. Sociology also makes use of hypothesis in carrying our sociological research but this practice is not always strictly adhered to. Especially when a sociologist is trying to explore society, about which he knows very little, it would not be possible to begin the research with hypothesis. Some example of hypothesis which may be used in sociological enquiry can be.

(a) Crime rates are higher in urban areas than in rural areas.

(b) Pace of urbanization increases with that of industrialization.

Sometimes hypothesis may be tested under experimental conditions. Most of the established sciences do use experimental method quite successfully. However, in Sociology, experimental method is only rarely possible due to both practical and ethical reason: so observation is carried out mostly under non-experimental conditions. Sources of data include social survey, observational and interview methods etc.

Participant Observation Described

Participant Observation is usually just one part of a cluster of other non-experimental, inductive, field-based research strategies. These guidelines refer only to the Participant Observation component.

In Participant Observation the researcher is, to a greater or lesser extent, immersed in the day-to-day activities of the people being studied. The objective is usually to record conduct under the widest range of possible settings. In this way, participant observation differs from 'naturalistic observation', as discussed in the Tri-Council Policy Statement (TCPS) because the latter does not involve interaction between researcher and researched.

Insofar as information is often the result of dialogical interaction between the researcher and the informants, participant observation covers a wide range of ethical issues that are complex and often unpredictable. Because most participant observation involves long term presence among the people being studied, the informed consent process should be dynamic and continuous. Starting with the project design it should continue throughout the participant observation period by way of dialogue with those studied.

Participant Observation was historically associated with a form of research in which the researchers resides for extended periods of time in a small community. These guidelines, however, refer also to Participant Observation in a wide variety of settings, and over longer and shorter periods of time; for example, participant observation can transpire in institutions, class rooms and markets, or it may involve travelling with migrants, or interacting with specific categories of people.

SCHEDULE

Schedule is the tool or instrument used to collect data from the respondents while interview is conducted. Schedule contains questions, statements (on which opinions are elicited) and blank spaces/tables for filling up the respondents. The features of schedules are :

- The schedule is presented by the interviewer. The questions are asked and the answers are noted down by him.
- The list of questions is a more formal document, it need not be attractive.
- The schedule can be used in a very narrow sphere of social research.

The main purposes of schedule are three fold :

1. To provide a standardized tool for observation or interview in order to attain objectivity,
2. To act as memory tickler i.e., the schedule keeps the memory of the interviewer/ observer refreshed and keeps him reminded of the different aspects that are to be particularly observed, and
3. To facilitate the work of tabulation and analysis.

Types of Schedule

There are several kinds of schedule. Rating Schedules is a schedule used to obtain opinions, preferences etc, respondents over statements on the phenomenon studied. The schedule consists of positive and negative statements of opinion on the phenomenon. Documents Schedules are used to collect data/ information from recorded evidences and/or case histories. Here the blanks, functional issues related blanks and the like to be filled up from records and documents are present. Survey

Schedules are like questionnaires. Observation Schedules are schedules used when observational method of data collection is used. These could be structured or unstructured interview schedules are used for collecting data when interview method of communication with the respondents is used.

Essentials of a Good Schedule

A good schedule must have the following features

- Content: Should cover questions or statements relating to all significant aspects of the study.
- Dissectional: Should look into the problem analytically, dissecting every, major and significant components of the problem.
- Context: Should suit the context in which it is applied. Different types of studies need different schedules.
- Criterion: Should use sound logic in classifying respondents based opinions expressed.
- Construction: Should be constructed in such a way that questions statements progress gradually and in order. Better it is sub-divided into parts, each part deeding with a certain sub topic of the issue studied. For each objective, a separate part may be devoted.
- Language: Should be linguistically superbly designed. Clear and straight forward language be used.
- Reliable: Should be reliable such that same results are obtained whenever the schedule is used when everything else remains same.
- Mechanical Aspects: Paper used, margin space given, spacing, printing, size of letters, etc. should be normal.
- Size: Should not too length nor too short. Should give fair coverage to the topic.
- Qualities to be Avoided: Long, complex, presumptuous, personal, embarrassing, hypothetical issues, morality oriented, upsetting type and necessary questions must be avoided.

To sum up, accurate information and accurate response are the two essential conditions of a good schedule. Accurate communication is effected by proper wording of questions so as to produce desired sense without any ambiguity. Accurate response is said to have been achieved when replies contain the information sought for. The response is achieved by stimulating the respondents to fill the schedule. Besides, the physical structure of the schedule should be attractive; the questions asked or information sought should be adequate and relevant to the enquiry, so that final generalization may be based upon it. The information sought should not only be valid, it should also be capable of being tabulated and if possible being subjected to statistical analysis.

Procedure for Formulating a Schedule

1. Study the different aspects of the problem. The problem under study should first of all be split up into various aspects. The determination of these aspects will depend upon clear understanding of the problem under study.
2. Sub-divide the problem to get necessary information. Each aspect has again to be broken up into a number of sub-parts. These sub-parts should be quite exhaustive to give a full and complete picture of-the aspect under study.
3. Class questions. Care should be taken to see that the questions convey the exact sense. Respondents will be willing to supply information without any hesitation, bias or distortion of facts, if questions are exact and clear.
4. Serialization of Questions. In order to obtain well-organised information, it is necessary that the questions should be presented to the respondents in a well-ordered serial. It has been experienced to various field studies that the change in the order of questions affects the answers adversely.
5. Testing the validity of schedule. Whatever may be the

degree of precaution taken, some slips are based to be left out and these can be located when the schedule is put into a reliability and validity test.

6. Division. The schedule be divided into adequate number of divisions. Introductory part, instructional part, issues related parts, etc. are certain parts by which the schedule is divided into parts.
7. Appropriate form of questions. Use appropriate forms of questions at appropriate places. Open ended, close ended, pictorial, Yes or No (Questions), multiple choice questions, etc. can be used.

QUESTIONNAIRE

Questionnaires are one of the most popular methods of conducting scholarly research. They provide a convenient way of gathering information from a target population.

Advantages and Disadvantages of Written Questionnaires

Questionnaires are easy to analyse, and most statistical analysis software can easily process them. They are cost effective when compared to face-to-face interviews, mostly because of the costs associated with travel time. This is especially true for studies involving large sample sizes and large geographic areas. Written questionnaires become even more cost effective as the number of research questions increases.

Questionnaires are familiar to most people. Nearly everyone has had some experience completing questionnaires and they generally do not make people apprehensive. They are less intrusive than telephone or face-to-face surveys. When respondents receive a questionnaire in the mail, they are free to complete it on their own time-table. Unlike other research methods, the respondent is not interrupted by the research instrument. On the other hand, questionnaires are simply not suited for some people. For example, a written survey to a group of poorly educated people might not work because of reading skill problems. More frequently, some people are turned off by written questionnaires because of misuse.

Written questionnaires reduce interviewer bias because there is uniform question presentation. Unlike in-person interviewing, there are no verbal or visual clues to influence a respondent to answer in a particular way. Many investigators have reported that interviewer voice inflections and mannerisms can bias responses. Written surveys are not subject to this bias because there is no interviewer. On the other hand, the lack of an interviewer limits the researcher's ability to probe responses. Structured questionnaires often lose the "flavour of the response", because respondents often want to qualify their answers. By allowing frequent space for comments, the researcher can partially overcome this disadvantage.

A common criticism of mail surveys is that they often have low response rates. Low response is the curse of statistical analysis, and it can dramatically lower confidence in the results. While response rates vary widely from one questionnaire to another, well-designed studies consistently produce high response rates.

When returned questionnaires arrive in the mail, it's natural to assume that the respondent is the same person you sent the questionnaire to. A number of researchers have reported that this may not actually be the case. Many times business questionnaires get handed to other employees for completion. Housewives sometimes respond for their husbands. Kids respond as a prank. For a variety of reasons, the respondent may not be who you think it is. In a summary of five studies sponsored by the British Government, Scott reports that up to ten per cent of the returned questionnaires had been completed by someone other than the intended person.

Response Rate

Response rate is the single most important indicator of how much confidence can be placed in the results of a mail survey. A low response rate can be devastating to the reliability of a study. Fortunately, "low response rates are not an inherent shortcoming of mail surveys", and the researcher must do everything possible to maximize response. Much of the research in questionnaire methodology has centred around techniques to maximize response. However, Jones and Lang point out that increasing the response rate does not necessarily improve the precision of survey results.

Following up on Nonrespondents

One of the most powerful tool for increasing response is to use follow-ups or reminders. "Traditionally, between 5 and 65 per cent of those sent questionnaires respond without follow-up reminders. These rates are too low to yield confident results". The need to follow up on nonrespondents is clear.

Researchers can increase the response from follow-up attempts by including another copy of the questionnaire. The most important consideration is that the investigator "designs the follow-up procedure by taking into consideration the unique characteristics of the people in the sample." The most successful follow-ups have been achieved by phone calls.

Many researchers have examined whether postcard follow-ups are effective in increasing response. The vast majority of these studies show that a follow-up postcard increases response rate, and a meta-analysis by Fox, Crask, and Kim reveals an aggregate gain of 3.5 per cent. The postcard serves as an effective reminder for subjects who have forgotten to complete the survey.

Nonresponse Bias

Many studies have attempted to determine if there is a difference between respondents and nonrespondents. Some researchers have reported that people who respond to surveys answer questions differently than those who do not. Others have found that late responders answer differently than early responders, and that the differences may be due to the different levels of interest in the subject matter. One researcher, who examined a volunteer organization, reported that those more actively involved in the organization were more likely to respond.

Demographic characteristics of nonrespondents have been investigated by many researchers. Most studies have found that nonresponse is associated with low education. However, one reseacher reported that demographic characteristics such as age, education, and employment status were the same for respondents and nonrespondents. Another study found that nonrespondents were more often single males.

Most researchers view nonresponse bias as a continuum, ranging from fast responders to slow responders. In fact, one study used extrapolation to estimate the magnitude of bias created by nonresponse. Another group of researchers argue that nonresponse should not be viewed as a continuum, and "that late respondents do not provide a suitable basis for estimating the characteristics of nonrespondents".

Goal Definition

Most problems with questionnaires can be traced back to the design phase of the project. Well-defined goals are the best way to assure a good questionnaire design. One of the best ways to clarify the study goals is to decide how the information will be used.. Study goals should be committed to writing. When the goals of a study can be expressed in a few clear and concise sentences, the design of the questionnaire becomes considerably easier. The questionnaire is developed to directly address the goals of the study.

One important way to assure a successful survey is to include other experts and relevant decision-makers in the questionnaire design process. Their suggestions will improve the questionnaire and they will subsequently have more confidence in the results.

General Layout and Format Considerations

The physical appearance of a written survey may largely determine if the respondent will return it. Therefore, it is important to use professional production methods for the questionnaire—either desktop publishing or typesetting and keylining. Every questionnaire should have a title that is short and meaningful to the respondent. The rationale is that a questionnaire with a title will be perceived as more credible than one without.

Well-designed questionnaires include clear and concise instructions on how they should be completed. These must be very easy to understand, so use short sentences and basic vocabulary. The questionnaire itself should have the return address printed on it since questionnaires often get separated from the reply envelopes.

Questionnaires should use simple and direct language. The questions must be clearly understood by the respondent, and have the same meaning that the researcher intended. The wording of a question should be simple, to the point, and familiar to the target population. Surprisingly, several researchers have found that longer questions elicit more information than shorter ones, and that the information tends to be more accurate. However, it is generally accepted that questionnaire items should be simply stated and as brief as possible. The rationale is that this will reduce misunderstandings and make the questionnaire appear easier to complete. One way to eliminate misunderstandings is to emphasize crucial words in each item by using bold, italics or underlining.

Uncommon words, jargon, and abbreviations may be included in a questionnaire provided that they are familiar to the population being investigated. Slang is often ambiguous, and should be excluded from all questionnaires.

Questionnaires should leave adequate space for respondents to make comments. One criticism of questio-nnaires is their inability to retain the "flavour" of a response. Leaving space for comments will provide valuable information not captured by the response categories. Leaving white space also makes the questionnaire look easier and this might increase response.

Researchers should design the questionnaire so it holds the respondent's interest. The goal is to make the respondent want to complete the questionnaire. One way to keep a questionnaire interesting is to provide variety in the type of items used. Varying the questioning format will also prevent respondents from falling into "response sets".

The Order of the Questions

Questionnaires should begin with a few non-threatening and easy to answer items. If the first items are too difficult or threatening, there is little chance that the person will complete the questionnaire. People generally look at the first few questions before deciding whether or not to complete the questionnaire. The researcher can encourage response by starting with a few interesting and nonthreatening questions.

Likewise, the most important items should appear in the first half of the questionnaire. Respondents often send back partially completed questionnaires. By putting the most important items near the beginning, the partially completed questionnaires will still contain important information.

Items on a questionnaire should be grouped into logically coherent parts. Grouping questions that are similar will make the questionnaire easier to complete, and the respondent will feel more comfortable. Questions that use the same response formats, or those that cover a specific topic, should appear together.

Each question should follow comfortably from the previous question. Writing a questionnaire is similar to writing anything else. Transitions between questions should be smooth. Questionnaires that jump from one unrelated topic to another feel disjointed and are not likely to produce high response rates.

Most investigators have found that the order in which questions are presented can affect the way that people respond. One study reported that questions in the latter half a questionnaire were more likely to be omitted, and contained fewer extreme responses. Carp suggested that it may be necessary to prevent general questions before specific ones in order to avoid response contamination. McFarland reported that when specific questions were asked before general questions, respondents tended to exhibit greater interest in the general questions. A few researchers, however, have found that question-order does not effect responses. Bradburn and Mason reported that interviews involving self-reports and self-evaluations were unaffected by question order. Clancey and Wachsler found that responses to questions were similar regardless of where the questions appeared in a questionnaire. Bishop et al. reported that question-order effects existed in interviews, but not in written surveys. Ayidiya and McClendon reported mixed results, where some questions were subject to order effects, and other similar questions were not.

Anonymity and Confidentiality

As a general rule, long questionnaires get less response than short questionnaires. However, some studies have shown that the length of a questionnaire does not necessarily affect response. "Seemingly more important than length is question content." A subject is more likely to respond if they are involved and interested in the research topic. Questions should be meaningful and interesting to the respondent.

Colour of the Paper

One study found that the colour of the paper. Nevertheless, Berdie, Anderson and Neibuhr suggest that colour might make the survey more appealing. Another early study examined the ink and paper colour combinations that provide the greatest legibility. The authors suggest three different ink colours for white paper: black, grass green, and lustre blue. The only other recommended combination is black ink on yellow paper. Some investigators have examined the effect of using a green paper compared to white paper. Two studies reported no significant differences in response rates, while another reported a 9.1 per cent difference. A meta-analysis of these studies calculated an average aggregate increase of 2.0 per cent when using a green questionnaire.

Incentives

Many researchers have examined the effect of providing a variety of nonmonetary incentives to subjects. These include token gifts such as small packages of coffee, ball-point pens, postage stamps, or key rings, trading stamps, participation in a raffle or lottery, or a donation to a charity in the respondent's name. Generally, nonmonetary incentives have resulted in an increased response.

There can be little doubt that monetary incentives increase response. Only a few investigators have reported no increase in response. The overwhelming majority have reported increased response by including monetary incentives.

Church conducted of meta-analysis of 38 prior studies that used some form of an incentive. Monetary and nonmonetary incentives were effective only when enclosed with the survey. The promise of an incentive for a returned questionnaire was not effective in increasing response. The average increase in response rate for monetary and nonmonetary incentives was 19.1 per cent and 7.9 per cent, respectively.

Many researchers have found that higher monetary incentives generally work better than smaller ones. Armstrong proposed a diminishing return model, where increasing the amount of the incentive would have a decreasing effect on response rate. A meta-analysis performed by Fox, Crask, and Kim applied Armstrong's diminishing return model to fifteen studies. An incentive of 25¢ increased the response rate by an average of 16 per cent, and $1 increased the response by 31 per cent.

It is not known whether the effects of incentives disappear after follow-up mailings. Kephart and Bressler found that a 25¢ incentive significantly increased response, however, the effect disappeared after one follow-up mailing. Another study using a 25¢ incentive reported a significant difference, and the difference continued to be significant even after three follow-up mailings. James and Bolstein reported that four mailings without an incentive produced a better response than one mailing with an incentive. However, incentives of $1 and $2 with follow-ups produced a significantly better response than the same number of follow-ups with no incentive. Nederhof used a ball-point pen as an incentive and reported that "the effect of nonmonetary incentives on response rates disappears after the first mailing."

It is not clear whether offering to share the results of the research provides sufficient incentive to affect response. Mullner, Levy, Byre, and Matthews report that mentioning the offer in a cover letter did not increase response, while two older studies found that it did.

Notification of a Cutoff Date

Several researchers have examined the effect of giving subjects a deadline for responding While a deadline will usually reduce the time from the mailing until the returns begin arriving, it appears that it does not increase response, and may even reduce the response. One possible explanation is that a cutoff date might dissuade procrastinators from completing the questionnaire after the deadline has past. A meta-analysis by Fox, Crask and Kim revealed an aggregate increase in response rate of 1.7 per cent, which was not significant.

Reply Envelopes and Postage

A good questionnaire makes it convenient for the respondent to reply. Mail surveys that include a self-addressed stamped reply envelope get better response than business reply envelopes, although they are more expensive since you also pay for the non-respondents. Some investigators have suggested that people might feel obligated to complete the questionnaire because of the guilt associated with throwing away money--that is, the postage stamp. Others have pointed out that using a business reply permit might suggest advertising to some people. Another possibility is that a business reply envelope might be perceived as less personal.

Armstrong and Lusk performed a meta-analysis on 34 studies comparing stamped versus business reply postage. They calculated that stamped reply envelopes had a 9 per cent greater aggregate effect than business reply envelopes. In a subsequent meta-analysis on nine studies, Fox, Crask, and Kim reported an aggregate effect of 6.2 per cent.

INTERVIEW

Interviews are a far more personal form of research than questionnaires. In the personal interview, the interviewer works directly with the respondent. Unlike with mail surveys, the interviewer has the opportunity to probe or ask follow-up questions. And, interviews are generally easier for the respondent, especially if what is sought is opinions or impressions. Interviews can be very time consuming and they are resource intensive. The interviewer is considered a part of the measurement instrument and interviewers have to be well trained in how to respond to any contingency.

Almost everyone is familiar with the telephone interview. Telephone interviews enable a researcher to gather information rapidly. Most of the major public opinion polls that are reported were based on telephone interviews.

Like personal interviews, they allow for some personal contact between the interviewer and the respondent. And, they allow the interviewer to ask follow-up questions. But they also have some major disadvantages. Many people don't have publicly-listed telephone numbers. Some don't have telephones. People often don't like the intrusion of a call to their homes. And, telephone interviews have to be relatively short or people will feel imposed upon.

Interviews are among the most challenging and rewarding forms of measurement. They require a personal sensitivity and adaptability as well as the ability to stay within the bounds of the designed protocol.

Here, I describe the preparation you need to do for an interview study and the process of conducting the interview itself.

The Role of the Interviewer

The interviewer is really the "jack-of-all-trades" in survey research. The interviewer's role is complex and multifaceted.

It includes the following tasks:

- *Locate and enlist cooperation of respondents*: The interviewer has to find the respondent. In door-to-door surveys, this means being able to locate specific addresses. Often, the interviewer has to work at the least desirable times (like immediately after dinner or on weekends) because that's when respondents are most readily available.
- *Motivate respondents to do good job*: If the interviewer does not take the work seriously, why would the respondent? The interviewer has to be motivated and has to be able to communicate that motivation to the respondent. Often, this means that the interviewer has to be convinced of the importance of the research.
- *Clarify any confusion/concerns*: Interviewers have to be able to think on their feet. Respondents may raise objections or concerns that were not anticipated. The interviewer has to be able to respond candidly and informatively.
- *Observe quality of responses*: Whether the interview is personal or over the phone, the interviewer is in the best position to judge the quality of the information that is being received. Even a verbatim transcript will not adequately convey how seriously the respondent took the task, or any gestures or body language that were evident.
- *Conduct a good interview*: Last, and certainly not least, the interviewer has to conduct a good interview! Every interview has a life of its own. Some respondents are

motivated and attentive, others are distracted or disinterested. The interviewer also has good or bad days. Assuring a consistently high-quality interview is a challenge that requires constant effort.

Training the Interviewers

One of the most important aspects of any interview study is the training of the interviewers themselves. In many ways the interviewers are your measures, and the quality of the results is totally in their hands. Even in small studies involving only a single researcher-interviewer, it is important to organize in detail and rehearse the interviewing process before beginning the formal study.

Here are some of the major topics that should be included in interviewer training:

- *Describe the entire study*: Interviewers need to know more than simply how to conduct the interview itself. They should learn about the background for the study, previous work that has been done, and why the study is important.
- *State who is sponsor of research*: Interviewers need to know who they are working for. They — and their respondents — have a right to know not just what agency or company is conducting the research, but also, who is paying for the research.
- *Teach enough about survey research*: While you seldom have the time to teach a full course on survey research methods, the interviewers need to know enough that they respect the survey method and are motivated. Sometimes it may not be apparent why a question or set of questions was asked in a particular way. The interviewers will need to understand the rationale for how the instrument was constructed.
- *Explain the sampling logic and process*: Naive interviewers may not understand why sampling is so important. They may wonder why you go through all

the difficulties of selecting the sample so carefully. You will have to explain that sampling is the basis for the conclusions that will be reached and for the degree to which your study will be useful.

- *Explain interviewer bias*: Interviewers need to know the many ways that they can inadvertently bias the results. And, they need to understand why it is important that they not bias the study. This is especially a problem when you are investigating political or moral issues on which people have strongly held convictions. While the interviewer may think they are doing good for society by slanting results in favour of what they believe, they need to recognize that doing so could jeopardize the entire study in the eyes of others.
- *"Walk through" the interview*: When you first introduce the interview, it's a good idea to walk through the entire protocol so the interviewers can get an idea of the various parts or phases and how they interrelate.

Explain respondent selection procedures, including:

- *Reading maps*: It's astonishing how many adults don't know how to follow directions on a map. In personal interviews, the interviewer may need to locate respondents who are spread over a wide geographic area. And, they often have to navigate by night (respondents tend to be most available in evening hours) in neighbourhoods they're not familiar with. Teaching basic map reading skills and confirming that the interviewers can follow maps is essential.
- *Identifying households*: In many studies it is impossible in advance to say whether every sample household meets the sampling requirements for the study. In your study, you may want to interview only people who live in single family homes. It may be impossible to distinguish townhouses and apartment buildings in your sampling frame. The interviewer must know how to identify the appropriate target household.

- *Identify respondents*: Just as with households, many studies require respondents who meet specific criteria. For instance, your study may require that you speak with a male head-of-household between the ages of 30 and 40 who has children under 18 living in the same household. It may be impossible to obtain statistics in advance to target such respondents. The interviewer may have to ask a series of filtering questions before determining whether the respondent meets the sampling needs.
- *Rehearse interview*: You should probably have several rehearsal sessions with the interviewer team. You might even videotape rehearsal interviews to discuss how the trainees responded in difficult situations. The interviewers should be very familiar with the entire interview before ever facing a respondent.
- *Explain supervision*: In most interview studies, the interviewers will work under the direction of a supervisor. In some contexts, the supervisor may be a faculty advisor; in others, they may be the "boss." In order to assure the quality of the responses, the supervisor may have to observe a subsample of interviews, listen in on phone interviews, or conduct follow-up assessments of interviews with the respondents. This can be very threatening to the interviewers. You need to develop an atmosphere where everyone on the research team -- interviewers and supervisors -- feel like they're working together towards a common end.
- *Explain scheduling*: The interviewers have to understand the demands being made on their schedules and why these are important to the study. In some studies it will be imperative to conduct the entire set of interviews within a certain time period. In most studies, it's important to have the interviewers available when it's convenient for the respondents, not necessarily the interviewer.

The Personal Interview Method

The personal interview is the most frequently used method. It is a direct form of investigation where trained interviewers get information from selected individuals. A formal questionnaire is usually used for the interview. The place in which the interview is conducted depends on the subject and on the method of sampling. It may take place in the street or it may be a 'Hall Test', that takes place in a town hall or other public building. If you want to speak to elderly or disabled people, this is best done in their homes or some place that they visit such as a lunch club. It should be by appointment only; never just knock on a door and expect to be let in. Children should always be accompanied if they are carrying out questionnaires in homes.

The Focused Interview Method

The focused interview differs from the personal interview in that respondents are encouraged to talk freely, while the interviewer reports what they say. They may even record it on a tape for later analysis. To keep the interview to the point, guiding questions are sometimes put to the respondent. Often, more information can be obtained this way, than when detailed, fixed questions are asked.

Disadvantages of personal and focused interviews:

1. There is great danger that the interviewer, when recording the answers, will interpret them in their own way.
2. The interpretation of the interviews by the researcher is also very difficult and gives an opportunity for personal bias to distort the findings.
3. Statistical analysis of the findings is either very difficult or impossible since the information may not be easy to quantify or code.
4. The interview takes a long time, which increases the cost per interview.

5. There is a high proportion of irrelevant information in the data.

The Telephone Interview Method

This is similar to the personal interview but obviously takes place over the telephone. Again the respondents are asked a set list of questions relevant to the study. This method is becoming very common for market research, as well as being used by service companies, such as banks, who want to make contact with their customers, either to improve services or to sell additional ones.

Advantages:

- It is a quick method for conducting a number of interviews within a short time.
- The interviewers can be supervised easily.
- The cost per interview is low.
- The sampling can be spread over the country and travelling is eliminated.
- People who might otherwise be inaccessible, can be interviewed, since the interview can be very brief and arranged for a time that is convenient to the respondent.

Disadvantages:

- Telephone subscribers may not be representative of the general population, Mobile phone numbers may be used which do not give information about the location of the respondent.
- Only a short questionnaire can be used.
- Observation is not possible, so that the interviewers have to rely totally on what the respondent tells them.
- The times during the day when respondents can be called are limited, for example to office hours, or early evening, and it is difficult to predict such times. Calling during meals or when people are watching TV can lead to negative responses.

- 'Call-backs' have to be made when the number is engaged.

The Panel Method

The panel method is used to study changes over time. A panel of the same respondents are used and they are questioned about the same sort of thing over a period of time. There are several types of panel including the consumer-purchasing panel, the consumer-product testing panel, or the television audience panel.

The panel is often recruited by means of personal interviews of a cross-section of the population. The respondents are given diaries in which they enter, for example, every time they buy one of the products being surveyed. They return the diaries at regular intervals. Alternatively, the panel may be interviewed about the relevant facts periodically. This method has been successfully adopted for radio, television and opinion research.

Advantages:

- The method is especially useful for research into trends, as the same individuals are questioned over a period of time.
- Data collected over a period of time can be accumulated and the factors underlying the change can be analysed.
- The case histories of panel members can be established to give relevant background material to responses.
- The panel can sometimes be used for enquiries on other subjects, provided that these are not likely to affect the reliability of the panel for its main purpose.

Disadvantages:

- Individuals may leave the panel.
- If people refuse to join the panel it may no longer represent a target population.
- Being a member of the panel over a long period of time may affect the opinions and behaviour of panelists, so

that their responses may no longer be representative of the population at large.

- The original recruiting drive is usually expensive so investment takes a long time to yield returns.
- Panel members are usually rewarded in some small way, which adds to the overall cost.

The Group Interview Method

A small and carefully selected group of people is invited to a discussion on whatever topic is under review. A questionnaire may be provided, but more usually, the group is encouraged to discuss the matter freely, following a basic agenda. The discussion may be recorded on tape, if the respondents agree, or an observer may be present to take notes. The interviewer's task is to remain in the background and to intervene only to bring the discussion back to the point.

Advantages:

- Group interviews are appropriate in research concerned with motives and opinions where such factors as social status and acceptance are involved. Such factors are brought out through the dynamic group situation.
- The group interview is relatively inexpensive as one interviewer can listen to up to ten people at a time.
- The free discussion of the group on a topic can provide valuable information for pilot studies
- The spontaneity of the discussion may produce information and attitudes that cannot be obtained by other methods.

Disadvantages:

- It is usually very doubtful whether such a group can be regarded as really representative of the population at large.
- Statistical analysis of the material is usually difficult, if not impossible.

- The influence of the more vocal group members on group opinion is hard to estimate.
- In the group situation, people may assume roles and behaviour that are not characteristic of their usual behaviour.
- Some groups are difficult to assemble, for example, managing directors.

Self-administered and Group-administered Questionnaires

The interviewer is often a person in authority such as a teacher. They briefly explain the purpose and requirements of the survey to the respondent, or group of respondents, and then leaves them alone to complete the questions. The method usually gives a high response rate and a minimum of interviewer bias. It has the benefit of a degree of interviewer assessment of the respondents, a better explanation to the respondents and personal contact.

For groups of respondents assembled together, the interviewer distributes the questionnaire to the assembly or reads aloud each question for immediate completion. All respondents then answer each question in the same order. Groups of forty can be handled in this way, but they can affect answers by copying, talking and asking questions.

Format of the Interview

The following stages usually occur:

- Decide on the aims of the study and what you are trying to investigate - usually called the 'hypothesis' or 'null hypothesis'. For example, 'men are more interested in sport than women'.
- Review the relevant literature and discuss with other people. This includes deciding how the data will be analysed, and making sure that the information is collected in a suitable format.

- Design the study, making the hypothesis specific to the situation. For example, 'men are more interested in playing golf than women'.
- Compose the interview questions that will bring out the information that you need for your study.
- Carry out a small test to make sure that you have phrased the questions adequately and modify them if you need to.
- Select a sample of subjects to be approached.
- Collect your data.
- Sort out and process your data. This can include giving codes to the answers so that they can be put on a computer spreadsheet for analysis by a statistical package.
- Do the statistical analysis.
- Put all of the results together and see what they are telling you. This is the part where the hypothesis is tested to see, for example, if men statistically do play more golf than women.
- Write up the results, relating the findings to other research, drawing ceases and interpretations.

Anonymity

Data obtained by means of questionnaires is confidential, in the sense that no responses or findings should ever be published which could be traced back to particular individuals. This is a requirement of the Data Protection Act. In enlisting co-operation for any survey, respondents are usually given this assurance and a guarantee of anonymity. This is often crucial in obtaining frank and revealing responses. Where possible, therefore, you should not ask respondents to put their names on, or to sign, their questionnaires. If you need to maintain a check on non-respondents, the questionnaires can be numbered and cross-referenced back to individuals.

9

Sampling

Sampling is a process used in statistical analysis in which a predetermined number of observations are taken from a larger population. The methodology used to sample from a larger population depends on the type of analysis being performed, but it may include simple random sampling or systematic sampling.

CHARACTERISTICS

Sampling is that part of statistical practice concerned with the selection of a subset of individual observations within a population of individuals intended to yield some knowledge about the population of concern, especially for the purposes of making predictions based on statistical inference. Sampling is an important aspect of data collection.

Researchers rarely survey the entire population for two reasons : the cost is too high, and the population is dynamic in that the individuals making up the population may change over time.

The three main advantages of sampling are that the cost is lower, data collection is faster, and since the data set is smaller it is possible to ensure homogeneity and to improve the accuracy and quality of the data.

Each observation measures one or more properties (such as weight, location, colour) of observable bodies distinguished as independent objects or individuals. In survey sampling, survey weights can be applied to the data to adjust for the sample design. Results from probability theory and statistical theory are employed to guide practice. In business and medical research, sampling is widely used for gathering information about a population.

Process

The sampling process comprises several stages:

- Defining the population of concern
- Specifying a sampling frame, a set of items or events possible to measure
- Specifying a sampling method for selecting items or events from the frame
- Determining the sample size
- Implementing the sampling plan
- Sampling and data collecting.

Population Definition

Successful statistical practice is based on focused problem definition. In sampling, this includes defining the population from which our sample is drawn. A population can be defined as including all people or items with the characteristic one wishes to understand. Because there is very rarely enough time or money to gather information from everyone or everything in a population, the goal becomes finding a representative sample (or subset) of that population.

Sometimes that which defines a population is obvious. For example, a manufacturer needs to decide whether a batch of material from production is of high enough quality to be released to the customer, or should be sentenced for scrap or rework due to poor quality. In this case, the batch is the population.

Although the population of interest often consists of physical objects, sometimes we need to sample over time, space, or some combination of these dimensions. For instance, an investigation of supermarket staffing could examine checkout line length at various times, or a study on endangered penguins might aim to understand their usage of various hunting grounds over time. For the time dimension, the focus may be on periods or discrete occasions.

In other cases, our 'population' may be even less tangible. For example, Joseph Jagger studied the behaviour of roulette wheels at a casino in Monte Carlo, and used this to identify a biased wheel. In this case, the 'population' Jagger wanted to investigate was the overall behaviour of the wheel (i.e. the probability distribution of its results over infinitely many trials), while his 'sample' was formed from observed results from that wheel. Similar considerations arise when taking repeated measurements of some physical characteristic such as the electrical conductivity of copper.

This situation often arises when we seek knowledge about the cause system of which the *observed* population is an outcome. In such cases, sampling theory may treat the observed population as a sample from a larger 'superpopulation'. For example, a researcher might study the success rate of a new 'quit smoking' program on a test group of 100 patients, in order to predict the effects of the program if it were made available nationwide. Here the superpopulation is "everybody in the country, given access to this treatment"-a group which does not yet exist, since the program isn't yet available to all.

Note also that the population from which the sample is drawn may not be the same as the population about which we actually want information. Often there is large but not complete overlap between these two groups due to frame issues etc. Sometimes they may be entirely separate-for instance, we might study rats in order to get a better understanding of human health, or we might study records from people born in 2008 in order to make predictions about people born in 2009.

Time spent in making the sampled population and population of concern precise is often well spent, because it raises many issues, ambiguities and questions that would otherwise have been overlooked at this stage.

Sampling Frame

In the most straightforward case, such as the sentencing of a batch of material from production (acceptance sampling by lots), it is possible to identify and measure every single item in the population and to include any one of them in our sample. However, in the more general case this is not possible. There is no way to identify all rats in the set of all rats. Where voting is not compulsory, there is no way to identify which people will actually vote at a forthcoming election (in advance of the election). These imprecise populations are not amenable to sampling in any of the ways below and to which we could apply statistical theory. As a remedy, we seek a *sampling frame* which has the property that we can identify every single element and include any in our sample. The most straightforward type of frame is a list of elements of the population (preferably the entire population) with appropriate contact information. For example, in an opinion poll, possible sampling frames include:

- Electoral register
- Telephone directory.

Not all frames explicitly list population elements. For example, a street map can be used as a frame for a door-to-door survey; although it doesn't show individual houses, we can select streets from the map and then visit all houses on those streets.

The sampling frame must be representative of the population and this is a question outside the scope of statistical theory demanding the judgment of experts in the particular subject matter being studied. All the above frames omit some people who will vote at the next election and contain some people who will not; some frames will contain multiple records for the same person.

People not in the frame have no prospect of being sampled. Statistical theory tells us about the uncertainties in extrapolating from a sample to the frame. In extrapolating from frame to population, its role is motivational and suggestive.

To the scientist, however, representative sampling is the only justified procedure for choosing individual objects for use as the basis of generalization, and is therefore usually the only acceptable basis for ascertaining truth. —Andrew A. Marino

It is important to understand this difference to steer clear of confusing prescriptions found in many web pages.

In defining the frame, practical, economic, ethical, and technical issues need to be addressed. The need to obtain timely results may prevent extending the frame far into the future.

The difficulties can be extreme when the population and frame are disjoint. This is a particular problem in forecasting where inferences about the future are made from historical data. In fact, in 1703, when Jacob Bernoulli proposed to Gottfried Leibniz the possibility of using historical mortality data to predict the probability of early death of a living man, Gottfried Leibniz recognized the problem in replying:

Nature has established patterns originating in the return of events but only for the most part. New illnesses flood the human race, so that no matter how many experiments you have done on corpses, you have not thereby imposed a limit on the nature of events so that in the future they could not vary. —Gottfried Leibniz

Kish posited four basic problems of sampling frames:

1. Missing elements: Some members of the population are not included in the frame.
2. Foreign elements: The non-members of the population are included in the frame.
3. Duplicate entries: A member of the population is surveyed more than once.
4. Groups or clusters: The frame lists clusters instead of individuals.

A frame may also provide additional 'auxiliary information' about its elements; when this information is related to variables or groups of interest, it may be used to improve survey design. For instance, an electoral register might include name and sex;

this information can be used to ensure that a sample taken from that frame covers all demographic categories of interest. (Sometimes the auxiliary information is less explicit; for instance, a telephone number may provide some information about location.)

Having established the frame, there are a number of ways for organizing it to improve efficiency and effectiveness. It's at this stage that the researcher should decide whether the sample is in fact to be the whole population and would therefore be a census.

ADVANTAGES AND DISADVANTAGES

Sampling may be defined as the procedure in which a sample is selected from an individual or a group of people of certain kind for research purpose. In sampling, the population is divided into a number of parts called sampling units.

Sampling

Advantages of sampling

Sampling ensures convenience, collection of intensive and exhaustive data, suitability in limited resources and better rapport. In addition to this, sampling has the following advantages also.

1. Low cost of sampling: If data were to be collected for the entire population, the cost will be quite high. A sample is a small proportion of a population. So, the cost will be lower if data is collected for a sample of population which is a big advantage.
2. Less time consuming in sampling: Use of sampling takes less time also. It consumes less time than census technique. Tabulation, analysis etc., take much less time in the case of a sample than in the case of a population.
3. Scope of sampling is high: The investigator is concerned with the generalization of data. To study a whole

population in order to arrive at generalizations would be impractical.

Some populations are so large that their characteristics could not be measured. Before the measurement has been completed, the population would have changed. But the process of sampling makes it possible to arrive at generalizations by studying the variables within a relatively small proportion of the population.

4. Accuracy of data is high: Having drawn a sample and computed the desired descriptive statistics, it is possible to determine the stability of the obtained sample value. A sample represents the population from which its is drawn. It permits a high degree of accuracy due to a limited area of operations. Moreover, careful execution of field work is possible. Ultimately, the results of sampling studies turn out to be sufficiently accurate.
5. Organization of convenience: Organizational problems involved in sampling are very few. Since sample is of a small size, vast facilities are not required. Sampling is therefore economical in respect of resources. Study of samples involves less space and equipment.
6. Intensive and exhaustive data: In sample studies, measurements or observations are made of a limited number. So, intensive and exhaustive data are collected.
7. Suitable in limited resources: The resources available within an organization may be limited. Studying the entire universe is not viable. The population can be satisfactorily covered through sampling. Where limited resources exist, use of sampling is an appropriate strategy while conducting marketing research.
8. Better rapport: An effective research study requires a good rapport between the researcher and the respondents. When the population of the study is large, the problem of rapport arises. But manageable samples permit the researcher to establish adequate rapport with the respondents.

Disadvantages of sampling

The reliability of the sample depends upon the appropriateness of the sampling method used. The purpose of sampling theory is to make sampling more efficient. But the real difficulties lie in selection, estimation and administration of samples.

Disadvantages of sampling may be discussed under the heads:

- Chances of bias
- Difficulties in selecting truly a representative sample
- Need for subject specific knowledge
- changeability of sampling units
- impossibility of sampling.

Chances of bias

The serious limitation of the sampling method is that it involves biased selection and thereby leads us to draw erroneous conclusions. Bias arises when the method of selection of sample employed is faulty. Relative small samples properly selected may be much more reliable than large samples poorly selected.

Difficulties in selecting a truly representative sample

Difficulties in selecting a truly representative sample produces reliable and accurate results only when they are representative of the whole group. Selection of a truly representative sample is difficult when the phenomena under study are of a complex nature. Selecting good samples is difficult.

In adequate knowledge in the subject

Use of sampling method requires adequate subject specific knowledge in sampling technique. Sampling involves statistical analysis and calculation of probable error. When the researcher lacks specialized knowledge in sampling, he may commit serious mistakes. Consequently, the results of the study will be misleading.

Changeability of units

When the units of the population are not in homogeneous, the sampling technique will be unscientific. In sampling, though the number of cases is small, it is not always easy to stick to the, selected cases. The units of sample may be widely dispersed.

Some of the cases of sample may not cooperate with the researcher and some others may be inaccessible. Because of these problems, all the cases may not be taken up. The selected cases may have to be replaced by other cases. Changeability of units stands in the way of results of the study.

Impossibility of sampling

Deriving a representative sample is difficult, when the universe is too small or too heterogeneous. In this case, census study is the only alternative. Moreover, in studies requiring a very high standard of accuracy, the sampling method may be unsuitable. There will be chances of errors even if samples are drawn most carefully.

TYPES OF SAMPLING

We may then consider different types of probability samples. Although there are a number of different methods that might be used to create a sample, they generally can be grouped into one of two categories: *probability samples* or *non-probability* samples.

Probability Samples

The idea behind this type is random selection. More specifically, each sample from the population of interest has a known probability of selection under a given sampling plan..

Simple Random Sampling

The most widely known type of a random sample is the simple random sample (SRS). This is characterized by the fact that the probability of selection is the same for every case in the population. Simple random sampling is a method of selecting n units from a population of size N such that every possible sample of size an has equal chance of being drawn.

An example may make this easier to understand. Imagine you want to carry out a survey of 100 voters in a small town with a population of 1,000 eligible voters. With a town this size, there are "old-fashioned" ways to draw a sample. For example, we could write the names of all voters on a piece of paper, put all pieces of paper into a box and draw 100 tickets at random. You shake the box, draw a piece of paper and set it aside, shake again, draw another, set it aside, etc. until we had 100 slips of paper. These 100 form our sample. And this sample would be drawn through a simple random sampling procedure - at each draw, every name in the box had the same probability of being chosen.

In real-world social research, designs that employ simple random sampling are difficult to come by. We can imagine some situations where it might be possible - you want to interview a sample of doctors in a hospital about work conditions. So you get a list of all the physicians that work in the hospital, write their names on a piece of paper, put those pieces of paper in the box, shake and draw.

But in most real-world instances it is impossible to list everything on a piece of paper and put it in a box, then randomly draw numbers until desired sample size is reached. There are many reasons why one would choose a different type of probability sample in practice.

Stratified Random Sampling

In this form of sampling, the population is first divided into two or more mutually exclusive segments based on some categories of variables of interest in the research. It is designed to organize the population into homogenous subsets before sampling, then drawing a random sample within each subset. With stratified random sampling the population of N units is divided into subpopulations of units respectively.

These subpopulations, called *strata*, are non-overlapping and together they comprise the whole of the population. When these have been determined, a sample is drawn from each, with a separate draw for each of the different strata. The sample sizes within the strata are denoted by respectively. If a SRS is taken within each stratum, then the whole sampling procedure is described as stratified random sampling.

The primary benefit of this method is to ensure that cases from smaller strata of the population are included in sufficient numbers to allow comparison. An example makes it easier to understand. Say that you're interested in how job satisfaction varies by race among a group of employees at a firm. To explore this issue, we need to create a sample of the employees of the firm.

However, the employee population at this particular firm is predominantly white:

- *African-American*: 9%
- *Asian*: 10%
- *Latino:* 6%
- *White:* 75%

If we were to take a simple random sample of employees, there's a good chance that we would end up with very small numbers of Blacks, Asians, and Latinos. That could be disastrous for our research, since we might end up with too few cases for comparison in one or more of the smaller groups.

Rather than taking a simple random sample from the firm's population at large, in a stratified sampling design, we ensure that appropriate numbers of elements are drawn from each racial group in proportion to the percentage of the population as a whole. Say we want a sample of 1000 employees - we would stratify the sample by race then randomly draw out 750 employees from the White group, 90 from the African American, 100 from the Asian, and 60 from the Latino. This yields a sample that is proportionately representative of the firm as a whole. Stratification is a common technique.

There are many reasons for this, such as:

- If data of known precision are wanted for certain subpopulations, than each of these should be treated as a population in its own right.
- Administrative convenience may dictate the use of stratification, for example, if an agency administering a survey may have regional offices, which can supervise the survey for a part of the population.
- Sampling problems may be inherent with certain sub populations, such as people living in institutions.
- Stratification may improve the estimates of characteristics of the whole population. It may be possible to divide a heterogeneous population into sub-populations, each of which is internally homogenous. If these strata are homogenous, *i.e.*, the measurements vary little from one part to another; a precise estimate of any stratum mean can be obtained from a small sample in that stratum. The estimate can then be combined into a precise estimate for the whole population.
- There is also a statistical advantage in the method, as a stratified random sample nearly always results in a smaller variance for the estimated mean or other population parametres of interest.

Systematic Sampling

This method of sampling is at first glance very different from SRS. In practice, it is a variant of simple random sampling that involves some listing of elements - every nth element of list is then drawn for inclusion in the sample. Say you have a list of 10,000 people and you want a sample of 1,000.

Creating such a sample includes three steps:

1. Divide number of cases in the population by the desired sample size. In this example, dividing 10,000 by 1,000 gives a value of 10.

2. Select a random number between one and the value attained in Step 1. In this example, we choose a number between 1 and 10 - say we pick 7.
3. Starting with case number chosen in Step 2, take every tenth record.

More generally, suppose that the N units in the population are ranked 1 to N in some order. To select a sample of n units, we take a part at random, from the 1st k units and take every k-th part thereafter.

The advantages of systematic sampling method over simple random sampling include:

1. It is easier to draw a sample and often easier to execute without mistakes. This is a particular advantage when the drawing is done in the field.
2. Intuitively, you might think that systematic sampling might be more precise than SRS. In effect it stratifies the population into n strata, consisting of the 1st k units, the 2nd k units, and so on. Thus, we might expect the systematic sample to be as precise as a stratified random sample with one part per stratum. The difference is that with the systematic one the units occur at the same relative position in the stratum whereas with the stratified, the position in the stratum is determined separately by randomization within each stratum.

HOW TO SELECT A SAMPLE

If a sample is to be used, by whatever method it is chosen, it is important that the individuals selected are representative of the whole population. This may involve specifically targeting hard to reach groups. For example, if the electoral roll for a town was used to identify participants, some people, such as the homeless, would not be registered and therefore excluded from the study by default.

There are several different sampling techniques available, and they can be subdivided into two groups: probability sampling and non-probability sampling. In probability (random) sampling, you start with a complete sampling frame of all eligible individuals from which you select your sample. In this way, all eligible individuals have a chance of being chosen for the sample, and you will be more able to generalise the results from your study. Probability sampling methods tend to be more time-consuming and expensive than non-probability sampling. In non-probability (non-random) sampling, you do not start with a complete sampling frame, so some individuals have no chance of being selected. Consequently, you cannot estimate the effect of sampling error and there is a significant risk of ending up with a non-representative sample which produces non-generalisable results. However, non-probability sampling methods tend to be cheaper and more convenient, and they are useful for exploratory research and hypothesis generation.

Probability Sampling Methods

Simple random sampling

In this case each individual is chosen entirely by chance and each member of the population has an equal chance, or probability, of being selected. One way of obtaining a random sample is to give each individual in a population a number, and then use a table of random numbers to decide which individuals to include. For example, if you have a sampling frame of 1000 individuals, labelled 0 to 999, use groups of three digits from the random number table to pick your sample. So, if the first three numbers from the random number table were 094, select the individual labelled "94", and so on.

As with all probability sampling methods, simple random sampling allows the sampling error to be calculated and reduces selection bias. A specific advantage is that it is the most straightforward method of probability sampling. A disadvantage of simple random sampling is that you may not select enough individuals with your characteristic of interest, especially if that characteristic is uncommon. It may also be difficult to define a complete sampling frame and inconvenient to contact them, especially if different forms of contact are required (email, phone, post) and your sample units are scattered over a wide geographical area.

Systematic sampling

Individuals are selected at regular intervals from the sampling frame. The intervals are chosen to ensure an adequate sample size. If you need a sample size n from a population of size x, you should select every x/n individual for the sample. For example, if you wanted a sample size of 100 from a population of 1000, select every 1000/100 = 10 member of the sampling frame.

Systematic sampling is often more convenient than simple random sampling, and it is easy to administer. However, it may also lead to bias, for example if there are underlying patterns in the order of the individuals in the sampling frame, such that the sampling technique coincides with the periodicity of the underlying pattern. As a hypothetical example, if a group of students were being sampled to gain their opinions on college facilities, but the Student Record Department's central list of all students was arranged such that the sex of students alternated between male and female, choosing an even interval (e.g. every 20 student) would result in a sample of all males or all females. Whilst in this example the bias is obvious and should be easily corrected, this may not always be the case.

Stratified sampling

In this method, the population is first divided into subgroups (or strata) who all share a similar characteristic. It is used when we might reasonably expect the measurement of interest to vary between the different subgroups, and we want to ensure representation from all the subgroups. For example, in a study of stroke outcomes, we may stratify the population by sex, to ensure equal representation of men and women. The study sample is then obtained by taking equal sample sizes from each stratum. In stratified sampling, it may also be appropriate to choose non-equal sample sizes from each stratum. For example, in a study of the health outcomes of nursing staff in a county, if there are three hospitals each with different numbers of nursing staff (hospital A has 500 nurses, hospital B has 1000 and hospital C has 2000), then it would be appropriate to choose the sample numbers from each hospital *proportionally* (e.g. 10 from hospital A, 20 from hospital B and 40 from hospital C). This ensures a more realistic and accurate estimation of the health outcomes of nurses across the county, whereas simple random sampling would over-represent nurses from hospitals A and B. The fact that the sample was stratified should be taken into account at the analysis stage.

Stratified sampling improves the accuracy and representativeness of the results by reducing sampling bias. However, it requires knowledge of the appropriate characteristics of the sampling frame (the details of which are not always available), and it can be difficult to decide which characteristic(s) to stratify by.

Clustered sampling

In a clustered sample, subgroups of the population are used as the sampling unit, rather than individuals. The population is divided into subgroups, known as clusters, which are randomly selected to be included in the study. Clusters are usually already defined, for example individual GP practices or towns could be identified as clusters. In single-stage cluster sampling, all members of the chosen clusters are then included in the study. In two-stage cluster sampling, a selection of individuals from each cluster is then randomly selected for inclusion. Clustering should be taken into account in the analysis. The General Household survey, which is undertaken annually in England, is a good example of a (one-stage) cluster sample. All members of the selected households (clusters) are included in the survey.

Cluster sampling can be more efficient that simple random sampling, especially where a study takes place over a wide geographical region. For instance, it is easier to contact lots of individuals in a few GP practices than a few individuals in many different GP practices. Disadvantages include an increased risk of bias, if the chosen clusters are not representative of the population, resulting in an increased sampling error.

Non-Probability Sampling Methods

Convenience sampling

Convenience sampling is perhaps the easiest method of sampling, because participants are selected based on availability and willingness to take part. Useful results can be obtained, but the results are prone to significant bias, because those who volunteer to take part may be different from those who choose not to (volunteer bias), and the sample may not be representative of other characteristics, such as age or sex. Note: volunteer bias is a risk of all non-probability sampling methods.

Quota sampling

This method of sampling is often used by market researchers. Interviewers are given a quota of subjects of a specified type to attempt to recruit. For example, an interviewer might be told to go out and select 20 adult men, 20 adult women, 10 teenage girls and 10 teenage boys so that they could interview them about their television viewing. Ideally the quotas chosen would proportionally represent the characteristics of the underlying population.

Whilst this has the advantage of being relatively straightforward and potentially representative, the chosen sample may not be representative of other characteristics that weren't considered (a consequence of the non-random nature of sampling).

Judgement (or Purposive) Sampling

Also known as selective, or subjective, sampling, this technique relies on the judgement of the researcher when choosing who to ask to participate. Researchers may implicitly thus choose a "representative" sample to suit their needs, or specifically approach individuals with certain characteristics. This approach is often used by the media when canvassing the public for opinions and in qualitative research.

Judgement sampling has the advantage of being time-and cost-effective to perform whilst resulting in a range of responses (particularly useful in qualitative research). However, in addition to volunteer bias, it is also prone to errors of judgement by the researcher and the findings, whilst being potentially broad, will not necessarily be representative.

Snowball sampling

This method is commonly used in social sciences when investigating hard-to-reach groups. Existing subjects are asked to nominate further subjects known to them, so the sample increases in size like a rolling snowball. For example, when carrying out a survey of risk behaviours amongst intravenous drug users, participants may be asked to nominate other users to be interviewed.

Snowball sampling can be effective when a sampling frame is difficult to identify. However, by selecting friends and acquaintances of subjects already investigated, there is a significant risk of selection bias (choosing a large number of people with similar characteristics or views to the initial individual identified).

FACTORS AFFECTING THE SIZE OF THE SAMPLE

Sample Size

The sample size is a measure of the number of individual samples that are present or have been observed during an experiment or a survey conducted. To understand it a little better, we can take an example. If we test 100 plants for a certain type of disease-causing virus, the sample size is 100. To carry out the survey, you received a 30,500 complete set of questionnaires, then the size of the sample is 30,500. The sample size in statistics is represented by the letter ‘n.’ Hence, the Sample Size definition is a measure of the number of samples for a particular study or research.

Factors Contributing To Sample Size Collection

There are certain factors which are taken into consideration before determining the sample size of a particular experiment or a study. These are-

- Size of the population- The size of the population that is being studied is the first thing that is considered to. The study that involves the conclusion from a larger area says an entire country will require a larger sample size in comparison to studying that includes smaller areas like a state or a city. The margin of error- Is another thing that is considered. Given the fact that the data that has been collected is accurate to what extent? There are high chances of errors in the data, so the margin of error is always considered.
- Standard deviation – Standard deviation refers to the amount of deviation seen in the individual sample and the whole group of samples. Let's say, for example, if the samples of soil are collected from a park, they are likely to show lesser deviation in the amount of nitrogen content in them, as opposed to the samples of soil that have been collected from across the nation.

What Dangers Are Related to Small Sample Size?

It has been said that smaller the smaller size, more in the accuracy of the findings!/Let us understand this by an example. A team decided to study how many people exercise daily in a country and what they did was pick up 5 people and interviewed them regarding the same. Two of them said that they exercise regularly. The outcome of the study would be that 40% of the population exercise regularly, and this would represent the country as a whole. The data does carry a lot of inaccuracy, and the Margin of error is quite high. So smaller the sample size, the higher are the margins of error and vice versa. Hence, it is advisable to select a large sample size to conduct any given experiment or study.

Calculating the Sample Size

To calculate the size of the sample, the figures you need are- Desired confidence level, margin or error, the total number of people in the population. There are two sample size formula-

1. Sample Size Calculation is Done In the Following Manner: Sample size can be calculated by (Percentage Distribution of 50)/ (?percentage of Margin of error/ Score of confidence level) squared)
2. Finite Population Correction- True Sample is equal to –(Size of sample*Population)/ (Size of sample+Population-1)

Understanding the concept of Sample Size better

The Sample Size examples would let us understand the concept even better. So here is one, In a given society the height of its residents is normally distributed at a standard deviation of 5 inches. Then, how will we find the minimum sample size required to construct a case study with the confidence level being 95% and the margin of error being 0.5 inch

The formula to determine the sample size is, n= Z 2 EZ 2 E

Where, E= 0.5 inch = 5 and = 1 – 0.95 = 0.05

Hence, Z /2 = Z 0.025 = 1.96

n=(Z 2 E)2

Putting the values, we get

N=1.96(5)0.51.96(5)0.52

Which comes out to be 384.16 and if we round it off, it is 385.

Conclusion

Not only a small sample size, but even the larger one is a problem. The interpretation with such large samples makes it difficult for the research and also affects the figures. Hence, it is not recommended to take larger samples. A moderately good amount of sample is what should be taken in order to obtain accurate results. Though there is no specified limit to decide the sample size but there are few thumb rules that can be followed. One of them says a minimum of 30 samples should be taken, and another says 12 minimum samples should be considered before carrying out a study.

Factors Influencing Sampling Process

Sample Size: Generally speaking, large samples are more representative of the population of interest than are small samples. The sampling error will decrease as the sample size increases. the question arises that how large sample is requires. There are no simple rules for determining the desired sample size.

Some factors to be considered are the homogeneity of the population, the degree of precision desired by the researcher, and the type of sampling procedure that will be used. If the population is very homogeneous or alike on all variables other than the one being measured, a small sample size may be sufficient. On the other hand, if the researcher wants to be very precise in generalizing to the population based on sample data, a large sample may be necessary for the sample to accurately represent the population. Finally when probability sampling methods are used, smaller samples are needed than when non-probability sampling techniques are employed.

Large sample size may be needed in the following instances:

1. Many uncontrolled variables are present. The researcher thinks that age may influence the study results, but is unable to control for this variable.
2. Small difference are expected in members of the population on the variable of interest. Small but important differences between members of the population may not be uncovered when small samples of each of the subgroups.

3. The population must be divided into subgroups, sample size must be increased to assure inclusion of members of each of the subgroups.
4. Drop out rate among subjects is expected to be high. his problem is especially likely to occur in longitudinal studies.
5. Statistical tests are used that require minimum sample size. Certain statistical tests require minimum members of responses in each cell of the data.

Although large samples are desirable, the law of diminishing returns implies. A samples of 100, or 10% may be necessary to obtain the required precision desired for a population of 1000. A 10% sample of a population of one million would require 1,00,000 elements. This would be a huge sample and would be unnecessary. In fact, samples of 2000 or 3000 are often sufficient to estimate the characteristics of the entire population of a country. A more important issue than the size of the sample is the representativeness of the sample. Election results can be predicted with very small percentages of votes counted because the polled voters have been thoroughly examined for representativeness in voting behavior.

It is always wise to set the sample size a little bit larger than what is actually desired (to allow for non response or subject drop out) and also to establish an absolute minimum size of the sample if only five subjects agree to participate. The researcher must make the decisions about the minimum acceptable sample size before the data collected begins.

Power analysis is a procedure that can be used to determine the needed sample size for a research study. This procedure is very important in experimental studies. The power of a statistical test is its ability to detect significance in a study when it is present. One factor that influences the power of a test is the sample size, that is used in the study. In many studies, researcher conclude that no significant differences exists between the experimental and the control group when, in fact, a difference would have been detected if the sample had been larger.

The researcher would be wise to perform a power analysis before conducting a study and make the decision not to conduct a study if the analysis indicates that the needed sample size would be very difficult to obtain.

Most nursing research studies are lacking Generalizations to total populations, therefore, are usually difficult to make with any degree of confidence. The use of small sample sizes dictates the need for studies to be replicated. If several investigations find, similar results when studying the same topic, generalizations to other populations are more appropriate.

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The Case Study Methods

Case study is both method and tool for research. Case study leads to very novel idea and no longer limited to the particular individual. In case study investigator tries to collect the bits in support of proposition. One case study if we take specific than prediction value is less while if the case is the representative sample then it has high prediction value. Case study methodological is not longitudinal study but it depends on the methods of information about the individual as far as possible.

MEANING

Case studies are used to:

- Understand more about *how* and *why* a present circumstance is happening.
- Explore complex phenomena (particularly salient in socio-environmental systems work).
- Formulate "lessons learned" which *may* be applicable to future cases.
- Communicate information through real life stories.

Case studies can be exploratory, descriptive, evaluative, or explanatory. We present exploratory and explanatory case studies below to demonstrate relevance in EPA research. Data collection methods vary, but common methods include participant observation, interviews, and/or archive analysis. Case studies can also use mixed methods where researchers combine qualitative and quantitative data and analysis.

An Exploratory Case Study

EPA scientists at the Great Lakes Toxicology and Ecology Division (GLTED) in Duluth, MN utilized an exploratory case study approach in the Great Lakes Region to understand the complex relationships that govern how EPA, state agencies and communities progress through the remediation and revitalization process.

This case study examined the whole process, starting from the remediation of contaminated sediment through the restoration of aquatic and riparian habitat through to the revitalization of communities, often referred to as remediation to restoration to revitalization (R2R2R). While scientists have hypothesized there is a relationship between the three steps of R2R2R, the study was designed to better understand *who* made decisions and *what* types of decisions were made in different settings. EPA scientists were specifically trying to determine how ecosystem services might be used in decision making. Understanding these relationships is important because this process is unfolding in Areas of Concern, or geographic areas designated by the Parties where significant impairment of beneficial uses has occurred as a result of human activities at the local level, throughout the region.

The St. Louis River AOC and City of Duluth area was chosen as the study site because of its potential to provide rich insights as decisions related to R2R2R were actively unfolding, and because EPA researchers had access to many community decision processes.

Data were collected through participant observation (when a researcher participates in and makes detailed observations of an experience) and document analysis in order to capture the experiences of state and government officials, as well as those of concerned residents. The data collected were analyzed to identify and characterize important aspects of the decision processes such as historical context, constraints, relationships, funding, and vision. The insights generated in the study contributed to an understanding of the variables that influence decision processes beyond a simple focus on the lack of data or information.

An Explanatory Case Study

Explanatory case studies are often used to understand the *how* and *why* of a phenomenon when it cannot be distinguished from its context. EPA scientists at the Atlantic Coastal Environmental Sciences Division (ACESD) in Narraganset, RI conducted socio-ecological systems research to address the three dimensions of sustainability (environment, society and economy) as they intersect with watersheds, water quality, and community support for decisions regarding nitrogen management in Cape Cod, MA. Cape Cod is highly dependent on its water resources and related ecosystem goods and services which serve diverse communities of residents, tourists and second homeowners or seasonal residents. However, most communities on Cape Cod lack sewer systems – which creates a non-point source challenge for nitrogen management of sensitive water resources with significant social and economic considerations.

ACESD scientists studied the social acceptability of various scientific approaches to reducing nitrogen. Social scientists conducted interviews with managers, government officials, consultants, and researchers on Cape Cod to determine:

- What makes different technologies seem more/less feasible for use in managing nitrogen?
- How can we optimize the use of different technologies to meet: economic constraints; ecological efficiency; social values?

Is Case Study Research Broadly Useful?

The two examples of case study research provided here illustrate how intensive qualitative social science provides a window into the human system where decisions are made.

The flexibility of the case study approach facilitates bringing different fields together to deepen our understanding of factors governing complex problems such as habitat restoration or nitrogen mitigation.

Case studies make it possible to deeply understand the context in which a solution is implemented, and to theorize the relationships between programs, agencies, and citizens from evidence. Understanding contextual factors that influence outcomes enhances the transferability of solutions or approaches to other programs, questions or issues.

Social science training, which emphasizes the ability to identify different perspectives (including one's own), greatly contributes to understanding the biases and assumptions that operate in all social situations and can confound the sharing of knowledge between ORD researchers and the communities they work with.

What is a case study research method?

Case studies are in-depth investigations of a single person, group, event or community. Typically, data are gathered from a variety of sources and by using several different methods (e.g. observations & interviews).

The case study research method originated in clinical medicine (the case history, i.e. the patient's personal history). In psychology, case studies are often confined to the study of a particular individual.

The information is mainly biographical and relates to events in the individual's past (i.e. retrospective), as well as to significant events which are currently occurring in his or her everyday life.

The case study is not itself a research method, but researchers select methods of data collection and analysis that will generate material suitable for case studies.

What is an example of a case study in psychology?

Case studies are widely used in psychology and amongst the best known were the ones carried out by Sigmund Freud, including Anna O and Little Hans.

Freud (1909a, 1909b) conducted very detailed investigations into the private lives of his patients in an attempt to both understand and help them overcome their illnesses. Even today case histories are one of the main methods of investigation in abnormal psychology and psychiatry.

This makes it clear that the case study is a method that should only be used by a psychologist, therapist or psychiatrist, i.e. someone with a professional qualification. There is an ethical issue of competence. Only someone qualified to diagnose and treat a person can conduct a formal case study relating to atypical (i.e. abnormal) behavior or atypical development.

How is a case study conducted?

The procedure used in a case study means that the researcher provides a description of the behavior. This comes from interviews and other sources, such as observation.

The client also reports detail of events from his or her point of view. The researcher then writes up the information from both sources above as the case study, and interprets the information.

The research may also continue for an extended period of time, so processes and developments can be studied as they happen.

Amongst the sources of data the psychologist is likely to turn to when carrying out a case study are observations of a person's daily routine, unstructured interviews with the participant herself (and with people who know her), diaries, personal notes (e.g. letters, photographs, notes) or official document (e.g. case notes, clinical notes, appraisal reports).

The case study method often involves simply observing what happens to, or reconstructing 'the case history' of a single participant or group of individuals (such as a school class or a specific social group), i.e. the idiographic approach.

The interview is also an extremely effective procedure for obtaining information about an individual, and it may be used to collect comments from the person's friends, parents, employer, workmates and others who have a good knowledge of the person, as well as to obtain facts from the person him or herself.

Most of this information is likely to be qualitative (i.e. verbal description rather than measurement) but the psychologist might collect numerical data as well.

How to analyze case study data

The data collected can be analyzed using different theories (e.g. grounded theory, interpretative phenomenological analysis, text interpretation, e.g. thematic coding).

All the approaches mentioned here use preconceived categories in the analysis and they are ideographic in their approach, i.e. they focus on the individual case without reference to a comparison group.

Interpreting the information means the researcher decides what to include or leave out. A good case study should always make clear which information is the factual description and which is an inference or the opinion of the researcher.

Strengths of Case Studies

- Provides detailed (rich qualitative) information.
- Provides insight for further research.
- Permitting investigation of otherwise impractical (or unethical) situations.

Case studies allow a researcher to investigate a topic in far more detail than might be possible if they were trying to deal with a large number of research participants (nomothetic approach) with the aim of 'averaging'.

Because of their in-depth, multi-sided approach case studies often shed light on aspects of human thinking and behavior that would be unethical or impractical to study in other ways.

Research which only looks into the measurable aspects of human behavior is not likely to give us insights into the subjective dimension to experience which is so important to psychoanalytic and humanistic psychologists.

Case studies are often used in exploratory research. They can help us generate new ideas (that might be tested by other methods). They are an important way of illustrating theories and can help show how different aspects of a person's life are related to each other.

The method is therefore important for psychologists who adopt a holistic point of view (i.e. humanistic psychologists).

Limitations of Case Studies

- Lacking scientific rigour and providing little basis for generalization of results to the wider population.
- Researchers' own subjective feeling may influence the case study (researcher bias).
- Difficult to replicate.
- Time-consuming and expensive.
- The volume of data, together with the time restrictions in place, impacted on the depth of analysis that was possible within the available resources.

Because a case study deals with only one person/event/group we can never be sure if the case study investigated is representative of the wider body of "similar" instances. This means the the conclusions drawn from a particular case may not be transferable to other settings.

Because case studies are based on the analysis of qualitative (i.e. descriptive) data a lot depends on the interpretation the psychologist places on the information she has acquired.

CRITERIA FOR EVALUATING THE METHOD OF CASE STUDY

The case study method is a learning technique in which the student is faced a particular problem, the case. The case study facilitates the exploration of a real issue within a defined context, using a variety of data sources (Baxter et al., 2008). In general terms, the case study analyzes a defined problem consisting in a real situation and uses real information as methodological tool. For chemical engineering students, the analysis of a case study gives them a global and holistic vision of a real problem at an engineering field, allowing to develop and apply their knowledge on unit operations and transport phenomena, being these the base education for a chemical engineer. Furthermore, this methodology allows students to develop and to enhance different skills, such as the capacity of comprehension and analysis of real problems the capacity to propose and evaluate alternatives for the improvement of the problem considered, to work collaboratively, also their capacity of information management and synthesis of problems.

In process engineering field the metallurgical processes occupy a substantial market segment. These industries process different kind of minerals, which are required within several supply chains to develop an interest product. Furthermore the fast growth of the world's population and the need of a better quality of life lead to greater minerals demand. In this context, the production of H_3BO_3 from boron ores is a real case study within the metallurgical field. The H_3BO_3 is used in many branches of the industry, such as nuclear technology, production of heat resistant materials, also in the medical, pharmaceutical and electronic related sectors, among others. The boron ores are available in huge quantities in nature. Turkey, as country, has the biggest boron resources in the world. However, Chile, Argentina and Bolivia, also share a large reserve of boron. Here in Chile, the most abundant boron ore in this region is the ulexite.

This case study is analyzed hierarchically and systematically, by process synthesis, which requires the integration of real data and the application of basic chemical engineering principles in order to generate process alternatives in the conceptual stage of the process design. The early stages in the process synthesis are characterized by deficient information and several uncertainties. Furthermore, a thorough search of information is needed. One alternative to describe the process synthesis to students of chemical engineering is through the hierarchical decision procedure introduced by Douglas (1985). The decisions are based on operational experience of designers, as well as on information obtained in research literature and previous designs developed. At the beginning, the hierarchical decision procedure developed by Douglas was focused in the gas-liquid process. However, to involve solid processing operations, key to metallurgical processes, the conceptual design of gas-liquid-solid processes was developed by Rajagopal et al. (1992). The hierarchical procedure consists of six decision levels. The process information, as well as the detail in the flowsheet structures increased in each level. Moreover, an economic assessment is also carried out in the last part of each level, in order to provide a quantitative comparison between the different processes alternatives developed.

The aim of this paper is to show and analyze the process synthesis based on the production of H_3BO_3 from ulexite ores, using different reaction agents. The different agents and the study of its behavior with ulexite ores can be found into the research literature.

This specific case study allows the generation of different alternatives for analysis. Therefore, is an effective tool for undergraduate student of chemical engineering. The methodology of Douglas is used as a systematic and hierarchical methodology to conceptual process design.

Case studies for evaluation - introductory resources

Case Studies usually explore a complex single instance (of an individual, organisation, project, event) taken as a whole in its context - providing a comprehensive description and analysis of that instance using multiple sources of data.

Case studies are useful when there is a concern to understand 'how' and 'why' questions and the process or project being investigated needs to be explored as a meaningful whole within its real life setting. In evaluation, explanatory case studies are useful to explain the presumed causal links in real-life interventions that are too complex for survey or experimental designs. Case studies can also be used in a variety of other ways, including exploratory case studies to illuminate aspects of a situation or setting about which little is already known.

The need to understand context usually means there are many factors and aspects of a situation that need to be taken into account even while there may not be comprehensive data on all of them. In this situation triangulation of evidence is crucial. It is important to build up a chain of evidence supporting the claims made about the case, but also to test rival explanations for the characteristics and events described. In turn, for evaluation as much as for other case studies, this means it is important to develop clear theories about how change is brought about by an intervention (its theory of change). Making clear the assumptions about how changes happen also supports the development of clear evaluation questions to guide data collection and analysis.

A definition from Yin (2009) suggests that a case study is an empirical enquiry that:

- investigates a contemporary phenomenon in depth and within its real life context, especially when
- the boundaries between the phenomenon and context are not clearly evident
- copes with the technically distinctive situation in where there will be many more variables of interest than data points, and as a result
- relies on multiple sources of evidence with data needing to converge in a triangulating fashion

Case studies are often misunderstood as a purely qualitative, descriptive method and criticised as being 'unrepresentative' compared to survey and other quantitative methods. However, the case study is not a 'sample', and the aim of a case study is not to enumerate the frequencies of one or two key variables in a way that can be seen as representative of a larger population to which the findings can be 'generalised'. Rather, case studies, like experiments, follow a logic of 'replication' - where it is the theory (of how change happens) which is tested and generalised to new cases in empirical studies (in technical terms the case study uses 'analytical generalisation' rather than the 'statistical generalisation' of randomised assignment to treatments).

On the other hand, many descriptive accounts are often wrongly called 'case studies' when none of the procedures that make up a rigorous case-study approach have been applied (teaching 'case-studies' are also usually a different thing from the rigorous case studies used in research or evaluation). Case studies, like any other method can be done rigorously or less so, depending on how carefully and thoughtfully they are designed and conducted. In many ways they are more difficult than other methods to do well, since they attempt to triangulate and combine a range of different types of data and a range of approaches to gather that data.

Comparing or contrasting a range of case studies can increase the confidence that the factors and processes being demonstrated through the case are more widely applicable.

CHARACTERISTICS

Case study

A case study involves an up-close, in-depth, and detailed examination of a particular case or cases, within a real-world context. For example, case studies in medicine may focus on an individual patient or ailment; case studies in business might cover a particular firm's strategy or a broader market; similarly, case studies in politics can range from a narrow happening over time (e.g., a specific political campaign) to an enormous undertaking (e.g., a World War).

Generally, a case study can highlight nearly any individual, group, organization, event, belief system, or action. A case study does not necessarily have to be one observation (N=1), but may include many observations (one or multiple individuals and entities across multiple time periods, all within the same case study). Research projects involving numerous cases are frequently called cross-case research, whereas a study of a single case is called within-case research.

Case study research has been extensively practiced in both the social and natural sciences.

Definition of case study

There are multiple definitions of case studies, which may emphasize the number of observations (a small N), the method (qualitative), the thickness of the research (a comprehensive examination of a phenomenon and its context), and the naturalism (a "real-life context" is being examined) involved in the research. There is general agreement among scholars that a case study does not necessarily have to entail one observation (N=1), but can include many observations within a single case or across numerous cases. For example, a case study of the French Revolution would at the bare minimum be an observation of two observations: France before and after a revolution. John Gerring writes that the N=1 research design is so rare in practice that it amounts to a "myth."

The term *cross-case* research is frequently used for studies of multiple cases, whereas *within-case* research is frequently used for a single case study.

John Gerring defines the case study approach as an "intensive study of a single unit or a small number of units (the cases), for the purpose of understanding a larger class of similar units (a population of cases)." According to Gerring, case studies lend themselves to an idiographic style of analysis, whereas quantitative work lends itself to a nomothetic style of analysis. He adds that "that the defining feature of qualitative work is its use of noncomparable observations—observations that pertain to different aspects of a causal or descriptive question", whereas quantitative observations are comparable.

According to John Gerring, the key characteristic that distinguishes case studies from all other methods is the "reliance on evidence drawn from a single case and its attempts, at the same time, to illuminate features of a broader set of cases." Scholars use case studies to shed light on a "class" of phenomena.

Case Study Research Designs

As with other social science methods, no single research design dominates case study research. Case studies can use at least four types of designs. First, there may be a "no theory first" type of case study design, which is closely connected to Kathleen M. Eisenhardt's methodological work. A second type of research design highlights the distinction between single- and multiple-case studies, following Robert K. Yin's guidelines and extensive examples. A third design deals with a "social construction of reality", represented by the work of Robert E. Stake. Finally, the design rationale for a case study may be to identify "anomalies". A representative scholar of this design is Michael Burawoy. Each of these four designs may lead to different applications, and understanding their sometimes unique ontological and epistemological assumptions becomes important. However, although the designs can have substantial methodological differences, the designs also can be used in explicitly acknowledged combinations with each other.

While case studies can be intended to provide bounded explanations of single cases or phenomena, they are often intended to theoretical insights about the features of a broader population.

Case Selection and Structure

Case selection in case study research is generally intended to both find cases that are a representative sample and which have variations on the dimensions of theoretical interest. Using that is solely representative, such as an average or typical case is often not the richest in information. In clarifying lines of history and causation it is more useful to select subjects that offer an interesting, unusual or particularly revealing set of circumstances. A case selection that is based on representativeness will seldom be able to produce these kinds of insights.

While random selection of cases is a valid case selection strategy in large-N research, there is a consensus among scholars that it risks generating serious biases in small-N research. Random selection of cases may produce unrepresentative cases, as well as uninformative cases. Cases should generally be chosen that have a high expected information gain. For example, outlier cases (those which are extreme, deviant or atypical) can reveal more information than the potentially representative case. A case may also be chosen because of the inherent interest of the case or the circumstances surrounding it. Alternatively it may be chosen because of researchers' in-depth local knowledge; where researchers have this local knowledge they are in a position to "soak and poke" as Richard Fenno put it, and thereby to offer reasoned lines of explanation based on this rich knowledge of setting and circumstances.

Beyond decisions about case selection and the subject and object of the study, decisions need to be made about purpose, approach and process in the case study. Gary Thomas thus proposes a typology for the case study wherein purposes are first identified (evaluative or exploratory), then approaches are delineated (theory-testing, theory-building or illustrative), then processes are decided upon, with a principal choice being between whether the study is to be single or multiple, and choices also about whether the study is to be retrospective, snapshot or diachronic, and whether it is nested, parallel or sequential.

In a 2015 article, John Gerring and Jason Seawright list seven case selection strategies:

1. Typical cases are cases that exemplify a stable cross-case relationship. These cases are representative of the larger population of cases, and the purpose of the study is to look *within* the case rather than compare it with other cases.

2. Diverse cases are cases that have variation on the relevant X and Y variables. Due to the range of variation on the relevant variables, these cases are representative of the full population of cases.
3. Extreme cases are cases that have an extreme value on the X or Y variable relative to other cases.
4. Deviant cases are cases that defy existing theories and common sense. They not only have extreme values on X or Y (like extreme cases), but defy existing knowledge about causal relations.
5. Influential cases are cases that are central to a model or theory (for example, Nazi Germany in theories of fascism and the far-right).
6. Most similar cases are cases that are similar on all the independent variables, except the one of interest to the researcher.
7. Most different cases are cases that are different on all the independent variables, except the one of interest to the researcher.

For theoretical discovery, Jason Seawright recommends using deviant cases or extreme cases that have an extreme value on the X variable.

Arend Lijphart, and Harry Eckstein identified five types of case study research designs (depending on the research objectives), Alexander George and Andrew Bennett added a sixth category:

1. In atheoretical (or configurative idiographic) case studies the goal is to describe a case very well, but not to contribute to a theory.
2. In interpretative (or disciplined configurative) case studies the goal is to use established theories to explain a specific case.
3. In hypothesis-generating (or heuristic) case studies the goal is to inductively identify new variables, hypotheses, causal mechanisms and causal paths.

4. In theory testing case studies the goal is to assess the validity and scope conditions of existing theories.
5. In plausibility probes the goal is to assess the plausibility of new hypotheses and theories.
6. In building block studies of types or subtypes the goal is to identify common patterns across cases.

Aaron Rapport reformulated "least-likely" and "most-likely" case selection strategies into the "countervailing conditions" case selection strategy. The countervailing conditions case selection strategy has three components:

1. The chosen cases fall within the scope conditions of both the primary theory being tested and the competing alternative hypotheses
2. For the theories being tested, the analyst must derive clearly stated expected outcomes
3. In determining how difficult a test is, the analyst should identify the strength of countervailing conditions in the chosen cases

In terms of case selection, Gary King, Robert Keohane, and Sidney Verba warn against "selecting on the dependent variable".

They argue for example that researchers cannot make valid causal inferences about war outbreak by only looking at instances where war did happen (the researcher should also look at cases where war did not happen). Scholars of qualitative methods have disputed this claim, however. They argue that selecting on the dependent variable can be useful depending on the purposes of the research. Barbara Geddes shares KKV's concerns with selecting on the dependent variable (she argues that it cannot be used for theory testing purposes), but she argues that selecting on the dependent variable can be useful for the purposes of theory creation and theory modification.

King, Keohane and Verba argue that there is no methodological problem in selecting on the explanatory variable, however. They do warn about multicollinearity (choosing two or more explanatory variables that perfectly correlate with each other).

Uses and Limits

Uses

Case studies have commonly been seen as a fruitful way to come up with hypotheses and generate theories. Classic examples of case studies that generated theories includes Darwin's theory of evolution (derived from his travels to the Easter Island), and Douglass North's theories of economic development (derived from case studies of early developing states, such as England).

Case studies are also useful for formulating concepts, which are an important aspect of theory construction. The concepts used in qualitative research will tend to have higher conceptual validity than concepts used in quantitative research (due to conceptual stretching: the unintentional comparison of dissimilar cases). Case studies add descriptive richness, and can have greater internal validity than quantitative studies. Case studies are suited to explain outcomes in individual cases, which is something that quantitative methods are less equipped to do.

Through fine-gained knowledge and description, case studies can fully specify the causal mechanisms in a way that may be harder in a large-N study. In terms of identifying "causal mechanisms", some scholars distinguish between "weak" and "strong chains". Strong chains actively connect elements of the causal chain to produce an outcome whereas weak chains are just intervening variables.

Case studies of cases that defy existing theoretical expectations may contribute knowledge by delineating why the cases violate theoretical predictions and specifying the scope conditions of the theory. Case studies are useful in situations of causal complexity where there may be equifinality, complex interaction effects and path dependency. Case studies can identify necessary and insufficient conditions, as well as complex combinations of necessary and sufficient conditions. They argue that case studies may also be useful in identifying the scope conditions of a theory: whether variables are sufficient or necessary to bring about an outcome.

Qualitative research may be necessary to determine whether a treatment is as-if random or not. As a consequence, good quantitative observational research often entails a qualitative component.

Limitations

Designing Social Inquiry (also called "KKV"), an influential 1994 book written by Gary King, Robert Keohane, and Sidney Verba, primarily applies lessons from regression-oriented analysis to qualitative research, arguing that the same logics of causal inference can be used in both types of research. The authors' recommendation is to increase the number of observations (a recommendation that Barbara Geddes also makes in *Paradigms and Sand Castles*), because few observations make it harder to estimate multiple causal effects, as well as increase the risk that there is measurement error, and that an event in a single case was caused by random error or unobservable factors. KKV sees process-tracing and qualitative research as being "unable to yield strong causal inference" due to the fact that qualitative scholars would struggle with determining which of many intervening variables truly links the independent variable with a dependent variable. The primary problem is that qualitative research lacks a sufficient number of observations to properly estimate the effects of an independent variable. They write that the number of observations could be increased through various means, but that would simultaneously lead to another problem: that the number of variables would increase and thus reduce degrees of freedom.

The purported "degrees of freedom" problem that KKV identify is widely considered flawed; while quantitative scholars try to aggregate variables to reduce the number of variables and thus increase the degrees of freedom, qualitative scholars intentionally want their variables to have many different attributes and complexity. For example, James Mahoney writes, "the Bayesian nature of process tracing explains why it is inappropriate to view qualitative research as suffering from a small-N problem and certain standard causal identification problems." By using Bayesian probability, it may be possible to makes strong causal inferences from a small sliver of data.

A commonly described limit of case studies is that they do not lend themselves to generalizability. Due to the small number of cases, it may be harder to ensure that the chosen cases are representative of the larger population. Some scholars, such as Bent Flyvbjerg, have pushed back on that notion.

As small-N research should not rely on random sampling, scholars must be careful in avoiding selection bias when picking suitable cases. A common criticism of qualitative scholarship is that cases are chosen because they are consistent with the scholar's preconceived notions, resulting in biased research.

Alexander George and Andrew Bennett note that a common problem in case study research is that of reconciling conflicting interpretations of the same data.

One limit of case study research is that it can be hard to estimate the magnitude of a causal effect.

Teaching case studies

Teachers may prepare a case study that will then be used in classrooms in the form of a "teaching" case study. For instance, as early as 1870 at Harvard Law School, Christopher Langdell departed from the traditional lecture-and-notes approach to teaching contract law and began using cases pled before courts as the basis for class discussions. By 1920, this practice had become the dominant pedagogical approach used by law schools in the United States.

Outside of law, teaching case studies have become popular in many different fields and professions, ranging from business education to science education. The Harvard Business School has been among the most prominent developers and users of teaching case studies.

Teachers develop case studies with particular learning objectives in mind. Additional relevant documentation, such as financial statements, time-lines, short biographies, and multimedia supplements (such as video-recordings of interviews) often accompany the case studies. Similarly, teaching case studies have become increasingly popular in science education, covering different biological and physical sciences. The National Center for Case Studies in Teaching Science has made a growing body of teaching case studies available for classroom use, for university as well as secondary school coursework.

11

Survey Method

INTRODUCTION

The survey is a non-experimental, descriptive research method. Surveys can be useful when a researcher wants to collect data on phenomena that cannot be directly observed (such as opinions on library services). Surveys are used extensively in library and information science to assess attitudes and characteristics of a wide range of subjects, from the quality of user-system interfaces to library user reading habits.

In a survey, researchers *sample* a *population*. Basha and Harter (1980) state that "a *population* is any set of persons or objects that possesses at least one common characteristic."

Examples of populations that might be studied are 1) all 1999 graduates of GSLIS at the University of Texas, or 2) all the users of UT General Libraries. Since populations can be quite large, researchers directly question only a *sample* (i.e. a small proportion) of the population.

OBJECTIVE OF SOCIAL SURVEY

The Survey method is the technique of gathering data by asking questions to people who are thought to have desired information. A formal list of questionnaire is prepared. Generally a non disguised approach is used. The respondents are asked questions on their demographic interest opinion.

Advantages of Survey Method

1. As compared to other methods (direct observation, experimentation) survey yield a broader range of information. Surveys are effective to produce information on socio-economic characteristics, attitudes, opinions, motives etc and to gather information for planning product features, advertising media, sales promotion, channels of distribution and other marketing variables.
2. Questioning is usually faster and cheaper that Observation.
3. Questions are simple to administer.
4. Data is reliable
5. The variability of results is reduced.
6. It is relatively simple to analyze, quote and interrelate the data obtained by survey method

Disadvantages of Survey Method

1. Unwillingness of respondents to provide information- This requires salesmanship on the part of the interviewer. The interviewer may assure that the information will be kept secret or apply the technique of offering some presents.
2. Inability of the respondents to provide information- This may be due to
   a. Lack of knowledge
   b. Lapse of memory
   c. Inability to identify their motives and provide "reasons why?" for their actions
3. Human Biases of the respondents are there, for eg: "Ego"
4. Symantec difficulties are there - it is difficult, if not impossible, to state a given question in such a way that it will mean exactly same thing to each respondent. Similarly two different wordings of the same question will frequently produce quite different results.

How to overcome the limitations of Survey Method

1. Careful framing and phrasing of questions.
2. Careful control of data gathering by employing specially trained investigators who will observe carefully report on subtle reactions of persons interviewed
3. Cautious interpretations by a clear recognition of the limitations of the data and understating of what exactly the data represents. This is especially true of responses to questions like - "What price would you be willing to pay for this product?"
4. Looking at facts in relative rather than absolute terms. For eg - A survey by a dentist team showed that the number of families in the middle income group used toothpaste taken by itself in the absolute sense, the results of the survey are in some doubt. Even though the individual group readings shall differ say for eg: for upper income group families it could be 90 %. Hence we should look at the facts in relative rather than in absolute terms

Objectives and subject matter of social survey

The following are the major objectives which social survey strives to achieve

1. Collection of data related to the social aspect of community: Social survey studies individuals as members of society and in this way studies social circumstances and problems.
2. Study of social problems, labor class and its problems: In social survey social problems and in particular, problems of the labor class like illiteracy, poverty, in sanitation, unemployment, drinking, crime, juvenile delinquency, prostitution, labor problems etc. are studied.
3. Practical and utilitarian view point: Studies of social survey are made from a practical and utilitarian

viewpoint in order that suggestions for constructive programs in solving different problems may be offered.

In this way, the subject matter of social survey includes—(1) demographic characteristic. (2) Social Environment. (3) activities of the members of the community. (4) opinions and attitudes.

The following are the important kinds of social survey

1. General or specialized surveys: Originally, social survey was taken to be two kinds –general and specialized. In the general survey the community is made the subject of study like a country, state, town or village. In the specialized or topical survey the study is confined to some special aspect only e.g. unemployment, health, cleanliness, labor welfare, child welfare etc.
2. Direct or indirect surveys: Direct survey is one in which the facts can be quantitatively interpreted while, on the other hand, no such quantitative interpretation is possible in the case of an indirect survey, e.g. the survey of population is direct, while on the other hand, the surveys of the state of health or the level of nutrition are indirect. Different problems of social sciences are studied by both kind of survey.
3. Census survey or sample survey: in the census survey the different parts of the entire area are individually studied and the figures are then complied into one. On the other hand, in the sample survey, instead of the whole is being studied, a part which represents the entire area is taken. Now this representative part is studied. Compared to the census survey, the sample survey is far less expensive and it is, therefore, very popular in the study of rural sociology which makes much use of it.
4. Primary or secondary surveys: in the primary survey, the survey work is started right from the beginning. In this, the survey or himself collects facts concurring with

his objectives and hence the primary surveys are more reliable and pure. But, if some data have already been collected in the study of any subject a new start has not to be made. The survey conducted under these circumstances is called a secondary survey. It is obvious that when the situation is favorable to a secondary survey there is much saving of time and money.

5. Initial or repetitive surveys: if the survey conducted in the area is the first of its kind, it is called an initial survey while if some survey has been done in the past then the present survey is termed a repetitive survey. An initial survey involves comparatively greater effort and exertion and comparable data are not available. In repetitive survey the information obtained is more reliable and can be compared.
6. Official, semi-official or private surveys: As the names indicate, official survey is the survey sponsored by the government, semi-official survey is the survey conducted by universities, district boards, municipalities and other similar semi-official institutions and private survey is a survey attempted by an individual. Among these, official survey has the greatest probability of success because it is not hampered by a dearth of finances or trained personnel. Semiofficial survey is not only less economic but also more difficult. In the private survey, the problem of expenditure, time and trained personnel is even more acute. But, in spite of the fundamental difficulties, some semi-official and private surveys have yielded better results than some government surveys.
7. Widespread or limited surveys: surveys are given these names according to their extension or coverage. A survey covering a greater area is called widespread survey while a more delimited or less extensive survey is known as a limited survey. A limited survey is comparatively more reliable and less liable to mistakes but it carries with it the probability of some of the facts being omitted.

On the other hand, a widespread survey includes many aspects of the subject under study and presents a more complete picture. But, due to its extension, it becomes less reliable because the probability of irregularities is increased.

8. Public or confidential surveys: it is evident from the very name that public surveys are those in which the processes and results of study are not concealed while the confidential surveys are those in which the processes and results are not revealed to people. Whether the survey is going to be public or confidential depends upon it nature and aim.
9. Postal or personal surveys: postal survey, as the term itself implies, is a method in which the survey or obtain the answers by sending the questionnaire by post. If the survey is to be a personal one then the surveyor has to move about the area to be surveyed and collect information. Postal survey certainly does economies upon effort and money but the information which it can obtain is very limited and lacks reliability. Although personal survey demands more time, energy and money the information obtained is correspondingly more comprehensive and more reliable.
10. Regular or ad-hoe surveys: regular surveys are conducted after the lapse of a fixed period of time. The organization made for an ad-hoe survey is temporary and is dissolved after the survey has been completed. An ad-hoe survey, in comparison with a regular survey, supplies less extensive and less comparative information but it, all the same time, involves the expenditure of less time, money and energy.

In the book *Social Survey in Town and Country Areas*, Herman N. Morse has accepted the following steps in the scientific methods of social survey:

1. Definition of the purpose or object.

2. Definition of the problem to be studied.
3. The analysis of this problem in a schedule.
4. The delimitation of the area or scope.
5. Examination of all documentary sources.
6. Field work.
7. Arrangement, tabulation and statistical analysis of the data.
8. The interpretation of the results.
9. Deduction.
10. Graphic expression.

Social surveys are carried on by official or non-official bodies with a set purpose or object, for example, to explore particular facts regarding a particular problem. This problem should also be well defined and precise. Clarity of the problem is the sine quo of all scientific research. Now each problem involves several important aspects which should be minutely studied. Hence, after defining the problem, it should be analyzed in a schedule. Then, the researcher should delimit the area of scope or survey. Without this delimitation, survey would be neither possible nor useful. For example, there can be no general survey of the working conditions of the laborers. Only the working conditions of the laborers at a particular factory or city may be studied. Now, actual survey starts. This is a twofold job, first, examination of documentary sources and second, field work. Examination of documentary sources is table work and if done properly, it will save much labor besides clarifying the actual lines of field work. The field work involves on the spot inquiries from the person concerned. For this, the surveyor should visit the area of survey and gather necessary information in the pre-planned schedule. After the gathering of the data through the above mentioned steps, facts are systematically arranged, tabulated and analyzed. These results are now to be interpreted. This requires a statistically keen understanding of the problem and an objective approach. In fact, interpretation of the results is the most important steps in a survey. This interpretation helps in the deduction of useful principles. Finally, the results are graphically expressed so that the whole thing may be understood at a glance.

Limitations of Social Survey

As in evident from the meaning and purpose of social survey, this method has certain limitations. It studies only one part of the society. In it the study of the working of the lower classes is made something of a specialty. Obviously enough, in social survey, there is no endeavor to obtain detailed information about the middle and the upper class people. But to be limited is no defect in any scientific method. The scientific method invariably studies only a delimited subject, a fact which constitutes its limitation, but it is, at the same time the secret of its success and validity. It is for this reason that the survey method yields organized, systematic and scientific information about the problem, on the basis of which, programs for social development and social reconstruction can be formed. It also protects the society from becoming disintegrated. Information regarding different aspects of social institutions and society is supplied by the use of the survey method.

CENSUS AND SAMPLE SURVEYS

Census Method

A census method is that process of the statistical list where all members of a population are analysed. The population relates to the set of all observations under concern. For instance, if you want to carry out a study to find out student's feedback about the amenities of your school, then all the students of your school would form a component of the 'population' for your study.

Data Collection in Statistics

In Statistics, the basis of all statistical calculations or interpretation lies in the collection of data. There are numerous methods of data collection. In this lesson, we shall focus on two primary methods and understand the difference between them. Both are suitable in different cases and the knowledge of these methods is important to understand when to apply which method. These two methods are the Census method and Sampling method.

Browse more Topics under Collection Of Data

- Source and Collection
- Sampling Errors and NSSO

Census Method

Census method is the method of statistical enumeration where all members of the population are studied. A population refers to the set of all observations under concern. For example, if you want to carry out a survey to find out student's feedback about the facilities of your school, all the students of your school would form a part of the 'population' for your study.

At a more realistic level, a country wants to maintain information and records about all households. It can collect this information by surveying *all* households in the country using the census method.

In our country, the Government conducts the Census of India every ten years. The Census appropriates information from households regarding their incomes, the earning members, the total number of children, members of the family, etc. This method must take into account all the units. It cannot leave out anyone in collecting data. Once collected, the Census of India reveals *demographic information* such as birth rates, death rates, total population, population growth rate of our country, etc. The last census was conducted in the year 2011.

Sampling Method

Like we have studied, the population contains units with some similar characteristics on the basis of which they are grouped together for the study. In the case of the Census of India, for example, the common characteristic was that all units are Indian nationals. But it is not always practical to collect information from all the units of the population.

It is a time-consuming and costly method. Thus, an easy way out would be to collect information from some representative group from the population and then make observations accordingly. This representative group which contains some units from the whole population is called the sample.

How to select a Sample?

The first most important step in selecting a sample is to determine the population. Once the population is identified, a sample must be selected. A good sample is one which is:

- Small in size.
- It provides adequate information about the whole population.
- It takes less time to collect and is less costly.

In the case of our previous example, you could choose students from your class to be the *representative sample* out of the population (all students in the school). However, there must be some rationale behind choosing the sample. If you think your class comprises a set of students who will give unbiased opinions/feedback or if you think your class contains students from different backgrounds and their responses would be relevant to your student, you must choose them as your sample. Otherwise, it is ideal to choose another sample which might be more relevant.

Again, realistically, the government wants estimates on the average income of the Indian household. It is difficult and time-consuming to study all households. The government can simply choose, say, 50 households from each state of the country and calculate the average of that to arrive at an *estimate*. This estimate is not necessarily the actual figure that would be arrived at if all units of the population underwent study. But, it approximately gives an idea of what the figure might look like.

STEPS INVOLVED IN SURVEY METHOD

Selection of Problem

As social survey deals with social problems, selection of the problem is the first stage. Therefore unless and until the surveyors are not sure of the nature, character and clarity of the problem, they should not embark upon social survey. The social surveyor is not supposed to deal with every problem or any kind of problem. Rather, as a careful observer, the social surveyor must examine the clarity and definiteness of the problem he comes across in a community.

Such a consideration must also take into account the practical and utilitarian aspect which has its significance in the life of a community. Therefore, while selecting the problem the surveyor must be motivated by the significance, clarity, practical concern and the accrual of tangible benefits to the community. Such a consideration about the problem is a sine qua non of any social survey.

Defining the Purpose

After the problem is chosen, the surveyor attempts on defining the objective of the survey by making the purpose transparent so as to give direction to proceed, because in the absence a crystal-clear definition of the aim the survey becomes directionless like a rudderless ship in the deep sea.

The success of a survey and the capability of a surveyor are gauged only in relation to attainment of goals. Hence, when goals are not clearly defined the surveyor will grope in dark. The goal may be generic or specific; it may be for collection of census data or for knowing the living conditions of the working class specifically. In any case the goal must be well-defined.

Defining the Problem Under Investigation

After having chosen the problem and defined the goals, the surveyor endeavors to determine the scope, nature and character of the problem. At this stage he gives the operational definition of the terms and concepts associated with the problem and incorporated in the survey. For example if the surveyor wishes to study the problem of drug addiction among the college youths he should define what he means by the term 'drug addiction'. He should also clarify different types of drugs causing addiction and the quantity of drugs taken per day indicating addiction.

Preparation of a Schedule

The constituent factors involved in the problem and its various elements need to be analyzed so as to present a constructive programme. This necessitates the formulation of a detailed and systematic list in order to gather the relevant information around as well as directly on the subject of study.

Constitution of a Commission

All the official surveys are undertaken after constituting a commission headed by a Director and some members who determine the policy and oversee its execution. The commission for survey is empowered to collect various types of data relevant to the study.

It also has access to classified material considered appropriate for the purpose of survey. If the situation warrants, the commission may be divided and sub-divided into various committees and sub- committees to deal with specialized matters. In case controversy arises over taking a decision, the views of the majority prevail.

Setting Limits

Determination of scope is the hall-mark of any scientific study. Understanding a problem necessitates systematic investigation into a limited and properly defined subject matter. Unless the scope is determined before the beginning of a survey, no phenomenon can be studied properly. Determination of scope takes into account the political and administrative division, different economic levels, biological bases, bases of social status, geographic bases etc.

Setting Time Limit

Not only cost estimate and trained investigators but also time estimate is essential for any successful survey. Whereas some problem needs immediate solution, some others may require gradual transformation; some surveys are also required to be conducted within specific time intervals. The problems which are of topical importance undergo the process of gradual change. But some problems like displacement of population, resettlement etc. need to be tackled immediately.

Certain statistics become irrelevant after lapse of specific period of time. If the governmental actions are not taken about the nature and the extent of relief needed on the basis of those statistics obtained by survey, the results of survey become inapplicable thereafter. We may take into account the report of Census Commission. If it is not submitted quickly, the data collected will be irrelevant as population of certain regions might have changed quantitatively as well as qualitatively.

The time limit should be fixed for every stage of social survey and this should be properly implemented. Otherwise delay in one stage will easily delay the completion of survey, along with fixation of time limit, the expenditure of money and energy are also the major consideration.

If time limit is too short, the results may lack reliability due to hasty checks and cross-checks, lack of care, likelihood of missing information etc. It is always wise to fix the time limit keeping in view the convenience of the informants as well as the tools and techniques employed for collection of data. For example, different amounts of time are consumed by observation, questionnaire, interview, biographical records, etc. Therefore the time limit of social survey should be set depending upon the employment of each of these techniques.

Apart from the above consideration, the competency of surveyor involved in social survey should also be considered while fixing the time limit, as the well trained and competent surveyor is more likely to consume less time than the novice or inexperienced or ordinary surveyor.

Decision about the Means of Information

Depending on the type of survey, different techniques of collection of information are employed. The preliminary data collected through primary survey are mostly obtained through questionnaire, schedule and even through direct interviewing of informants. On the contrary, secondary data are obtained through secondary survey on the basis of official and non-official reports and also through published and unpublished materials of primary survey.

Determination of the Units of Survey

In order to make the field workers free from any kind of dilemma, and to ensure smooth collection of data, the unit of survey should be defined in definite and unambiguous terms. The units should be stable, harmonized, simple and feasible of being surveyed. In case of a sample survey, the units chosen must have adequacy and representativeness. Therefore, the units in a sample survey need clear-cut definition. But when all the units are studied in census type of survey this requirement may not cause a problem.

Refinement of Data

As far as practicable, it must be determined before undertaking the actual survey as to what extent the materials collected can be refined. If it is a qualitative survey, the determination of accuracy and refinement should be directly proportional to the availability of man power, finance and time. However, despite the availability of the maximum amount of funds, time and man power, it is never possible to obtain cent per cent accuracy in qualitative survey. On the contrary, accuracy must be obtained to the last percentile.

Selection and Training of Field Workers and Researchers

While making selection of the primary investigators, the nature and scope of social survey should always be borne in mind. Intellectual acumen should not be only basis of selection.

Along with that the selector should also lay emphasis on the personal qualities: like pleasant personality, a good sense of humour, tactfulness ability to establish rapport with the informants and the like. After their selection, they will have to be properly trained so as to deal with various types of informants in the field.

Preparedness for Cooperation of the Informants

Unless the cooperation of the informants is obtained, there will be the problem of non-response as well as want of accurate information. Therefore prior to the survey being actually undertaken, it is essential to cause preparedness and responsiveness among the informants so as to obtain accurate information by the field workers. The informants must be assured that the information given by them will be kept strictly confidential.

METHODS OF COLLECTING DATA

Survey Data

Survey data can be gathered in many ways, such as with the use of questionnaires administered in person, interviews, and telephone surveys. Information attained through surveys benefits researchers by recording personal behaviours, attitudes, identities, and definitions from a high volume of respondents. Surveys are useful for gaining information that is difficult to discuss or cannot otherwise be calculated by observation, such as risk, fear, religious belief, and racial attitude. Ulmer and Wilson (2003) believe that the strength of using surveys comes from the fact that "the researcher can rely on outside observations. As a result, many scholars believe that surveys, under certain circumstances, provide more valid measures of phenomena than do official records". Moreover, surveys provide a systematic and structured method for acquiring information on the same topic from a large group of people in a relatively short amount of time.

However, survey data does have its limits. Surveys require that respondents answer questions honestly and accurately, and researchers must be aware that questions are subject to interpretation by the respondents. Therefore, it is recommended that researchers check with respondents on their answers to make sure there is as much uniformity in their interpretation as possible, employ surveys with a published record of reliability, and determine that questions asked in the survey accurately represent the study's intentions.

Esposito and Murphy (1999) believe the quantitative data typically acquired through survey responses do not give a very deep interpretation of occurrences, such as open-ended qualitative interviews would provide. These "snapshot", point-in-time measures give a shallow view that fails to give a rich or true assessment of the aspect of life being studied.

In order to study life for research purposes, access must be obtained to the information. The nature of the research and questions asked help establish the types of access required. Remenyi, Williams, Money, and Swartz (1998) believe that good research sites should have an entrance, trust can be established, and possibilities for gathering credible/quality and suitable evidence are available.

Finally, questions concerning data collection should analyse whether the strategy for collection has been clearly stated or not. Without a clearly articulated method for data collection, replications are obstructed and validity and reliability might come into question. These questions should address whether or not the best approach has been chosen for answering the primary research question.

Mixed Methods

Although mixed methods is not within the scope of the question addressed in the beginning of this chapter, it is being briefly described here, because of its apparent utility in survey research which is addressed as the focus of this chapter. Also, it has been included in this piece out of hindsight and necessity for possible usage in a proposed-future dissertation by the author. Determining whether to use qualitative or quantitative research should become more apparent as the research process unfolds. Hines (2000) believes that multiple methods provide construct validity, as well as internal and external validity, while allowing complex issues to be examined using the respondents' language. Creswell (2003) also indicates that using mixed-methods research will assist in making better interpretations because informants will be providing information that is both measurable and analysed through rich description. A mixed-methods approach will also aid in reducing researcher bias and allowing documentation to be measured and analysed more effectively. Likewise, Malterud (2001) states that, "qualitative studies can also be added to quantitative ones, to gain a better understanding of the meaning and implications of the findings".

Qualitative data is what often shapes the body of the research. Furthermore, it depicts the world as having several realities rather than one truth. On the other hand, quantitative research allows the use of data that identifies partial regularities, turnover in numbers, and statistical operations. Quantification shows a mixing and churning in numeric or sequential patterns and also emulates natural science. The practice of gathering and processing qualitative data should include the supplemental use of statistical hypothesis testing or comparing data sets with other samples and tests in order to confirm patterns.

Determining whether or not to use qualitative or quantitative research is not always so cut and dry. When great amounts of data are sought, quantitative research is often the most efficient and cost-effective research method. However, when data analysis and research questions require large amounts of description dealing with human experiences and perceptions, quantitative research could restrict the findings, making a qualitative approach ideal. The study itself should determine the method.

Ulmer and Wilson (2003) argue that “researchers can use qualitative data and statistical analysis without violating pragmatist ontological and epistemological positions” by meeting the following five conditions that serve to incorporate methods:

(a) Using quantification and statistical analysis of outcomes of social processes to sensitize or lay the groundwork for qualitative study of the social processes in question themselves; (b) understanding that quantification should not be seen as synonymous with empiricism; (c) specifying that individual and joint actors, not variables, exercise agency (i.e., variables do not think or do things, people do, and we create variables to represent those things); (d) remembering that social causality lies not in variables or statistical models but in interpretive processes as people individually and jointly define situations and act within them; and (e) striving to keep the conceptual distance between the quantified measures and the phenomena measured as small as possible (i.e., maximizing validity).

As Hines (2000) asserts, there is no one best method for conducting survey research. Qualitative research is valuable for describing events, circumstances, and other areas of human understanding, including people’s experiences and meanings in a normal social setting, as well as processes and structures. Similarly, Bryman (1993) believes qualitative research is best defined in studies of the social world; as it analyses and describes human behaviour from the point of view of those being studied. However, quantitative research too has value due to its ability to measure data, generalize findings, and make predictions.

These research strategies should not be thought of as incompatible, but complementary. Their procedures for interpreting data and other types of information are interpreted differently, and they answer different types of questions. Their underlying principle for increasing understanding of a subject, however, is the same, and they can be used to interpret or enhance one another. Mixed-methods research utilizes both qualitative and quantitative methods in order to explore a topic in breadth and depth. Mixed methods lead to a “truer analysis,” as Davies (2003) indicates, and quantitative discoveries should lead to a reflection on qualitative decision making in order to get a better understanding of the ideas in the "heads of economic actors and the models they use". Research should occur through multiple methods of gathering data for the purpose of drawing a robust conclusion. As Davies (2003) explains, incorporation of both qualitative and quantitative designs in research could yield results that would not have been identified through use of one method or the other. Mixed method clearly has their advantages in research and is often the answer to the debate over which type of research is best.

Although not every tool and method in either quantitative or qualitative research was discussed in this chapter, it is clear that each method represents a different paradigm, making no possible answer as to which is conclusively best. One primary conclusion that can be drawn from this chapter is that for any study proposed, one will not know which research method will produce the most accurate conclusions without examining the kind of knowledge sought. Once a survey is initiated and the data is collected, clues to new avenues that researchers should pursue and new questions to be asked will be revealed. During this process, researchers need to be aware of personal biases in collecting and analysing data. They should find ways to keep their own and their respondents' biases in check in order to produce results that accomplish what scholars have yearned to do for centuries—help society grow in knowledge through realized truths.

Sources and Methods of Primary Data

Data, or facts, may be derived from several sources. Data can be classified as primary data and secondary data. Primary data is data gathered for the first time by the researcher; secondary data is data taken by the researcher from secondary sources, internal or external. The researcher must thoroughly search secondary data sources before commissioning any efforts for collecting primary data. There are many advantages in searching for and analysing data before attempting the collection of primary data. In some cases, the secondary data itself may be sufficient to solve the problem. Usually the cost of gathering secondary data is much lower than the cost of organizing primary data. Moreover, secondary data has several supplementary uses. It also helps to plan the collection of primary data, in case, it becomes necessary. We shall therefore discuss secondary data first and then take up primary data. Secondary data is of two kinds, internal and external. Secondary data – whether internal or external – is data already collected by others, for purposes other than the solution of the problem on hand.

Business firms always have as great deal of internal secondary data with them. Sales statistics constitute the most important component of secondary data in marketing and the researcher uses it extensively. All the output of the MIS of the firm generally constitutes internal secondary data. This data is readily available; the market researcher gets it without much effort, time and money. The Internet is a great source of external secondary data. Many published, statistics and figures are available on the internet either free or for a fee. The yellow pages of telephone directories/stand alone yellow pages have become an established source of elementary business information. Tata Press, which first launched a stand alone yellow pages directory for Mumbai City, and 'GETIT' yellow pages have been leading in this field. Today, yellow pages publications are available for all cities and major town a in the country. New Horizons, a joint venture between the Living Media group of publications and Singapore Telecom has been publishing stand alone directories for specific businesses. Business India data base of the Business India publications had been publishing the Delhi Pages directory.

The Thomas Register is the world's most powerful industrial buying guide. It ensures a fast, frictionless flow of information between buyers and sellers of industrial goods and services. This purchasing tool is now available in India. The Thomas Register of Indian manufacturers or TRIM – is India's first dedicated manufacture-to-manufacture register. It features 120,000 listing of 40,000 industrial manufacturers and industrial service categories. It is available in print, CD forms and on the internet. The source Directory brought out by Mumbai based Source Publishers is another example. It covers contact information on advertising agencies and related services and products, music companies, market research agencies, marketing and sales promotion consultants, publication, radio stations and cable and satellite station telemarketing services, among others. It currently has editions for Metro cites.

The Industrial Product Finder (IPF): IPF details the many application of the new products and tells what is available and from whom. Most manufacturers of industrial products ensure that a description of their product is published in IPF before they hit the market. Phone data service: Agencies providing phone data services have also come up in major cities in recent times Melior Communication for example, offers a tele-data service. Basic data on a number of subjects/products can be had through call to the agency. The service is termed Tell me Business through phone service. Its main aim, like that of yellow pages, is to bring buyers and sellers of products together. It also provides some elementary databank support to researchers.

Survey Methodology and Common Data Collection

Mailed, self-administered questionnaires are a common data collection method used in family practice research. However, little guidance exists in the medical literature about survey methodology specifically designed for family practitioners. As a result, primary care physicians sometimes struggle with questionnaire design and interpretation. Our goal was to synthesize general survey methodology guidelines (from other disciplines as well as our own) in a manner that would be meaningful to novice family practice researchers. Research using self-developed questionnaires is a popular study design in family practice and is frequently used for gathering data on knowledge, beliefs, attitudes, and behaviours. A Medline literature search from 1966 to 2000 identified 53,101 articles related to questionnaires, of which 2088 were directly related to family practice. Despite the large number of questionnaire-related articles, however, only 2 in the general medical literature and 1 in the family practice literature were directly related to research methodology.

To obtain guidance on survey research methodology, novice family practice researchers often must go through volumes of information by specialists in other disciplines. For example, a search of a psychology database (PsychInfo) from 1966 to 2000 produced 45 articles about questionnaire methodology. The goal of this chapter is to synthesize pertinent survey research methodology tenets-from other disciplines as well as from family practice-in a manner that is meaningful to novice family practice researchers as well as to research consumers. This chapter is not aimed at answering all questions, but rather is meant to serve as a general guideline for those with little formal research training who seek guidance in developing and administering questionnaires.

Avoiding Common Pitfalls in Survey Research

Although constructing a questionnaire is not exceedingly complex, simple mistakes can be avoided by following some basic rules and guidelines. The Figure is a checklist for conducting a survey research project that combines guidelines and suggestions from published survey research literature, and the cumulative experience of the authors. Two of the authors (M.J.D. and K.C.O.) are experienced survey researchers who have published, in peer-reviewed journals, numerous studies that used questionnaires. One of the authors (MJD) has been teaching research to residents and junior faculty for over a decade, and has been an advisor on scores of resident, student, and faculty research projects. The perspective of the novice researcher is represented by 1 author (C.R.W.).

Getting Started

The "quick and dirty" approach is perhaps the most common pitfall in survey research. Because of the ease of administration and the relatively low cost of survey research, questionnaires can be developed and administered quickly. The researcher, however, should be sure to consider whether or not a survey is the most appropriate method to answer a research question. Adequate time must be given to thoroughly searching the relevant literature, developing and focusing on an appropriate research question, and defining the target population for the study. Large, multisite surveys are more likely to be generalizeable and to be published in peer-reviewed journals.

One way to avoid undertaking a project too rapidly and giving inadequate attention to the survey research process is for novice researchers to avoid independent research. Those with little or no experience must realize that researchers in both family practice and other fields perform research in teams, with the various participants bringing specific skills to the process. Oversights, mistakes, and biases in the design of questionnaires can always occur, whether a researcher is working independently or as a member of a team. It seems reasonable to assume, however, that significant problems are much less likely to occur when a multidisciplinary team approach is involved rather than an individual researcher undertaking a study independently.

Ideally, a research team should include a statistician, a professional with experience in the content areas of the study, and a senior investigator.

The desirable area of expertise, however, is often not readily available to family physicians, especially those in community-based settings. Individuals with some training in research who are interested in being involved can usually be found in colleges and universities, hospitals, and at the local public health department.

Psychologists, sociologists, health services researchers, public health epidemiologists, and nursing educators are all potential resources and possible collaborators. Establishing the necessary relationships to form an ad hoc research team is certainly more time and labour intensive than undertaking research independently, but generally results in the collection of more useful information.

Novices should consult survey methodology books before and during the study. Excellent resources are available that provide a comprehensive overview of survey methods, means for improving response rates, and methods for constructing relatively brief but thorough survey questions. Academic family practice fellowships often provide training in survey methodology. In addition, many family practice researchers respond favorably to requests for information or advice requested by telephone or email contact. The novice author of this chapter reports excellent success in contacting experts in this manner. With the advent of the Internet, a "cyberspace" team comprised of experts in the topic and the methodology is a reasonable and helpful option for the novice.

Survey Content and Structure

Novice researchers often assume that developing a questionnaire is an intuitive process attainable by virtually anyone, regardless of their level of research training. While it is true that questionnaires are relatively simple to construct, developing an instrument that is valid and reliable is not intuitive. An instrument is valid if it actually measures what we think it is measuring, and it is reliable if it measures the phenomenon consistently in repeated applications.

By following a few basic guidelines, those with limited research training can develop survey instruments capable of producing valid and reliable information. The 3 primary concerns for developing appropriate questions (items) are: (1) response format; (2) content; and (3) wording and placement.

Format

Questionnaires generally use a closed-ended format rather than an open-ended format. Closed formats spell out response options instead of asking study subjects to respond in their own words. Although there are many reasons for using closed formats, their primary advantages over open formats is that they are more specific and provide the same frame of reference to all respondents, and they allow quantitative analysis. A disadvantage is that they limit the possible range of responses envisioned by the investigators. Questionnaires with closed formats are therefore not as helpful as qualitative methods in the early, exploratory phases of a research project. Closed-ended items can be formatted into several different categories (classes) of measurement, based on the relationship of the response categories to one another. Nominal measurements are responses that are sorted into unordered categories, such as demographic variables (ie, sex, ethnicity). Ordinal measurements are similar to nominal, except that there is a definite order to the categories. For example, ordinal items may ask respondents to rank their preferences among a list of options from the least desirable to the most desirable.

Survey items that ask for respondents(delete apostrophe) to rank order preferences are often a more useful than items that state, "check all that apply." While checking all relevant responses may be necessary for certain items, such questions often lose valuable information as they can only supply raw percentages without supplying any comparison between responses.

Two additional tools used on questionnaires are continuous variables and scales. Continuous variables can be simple counts (eg, the number of times something occurred) or physical attributes (eg, age or weight). A general rule when collecting information on continuous variables is to avoid obtaining the information in ranges of categories unless absolutely necessary. Response categories that reflect ranges of responses can always be constructed after the information is gathered, but if the information is gathered in ranges from the start, it cannot later be expanded to reflect specific values.

Scales are used by survey researchers to assess the intensity of respondents' attitudes about a specific issue or issues. Likert scales are probably the best known and most widely used for measuring attitudes. These scales typically present respondents with a statement and ask them to indicate whether they "strongly agree," "agree," "neither agree nor disagree," "disagree," or "strongly disagree." The wording of the response categories can be changed to reflect other concepts (eg, approval or disapproval), and the standard 5-response format can be expanded or abbreviated if necessary.

There are no hard and fast rules for determining the number of response categories to use for scaled items, or whether to use a neutral category or one that reflects uncertainty. Research indicates that the reliability of respondents' ratings declines when using more than 9 rating scale points.

However, the reliability of a scale increases when the number of rating scale points is increased, with maximum benefit achieved with 5 or 7 scale points.

Since the objective of using scales is to gauge respondent's preferences, it is sometimes argued that a middle point or category of uncertainty category should not be used. Odd-numbered rating scales, however, conform better with the underlying tenets of many statistical tests, suggesting the need for including this category. As the number of rating scale points increases, respondents' use of the midpoint category decreases substantially. Thus, based on the available literature, it is generally advisable to use between 5 and 7 response categories and an uncertainty category, unless there is a compelling reason to force respondents to choose between 2 competing perspectives or alternatives.

Content

Items should not be included on questionnaires when the only justification for inclusion is that the investigator feels the information "would be really interesting to know." Rather, for each item, you should ask yourself how it addresses the study's research question and how it will be used in the data analysis stage of the study. Researchers should develop a data analysis plan in advance of administering a questionnaire to determine exactly how each question will be used in the analysis. When the relationship between a particular item and the study's research question is unclear, or it is not known how an item will be used in the analysis, the item should be removed from the questionnaire.

Wording and Placement of Questions

The wording of questions should be kept simple, regardless of the education level of the respondents. Questions should be kept as short and direct as possible since shorter surveys tend to have higher response rates. Each question should be scrutinized to ensure it is appropriate for the respondents and does not require or assume an inappropriate level of knowledge about a topic. Since first impressions are important for setting the tone of a questionnaire, never begin with sensitive or threatening questions. Questionnaires should begin with simple, introductory ("warm-up")"questions to help establish trust and an appropriate frame of mind for respondents. Other successful strategies are: (1) when addressing multiple topics, insert an introductory statement immediately preceding each topic (eg, "In the next section we would like to ask you about …"); (2) request demographic information at the end of the questionnaire; and (3) always provide explicit instructions to avoid any confusion on the part of respondents.

By following simple guidelines and common sense, most family practice researchers can construct valid and reliable questionnaires.

As a final safeguard, once a final draft of the questionnaire is completed, the researcher should always be the first respondent. By placing yourself in the respondent's role and taking the time to think about and respond to each question, problems with the instrument that were overlooked are sometimes identified.

Analysing Surveys of Questions

It is not within the scope of this project to address statistical analysis of survey data. Before attempting data analysis, investigators should receive appropriate training or consult with a qualified professional. There are 3 topics that can and should be understood by novice researchers related to data analysis.

Survey Coding

Before analysing survey data it is necessary to assign numbers (codes) to the responses obtained. Since the computer program that is used for analysing data does not know what the numbers mean, the researcher assigns meaning to the codes so that the results can be interpreted correctly.

Coding refers to the process of developing the codes, assigning them to responses, and documenting the decision rules used for assigning specific codes to specific response categories. For example, almost all questionnaires contain missing values when respondents elect to not answer an item. Unique codes need to be assigned to distinguish between an item's missing values, items that may not be applicable to a particular respondent, and responses that have a "none" or "no opinion" category.

Data can be entered into appropriate data files once codes have been assigned to responses and a codebook compiled that defines the codes and their corresponding response categories. It is important to ensure that the data are free of errors (are clean) prior to performing data analysis. Although many methods can be used for data cleaning (ie, data can be entered twice and results compared consistency), at a minimum all of the codes should be checked to ensure only legitimate codes appear.

Frequency distributions are tables produced by statistical software that display the number of respondents in each response category for each item (variable) used in the analysis. By carefully examining frequency tables, the researcher can check for illegitimate codes. Frequency tables also display the relative distribution of responses and allow identification of items that do not conform to expectations given what is known about the study population.

Sample Size

Since it is usually not possible to study all of the members of the group (population) of interest in a study, a subset (sample) of the population is generally selected for study from the sampling frame. Sampling is the process by which study subjects are selected from the target population, while the sample frame is the members of a population who have a chance of being included in the survey. In probability samples, each member of the sampling frame has a known probability of being selected for the study, whereas in nonprobability samples, the probability of selection is unknown. When a high degree of precision in sampling is needed to unambiguously identify the magnitude of a problem in a population or the factors that cause the problem, then probability sampling techniques must be used.

When conducting an analytical study that examines precisely whether statistically significant differences exist between groups in a population, power analysis is used to determine what size sample is needed to detect the differences. Estimates of sample size based on power are inversely related to the expected size of the differences "(effect size)"-that is, detecting smaller differences requires a larger sample. If an analytical study is undertaken to determine the magnitude of the differences between 2 groups, it is necessary to work with a statistician or other methodology expert to perform the appropriate power analysis.

In contrast to analytical studies, exploratory and descriptive studies can frequently be conducted without the need for a power analysis. While some descriptive studies may require the use of probability techniques and precise sample estimates, this often is not the case for studies that establish the existence of a problem or estimating its dimensions. When conducting an exploratory or descriptive study using a survey design and a nonprobability sampling technique, considerations other than effect size or precision are used to determine sample size. For example, the availability of eligible respondents, limitations of time and resources, and the need for pilot study data can all contribute to selecting a nonprobability sample. When these types of sampling techniques are used, however, it is important to remember that the validity and reliability of the findings are not assured, and the findings cannot be used to demonstrate the existence of differences between groups. The findings of these types of studies are only suggestive and have limited application beyond the specific study setting.

Response Rate

The response rate is a measure indicating the percentage of the identified sample that completed and returned the questionnaire. It is calculated by dividing the number of completed questionnaires by the total sample size identified for the study. For example, if a study is mailed to 500 physicians questionnaires and 100 returned a completed questionnaire, the response rate would be 20% (100/500).

The response rate for mailed questionnaires is extremely variable. Charities are generally content with a 1% to 3% response rate, the US Census Bureau expects to achieve a 99% rate, and among the general population, a 10% response rate is not uncommon. Although an 80% response rate is possible from an extremely motivated population, a rate of 70% is generally considered excellent.

The effect of nonresponse on the results of a survey depend on the degree to which those not responding are systematically different from the population from which they are drawn. When the response rate is high (ie, 95%), the results obtained from the sample will likely provide accurate information about the target population (sampling frame) even if the nonrespondents are distinctly different. However, if nonrespondents differ in a systematic way from the target population and the response rate is low, bias in how much the survey results accurately reflect the true characteristics of the target population is likely.

When calculating the response rate, participants who have died or retired can be removed from the denominator as appropriate. Nonrespondents, however, who refuse to participate, do not return the survey, or have moved should be included. This bias tends to be more problematic in "sensitive" areas of research than in studies of common, nonthreatening topics. Imputing values for missing data from nonrespondents is complex and generally should not be undertaken.

Given the importance of response rate, every effort must be made to obtain as many completed questionnaires as possible and strategies to maximize the response rate should be integrated into the study design. Some simple means for improving response rates include constructing a short questionnaire, sending a well-written and personalized cover letter containing your signature, and emphasizing the importance of the study and the confidentiality of responses. It is also advisable to include a self-addressed, stamped envelope for return responses, and sometimes a small incentive is worthwhile. The National Centre for Education Statistics notes that all surveys require some follow-up to achieve desirable response rates. Survey researchers, therefore, should develop procedures for monitoring responses and implement follow-up plans shortly after the survey begins.

Generally, 2 or 3 mailings are used to maximize response rates. Use of post card reminders is an inexpensive, though untested, method to increase response. Several randomized studies have reported an increase in response rate from physicians in private practice with the use of monetary incentives, although the optimum amount is debated. Everett et al compared the use of a $1 incentive vs no monetary incentive and found a significant increase with the incentive group (response rates: 63% in the $1 group; 45% in the no incentive group; $P < .0001$). Other studies have compared $2, $5, $10, $20, and $25 incentives and found that $2 or $5 incentives are most cost effective. Similar findings have been reported for physician surveys in other countries. In an assessment of incentive for enrollees in a health plan, a $2 incentive was more cost effective than a $5 incentive. A $1 incentive was as effective as $2 in significantly increasing response rate in a low-income population. Quality of responses have not varied by use of incentives and there does not appear to be an incentive-bias.

Use of lottery appears to also increase response rate in both physicians and the lay public, although there are no studies comparing lottery to a monetary incentive enclosed for all participants. Use of either certified or priority return mail appears to increase response rates, and may be more cost effective when used for the second mailing.

Pilot Testing and Survey

Though pilot testing is generally included in the development of a survey, it is often inadequately conducted. Frequently, investigators are eager to answer their research question and pilot testing is synonymous with letting a few colleagues take a quick look and make a few comments. One of the questions in the survey asked about how time is allotted for faculty to pursue scholarly activities and research (Format A). Unfortunately, the question mixes 2 types of time in 1 question: extended time away from the institution (sabbatical and mini-sabbatical) and time in the routine schedule. This was confusing to respondents and could have been avoided by separating the content into 2 separate questions (Format B).

Investigators should consider carefully whom to include in the pilot testing. Not only should this include the project team and survey "experts", but it should also include a sample of the target audience. Pilot testing among multiple groups provides feedback about the wording and clarity of questions, appropriateness of the questions for the target population, and the presence of redundant or unnecessary items.

One of the authors (C.R.W.) recently worked on her first questionnaire project.

Among the many lessons she learned was the value of a team in providing assistance, the importance of considering if the time spent on a particular activity makes it cost effective, and the need to be flexible depending on circumstances. She found that establishing good communication with the team cuts down on errors and wasted effort. Rewarding the team for all of their hard work improves morale and provides a positive model for future projects.

The mailed self-administered questionnaire is an important tool in primary care research. For family practice to continue its maturation as a research discipline, family practitioners need to be conversant in survey methodology and familiar with its pitfalls. We hope this primer-designed specifically for use in the family practice setting-will provide not only basic guidelines for novices but will also inspire further investigation.

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Technique of Interviewing

In social science, interviews are a method of data collection that involves two or more people exchanging information through a series of questions and answers. The questions are designed by a researcher to elicit information from interview participants on a specific topic or set of topics. These topics are informed by the author's research questions. Interviews typically involve an in-person meeting between two people (an interviewer and an interviewee), but interviews need not be limited to two people, nor must they occur in-person.

You may be wondering when you should choose interviews as your data collection method. Interviews are an excellent way to gather detailed information. They also have an advantage over surveys, as they can be adapted as you learn more information. Recall that survey data collection methods do not allow researchers to change the questions that are administered, even if a participant's response sparks some follow-up question in your mind. All participants must be asked the same questions in the same manner. The questions you decided to put on your survey during the design stage determine what data you get. In an interview, however, you can follow up on new and unexpected topics that emerge during the conversation. Trusting in emergence and learning from your participants are hallmarks of qualitative research. In this way, interviews are a useful method to employ when you want to know the story behind the responses you might receive in a written survey.

Interviews are also useful when your topic is rather complex, requires lengthy explanation, or needs a dialogue between two people to thoroughly investigate. Additionally, interviews may be the best method to utilize if your study involves describing the process by which a phenomenon occurs, like how a person makes a decision.

For example, you could use interviews to gather data about how people reach the decision not to have children and how others in their lives have responded to that decision. To understand these processes, you would need to exchange dialogue with respondents.

When they begin to share their story with you, new questions that hadn't occurred to you in prior interviews will arise because each person's story is unique. Further, closed-ended survey questions would not be as effective in capturing the complex process of choosing not to have children.

OBJECTIVES OF INTERVIEW

There's more types of interviews than most people think. An interview is generally a qualitative research technique which involves asking open-ended questions to converse with respondents and collect elicit data about a subject. The interviewer in most cases is the subject matter expert who intends to understand respondent opinions in a well-planned and executed series of questions and answers. Interviews are similar to focus groups and surveys when it comes to garnering information from the target market but are entirely different in their operation – focus groups are restricted to a small group of 6-10 individuals whereas surveys are quantitative in nature. Interviews are conducted with a sample from a population and the key characteristic they exhibit is their conversational tone.

Methods of Research Interviews

There are three methods to conduct research interviews, each of which is peculiar in its application and can be used according to the research study requirement.

Personal Interviews

Personal interviews are one of the most used types of interviews, where the questions are asked personally directly to the respondent. For this, a researcher can have a guide online surveys to take note of the answers. A researcher can design his/her survey in such a way that they take notes of the comments or points of view that stands out from the interviewee.

Advantage:

- Higher response rate.
- When the interviewees and respondents are face-to-face, there is a way to adapt the questions if this is not understood.
- More complete answers can be obtained if there is doubt on both sides or a particular information is detected that is remarkable.
- The researcher has an opportunity to detect and analyze the interviewee's body language at the time of asking the questions and taking notes about it.

Disadvantages:

- They are time-consuming and extremely expensive.
- They can generate distrust on the part of the interviewee, since they may be self-conscious and not answer truthfully.
- Contacting the interviewees can be a real headache, either scheduling an appointment in workplaces or going from house to house and not finding anyone.
- Therefore, many interviews are conducted in public places, such as shopping centers or parks. There are even consumer studies that take advantage of these sites to conduct interviews or surveys and give incentives, gifts, coupons, in short; There are great opportunities for online research in shopping centers.
- Among the advantages of conducting these types of interviews is that the respondents will have more fresh

information if the interview is conducted in the context and with the appropriate stimuli, so that researchers can have data from their experience at the scene of the events, immediately and first hand. The interviewer can use an online survey through a mobile device that will undoubtedly facilitate the entire process.

QUALITIES OF A GOOD INTERVIEWER AND HIS ROLE

How effective an interview is depends, for the main, on how good the interviewer is. A good interviewer will be

- Well prepared
- Confident
- Positive about the company and role
- A 'role model' for the prospective candidate in terms of dress/approach/timeliness/manner and so on
- Good at asking searching, relevant and non-discriminatory questions
- Good at listening to what is being said and what is not being said
- Unhurried
- Observant
- Able to tie up verbal and non-verbal communication and analyse any contradictions, as well as being able to hear what is not being said and probe for additional clarification
- Polite
- Encouraging
- An accurate note taker
- Punctual
- Well organised
- A good time keeper
- Consistent.

A good interviewer will usually follow a consistent, well-structured format. This is important because it helps the interviewer stick to time, keeps the interview on track and helps to give all the candidates a fair chance and prevent any accusations of discrimination. It also helps give confidence to anyone new to interviewing.

PRE-REQUISITES FOR SUCCESSFUL INTERVIEWING

You can have the greatest background in the world on paper, but if you can't perform, gain rapport, and articulate your skill set, you won't get the job. So, here's how to ace your next big interview.

Prepare Thoroughly

Preparation goes beyond just understanding and researching the company's website and perusing the annual report; they're a given. When I prep a professional for an interview, we get a specific game plan in place. The advantage of working with a recruiter is that they have the inside track on what the hiring manager is looking for and what to emphasize. However, whether or not you work with a recruiter, being prepared will make or break you.

Start by writing an outline of how you're going to approach the interview. Whatever you do, don't wing it! Although you must be ready to adjust in the moment, you'll be less anxious and perform better if you have a game plan walking in. At a minimum, you should have a job description you can work off so you know what technical skills to discuss. Give specific examples describing how you saved the company money or improved its processes. Results are what matter most when it comes to separating yourself from the competition.

Make a Good First Impression

Whether it's right or wrong, studies show that it takes only seven seconds for someone to judge you in a first meeting.

With that in mind, you need to stack the deck in your favor. Smile! When you smile at someone they'll usually smile back, so it's the perfect way to strike up some rapport. But make sure your smile is real. A natural smile will fade slowly: switch it on too fast or let it drop too soon and it doesn't feel sincere.

Also, although your appearance plays second fiddle to body language, it does have an impact. Make sure your suit is freshly laundered, your shoes are polished, and that tattoos are covered. Also, don't wear perfume or cologne as it can singlehandedly keep you from getting your dream job. Scent is a very individual thing, and your favorite violet-scented perfume might be your interviewer's least favorite.

Lastly, practice your handshake with a friend. Limp, weak handshakes can be interpreted as a lack of confidence and strength. So, make sure your grip is firm and confident—practice!

Run Offense, Not Defense

Asking open-ended questions is critical because it allows you to control the direction of the interview. Running offense gives you the advantage of being proactive versus reactive, which can happen when someone begins peppering you with difficult questions. Getting people to open up and talk about themselves also raises their self-esteem.

When I get feedback from a job seeker that the hiring manager wouldn't let them say two words, I think "Success!" Be prepared to ask at least five intelligent questions of the hiring manager. Suggestions include: "What is your biggest challenge over the next 12 months?" "Where can I make the biggest impact for the team in the first 90 days?" "Tell me about your management style and expectations?" "Do you have any concerns about my abilities?"

Use a Nonverbal Strategy

People like people who they perceive to be like themselves. Individuals feel comfortable when they believe they have something in common with the other person. Nonverbals are a subconscious way of connecting in an interview that can tip the scales in your favor. The concept of "mirroring" refers to the practice of copying the actions, terminology, and tonality of another person to create rapport. While in the interview, note the interviewer's body posture. If his/her arms or legs are crossed, then cross yours as well. If their elbows are on the table and they are leaning forward, do the same. Listen carefully to the terminology or adjectives they are using and implement the same words and tone in your responses. This will make them feel that, subconsciously, you are like them, which in turn builds trust.

Be Positive

Regardless of the reasons you're looking for a new job, stay positive about your current and past employers. Focus on the present and the future and steer the conversation to the value you can bring to the organization; leave behind any emotional baggage that could be misconstrued. For example, if you're leaving because you're experiencing conflict with your manager, reply that the corporate culture/philosophy is not a good fit for your long-term goals. Sharing too much information about negative experiences will lose you the opportunity, guaranteed.

Connect All the Dots

Your job during the interview is to connect the dots between your skill set and what the interviewer is looking for in a potential hire. Don't assume your audience knows anything about your current or past employer; make sure you volunteer the industry, product or service they provide and anything relevant to the situation. Make sure your technical skills are communicated effectively during the interview.

Ask for the Job!

At the end of the interview, if you're still interested in the opportunity, express it in no uncertain terms. Make a statement such as, "I really like what I've heard today and would be interested in exploring this opportunity further," or "I 'm interested in joining a team such as yours; what's the next step in the process?" Time and again, hiring managers tend to hire people who are excited about working with them.

SELECTION OF CASES

Case interviews are the core of the selection process right across McKinsey, Bain, BCG, the consulting wings of the Big Four, and any other high-end consultancies. To land a job at any of these firms, you will have to ace multiple case interviews. Before we can figure out how to prepare for a case interview, we will first have to understand in detail what you are up against. What format does a consulting case interview take, what is expected of you and how will you be assessed? Let's dive right in and find out!

CASE INTERVIEW FORMAT

Case interviews take very similar formats across the various consultancies where they are used.

Before landing an offer at McKinsey, Bain, BCG or any similar firm, you will have to complete between four and six case interviews, divided into two rounds, with each interview lasting approximately 50-60 minutes. Here is the typical case interview timeline:

1. First 15-30 minutes: Fit Interview, assessing your motivation to be a consultant in that specific firm and your leadership and teamwork traits.
2. Next 30-40 minutes: Case Interview
3. Last 5 minutes: Fit Interview, again. This time it's about your questions for the interviewer.

Both the Case and Fit interviews play crucial roles in the finial hiring decision. There is no "average" taken between case and fit interviews: if your performance is not up to scratch in either of the two you will not be able to move on to the next interview round or get an offer.

Difference between first and second round interviews

Despite interviews in the first and second round following the same format, seniority of the interviewer, time pressure (with usually three interviews in a row), and value at stake make a second round consulting case interview potentially one of the most challenging moments of your working life. There are three key differences between the two rounds:

1. Time pressure: the Final Round of case interviews test your ability to perform under pressure, with three interviews in a row and often very small breaks between them
2. Focus: Since interviewers in the Second Round tend to be more senior (usual partners with 12+ years experience), they will be more interested in your personality and ability to handle challenges independently. Some partners will drill down into your experiences and achievements to the extreme. They want to understand how you react to challenges and your ability to identify and learn from past mistakes.
3. Psychological pressure: while case interviews in the first round are usually more focused on having you simply crack the case, second round interviewers often use the "bad cop" strategy to test the way candidates react to challenges and uncertainty.

Is there a difference between McKinsey and other firms? McKinsey case interviews are not overwhelmingly different from those given by Bain, BCG, and other firms, with the McKinsey interview timeline breaking broadly the same as the one set out above. However, there are some differences in the specifics of how McKinsey administers both their case and fit interviews which it will pay to be aware of if you are applying to that firm.

McKinsey Case Interviews Most consulting case interview questions test your ability to crack a broad problem, with a case prompt often going like: "*How much would you pay for a banking* *licence in Ireland?*". You, as a candidate, are expected to identify your path to solve it (structure), leveraging your interviewer to collect the data and test your assumptions.

However, a McKinsey case interview - especially in the first round - is slightly different, with the *interviewer controlling the pace* of the conversation much more than in another case interviews. At McKinsey your interviewer will ask you a set of pre-determined questions, regardless of what your initial structure is. For each question, you will have to understand the problem, come up with a mini structure, ask for additional data (if necessary) and come to the conclusion that answers the question. Essentially, interviewer-led case studies are large cases made up of lots of mini-cases. he method you have to follow is basically the same as in the standard (or candidate-led) cases; with the main difference simply being that, instead of solving one big case, you are solving several mini-cases sequentially.

McKinsey Fit Interview - the McKinsey PEI : As with their cases, McKiney take a slightly more structured approach to the fit component of their interviews than do other firms. Indeed, the fit component of a McKinsey interview is sufficiently formalized that it has its own name - the McKinsey Personal Experience Interview, or McKinsey PEI for short.

There are two to three rounds of PEI and is typically more intense than the fit interviews of other firms, with each interview focusing on only one topic, but drilling down to an extreme.

As with case studies, the McKinsey format is slightly different - and it is good to know this in advance - but thisdoesn't actually affect your prep. You should be fully prepped and ready for an intense fit interview from Bain or BCG as well!

TRAINING OF INTERVIEWERS

Training interviewers to identify top-tier talent

Interviewer training should start with the basics. Teach your interviewers how to ask the right questions and how to evaluate answers to identify the best candidates. Share illegal interview questions that they should avoid asking and provide unconscious bias training so interviewers are evaluating candidates fairly. Also cover department-specific training, such as technical interviewing skills, that interviewers may need.

Training interviewers to engage top-tier talent

Next, train interviewers to provide a great candidate experience. Again, this isn't something that is intuitive to your interviewers. When they are focused on evaluating candidates, interviewers may forget that candidates are evaluating them in return. You want every candidate to walk away from the interview with a positive impression of your company, whether they are hired or not. That way, your top choice candidates will be more inclined to accept your offer, and all others will consider your company for future opportunities and speak highly of your company within their networks.

Once you've trained your team on interviewing at large, it's important to hold a kick-off meeting before you begin the interview process for any given position. This is a great way to align on expectations so everyone knows what you're looking for, and all candidates are evaluated on the same criteria and given the same experiences. Review the responsibilities the new hire would be responsible for, and the most critical competencies they should have. Then determine interview roles and assign questions to interviewers to assess the candidate's competencies.

Measuring interviewer effectiveness

Following the interview process, take your preparation full circle by evaluating each interviewer and using the data to inform your future interviewer selection and training. For instance, learn which interviewers tend to assign high scores to candidates you eventually hire. Use this data to select your most effective interviewers more often, and provide development opportunities to those who are not as effective. Also take into consideration any candidate feedback you receive. If, for instance, you learn that a candidate was kept waiting for an in-person interview, you can use that feedback to help your interviewers provide a better candidate experience in the future.

STATES IN INTERVIEW TECHNIQUE

Interviewing for a job can be nerve-wracking. You may feel uncomfortable "selling" yourself or fielding unexpected questions. Or the prospect of having to meet and impress new people may be enough to trigger stress or anxiety.

However, no matter how fearful you may be about interviewing for work, it's important to remember that interviewing is a skill you can learn. With the following tips and techniques, you can become a master at sharing your value with potential employers, presenting yourself effectively at interviews, and getting the job you want.

Interviewing techniques tip 1: Interview for as much as you can

Let's assume you have focused your search on certain types of jobs and types of employers. You have developed a preferred list of both. You have scanned the horizon, conducted research, compiled your questions, and engaged your network for assistance. Your resume is in order.

Then job openings start to pop up through your web searches and referrals from your network. Some seem close but others don't quite fit. You quickly skip over those jobs that are "beneath" you, have titles that appear to be foreign, or are in fields or industries you're unfamiliar with. You have decided to be focused and only apply for positions that exactly match your search criteria.

But limiting your job search limits the possibilities. Once you create too many filters and requirements, you can easily overlook opportunities. In this type of market you have to get out there and actively uncover opportunities. Don't dismiss opportunities to interview based upon superficial and narrow criteria. You never know when an interview for a "not-quite-right" job will result in a surprising match, a referral to another opening, or an entirely new position tailored to fit your unique experience and abilities.

Why you should interview as much as possible:

- You need the practice. Some of you have not interviewed for a while. You need to refine your story and improve your communication skills, which require practice. That means interviewing as much as you can.
- Interviewing will refine your job search. By getting out there and interviewing, you'll learn about new trends, positions, and opportunities, your perspective will shift, and you'll see new paths that you were previously unaware of.
- Interviewing will make your network stronger. As you engage your network for interview referrals and recommendations, you will not only strengthen existing connections, but you'll meet new people who are connected to your network.
- Interviewing may lead to unexpected opportunities. If you have the skills and impress in the interview, that carries weight in the organization. Employers want to place good people and may even refer you to opportunities outside of the firm.

Interviewing techniques tip 2: Develop a compelling story

We tend to conclude that our lives are pretty much the same as other people's, that they're average and boring. As a result, many people don't tell their own story well. But your story is so much better than you think. The way your life has evolved; the things you've learned; your achievements, failings, and dreams—these things are unique to you and much more interesting than you realize. Sharing your well thought-out story is a powerful interviewing technique.

Your story is what helps people understand who you are and where you are going. So learn to tell your story and tell it well, especially for interviewing and networking purposes. Putting together your story takes a lot of work and practice. However, the benefits to you and to your career are enormous. Your stories:

- Give you confidence
- Increase your self-awareness
- Bring humanity to your resume
- Make you memorable and set you apart

Developing your story for job interviews

- Take a comprehensive inventory of the chapters of your life. Think about major events, memories, and turning points that shaped who you are. Make notes about your feelings, expectations, and frustrations, or what you learned, accomplished, and experienced. Organize your chapters by time periods or jobs.
- Focus on memorable "aha" moments. These stories need to have vivid dimensions so people will experience that moment with you. It may have been a moment with your mom on the porch, or a trip you took to a faraway place, or what a boss or mentor told you. The stories don't have to be dramatic, just meaningful to you.
- Uncover the themes in your story. What emerges as your passion? Mentoring others, doing research, helping a specific type of client, advancing knowledge in your field? What gives you joy? Are you a teacher, a leader, an entrepreneur, a risk taker?
- Reflect on your career path. How have you arrived where you are today? Why did you make certain choices? Who helped you along the way? What motivated you then and now? Have your career goals remained the same or have they changed? Are you someone who likes new projects? Or executes the details of someone else's vision?

Practice makes perfect

Once you've developed your story, the next step is to practice telling it—saying it out loud, ideally to others. Don't wait until the interview to tell it for the first time. Try reciting it into a tape recorder or sharing it with a confidante for feedback. Get over your feelings of story inadequacy or thinking that a job well done speaks for itself.

As you become more comfortable in how to tell your story, you will see that your life has not just been a string of random events. Your story has a past and it has a future and the road ahead becomes clearer when you understand where you have been. The ultimate test will be the next time someone says, "Tell me about yourself."

Interviewing techniques tip 3: Tailor your story to the job

Applying your story to a specific employer or job is the next step. Lining up the stories that apply to the opportunity at hand is critical. Put yourself in the interviewer's shoes and pose the questions you would ask. Which stories are relevant to this job interview? Think about personal stories that show how you handled change, made choices under pressure, or learned lessons from mistakes and failures. You should also think about stories you can tell in the interview that reveal your skill set.

Learning and appreciating your story is a prerequisite to any interview process. Don't rely on your ability to think on your feet. Anticipate the questions and have answers at the ready. In the end, this is about making a great and memorable impression that demonstrates competency and ability.

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Questionnaire

A questionnaire is a research instrument consisting of a series of questions (or other types of prompts) for the purpose of gathering information from respondents. The questionnaire was invented by the Statistical Society of London in 1838.

Although questionnaires are often designed for statistical analysis of the responses, this is not always the case.

Questionnaires have advantages over some other types of surveys in that they are cheap, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. However, such standardized answers may frustrate users as the possible answers may not accurately represent their desired responses. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and respond to them. Thus, for some demographic groups conducting a survey by questionnaire may not be concretely feasible.

History

One of the earliest questionnaires was Dean Milles' Questionnaire of 1753.

Types

A distinction can be made between questionnaires with questions that measure separate variables, and questionnaires with questions that are aggregated into either a scale or index. Questionnaires with questions that measure separate variables, could, for instance, include questions on:

- preferences (e.g. political party)
- behaviors (e.g. food consumption)
- facts (e.g. gender)

Questionnaires with questions that are aggregated into either a scale or index include for instance questions that measure:

- latent traits
- attitudes (e.g. towards immigration)
- an index (e.g. Social Economic Status)

Examples

- A food frequency questionnaire (FFQ) is a questionnaire the type of diet consumed in people, and may be used as a research instrument. Examples of usages include assessment of intake of vitamins or toxins such as acrylamide.

Questionnaire construction

Question type

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

- Dichotomous, where the respondent has two options
- Nominal-polytomous, where the respondent has more than two unordered options

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

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

Question sequence

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

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

1. Screens
2. Warm-ups
3. Transitions
4. Skips
5. Difficult
6. Classification

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

Classification, or demographic question should be at the end because typically they can feel like personal questions which will make respondents uncomfortable and not willing to finish survey.

Basic rules for questionnaire item construction

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

Multi-item scales

Within social science research and practice, questionnaires are most frequently used to collect quantitative data using multi-item scales with the following characteristics:

- Multiple statements or questions (minimum e"3; usually e"5) are presented for each variable being examined.
- Each statement or question has an accompanying set of equidistant response-points (usually 5-7).

- Each response point has an accompanying verbal anchor (e.g., "strongly agree") ascending from left to right.
- Verbal anchors should be balanced to reflect equal intervals between response-points.
- Collectively, a set of response-points and accompanying verbal anchors are referred to as a rating scale. One very frequently-used rating scale is a Likert scale.
- Usually, for clarity and efficiency, a single set of anchors is presented for multiple rating scales in a questionnaire.
- Collectively, a statement or question with an accompanying rating scale is referred to as an item.
- When multiple items measure the same variable in a reliable and valid way, they are collectively referred to as a multi-item scale, or a psychometric scale.
- The following types of reliability and validity should be established for a multi-item scale: internal reliability, test-retest reliability (if the variable is expected to be stable over time), content validity, construct validity, and criterion validity.
- Factor analysis is used in the scale development process.
- Questionnaires used to collect quantitative data usually comprise several multi-item scales, together with an introductory and concluding section.

Questionnaire administration modes

Main modes of questionnaire administration include:

- Face-to-face questionnaire administration, where an interviewer presents the items orally.
- Paper-and-pencil questionnaire administration, where the items are presented on paper.
- Computerized questionnaire administration, where the items are presented on the computer.
- Adaptive computerized questionnaire administration, where a selection of items is presented on the computer,

and based on the answers on those items, the computer selects the following items optimized for the testee's estimated ability or trait.

Concerns with questionnaires

While questionnaires are inexpensive, quick, and easy to analyze, often the questionnaire can have more problems than benefits. For example, unlike interviews, the people conducting the research may never know if the respondent understood the question that was being asked. Also, because the questions are so specific to what the researchers are asking, the information gained can be minimal.

Often, questionnaires such as the Myers-Briggs Type Indicator, give too few options to answer; respondents can answer either option but must choose only one response. Questionnaires also produce very low return rates, whether they are mail or online questionnaires.

The other problem associated with return rates is that often the people who do return the questionnaire are those who have a really positive or a really negative viewpoint and want their opinion heard. The people who are most likely unbiased either way typically don't respond because it is not worth their time.

One key concern with questionnaires is that there may contain quite large measurement errors. These errors can be random or systematic. Random errors are caused by unintended mistakes by respondents, interviewers, and/or coders. Systematic error can occur if there is a systematic reaction of the respondents to the scale used to formulate the survey question. Thus, the exact formulation of a survey question and its scale is crucial, since they affect the level of measurement error.

Further, if the questionnaires are not collected using sound sampling techniques, often the results can be non-representative of the population—as such a good sample is critical to getting representative results based on questionnaires.

CONTENT OF QUESTIONS

The spark behind every great discovery that has taken place on this planet has been the spirit of inquiry. When that inquiry is directed outwards – "What is this? How does it happen?" it is science and when it is directed inwards – "Who am I? What am I here for? What do I really want?" it is spirituality.

We have a daily informal gathering every evening and after some group singing, I take questions from those present. Over so many years, I must have been asked hundreds of thousands of questions on various topics. Even though the number of possible questions that can be asked is huge, there are really only five types of questions.

1. Out of misery: Many times people ask questions when they are feeling miserable. They are usually of the nature "Why did this happen to me?", "What did I do to deserve this?" etc. When you see someone asking a question out of pain, just listen to them. They just want somebody to hear them out. They are not really looking for an answer.
2. Out of anger: "I did nothing wrong. I was right. Why am I being blamed? Why is this happening?" This is the kind of questions that arise out of anger. Here also, the person is caught in the whirlpool of their feelings and emotions and they want to justify them by asking such questions. When somebody is in such a volatile state of mind, no matter what answer you give, it doesn't go in. On the contrary, it gives rise to more questions and justifications.
3. To draw attention: Some people ask questions just to show everyone that they are also there. Their satisfaction lies in asking the question so that everybody notices them rather than finding the answer.
4. To test: There are some who ask questions to test if the other person knows. They already have an answer in

their mind and want to compare if the other's answer matches with theirs.

5. With sincerity: The fifth type of questions is asked by people who sincerely want to know something and have faith that the person they are asking knows and will tell them. It is only this type of question that should be answered.

Most of the ancient scriptures – whether it is the Bhagvad Gita, Yoga Vasishtha, Ashtavakra Gita, Tripura Rahasya or the Upanishads, begin with a question. The questions that have been asked here are not merely out of curiosity but also with a sense of closeness. Upanishad itself means sitting close to the Master, not just physically but feeling close to the Master. Knowledge needs an atmosphere of belongingness to flourish. The closer you feel to the Master, the more knowledge unfolds by itself.

Every particle of this Existence is brimming with intelligence – the seed knows when to sprout and the flower knows when to bloom. All of life that is happening in this Creation is expressing that Infinite Intelligence. When you begin to behold this breathtaking phenomenon taking place all around you, all your questions start dissolving into an overwhelming sense of wonder. And that is the Art of Living.

Content question

A content question is a question with which the speaker asks the hearer to supply specific information about participants or settings. Content questions contrast primarily with polar questions, which just ask for a 'yes' or 'no' answer.

Question Content

For each question in your survey, you should ask yourself how well it addresses the content you are trying to get at. Here are some content-related questions you can ask about your survey questions.

Is the Question Necessary/Useful?

Examine each question to see if you need to ask it at all and if you need to ask it at the level of detail you currently have.

- Do you need the age of *each* child or just the *number of children under 16*?
- Do you need to *ask income* or can you *estimate*?

Are Several Questions Needed?

This is the classic problem of the double-barreled question. You should think about splitting each of the following questions into two separate ones. You can often spot these kinds of problems by looking for the conjunction "and" in your question.

- What are your feelings towards African-Americans *and* Hispanic-Americans?
- What do you think of proposed changes in benefits *and* hours?

Another reason you might need more than one question is that the question you ask does not cover all possibilities. For instance, if you ask about earnings, the respondent might not mention all income (e.g., dividends, gifts). Or, if you ask the respondents if they're in favor of public TV, they might not understand that you're asking generally. They may not be in favor of public TV for themselves (they never watch it), but might favor it very much for their children (who watch *Sesame Street* regularly). You might be better off asking two questions, one for their own viewing and one for other members of their household. Sometimes you need to ask additional questions because your question does not give you enough context to interpret the answer. For instance, if you ask about attitudes towards Catholics, can you interpret this without finding out about their attitudes towards religion in general, or other religious groups?

At times, you need to ask additional questions because your question does not determine the intensity of the respondent's attitude or belief. For example, if they say they support public TV, you probably should also ask them whether they ever watch it or if they would be willing to have their tax dollars spent on it. It's one thing for a respondent to tell you they support something. But the intensity of that response is greater if they are willing to back their sentiment of support with their behavior.

STRUCTURE OF TYPOLOGY OF QUESTIONNAIRE

Essentials of Questionnaire Construction

- Questionnaire design is a very crucial and important part of the research because an inappropriate questionnaire misleads the research, academics, and policymaking.
- Therefore, a set of adequate and appropriate questions in a sequential order is required in a questionnaire.
- The format of the questionnaire mostly depends on the type of questionnaire used.

Types of Questionnaire

There are roughly two types of questionnaires, structured and unstructured. A mixture of these both is the quasi-structured questionnaire that is used mostly in social science research.

- Structured questionnaires include pre-coded questions with well-defined skipping patterns to follow the sequence of questions. Most of the quantitative data collection operations use structured questionnaires. Fewer discrepancies, easy to administer consistency in answers and easy for the data management are advantages of such structured questionnaires.
- Unstructured questionnaires include open-ended and vague opinion-type questions. Maybe questions are not in the format of interrogative sentences and the moderator or the enumerator has to elaborate the sense

of the question. Focus group discussions use such a questionnaire.

- Not all questions are easily pre-coded with almost possible alternatives to answers. Given answer alternatives of some questions in the standard questionnaires are left as 'others' (please specify). A common and pragmatic practice is that most of the questions are structured, however, it is comfortable to have some unstructured questions whose answers are not feasible to enumerate completely. Such a type of questionnaire is called a quasi-structured questionnaire.

The Format of Questionnaire

Size:

- It should be smaller in size than that of the schedule.
- The extent in length and breadth should be appropriate.
- It should not be more than two or three pages as to the nature of the research.

Appearance:

- It should be constructed on a good quality paper and printing.
- It should have an attractive layout.

Clarity:

- The questions should be short, clear in terms, tenure, and expression.

Sequence:

- The question should be arranged according to the importance and preference.

Communicability:

- The questions of the questionnaire should be able to keep the interest of the respondents

Span:

- The length of the questions of the questionnaire should be as short as possible.

- The questionnaire should not be long in length.

Question Types in a Questionnaire

The questions asked can take two forms:

- Restricted questions, also called closed-ended, are the ones that ask the respondent to make choices — yes or no, check items on a list, or select from multiple choice answers.

Restricted questions are easy to tabulate and compile.

- Unrestricted questions are open-ended and allow respondents to share feelings and opinions that are important to them about the matter at hand.

Unrestricted questions are not easy to tabulate and compile, but they allow respondents to reveal the depth of their emotions.

- If the objective is to compile data from all respondents, then sticking with restricted questions that are easily quantified is better.
- If degrees of emotions or depth of sentiment are to be studied, then develop a scale to quantify those feelings.

Characteristics of Good Questions in a Questionnaire

General rules of question crafting:

- Clear objective
- Simple language
- Clear concepts
- Without bias
- Adequate answer options
- Shorter questions
- The single question at a time
- Affirmative sentences
- Mathematics not imposed
- Short/clear reference periods
- Avoid question reference

Question Types to be avoided in a Questionnaire

1. Question without objective
   - Each question should have an objective.

Example: The proposed research is to assess the knowledge of respondents on sexually transmitted diseases. If the proposed analytical framework has no consideration of the educational (by discipline) background of the respondent it is futile to ask: "Which subject did you study at university before you joined the recent job?"

2. Complex language
   - The language of the questionnaire should not be complicated to understand. The vocabulary of the respondents should be used in the questionnaire.
   - A simple language is preferred. The use of rhetorical and elite language creates problems while the questionnaire is administered.

Example: Did you realize the complexities of life in a different way by the behavior of your spouse when you were tested positive with HIV/AIDS? Instead, the questions like Do your spouse knows about your HIV positive? (If Yes, Do you find a change in his/her behavior? If Yes, What kind)

3. Ambiguous concepts
   - Ambiguous concepts should not be incorporated into the questions.

Example: What is your opinion about some medical researches that pledge for the high prevalence of transmission of HIV among the elite group of Nepal after the restoration of a multiparty system? This question has three major elements as medical research, HIV transmission, and restoration of multiparty democracy. Elite group and high prevalence are other minor elements. Respondent would not be able to correctly form his/her opinion.

Reference of previous questions: It is extremely not suggested to ask the questions like "As I asked in Question number 12 above about ….. “. If reference or cue of previous questions is required to recall the answer of respondents by stating full questions and answers to continue the further interview.

Longer and vague reference periods: Reference periods should be clear and preferably shorter. Longer reference period causes recall lapse errors. These errors mislead the research.

For example, after the year of a greater earthquake or in these ten years how many times did you visit the health post for antenatal check-ups? Instead “ How many times did you visit health post for a check-up during the period of your last pregnancy (or three months)?

Questions with calculations:

- As far as possible, avoid all calculation seeking questions. Respondents do hesitate to calculate and there is always the possibility of receiving wrong answers.
- Respondents who can not calculate also give wrong answers to hide their ignorance and who can, they also have a tendency of wrong calculation to exhibit their confidence in calculations.

Example: What percent of your income is spent on the treatment? Instead, use “What is your monthly income?” as a preceding question of “How much do you spend in your treatment?” and calculation should be performed in the data processing and analysis phase.

- Do not give strains to the respondents.

Double negative (Double-barrelled):

- Double negatives must be avoided in the language of the question.
- Double negative gives positive meaning but sounds like negation to the statement. It also creates confusion for the interviewers and respondents.

Example: ”Do not you want to move from this place not to expose yourself?” Instead, “Do you want to move from this place to hide?” would be better.

Two in one Questions:

- Merging of two questions into one should be completely avoided.
- Such merging often confuses the respondent and according to the cognitive capacity, some respondents serve answers to the latter and some to the former.
- No, all respondents provide answers to both parts.

Example: When did you visit your spouse and how many nights did you spend there? There are clearly 2 questions and they are to be segregated.

Leading and embarrassing questions (Wording, Leading and threatening):

- Leading and embarrassing questing should be biased.
- People feel offensive to answer these questions.
- Such questions also lead towards biased answers, therefore these are to be avoided.

Example: Don't you agree that persons with HIV positive have also rights to marry? Or suppose, you are suffering from HIV positive, should not you have the right to marry? Such types of questions insist the respondent provide answers that match the positive or negative tone of the question itself.

IMPLEMENTATION OR ADMINISTRATION OF THE QUESTIONNAIRE

Questionnaires

Many of the same principles that are relevant to the design of forms for data input are important here as well. Although the intent of the questionnaire is to gather information on attitudes, beliefs, behavior, and characteristics whose impact may substantially alter users' work, respondents are not always motivated to respond.

Remember that organizational members as a whole tend to receive too many surveys, many of which are often ill-conceived and trivial.

A well-designed, relevant questionnaire can help overcome some of this resistance to respond.

Here are some rules for designing a good questionnaire:

1. Allow ample white space.
2. Allow ample space to write or type in responses.
3. Make it easy for respondents to clearly mark their answers.
4. Be consistent in style.

When you design questionnaires for the Web, apply the same rules you use when designing paper questionnaires. Most software packages allow you to insert one of the commonly used data entry formats shown in the figure illustrated below. Following the four guidelines should help you gain a better response rate to the questionnaire.

QUESTION ORDER. There is no best way to order questions on the questionnaire. Once again, as you order questions, you must think about your objectives in using the questionnaire and then determine the function of each question in helping you to achieve your objectives. It is also important to see the questionnaire through the respondent's eyes. Some guidelines for ordering questions are:

1. Place questions that are important to respondents first.
2. Cluster items of similar content together.
3. Introduce less controversial questions first.

You want respondents to feel as unthreatened by and interested in the questions being asked as possible, without getting overwrought about a particular issue.

Administering Questionnaires

RESPONDENTS. Deciding who will receive the questionnaire is handled in conjunction with the task of setting up objectives for its results. Sampling, helps the systems analyst to determine what sort of representation is necessary and hence what kind of respondents should receive the questionnaire.

Recipients are often chosen as representative because of their rank, length of service with the company, job duties, or special interest in the current or proposed system. Be sure to include enough respondents to allow for a reasonable sample in the event that some questionnaires are not returned or some response sheets are incorrectly completed and thus must be discarded.

Methods Of Administering The Questionnaire. The systems analyst has several options for administering the questionnaire, and the choice of administration method is often determined by the existing business situation. Options for administering the questionnaire include the following:

1. Convening all concerned respondents together at one time.
2. Personally handing out blank questionnaires and taking back completed ones.
3. Allowing respondents to self-administer the questionnaire at work and drop it in a centrally located box.
4. Mailing questionnaires to employees at branch sites and supplying a deadline, instructions, and return postage.
5. Administering the questionnaire electronically either via email or on the Web.

Each of these five methods has advantages and disadvantages. Most commonly, respondents are allowed to self-administer the questionnaire. Response rates with this method are a little lower than with the other methods, because people may forget about the form, lose it, or purposely ignore it. Self-administration, however, allows people to feel that their anonymity is ensured and may result in less guarded answers from some respondents. Both email and Web surveys fall into the category of self-administered questionnaires.

Administering the questionnaire electronically, either via email or posted on the Web, is one way to quickly reach current system users. Costs of duplication are minimized. In addition, responses can be made at the convenience of the respondent and then can be automatically collected and stored electronically. Some software permits respondents to begin answering a survey, save their answers, and return to it for completion if they are interrupted. Reminders to respondents can be easily and inexpensively sent via email, as can notifications to the analyst about when the respondent has opened the email. Some software now turns email data into data tables for use in spreadsheet or statistical analysis software.

Research shows that respondents are willing to answer questions about highly sensitive matters via the Internet. Thus, questions that may be difficult to pose in person regarding systems problems may be acceptable to ask on a Web survey.

USE OF QUESTIONNAIRE IN RESEARCH IN SOCIAL SCIENCES

A questionnaire is a research instrument consisting of a series of questions for the purpose of gathering information from respondents. Questionnaires can be thought of as a kind of written interview. They can be carried out face to face, by telephone, computer or post.

Questionnaires provide a relatively cheap, quick and efficient way of obtaining large amounts of information from a large sample of people.

Data can be collected relatively quickly because the researcher would not need to be present when the questionnaires were completed. This is useful for large populations when interviews would be impractical.

However, a problem with questionnaires is that respondents may lie due to social desirability. Most people want to present a positive image of themselves and so may lie or bend the truth to look good, e.g., pupils would exaggerate revision duration.

Questionnaires can be an effective means of measuring the behavior, attitudes, preferences, opinions and, intentions of relatively large numbers of subjects more cheaply and quickly than other methods.

Often a questionnaire uses both open and closed questions to collect data. This is beneficial as it means both quantitative and qualitative data can be obtained.

Closed Questions

Closed questions structure the answer by only allowing responses which fit into pre-decided categories.

Data that can be placed into a category is called nominal data. The category can be restricted to as few as two options, i.e., dichotomous (e.g., 'yes' or 'no,' 'male' or 'female'), or include quite complex lists of alternatives from which the respondent can choose (e.g., polytomous).

Closed questions can also provide ordinal data (which can be ranked). This often involves using a continuous rating scale to measure the strength of attitudes or emotions.

For example, strongly agree / agree / neutral / disagree / strongly disagree / unable to answer.

Closed questions have been used to research type A personality (e.g., Friedman & Rosenman, 1974), and also to assess life events which may cause stress (Holmes & Rahe, 1967), and attachment (Fraley, Waller, & Brennan, 2000).

Strengths

- They can be economical. This means they can provide large amounts of research data for relatively low costs. Therefore, a large sample size can be obtained which should be representative of the population, which a researcher can then generalize from.
- The respondent provides information which can be easily converted into quantitative data (e.g., count the number of 'yes' or 'no' answers), allowing statistical analysis of the responses.
- The questions are standardized. All respondents are asked exactly the same questions in the same order.

This means a questionnaire can be replicated easily to check for reliability. Therefore, a second researcher can use the questionnaire to check that the results are consistent.

Limitations

- They lack detail. Because the responses are fixed, there is less scope for respondents to supply answers which reflect their true feelings on a topic.

Open Questions

Open questions allow people to express what they think in their own words. Open-ended questions enable the respondent to answer in as much detail as they like in their own words.

For example: "can you tell me how happy you feel right now?"

If you want to gather more in-depth answers from your respondents, then open questions will work better. These give no pre-set answer options and instead allow the respondents to put down exactly what they like in their own words.

Open questions are often used for complex questions that cannot be answered in a few simple categories but require more detail and discussion.

Lawrence Kohlberg presented his participants with moral dilemmas. One of the most famous concerns a character called Heinz who is faced with the choice between watching his wife die of cancer or stealing the only drug that could help her.

Participants were asked whether Heinz should steal the drug or not and, more importantly, for their reasons why upholding or breaking the law is right.

Strengths

- Rich qualitative data is obtained as open questions allow the respondent to elaborate on their answer. This means the research can find out why a person holds a certain attitude.

Limitations

- Time-consuming to collect the data. It takes longer for the respondent to complete open questions. This is a problem as a smaller sample size may be obtained.
- Time-consuming to analyze the data. It takes longer for the researcher to analyze qualitative data as they have to read the answers and try to put them into categories by coding, which is often subjective and difficult. However, Smith (1992) has devoted an entire book to the issues of thematic content analysis the includes 14 different scoring systems for open-ended questions.
- Not suitable for less educated respondents as open questions require superior writing skills and a better ability to express one's feelings verbally.

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Schedule

A schedule is a structure of a set of questions on a given topic which are asked by the interviewer or investigator personally. The order of questions, the language of the questions and the arrangement of parts of the schedule are not changed. However, the investigator can explain the questions if the respondent faces any difficulty. It contains direct questions as well as questions in tabular form.

Schedule include open-ended questions and close-ended questions. Open-ended questions allow the respondent considerable freedom in answering. However, questions are answered in details.

Close-ended questions have to be answered by the respondent by choosing an answer from the set of answers given under a question just by ticking.

Following are the different types of schedules used by social scientists and anthropologists.

- *Village or community schedule:* It is used by census researchers who collect general information on populations, occupations, etc.
- *Family or Household schedule:* It gives full demographic details of households, the status of individuals, data on education, age, family relations, etc.
- *Opinion or attitude schedule:* To schedule the views of the population regarding an issue.

Questionnaire in Research Methodology

A questionnaire refers to a device for securing answers to questions by using a form which the respondent fills in by himself. It consists of some questions printed or typed in a definite order. These forms are actually mailed to the respondent who was expected to read and understand the questions and reply to them by writing the relevant answers in the spaces provided. Ideally, speaking respondent must answer to a verbal stimulus and give a written or verbal response. It is totally devoid of any table. Its purpose is to collect information from the respondents who are scattered over a vast area.

Questionnaires include open-ended questions and close-ended questions. Open-ended questions allow the respondent considerable freedom in answering. However, questions are answered in details. Close-ended questions have to be answered by the respondent by choosing an answer from the set of answers given under a question just by ticking.

Following are the different types of Questionnaire used by social scientists and anthropologists.

- *Structured questionnaire:* It includes definite, concrete and pre-obtained questions which were prepared in advance.
- *Closed-form questionnaire:* It is used when categorized data is required.
- *Pictorial questionnaire:* It is used to promote interest in answering after seeing the pictures on a particular theme.
- *Unstructured questionnaire:* Designed to obtained viewpoints, opinions, attitudes and to show relationships and interconnections between data which might escape notice under more mechanical types of interrogations.

A schedule, however, takes more time as compared to a questionnaire. A questionnaire has less data collecting ability than a schedule. A questionnaire can cover a very wide field of data whereas a schedule is a problem-oriented data collecting method. A questionnaire takes for itself and is self-explanatory, whereas schedule has to be explained by the investigator.

Similarities between Schedule and Questionnaire

- Both are set of related items having questions relating to a central problems.
- Both use mainly structured questions and these questions are so phased and interlocked that they have a built in mechanism for testing the reliability and validity of the response.
- In both the same set of questions is administered to all the respondents and comparable results are obtained.
- Both these instruments has to be used with the same general principles of designs and have to take into account the same problems and basic difficulties they have to be limited in lend.
- In both, the central problem has to be concentrated upon the following considerations involved in the problem of evolving the questionnaire and a schedule as a unit. 1.Drawing the responding into a situation through awake and interest. 2.Proceeding from simple to complex questions. 3.No early and sudden request for information of a personal and embracing intimate nature. 4.Not asking embarrassing questions without giving the respondent an opportunity to explain himself. 5.Moving smoothly from one item to another.
- In both certain types of questions have to be eliminated such as vague and ambiguous questions, emotionally changed questions, loaded and leading questions, questions eliciting no response and questions having structured response to the queries, violence to the existing facts.
- In both pilot studies and pre-tests are necessary for formulating the instrument and for bringing them to the final form. They have to go through the same stages of development.

MEANING

The schedule is a proforma which contains a list of questions filled by the research workers or enumerators, specially appointed for the purpose of data collection. Enumerators go to the informants with the schedule, and ask them the questions from the set, in the sequence and record the replies in the space provided. There are certain situations, where the schedule is distributed to the respondents, and the enumerators assist them in answering the questions.

Enumerators play a major role in the collection of data, through schedules. They explain the aims and objects of the research to the respondents and interpret the questions to them when required. This method is little expensive as the selection, appointment and training of the enumerators require a huge amount. It is used in case of extensive enquiries conducted by the government agencies, big organisations. Most common example of data collection through schedule is population census.

Meaning of Scheduling

Scheduling is the process of prescribing "When" each operation in a production process is to be executed. According to Kimball and Kimball, Scheduling is "The determination of time that is required to perform each operation and also the time required to perform the entire series of operations as routed."

Thus scheduling can be termed as:

(i) A detail of when and where each operation in the a manufacturing process is to be performed or executed.

(ii) Establishment of an activity time table which gives at which time to start and/or finish each event or operation comprising any procedure or process.

OBJECTIVES OF SCHEDULE

The fundamental objective of scheduling is to arrange the manufacturing activities in such a way that the cost of production is minimized and the goods produced are delivered on due dates.

In general scheduling meets the following objectives:

(i) In order to meet the delivery dates the sequence of operations is properly planned.

(ii) To have minimum total time of production by having better resources utilisation.

(iii) For having maximum capacity utilization and reducing the labour cost by minimization of idleness of machines and manpower.

(iv) To avoid unbalanced allocation of work among the various departments and workstations.

Factors Affecting Scheduling

Scheduling finalizes the planning phase of P.P.C. The following factors affect production scheduling and are to be considered before finalising the scheduling plan.

External Factors

These are the factors which are not within the control of the organisation's management. They are dictated by the outside forces to which the management adjusts.

Such important factors are as follows:

(i) Customer's demand: This demand is estimated by the sales forecasting deptt. Scheduling is based on the forecasts of the expected sales of specific products in the continuous production. The forecast is made on the basis of expected volume of business in case of intermittent production.

(ii) Delivery dates of customer's: In a continuous or mass production with seasonal demand, the scheduling should be decided in such a way that there is a balanced production throughout the year reducing the stock of inventories with a constant level of production. In case of the intermittent production with the seasonal demand, it may be adjusted by giving delivery on agreeable delivery dates to the consumer orders.

(iii) Stock of goods already lying with dealers and retailers: This situation arises in case of continuous production of standardized goods. Usually the dealers and retailers are maintaining certain stock levels with them. The scheduling should be based on the stock position with the retailers and dealers.

TYPES OF SCHEDULES

Internal Factors

The factors within the control of management should be manipulated in such a way that objectives of the production function can be achieved most efficiently and economically.

Some important such factors are as follows:

1. Stock of Finished Products with the Enterprise: Where the production is made to stock, the scheduling should be adjusted to the stock of finished products with the dealers. The new sales forecast should be made and the scheduling should be done in the light of the fluctuations in the stock holding.
2. Time Interval to Process Finished Products from Raw Material: This is the time required to process every sub assembly, and the finished product from the raw materials.
3. Availability of Machines and Equipment: The various machines and equipment have varying production capacities. Moreover their occupancy scheduling can be prepared with the help of machine load charts.
4. Availability of Manpower: The scheduling should be done in the light of the availability of the manpower. The production rush should be adjusted to overtime working or hiring of the temporary labour.
5. Availability of Materials: Sometimes stock out conditions interrupts the production flow. Proper stock levels should

be maintained to facilitate scheduling in continuous production. In case of probable stock out of strategic goods, extra efforts should be made to procure them as far as possible and the limited stock in hand should be issued only for critical operations.

6. Manufacturing Facilities: The manufacturing facilities in terms of power requirements, material handling services, store keeping and such other facilities should be provided in accurate quantities so that it may not affect the smooth production flow adversely and facilitate the scheduling function.
7. Feasibility of Economic Production Runs: Under the economic lot production, the two costs i.e. set up cost and the carrying cost are equated.
8. Types of Manufacturing a Product: This determines the proper scheduling procedure.

The difference is as follows:

(a) Lot Manufacture: In this case product is manufactured in lots or on job orders. It can be further divided as follows:

(i) Manufacturing to Order: Whenever orders go through the shops for separate parts, in single or multiple pieces, each part has to pass through many processes. Assembly shall depend on all parts ready at same time. e.g., castings and stampings (finished and unfinished) both requiring assembly.

(ii) Manufacturing to Stock: This is different from the previous one principally in that very large number of pieces is involved, so it is more convenient to produce large quantities and put them into stock to be used for assembly as required. Parts are produced through separate lots at predetermined intervals over a period. In this case assembly is an independent operation and can run as long as parts are available in stock.

(b) Continuous/Mass Manufacture: The case may be for single product, multiproduct or assembly product continuous manufacture. In single product, it goes through a series of processes without assembly. Output is usually calculated in weeks or months instead of by orders. The only change can be increase or decrease in output as demand indicates.

In the multi- or assembly-product manufacture, parts rather more important parts are produced continuously, each operation having a given output per-day, all being proportionately increased or decreased as indicated by demand.

As far as scheduling is concerned this is equivalent to several streams of continuous manufacture sub assembly, assembly and simultaneous final products increase or decrease with the output of the parts/components.

Components of Scheduling

Starting from the customer's orders to delivery of finished products, the schedule cycle may be divided into following steps. Every step shall require some time which may vary from order to order. These steps will occur in the beginning in case of the standardized production processes, but may be modified whenever there is a change in design, processing, procurement or sales volume.

Preliminaries to Manufacture

(a) Credit Checking Period: This is very little for well-established customers and well-known companies.

(b) Time for Preparing Production Order by Sales Deptt: It consists of expressing and rewriting the orders into production orders with some identifying number, shipping date and authorizing the manufacturing deptt to proceed with production.

(c) Time for Engineering Department: The manufacturing department and the engineering department will concurrently receive a copy of production order and if necessary will proceed with the design, drafting, specification and bill of materials etc.

Time Consumed in Production Planning

The production control department is to determine the shipping date by fitting the work into the current plant manufacturing schedule. Too liberal or tight schedules should be avoided. Practically it is difficult to predict the actual course of events, but good approximation will help in establishing various allowances.

Time taken by planning department for processing and onward transmission of the order to the production department is known as production planning time. By overlapping the activities of various departments much time can be saved.

Procurement Cycle Time

Procurement cycle time is the time consumed for receiving, inspection of various raw materials and purchased components parts. The activities of ordering, raw materials or parts, their inspection and deliveries may be simultaneous, only the largest time among these should be considered.

Time for Storage of Raw Materials

The time between the receiving of the raw material and its delivery for production purposes is known as raw material storage time.

Tooling Time

The delivery dates may be delayed due to non-availability of tooling such as jigs, fixtures and other tools. Thus these require planning well in advance by the methods engineering department.

When the procurement for materials or parts is started, the design and manufacture or purchase of materials should also start. The availability of tools should be ascertained before they are put on the job.

Processing Cycle Time in Factory

The factory processing requires planning and scheduling which should give the shortest cycle time commensurate with existing load and most economic utilization of available equipment capacity.

Most of the processes are of over lapping nature as they are scheduled according to (i) the available and open machine capacity (ii) time when materials can be obtained (iii) sequence in which parts are required and (iv) coordination of sub assembly and assembly programme. The schedule will provide the net overall processing time beginning with the first part to the finish of last. Thus the net factory time may be determined by subtracting the overlap time if any.

Time for Storage of Components/Parts

This will be considered only if parts are manufactured in advance of schedule and must wait for their turn for assembly or assembly in the store.

Transit Time

The time consumed in moving the work between various departments. It must be taken into scheduling.

Sub-Assembly Time

In most cases it over laps with factory processes.

Final Assembly, Testing and Shipping Time

Final testing time of the assembly can be calculated by totalling the time taken by each unit of product in testing. Most of the times, units are inspected in groups. The net time from beginning to finish is the time to be included in the schedule. In case of packing and shipping one unit, the time consumed for this purpose should be taken into consideration.

Scheduling Procedure

Scheduling normally starts with the master schedule typical form of which i.e. the master schedule of a milling machine is shown following figure as described in the example. A master schedule resembles control office which completes information regarding all the orders in hand. Master schedule is a weekly breakdown of the production requirements. The total capacity in any week can be calculated.

As the orders are received, depending upon their delivery dates they are recorded on the master schedule. When the shop capacity is full for the concerned week newly acquired orders are carried to next week and so on. So a master schedule is continuously updated, it tells the running total of master schedule is basis for further scheduling techniques.

Scheduling Procedure for Different Types of Production

The scheduling procedure varies from plant to plant and with type of production.

The following are different cases:

1. For Intermittent Production: It involves the following:

(a) Scheduling within the Order: Relative dates at which each process on each component or lot shall be started or finished is essential to be determined so as to fit it in other orders.

(b) Scheduling of Order in Relation to Other Orders: In stock manufacturing this will depend upon the relative dates at which each component should be completed for stock, whereas in case of customer production. This will depend upon delivery date of order. Sequence of order to be assigned to each machine can be determined.

(c) Scheduling to Machine: With the required completion date for an order, reference to a schedule of relative processing dates will show when each process should be initiated. Reference to machine load records will provide the nearest available date for starting. When all processes on all parts or lots have been assigned to machines, scheduling is complete.

In custom order production, in the absence of rush orders, scheduling is very easy. In situations like this, company must have at hand the exact load data to make detailed, accurate schedule for keeping a tight production control to meet the delivery commitments. In production to stock, manufacturing is done for stock and control problems are simple.

Gantt chart are normally used to give the detailed picture of the load and schedule of departments or plants.

For Continuous Production

In this case scheduling is a simple problem but to coordinate production with sales, inventory levels, purchasing, engineering and financial operations, the careful planning is essential.

In case of single product continuous production, variation in the production can be achieved very easily. In case of assembly product continuous production, scheduling problem increases. In practice owing to the limitation of equipment manpower and materials, it is difficult to achieve completion of all parts when required. This may be due to breakdowns, excessive rejection and inaccuracy of estimates.

CONSTRUCTION OF A SCHEDULE

Questionnaire construction refers to the design of a questionnaire to gather statistically useful information about a given topic. When properly constructed and responsibly administered, questionnaires can provide valuable data about any given subject.

Questionnaires

Questionnaires are frequently used in quantitative marketing research and social research. They are a valuable method of collecting a wide range of information from a large number of individuals, often referred to as respondents.

What is often referred to as "adequate questionnaire construction" is critical to the success of a survey. Inappropriate questions, incorrect ordering of questions, incorrect scaling, or a bad questionnaire format can make the survey results valueless, as they may not accurately reflect the views and opinions of the participants.

Different methods can be useful for checking a questionnaire and making sure it is accurately capturing the intended information. Initial advice may include:

- consulting subject-matter experts
- using questionnaire construction guidelines to inform drafts, such as the Tailored Design Method, or those produced by National Statistical Organisations.

Empirical tests also provide insight into the quality of the questionnaire. This can be done by:

- conducting cognitive interviewing. By asking a sample of potential-respondents about their interpretation of the questions and use of the questionnaire, a researcher can
- carrying out a small pretest of the questionnaire, using a small subset of target respondents. Results can inform a researcher of errors such as missing questions, or logical and procedural errors.
- estimating the measurement quality of the questions. This can be done for instance using test-retest, quasi-simplex, or mutlitrait-multimethod models.
- predicting the measurement quality of the question. This can be done using the software Survey Quality Predictor (SQP).

Types of questions

- Closed-ended questions – Respondents' answers are limited to a fixed set of responses.
    - o Yes/no questions – The respondent answers with a "yes" or a "no".
    - o Multiple choice – The respondent has several option from which to choose.
    - o Scaled questions – Responses are graded on a continuum (e.g.: rate the appearance of the product

on a scale from 1 to 10, with 10 being the most preferred appearance). Examples of types of scales include the Likert scale, semantic differential scale, and rank-order scale.

- o Matrix questions – Identical response categories are assigned to multiple questions. The questions are placed one under the other, forming a matrix with response categories along the top and a list of questions down the side. This is an efficient use of page space and the respondents' time.

- Open-ended questions – No options or predefined categories are suggested. The respondent supplies their own answer without being constrained by a fixed set of possible responses. Examples include:
  - o Completely unstructured – For example, "What is your opinion on questionnaires?"
  - o Word association – Words are presented and the respondent mentions the first word that comes to mind.
  - o Sentence completion – Respondents complete an incomplete sentence. For example, "The most important consideration in my decision to buy a new house is..."
  - o Story completion – Respondents complete an incomplete story.
  - o Picture completion – Respondents fill-in an empty speech balloon.
  - o Thematic apperception test – Respondents explain a picture or create a story about what they think is happening in the picture.
- Contingency question – A question that is answered only if the respondent gives a particular response to a previous question. This avoids asking questions of people that do not apply to them (for example, asking men if they have ever been pregnant).

What is a Construction Schedule?

A construction schedule is an entire blueprint of how a project will be executed and by when. A construction schedule outlines project timeframes/ milestones and tracks project progress to keep everything on-time and on-budget. It's the backbone of any thriving project management for construction.

A construction schedule includes:

- Project deliverables
- Resource management
- Asset allocations
- Tasks required to finish construction
- Dependencies between different tasks
- Construction deadlines and task durations
- Budget and costing of involved parts

Construction schedules are periodically assessed by project managers to make sure that the construction is going as plan and will be completed within the set timeframe.

Even though creating a construction schedule can be time-consuming, it can significantly help you avoid issues, give you a sense of direction, and enable you to manage project resources.

15

Data Processing

This chapter concerns research on collecting, representing, and analyzing the data that underlie behavioral and social sciences knowledge. Such research, methodological in character, includes ethnographic and historical approaches, scaling, axiomatic measurement, and statistics, with its important relatives, econometrics and psychometrics. The field can be described as including the self-conscious study of how scientists draw inferences and reach conclusions from observations. Since statistics is the largest and most prominent of methodological approaches and is used by researchers in virtually every discipline, statistical work draws the lion's share of this chapter's attention.

Problems of interpreting data arise whenever inherent variation or measurement fluctuations create challenges to understand data or to judge whether observed relationships are significant, durable, or general. Some examples: Is a sharp monthly (or yearly) increase in the rate of juvenile delinquency (or unemployment) in a particular area a matter for alarm, an ordinary periodic or random fluctuation, or the result of a change or quirk in reporting method?

Do the temporal patterns seen in such repeated observations reflect a direct causal mechanism, a complex of indirect ones, or just imperfections in the data? Is a decrease in auto injuries an effect of a new seat-belt law? Are the disagreements among people describing some aspect of a subculture too great to draw valid inferences about that aspect of the culture?

Such issues of inference are often closely connected to substantive theory and specific data, and to some extent it is difficult and perhaps misleading to treat methods of data collection, representation, and analysis separately. This report does so, as do all sciences to some extent, because the methods developed often are far more general than the specific problems that originally gave rise to them. There is much transfer of new ideas from one substantive field to another—and to and from fields outside the behavioral and social sciences. Some of the classical methods of statistics arose in studies of astronomical observations, biological variability, and human diversity. The major growth of the classical methods occurred in the twentieth century, greatly stimulated by problems in agriculture and genetics. Some methods for uncovering geometric structures in data, such as multidimensional scaling and factor analysis, originated in research on psychological problems, but have been applied in many other sciences. Some time-series methods were developed originally to deal with economic data, but they are equally applicable to many other kinds of data.

EDITING

Data editing

Data editing is defined as the process involving the review and adjustment of collected survey data. Data editing helps define guidelines that will reduce potential bias and ensure consistent estimates leading to a clear analysis of the data set by correct inconsistent data using the methods later in this chapter. The purpose is to control the quality of the collected data. Data editing can be performed manually, with the assistance of a computer or a combination of both.

Editing methods

Editing methods refer to a range of procedures and processes used for detecting and handling errors in data. Data editing is used with the goal to improve the quality of statistical data produced. These modifications can greatly improve the quality of analytics created by aiming to detect and correct errors. Examples of different techniques to data editing such as micro-editing, macro-editing, selective editing, or the different tools used to achieve data editings such as graphical editing and interactive editing.

Interactive editing

The term interactive editing is commonly used for modern computer-assisted manual editing. Most interactive data editing tools applied at National Statistical Institutes (NSIs) allow one to check the specified edits during or after data entry, and if necessary to correct erroneous data immediately. Several approaches can be followed to correct erroneous data:

- Re-contact the respondent
- Compare the respondent's data to his data from the previous year
- Compare the respondent's data to data from similar respondents
- Use the subject matter knowledge of the human editor

Interactive editing is a standard way to edit data. It can be used to edit both categorical and continuous data.

Interactive editing reduces the time frame needed to complete the cyclical process of review and adjustment. Interactive editing also requires an understanding of the data set and the possible results that would come from an analysis of the data.

Selective editing

Selective editing is an umbrella term for several methods to identify the influential errors, and outliers. Selective editing techniques aim to apply interactive editing to a well-chosen subset of the records, such that the limited time and resources available for interactive editing are allocated to those records where it has the most effect on the quality of the final estimates of published figures. In selective editing, data is split into two streams:

- The critical stream
- The non-critical stream

The critical stream consists of records that are more likely to contain influential errors. These critical records are edited in a traditional interactive manner. The records in the non-critical stream which are unlikely to contain influential errors are not edited in a computer-assisted manner.

Data Editing Techniques

Data editing can be accomplished in many ways and primarily depends on the data set that is being explored.

Editing of Data

Editing is the first step in data processing. Editing is the process of examining the data collected in questionnaires/ schedules to detect errors and omissions and to see that they are corrected and the schedules are ready for tabulation. When the whole data collection is over a final and a thorough check up is made. Mildred B. Parten in his book points out that the editor is responsible for seeing that the data are;

1. Accurate as possible,
2. Consistent with other facts secured,
3. Uniformly entered,
4. As complete as possible,
5. Acceptable for tabulation and arranged to facilitate coding tabulation.

There are different types of editing. They are:

1. Editing for quality asks the following questions: are the data forms complete, are the data free of bias, are the recordings free of errors, are the inconsistencies in responses within limits, are there evidences to show dishonesty of enumerators or interviewers and are there any wanton manipulation of data.

2. Editing for tabulation does certain accepted modification to data or even rejecting certain pieces of data in order to facilitate tabulation. or instance, extremely high or low value data item may be ignored or bracketed with suitable class interval.
3. Field Editing is done by the enumerator. The schedule filled up by the enumerator or the respondent might have some abbreviated writings, illegible writings and the like. These are rectified by the enumerator. This should be done soon after the enumeration or interview before the loss of memory. The field editing should not extend to giving some guess data to fill up omissions.
4. Central Editing is done by the researcher after getting all schedules or questionnaires or forms from the enumerators or respondents. Obvious errors can be corrected. For missed data or information, the editor may substitute data or information by reviewing information provided by likely placed other respondents. A definite inappropriate answer is removed and "no answer" is entered when reasonable attempts to get the appropriate answer fail to produce results.

Editors must keep in view the following points while performing their work:

1. They should be familiar with instructions given to the interviewers and coders as well as with the editing instructions supplied to them for the purpose,
2. While crossing out an original entry for one reason or another, they should just draw a single line on it so that the same may remain legible,
3. They must make entries (if any) on the form in some distinctive color and that too in a standardized form,
4. They should initial all answers which they change or supply,
5. Editor's initials and the data of editing should be placed on each completed form or schedule.

CLASSIFICATION

Classification of Data

Classification or categorization is the process of grouping the statistical data under various understandable homogeneous groups for the purpose of convenient interpretation. A uniformity of attributes is the basic criterion for classification; and the grouping of data is made according to similarity. Classification becomes necessary when there is a diversity in the data collected for meaningless for meaningful presentation and analysis. However, it is meaningless in respect of homogeneous data. A good classification should have the characteristics of clarity, homogeneity, equality of scale, purposefulness and accuracy.

Objectives of Classification are below:

1. The complex scattered and haphazard data is organized into concise, logical and intelligible form.
2. It is possible to make the characteristics of similarities and dis – similarities clear.
3. Comparative studies is possible.
4. Understanding of the significance is made easier and thereby good deal of human energy is saved.
5. Underlying unity amongst different items is made clear and expressed.
6. Data is so arranged that analysis and generalization becomes possible.

Classification is of two types, viz., quantitative classification, which is on the basis of variables or quantity and qualitative classification, in which classification according to attributes. The former is the way of, grouping the variables, say, quantifying the variables in cohesive groups, while the latter groups the data on the basis of attributes or qualities. Again, it may be multiple classification or dichotomous classification. The former is the way of making many (more than two) groups on the basis of some quality or attributes while the latter is the classification into two groups on the basis of presence or absence of a certain quality. Grouping the workers of a factory under various income (class intervals) groups come under the multiple classification; and making two groups into skilled workers and unskilled workers is the dichotomous classification. The tabular form of such classification is known as statistical series, which may be inclusive or exclusive.

TRANSCRIPTION

Why use transcription for qualitative data?

Qualitative research is more about exploring an idea or a topic instead of finding specific, concrete, objective answers. Since qualitative research focuses on individuals, groups, and cultures, its data can't be measured with tools like thermometers and scales. Instead, qualitative data is measured with questionnaires, observations, or interviews. All this can make qualitative data more difficult to record and copy compared with quantitative data.

Qualitative researchers are focused on understanding a person's opinion or why people behave in certain ways. This means that researchers may conduct and record focus groups, group discussions, individual interviews, or observations of a person or group of people. They may capture and preserve the resulting data with video or audio recordings.

These interviews and other events create important data. However, that data is usually unstructured and needs to be sorted through and organized before researchers can make sense of it.

This is where qualitative data transcription is incredibly important. Transcription creates a text-based version of any original audio or video recording. Qualitative data transcription provides a good first step in arranging your data systematically and analyzing it.

Transcription is vital for qualitative research because it:

- Puts qualitative data and information into a text-based format

- Makes data easier to analyze and share
- Allows researchers to become more immersed into the data they collect
- Helps researchers create a narrative with their data
- Makes patterns easier to find
- Helps preserve the accuracy and integrity of the data
- Lets researchers focus on their observations instead of worrying about note-taking

Once data is transcribed in a text format, it can be put into a spreadsheet or similar type of document, or entered into a qualitative data analysis tool. After data transcription, a qualitative researcher can read through and annotate the transcriptions, then conceptualize and organize the data to conduct inductive or deductive analysis. From there, it is a lot easier to make connections between different observations or findings, and then write them up in the form of a study, report, or article.

Using Rev Transcription for Qualitative Data Analysis and Research

If you're a researcher, you know how time-consuming each step of the process can be. Qualitative analysis and research involves a lot of hard work that generates a lot of data to be recorded, organized, and analyzed.

If you're looking for any way to shorten or speed up the process without sacrificing the integrity of your research, hiring someone else to transcribe your recordings is vital. Using a professional outside transcription service can help you streamline your process, save time, and ensure that you preserve the quality and usability of the original recordings you capture.

Rev's transcription services not only help you capture more value from your recorded audio and video, but also offer a smooth, easy, online experience. Our human, native English-speaking transcriptionists can capture the details of your interviews, conversations, and observations, so you can put more attention where it's needed. It's easy to get started with Rev transcription:

1. Securely upload files from your computer or paste a URL from the web. Add any notes, like a glossary or speaker names, that you think may help the transcriptionist.
2. Choose your payment method. Rev.com transcription starts at $1.25 per audio minute, although you can add features like verbatim transcription or rush delivery.
3. Let our 50,000+ professionals get started transcribing your files. We promise 99% accuracy or better, 100% guaranteed. You'll get your transcript back as a document you can view and edit with our tools, then share with anyone.

No matter the day of the week, we provide quick transcription turnarounds. Standard delivery is at least 12 hrs for most files under 30 minutes, although the exact time will depend on the length of the recording and the quality of the audio.

Here at Rev, we require our transcriptionists to meet rigorous quality standards before working on customer files. We also have a team of reviewers that works with the transcriptionists to ensure that your files are ready for delivery.

CODING

Coding of Data

Coding is necessary for efficient analysis and through it the several replies may be reduced to a small number of classes which contain the critical information required for analysis. Coding decisions should usually be taken at the designing stage of the questionnaire. This makes it possible to pre-code the questionnaire choices and which in turn is helpful for computer tabulation as one can straight forward key punch from the original questionnaires. But in case of hand coding some standard method may be used. One such standard method is to code in the margin with a colored pencil. The other method can be to transcribe the data from the questionnaire to a coding sheet. Whatever method is adopted, one should see that coding errors are altogether eliminated or reduced to the minimum level.

Coding is the process/operation by which data/responses are organized into classes/categories and numerals or other symbols are given to each item according to the class in which it falls. In other words, coding involves two important operations; (a) deciding the categories to be used and (b) allocating individual answers to them. These categories should be appropriate to the research problem, exhaustive of the data, mutually exclusive and uni – directional Since the coding eliminates much of information in the raw data, it is important that researchers design category sets carefully in order to utilize the available data more fully.

The study of the responses is the first step in coding. In the case of pressing – coded questions, coding begins at the preparation of interview schedules. Secondly, coding frame is developed by listing the possible answers to each question and assigning code numbers or symbols to each of them which are the indicators used for coding. The coding frame is an outline of what is coded and how it is to be coded. That is, a coding frame is an outline of what is coded and how it is to be coded. That is, coding frame is a set of explicit rules and conventions that are used to base classification of observations variable into values which are which are transformed into numbers. Thirdly, after preparing the sample frame the gradual process of fitting the answers to the questions must be begun. Lastly, transcription is undertaken i.e., transferring of the information from the schedules to a separate sheet called transcription sheet. Transcription sheet is a large summary sheet which contain the answer/codes of all the respondents. Transcription may not be necessary when only simple tables are required and the number of respondents are few.

Coding (social sciences)

In the social sciences, coding is an analytical process in which data, in both quantitative form (such as questionnaires results) or qualitative form (such as interview transcripts) are categorized to facilitate analysis.

One purpose of coding is to transform the data into a form suitable for computer-aided analysis. This categorization of information is an important step, for example, in preparing data for computer processing with statistical software. Prior to coding, an annotation scheme is defined. It consists of codes or tags. During coding, coders manually add codes into data where required features are identified. The coding scheme ensures that the codes are added consistently across the data set and allows for verification of previously tagged data. Some studies will employ multiple coders working independently on the same data. This also minimizes the chance of errors from coding and is believed to increase the reliability of data.

Directive

One code should apply to only one category and categories should be comprehensive. There should be clear guidelines for *coders* (individuals who do the coding) so that code is consistent.

Quantitative approach

For quantitative analysis, data is coded usually into measured and recorded as nominal or ordinal variables.

Questionnaire data can be *pre-coded* (process of assigning codes to expected answers on designed questionnaire), *field-coded* (process of assigning codes as soon as data is available, usually during fieldwork), *post-coded* (coding of open questions on completed questionnaires) or *office-coded* (done after fieldwork). Note that some of the above are not mutually exclusive.

In social sciences, spreadsheets such as Excel and more advanced software packages such as R, Matlab, PSPP/SPSS, DAP/SAS, MiniTab and Stata are often used.

Qualitative approach

For disciplines in which a qualitative format is preferential, including ethnography, humanistic geography or phenomenological psychology a varied approach to coding can be applied. Iain Hay (2005) outlines a two-step process beginning with basic coding in order to distinguish overall themes, followed by a more in depth, interpretive code in which more specific trends and patterns can be interpreted.

Much of qualitative coding can be attributed to either grounded or *a priori* coding. Grounded coding refers to allowing notable themes and patterns emerge from the document themselves, where as *a priori* coding requires the researcher to apply pre-existing theoretical frameworks to analyze the documents.

As coding methods are applied across various texts, the researcher is able to apply axial coding, which is the process of selecting core thematic categories present in several documents to discover common patterns and relations.

Coding is considered a process of discovery and is done in cycles. Prior to constructing categories, a researcher might apply a first and second cycle coding methods. There are a multitude of methods available, and a researcher will want to pick one that is suited for the format and nature of their documents. Not all methods can be applied to every type of document. Some examples of first cycle coding methods include:

- *In Vivo Coding*: codes terms and phrases used by the participants themselves. The objective is to attempt to give the participants a voice in the research.
- *Process Coding*: this method uses gerunds ("-ing" words) only to describe and display actions throughout the document. It is useful for examining processes, emotional phases and rituals.
- *Versus Coding*: uses binary terms to describe groups and processes. The goal is to see which processes and organizations are in conflict with each other throughout

the document. These can be both conceptual and grounded objects.

- *Values Coding*: codes that attempt to exhibit the inferred values, attitudes and beliefs of participants. In doing so, the research may discern patterns in world views.
- *Sub-coding*: Other names of this method are embedded coding, nested coding or joint coding. This involves assigning primary and second order codes to a word or phrase. It serves the purpose of adding detail to a code. The primary and secondary codes are often called parent and children codes.
- *Simultaneous Coding:* When same parts of the data have different meanings and two or more codes are applied to the same parts, then this kind of coding is called Simultaneous Coding.

The process can be done manually, which can be as simple as highlighting different concepts with different colours, or fed into a software package. Some examples of qualitative software packages include Atlas.ti, MAXQDA, NVivo, QDA Miner, and RQDA.

After assembling codes it is time to organize them into broader themes and categories. The process generally involves identifying themes from the existing codes, reducing the themes to a manageable number, creating hierarchies within the themes and then linking themes together through theoretical modeling.

Memos

Creating memos during the coding process is integral to both grounded and a priori coding approaches. Qualitative research is inherently reflexive; as the researcher delves deeper into their subject, it is important to chronicle their own thought processes through reflective or methodological memos, as doing so may highlight their own subjective interpretations of data. It is crucial to begin memoing at the onset of research. Regardless of the type of memo produced, what is important is that the process initiates critical thinking and productivity in the research. Doing so will facilitate easier and more coherent analyses as the project draws on. Memos can be used to map research activities, uncover meaning from data, maintaining research momentum and engagement and opening communication.

TABULATION

Tabulation is the process of summarizing raw data and displaying it in compact form for further analysis. Therefore, preparing tables is a very important step. Tabulation may be by hand, mechanical, or electronic. The choice is made largely on the basis of the size and type of study, alternative costs, time pressures, and the availability of computers, and computer programmes. If the number of questionnaire is small, and their length short, hand tabulation is quite satisfactory.

Table may be divided into: (i) Frequency tables, (ii) Response tables, (iii) Contingency tables, (iv) Uni-variate tables, (v) Bi-variate tables, (vi) Statistical table and (vii) Time series tables.

Generally a research table has the following parts: (a) table number, (b) title of the table, (c) caption (d) stub (row heading), (e) body, (f) head note, (g) foot note.

As a general rule the following steps are necessary in the preparation of table:

1. Title of table: The table should be first given a brief, simple and clear title which may express the basis of classification.
2. Columns and rows: Each table should be prepared in just adequate number of columns and rows.
3. Captions and stubs: The columns and rows should be given simple and clear captions and stubs.
4. Ruling: Columns and rows should be divided by means of thin or thick rulings.
5. Arrangement of items; Comparable figures should be arranged side by side.

6. Deviations: These should be arranged in the column near the original data so that their presence may easily be noted.
7. Size of columns: This should be according to the requirement.
8. Arrangements of items: This should be according to the problem.
9. Special emphasis: This can be done by writing important data in bold or special letters.
10. Unit of measurement: The unit should be noted below the lines.
11. Approximation: This should also be noted below the title.
12. Foot – notes: These may be given below the table.
13. Total: Totals of each column and grand total should be in one line.
14. Source : Source of data must be given. For primary data, write primary data.

It is always necessary to present facts in tabular form if they can be presented more simply in the body of the text. Tabular presentation enables the reader to follow quickly than textual presentation. A table should not merely repeat information covered in the text. The same information should not, of course be presented in tabular form and graphical form. Smaller and simpler tables may be presented in the text while the large and complex table may be placed at the end of the chapter or report.

What is the Meaning of Tabulation?

Tabulation refers to the system of processing data or information by arranging it into a table. With tabulation, numeric data is arrayed logically and systematically into columns and rows, to aid in their statistical analysis.

The purpose of tabulation is to present a large mass of complicated information in an orderly fashion and allow viewers to draw reasonable conclusions and interpretations from them.

What are the Essential Parts of a Table?

To tabulate data correctly, one must learn about the eight essential parts of a table. These are as follows –

1. Table Number – This is the first part of a table and is given on top of any table to facilitate easy identification and for further reference.
2. Title of the Table – One of the most important parts of any table, its title is placed on top of the same and narrates its contents. It is imperative that the title be brief, crisp and carefully-worded to describe the tables' contents effectively.
3. Headnote – The headnote of a table is presented in the portion just below the title. It provides information about the unit of data in the table, like "amount in Rupees" or "quantity in kilograms", etc.
4. Column Headings or Captions – Captions are the portion of the table on top of each column which explains the figures under each column.
5. Row Headings or Stubs – The title of each horizontal row is called a stub.
6. Body of a Table – This is the portion that contains the numeric information collected from investigated facts. The data in the body is presented in rows which are read horizontally from left to right and in columns, read vertically from top to bottom.
7. Footnote – Given at the bottom of a table above the source note, a footnote is used to state any fact that is not clear from the table's title, headings, caption or stub.

   For instance, if a table denotes the profit earned by a company, a footnote can be used to state if said profit is earned before or after tax calculations.

8. Source Note – As its name suggests, a source note refers to the source from where the table's information has been collected.

Complex Tabulation

These are the types of tables which represent the division of data into two or more categories based on two or more characteristics. This type of data tabulation can be divided into three types. These are –

i. Two Way Tables – These tables illustrate information collected from two mutually dependent questions. For instance, say that a table has to illustrate the highest population in different states of India. This can be done in a one-way table. But if the population has to be compared in terms of the total number of males and females in each state, it will require a two way table.

ii. Three-Way Table – Like the above mentioned category, three-way tables illustrate information collected from three mutually dependent and inter-related questions.

   Let us take the above example and elaborate on that further with another category added to the table – the position of literacy amongst the male and female population in each state. The tabulation for these categories has to be put down in a three-way table.

iii. Manifold Table – These tables are utilised to illustrate information collected from more than three interrelated questions or characteristics.

What are the Rules of Tabulation?

There are a few general rules that have to be followed while constructing tables. These are –

- Tables illustrated should be self-explanatory. Even though footnotes form a part of tables, they should not be mandatory to explain the meaning of the data presented in a table.

- If the volume of information is substantial, it is best to put them down in multiple tables instead of a single one. This reduces the chances of mistakes and defeats the purpose of forming a table. However, each table formed should also be complete in itself and serve the purpose of analysis.
- The number of rows and columns should be kept minimal to present information in a crisp and concise manner.
- Before tabulating, data should be approximated, wherever necessary.
- Stubs and captions should be self-explanatory and should not require the help of footnotes to be comprehended.
- If certain positions of data collected cannot be tabulated under any stub or captions, they should be put down in a separate table under the heading of miscellaneous.
- Quantity and quality of data should not be compromised under any scenario while forming a table.

These are but a few important rules of tabulation. To learn more about tabulation, its application and importance refer to Vedantu's study material and enrol in our live online classes today!

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Analysis and Interpretation of Data

Data analysis and interpretation is the process of assigning meaning to the collected information and determining the conclusions, significance, and implications of the findings. The steps involved in data analysis are a function of the type of information collected, however, returning to the purpose of the assessment and the assessment questions will provide a structure for the organization of the data and a focus for the analysis.

The analysis of *NUMERICAL (QUANTITATIVE) DATA* is represented in mathematical terms. The most common statistical terms include:

- Mean – The mean score represents a numerical average for a set of responses.
- Standard deviation – The standard deviation represents the distribution of the responses around the mean. It indicates the degree of consistency among the responses. The standard deviation, in conjunction with the mean, provides a better understanding of the data. For example, if the mean is 3.3 with a standard deviation (StD) of 0.4, then two-thirds of the responses lie between 2.9 (3.3 – 0.4) and 3.7 (3.3 + 0.4).
- Frequency distribution – Frequency distribution indicates the frequency of each response. For example,

if respondents answer a question using an agree/disagree scale, the percentage of respondents who selected each response on the scale would be indicated. The frequency distribution provides additional information beyond the mean, since it allows for examining the level of consensus among the data.

Higher levels of statistical analysis (e.g., t-test, factor analysis, regression, ANOVA) can be conducted on the data, but these are not frequently used in most program/project assessments.

The analysis of *NARRATIVE (QUALITATIVE) DATA* is conducted by organizing the data into common themes or categories. It is often more difficult to interpret narrative data since it lacks the built-in structure found in numerical data. Initially, the narrative data appears to be a collection of random, unconnected statements. The assessment purpose and questions can help direct the focus of the data organization. The following strategies may also be helpful when analyzing narrative data.

Focus groups and Interviews:

- Read and organize the data from each question separately. This approach permits focusing on one question at a time (e.g., experiences with tutoring services, characteristics of tutor, student responsibility in the tutoring process).
- Group the comments by themes, topics, or categories. This approach allows for focusing on one area at a time (e.g., characteristics of tutor – level of preparation, knowledge of content area, availability).

Documents: Code content and characteristics of documents into various categories (e.g., training manual – policies and procedures, communication, responsibilities).

Observations: Code patterns from the focus of the observation (e.g., behavioral patterns – amount of time engaged/ not engaged in activity, type of engagement, communication, interpersonal skills).

The analysis of the data via statistical measures and/or narrative themes should provide answers to the assessment questions. Interpreting the analyzed data from the appropriate perspective allows for determination of the significance and implications of the assessment.

Qualitative Data Interpretation

Qualitative data analysis can be summed up in one word – categorical. With qualitative analysis, data is not described through numerical values or patterns, but through the use of descriptive context (i.e., text).

Typically, narrative data is gathered by employing a wide variety of person-to-person techniques. These techniques include:

- Observations: detailing behavioral patterns that occur within an observation group. These patterns could be the amount of time spent in an activity, the type of activity and the method of communication employed.
- Documents: much like how patterns of behavior can be observed, different types of documentation resources can be coded and divided based on the type of material they contain.
- Interviews: one of the best collection methods for narrative data. Enquiry responses can be grouped by theme, topic or category. The interview approach allows for highly-focused data segmentation.

A key difference between qualitative and quantitative analysis is clearly noticeable in the interpretation stage. Qualitative data, as it is widely open to interpretation, must be "coded" so as to facilitate the grouping and labeling of data into identifiable themes. As person-to-person data collection techniques can often result in disputes pertaining to proper analysis, qualitative data analysis is often summarized through three basic principles: notice things, collect things, think about things.

Quantitative Data Interpretation

If quantitative data interpretation could be summed up in one word (and it really can't) that word would be "numerical." There are few certainties when it comes to data analysis, but you can be sure that if the research you are engaging in has no numbers involved, it is not quantitative research. Quantitative analysis refers to a set of processes by which numerical data is analyzed. More often than not, it involves the use of statistical modeling such as standard deviation, mean and median. Let's quickly review the most common statistical terms:

- Mean: a mean represents a numerical average for a set of responses. When dealing with a data set (or multiple data sets), a mean will represent a central value of a specific set of numbers. It is the sum of the values divided by the number of values within the data set. Other terms that can be used to describe the concept are arithmetic mean, average and mathematical expectation.
- Standard deviation: this is another statistical term commonly appearing in quantitative analysis. Standard deviation reveals the distribution of the responses around the mean. It describes the degree of consistency within the responses; together with the mean, it provides insight into data sets.
- Frequency distribution: this is a measurement gauging the rate of a response appearance within a data set. When using a survey, for example, frequency distribution has the capability of determining the number of times a specific ordinal scale response appears (i.e., agree, strongly agree, disagree, etc.). Frequency distribution is extremely keen in determining the degree of consensus among data points.

Typically, quantitative data is measured by visually presenting correlation tests between two or more variables of significance. Different processes can be used together or separately, and comparisons can be made to ultimately arrive at a conclusion. Other signature interpretation processes of quantitative data include:

- Regression analysis
- Cohort analysis
- Predictive and prescriptive analysis

Now that we have seen how to interpret data, let's move on and ask ourselves some questions: what are some data interpretation benefits? Why do all industries engage in data research and analysis? These are basic questions, but that often don't receive adequate attention.

ANALYSIS OF DATA

Data analysis is a process of inspecting, cleansing, transforming, and modelling data with the goal of discovering useful information, informing conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, and is used in different business, science, and social science domains. In today's business world, data analysis plays a role in making decisions more scientific and helping businesses operate more effectively.

Data mining is a particular data analysis technique that focuses on statistical modelling and knowledge discovery for predictive rather than purely descriptive purposes, while business intelligence covers data analysis that relies heavily on aggregation, focusing mainly on business information. In statistical applications, data analysis can be divided into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA). EDA focuses on discovering new features in the data while CDA focuses on confirming or falsifying existing hypotheses. Predictive analytics focuses on the application of statistical models for predictive forecasting or classification, while text analytics applies statistical, linguistic, and structural techniques to extract and classify information from textual sources, a species of unstructured data. All of the above are varieties of data analysis.

Data integration is a precursor to data analysis, and data analysis is closely linked to data visualization and data dissemination.

The process of data analysis

Analysis, refers to dividing a whole into its separate components for individual examination. *Data analysis*, is a process for obtaining raw data, and subsequently converting it into information useful for decision-making by users. *Data*, is collected and analyzed to answer questions, test hypotheses, or disprove theories.

Statistician John Tukey, defined data analysis in 1961, as:

"Procedures for analyzing data, techniques for interpreting the results of such procedures, ways of planning the gathering of data to make its analysis easier, more precise or more accurate, and all the machinery and results of (mathematical) statistics which apply to analyzing data."

There are several phases that can be distinguished, described below. The phases are iterative, in that feedback from later phases may result in additional work in earlier phases. The CRISP framework, used in data mining, has similar steps.

Data requirements

The data is necessary as inputs to the analysis, which is specified based upon the requirements of those directing the analysis or customers (who will use the finished product of the analysis). The general type of entity upon which the data will be collected is referred to as an experimental unit (e.g., a person or population of people). Specific variables regarding a population (e.g., age and income) may be specified and obtained. Data may be numerical or categorical (i.e., a text label for numbers).

Data collection

Data is collected from a variety of sources. The requirements may be communicated by analysts to custodians of the data; such as, Information Technology personnel within an organization. The data may also be collected from sensors in the environment, including traffic cameras, satellites, recording devices, etc. It may also be obtained through interviews, downloads from online sources, or reading documentation.

Data processing

Data, when initially obtained, must be processed or organized for analysis. For instance, these may involve placing data into rows and columns in a table format (*known as* structured data) for further analysis, often through the use of spreadsheet or statistical software.

Data cleaning

Once processed and organized, the data may be incomplete, contain duplicates, or contain errors. The need for *data cleaning* will arise from problems in the way that the datum are entered and stored. Data cleaning is the process of preventing and correcting these errors. Common tasks include record matching, identifying inaccuracy of data, overall quality of existing data, deduplication, and column segmentation.

Such data problems can also be identified through a variety of analytical techniques. For example; with financial information, the totals for particular variables may be compared against separately published numbers that are believed to be reliable. Unusual amounts, above or below predetermined thresholds, may also be reviewed.

There are several types of data cleaning, that are dependent upon the type of data in the set; this could be phone numbers, email addresses, employers, or other values. Quantitative data methods for outlier detection, can be used to get rid of data that appears to have a higher likelihood of being input incorrectly. Textual data spell checkers can be used to lessen the amount of mis-typed words. However, it is harder to tell if the words themselves are correct.

Exploratory data analysis

Once the datasets are cleaned, it can then be analyzed. Analysts may apply a variety of techniques, referred to as exploratory data analysis, to begin understanding the messages contained within the obtained data. The process of data exploration may result in additional data cleaning or additional requests for data; thus, the initialization of the *iterative phases* mentioned in the lead paragraph of this section. Descriptive statistics, such as, the average or median, can be generated to aid in understanding the data. Data visualization is also a technique used, in which the analyst is able to examine the data in a graphical format in order to obtain additional insights, regarding the messages within the data.

Modelling and algorithms

Mathematical formulas or models (known as algorithms), may be applied to the data in order to identify relationships among the variables; for example, using correlation or causation. In general terms, models may be developed to evaluate a specific variable based on other variable(s) contained within the dataset, with some *residual error* depending on the implemented model's accuracy (*e.g.*, Data = Model + Error).

Inferential statistics, includes utilizing techniques that measure the relationships between particular variables. For example, regression analysis may be used to model whether a change in advertising (*independent variable X*), provides an explanation for the variation in sales (*dependent variable Y*). In mathematical terms, Y (sales) is a function of X (advertising). It may be described as ($Y = aX + b$ + error), where the model is designed such that (a) and (b) minimize the error when the model predicts Y for a given range of values of X. Analysts may also attempt to build models that are descriptive of the data, in an aim to simplify analysis and communicate results.

Data product

A data product is a computer application that takes *data inputs* and generates *outputs*, feeding them back into the environment. It may be based on a model or algorithm. For instance, an application that analyzes data about customer purchase history, and uses the results to recommend other purchases the customer might enjoy.

Communication

Once data is analyzed, it may be reported in many formats to the users of the analysis to support their requirements. The users may have feedback, which results in additional analysis. As such, much of the analytical cycle is iterative.

When determining how to communicate the results, the analyst may consider implementing a variety of data visualization techniques to help communicate the message more clearly and efficiently to the audience. Data visualization uses information displays (graphics such as, tables and charts) to help communicate key messages contained in the data. Tables are a valuable tool by enabling the ability of a user to query and focus on specific numbers; while charts (e.g., bar charts or line charts), may help explain the quantitative messages contained in the data.

Quantitative messages

Stephen Few described eight types of quantitative messages that users may attempt to understand or communicate from a set of data and the associated graphs used to help communicate the message. Customers specifying requirements and analysts performing the data analysis may consider these messages during the course of the process.

1. Time-series: A single variable is captured over a period of time, such as the unemployment rate over a 10-year period. A line chart may be used to demonstrate the trend.

2. Ranking: Categorical subdivisions are ranked in ascending or descending order, such as a ranking of sales performance (the *measure*) by salespersons (the *category*, with each salesperson a *categorical subdivision*) during a single period. A bar chart may be used to show the comparison across the salespersons.
3. Part-to-whole: Categorical subdivisions are measured as a ratio to the whole (i.e., a percentage out of 100%). A pie chart or bar chart can show the comparison of ratios, such as the market share represented by competitors in a market.
4. Deviation: Categorical subdivisions are compared against a reference, such as a comparison of actual vs. budget expenses for several departments of a business for a given time period. A bar chart can show the comparison of the actual versus the reference amount.
5. Frequency distribution: Shows the number of observations of a particular variable for a given interval, such as the number of years in which the stock market return is between intervals such as 0–10%, 11–20%, etc. A histogram, a type of bar chart, may be used for this analysis.
6. Correlation: Comparison between observations represented by two variables (X,Y) to determine if they tend to move in the same or opposite directions. For example, plotting unemployment (X) and inflation (Y) for a sample of months. A scatter plot is typically used for this message.
7. Nominal comparison: Comparing categorical subdivisions in no particular order, such as the sales volume by product code. A bar chart may be used for this comparison.
8. Geographic or geospatial: Comparison of a variable across a map or layout, such as the unemployment rate by state or the number of persons on the various floors of a building. A cartogram is a typical graphic used.

Techniques for analyzing quantitative data

Author Jonathan Koomey has recommended a series of best practices for understanding quantitative data. These include:

- Check raw data for anomalies prior to performing an analysis;
- Re-perform important calculations, such as verifying columns of data that are formula driven;
- Confirm main totals are the sum of subtotals;
- Check relationships between numbers that should be related in a predictable way, such as ratios over time;
- Normalize numbers to make comparisons easier, such as analyzing amounts per person or relative to GDP or as an index value relative to a base year;
- Break problems into component parts by analyzing factors that led to the results, such as DuPont analysis of return on equity.

For the variables under examination, analysts typically obtain descriptive statistics for them, such as the mean (average), median, and standard deviation. They may also analyze the distribution of the key variables to see how the individual values cluster around the mean.

The consultants at McKinsey and Company named a technique for breaking a quantitative problem down into its component parts called the MECE principle. Each layer can be broken down into its components; each of the sub-components must be mutually exclusive of each other and collectively add up to the layer above them. The relationship is referred to as "Mutually Exclusive and Collectively Exhaustive" or MECE. For example, profit by definition can be broken down into total revenue and total cost. In turn, total revenue can be analyzed by its components, such as the revenue of divisions A, B, and C (which are mutually exclusive of each other) and should add to the total revenue (collectively exhaustive).

Analysts may use robust statistical measurements to solve certain analytical problems. Hypothesis testing is used when a particular hypothesis about the true state of affairs is made by the analyst and data is gathered to determine whether that state of affairs is true or false. For example, the hypothesis might be that "Unemployment has no effect on inflation", which relates to an economics concept called the Phillips Curve. Hypothesis testing involves considering the likelihood of Type I and type II errors, which relate to whether the data supports accepting or rejecting the hypothesis.

Regression analysis may be used when the analyst is trying to determine the extent to which independent variable X affects dependent variable Y (e.g., "To what extent do changes in the unemployment rate (X) affect the inflation rate (Y)?"). This is an attempt to model or fit an equation line or curve to the data, such that Y is a function of X.

Necessary condition analysis (NCA) may be used when the analyst is trying to determine the extent to which independent variable X allows variable Y (e.g., "To what extent is a certain unemployment rate (X) necessary for a certain inflation rate (Y)?"). Whereas (multiple) regression analysis uses additive logic where each X-variable can produce the outcome and the X's can compensate for each other (they are sufficient but not necessary), necessary condition analysis (NCA) uses necessity logic, where one or more X-variables allow the outcome to exist, but may not produce it (they are necessary but not sufficient). Each single necessary condition must be present and compensation is not possible.

Essential Types Of Data Analysis Methods

Before diving into the seven essential types of data analysis methods, it is important that we go over really fast through the main analysis categories. Starting with the category of descriptive analysis up to prescriptive analysis, the complexity and effort of data evaluation increases, but also the added value for the company.

Descriptive analysis - What happened.

The descriptive analysis method is the starting point to any analytic process, and it aims to answer the question of what happened? It does this by ordering, manipulating, and interpreting raw data from various sources to turn it into valuable insights to your business.

Performing descriptive analysis is essential, as it allows us to present our data in a meaningful way. Although it is relevant to mention that this analysis on its own will not allow you to predict future outcomes or tell you the answer to questions like why something happened, but it will leave your data organized and ready to conduct further analysis.

Exploratory analysis - How to explore data relationships.

As its name suggests, the main aim of the exploratory analysis is to explore. Prior to it, there's still no notion of the relationship between the data and the variables. Once the data is investigated, the exploratory analysis enables you to find connections and generate hypotheses and solutions for specific problems. A typical area of application for exploratory analysis is data mining.

Diagnostic analysis - Why it happened.

One of the most powerful types of data analysis. Diagnostic data analytics empowers analysts and business executives by helping them gain a firm contextual understanding of *why something happened.* If you know why something happened as well as *how it happened,* you will be able to pinpoint the exact ways of tackling the issue or challenge.

Designed to provide direct and actionable answers to specific questions, this is one of the world's most important methods in research, among its other key organizational functions such as retail analytics, e.g.

Predictive analysis - What will happen.

The predictive method allows you to look into the future to answer the question: *what will happen?* In order to do this, it uses the results of the previously mentioned descriptive, exploratory, and diagnostic analysis, in addition to machine learning (ML) and artificial intelligence (AI). Like this, you can uncover future trends, potential problems or inefficiencies, connections, and casualties in your data.

With predictive analysis, you can unfold and develop initiatives that will not only enhance your various operational processes but also help you gain an all-important edge on the competition. If you understand why a trend, pattern, or event happened through data, you will be able to develop an informed projection of how things may unfold in particular areas of the business.

Prescriptive analysis - How will it happen.

Another of the most effective types of data analysis methods in research. Prescriptive data techniques cross over from predictive analysis in the way that it revolves around using patterns or trends to develop responsive, practical business strategies.

By drilling down into prescriptive analysis, you will play an active role in the data consumption process by taking well-arranged sets of visual data and using it as a powerful fix to emerging issues in a number of key business areas, including marketing, sales, customer experience, HR, fulfillment, finance, logistics analytics, and others.

STATISTICAL ANALYSIS

The data acquired for quantitative marketing research can be analysed by almost any of the range of techniques of statistical analysis, which can be broadly divided into descriptive statistics and statistical inference.

An important set of techniques is that related to statistical surveys. In any instance, an appropriate type of statistical analysis should take account of the various types of error that may arise, as outlined below.

Reliability and Validity

Research should be tested for reliability, generalizability, and validity. Generalizability is the ability to make inferences from a sample to the population.

Reliability is the extent to which a measure will produce consistent results. Test-retest reliability checks how similar the results are if the research is repeated under similar circumstances. Stability over repeated measures is assessed with the Pearson coefficient. Alternative forms reliability checks how similar the results are if the research is repeated using different forms. Internal consistency reliability checks how well the individual measures included in the research are converted into a composite measure. Internal consistency may be assessed by correlating performance on two halves of a test (split-half reliability). The value of the Pearson product-moment correlation coefficient is adjusted with the Spearman-Brown prediction formula to correspond to the correlation between two full-length tests. A commonly used measure is Cronbach's á, which is equivalent to the mean of all possible split-half coefficients. Reliability may be improved by increasing the sample size.

Validity asks whether the research measured what it intended to. Content validation (also called face validity) checks how well the content of the research are related to the variables to be studied. Are the research questions representative of the variables being researched. It is a demonstration that the items of a test are drawn from the domain being measured. Criterion validation checks how meaningful the research criteria are relative to other possible criteria. When the criterion is collected later the goal is to establish predictive validity. Construct validation checks what underlying construct is being measured. There are three variants of construct validity. They are convergent validity (how well the research relates to other measures of the same construct), discriminant validity (how poorly the research relates to measures of opposing constructs), and nomological validity (how well the research relates to other variables as required by theory). Internal validation, used primarily in experimental research designs, checks the relation between the dependent and independent variables. Did the experimental manipulation of the independent variable actually cause the observed results? External validation checks whether the experimental results can be generalized.

Validity implies reliability : a valid measure must be reliable. But reliability does not necessarily imply validity :a reliable measure need not be valid.

Types of Errors

Random sampling errors:

- sample too small
- sample not representative
- inappropriate sampling method used
- random errors.

Research design errors:

- bias introduced
- measurement error
- data analysis error
- sampling frame error
- population definition error
- scaling error
- question construction error.

Interviewer errors:

- recording errors
- cheating errors
- questioning errors
- respondent selection error.

Respondent errors:

- non-response error
- inability error
- falsification error.

Hypothesis errors:

- type I error (also called alpha error)
  - o the study results lead to the rejection of the null hypothesis even though it is actually true
- type II error (also called beta error)
  - o the study results lead to the acceptance (non-rejection) of the null hypothesis even though it is actually false.

Statistical Analysis Defined

What is statistical analysis? It's the science of collecting, exploring and presenting large amounts of data to discover underlying patterns and trends. Statistics are applied every day – in research, industry and government – to become more scientific about decisions that need to be made. For example:

- Manufacturers use statistics to weave quality into beautiful fabrics, to bring lift to the airline industry and to help guitarists make beautiful music.
- Researchers keep children healthy by using statistics to analyze data from the production of viral vaccines, which ensures consistency and safety.
- Communication companies use statistics to optimize network resources, improve service and reduce customer churn by gaining greater insight into subscriber requirements.
- Government agencies around the world rely on statistics for a clear understanding of their countries, their businesses and their people.

Look around you. From the tube of toothpaste in your bathroom to the planes flying overhead, you see hundreds of products and processes every day that have been improved through the use of statistics.

Statistical Computing

Traditional methods for statistical analysis – from sampling data to interpreting results – have been used by scientists for thousands of years. But today's data volumes make statistics ever more valuable and powerful. Affordable storage, powerful computers and advanced algorithms have all led to an increased use of computational statistics.

Whether you are working with large data volumes or running multiple permutations of your calculations, statistical computing has become essential for today's statistician. Popular statistical computing practices include:

- Statistical programming – From traditional analysis of variance and linear regression to exact methods and statistical visualization techniques, statistical programming is essential for making data-based decisions in every field.
- Econometrics – Modeling, forecasting and simulating business processes for improved strategic and tactical planning. This method applies statistics to economics to forecast future trends.
- Operations research – Identify the actions that will produce the best results – based on many possible options and outcomes. Scheduling, simulation, and related modeling processes are used to optimize business processes and management challenges.
- Matrix programming – Powerful computer techniques for implementing your own statistical methods and exploratory data analysis using row operation algorithms.
- Statistical visualization – Fast, interactive statistical analysis and exploratory capabilities in a visual interface can be used to understand data and build models.
- Statistical quality improvement – A mathematical approach to reviewing the quality and safety characteristics for all aspects of production.

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Scaling Techniques

Scaling technique is a method of placing respondents in continuation of gradual change in the pre-assigned values, symbols or numbers based on the features of a particular object as per the defined rules. All the scaling techniques are based on four pillars, i.e., order, description, distance and origin.

INTRODUCTION

Scaling is the process of removing dental calculus from your teeth and gums. Calculus is a buildup of bacteria that hardens and sticks to your teeth. Normal brushing methods may not be able to remove it, especially as it hardens underneath your gumline. During scaling and root planing, the dentist or hygienist will numb you so that you do not feel any pain as they clean underneath your gingiva.

PURPOSE OF SCALING

In the social sciences, scaling is the process of measuring or ordering entities with respect to quantitative attributes or traits. For example, a scaling technique might involve estimating individuals' levels of extraversion, or the perceived quality of products. Certain methods of scaling permit estimation of magnitudes on a continuum, while other methods provide only for relative ordering of the entities.

The level of measurement is the type of data that is measured. The word scale, including in academic literature, is sometimes used to refer to another composite measure, that of an index. Those concepts are however different.

CHARACTERISTICS OF A GOOD SCALE

Scaling is the branch of measurement that involves the construction of an instrument that associates qualitative constructs with quantitative metric units. Scaling evolved out of efforts in psychology and education to measure "unmeasurable" constructs like authoritarianism and self-esteem. In many ways, scaling remains one of the most arcane and misunderstood aspects of social research measurement. And, it attempts to do one of the most difficult of research tasks – measure abstract concepts.

Scaling techniques are levels of measurements that are used by businesses to assess customer satisfaction, preferences and other aspects of the sales process. Organisations use polls, surveys, and questionnaires to conduct market research in order to determine how customers feel about their product or service.

The data obtained can be used to identify areas of improvement and to develop better products. Commonly used scaling techniques by business organisations and market researchers are nominal, interval, ordinal and ratio scales. The nominal scale being the lowest and most primitive scale whilst the ratio scale is the most informative measurement.

Nominal Scale

Nominal scales are adopted for non-numeric labelling. This scaling technique is used to measure qualitative data. Observations of a qualitative nature can only be classified and counted with no particular order. A business can divide a country into provinces or cities and when reporting the data there is no natural order or rank assigned to the observations. Any province or city can be reported first or last with no importance assigned to the order. Gender is another example of a nominal scale technique where no gender is regarded more important than the other. If a supermarket wants data on the number of women and men that enter the store, either male or female observations can be reported first.

Ordinal Scale

The ordinal scaling technique is a higher measurement compared to a nominal scaling technique. Data classifications are represented by sets of labels or names that have relative value, meaning that the data classified can be ranked or ordered. With this type of scaling technique one classification is higher or better than the other. On a questionnaire If a customer ticks a product as 'superior' it means 'superior' is better that 'good'. If another customer classifies a product as 'good' it means that 'good' is better than 'average' and so on. The order of data has meaning on an ordinal scale where the rating increases or decreases with order. However, the ordinal scaling technique cannot distinguish the amount of difference between groups. That is, on an ordinal scale of 'superior, good, average and poor', "good" doesn't imply twice as "poor" and "superior" doesn't imply twice as "average". Also, it is impossible to tell if the difference between "superior" and "good" is the same as the difference between "average" and "poor". Examples where ordinal scaling techniques can be used is when a company wants to assess how customers rate them in terms of customer service, product functionality or customer satisfaction.

Interval Scale

The interval level scaling technique is a scaling technique which is above the ordinal and nominal scaling techniques. This scaling technique includes all the characteristics of the ordinal scale. What makes the interval scaling technique more superior than the ordinal scale is that the difference between values has meaning, it is a constant size. Temperature is a good example of an interval scale. The temperature figures can be easily ranked, the difference between the figures has meaning and can be determined. The difference between 20 degrees Celsius and 25 degrees Celsius, 5 is the same as the difference between 30 degrees Celsius and 35 degrees Celsius which is also 5. However, zero does not imply the absence of condition on an interval scale. Another example is the standard USA women's dress sizes where size zero doesn't mean the absence of material. In addition, an interval scale doesn't have reasonable ratios. Dividing a dress size 28 by a size 14 doesn't make sense. However, this scaling technique can help market researchers obtain better comparison between groups and objects.

Ratio Scale

A ratio scaling technique is the highest primary scaling technique. All quantitative data is recorded on a ratio scale of measurement. This scaling technique has the properties of the interval scale and ordinal scale. The zero point and the ratio between measurements is meaningful. Examples of ratio scale measurements are wages, distance and money. Zero dollars mean the absence of money and $4 is two times $2. A ratio scaling can be used to asses income levels of potential customers in order to determine their spending power.

SCALE EVALUATION

Scales should be tested for reliability, generalizability, and validity. Generalizability is the ability to make inferences from a sample to the population, given the scale one have selected. Reliability is the extent to which a scale will produce consistent results. Test-retest reliability checks how similar the results are if the research is repeated under similar circumstances. Alternative forms reliability checks how similar the results are if the research is repeated using different forms of the scale. Internal consistency reliability checks how well the individual measures included in the scale are converted into a composite measure.

Scales and indexes have to be validated. Internal validation checks the relation between the individual measures included in the scale, and the composite scale itself. External validation checks the relation between the composite scale and other indicators of the variable, indicators not included in the scale. Content validation (also called face validity) checks how well the scale measures what is supposed to measured. Criterion validation checks how meaningful the scale criteria are relative to other possible criteria. Construct validation checks what underlying construct is being measured. There are three variants of construct validity. They are convergent validity, discriminant validity, and nomological validity (Campbell and Fiske, 1959; Krus and Ney, 1978). The coefficient of reproducibility indicates how well the data from the individual measures included in the scale can be reconstructed from the composite scale.

TYPES OF SCALES

Types of Scaling Techniques

The researchers have identified many scaling techniques; today, we will discuss some of the most common scales used by business organizations, researchers, economists, experts, etc.

These techniques can be classified as primary scaling techniques and other scaling techniques. Let us now study each of these methods in-depth below:

Primary Scaling Techniques

The major four scales used in statistics for market research consist of the following:

Nominal scales are adopted for non-quantitative (containing no numerical implication) labelling variables which are unique and different from one another.

Types of Nominal Scales:

1. Dichotomous: A nominal scale that has only two labels is called 'dichotomous'; *for example*, Yes/No.
2. Nominal with Order: The labels on a nominal scale arranged in an ascending or descending order is termed as 'nominal with order'; *for example*, Excellent, Good, Average, Poor, Worst.

3. Nominal without Order: Such nominal scale which has no sequence, is called 'nominal without order'; *for example*, Black, White.

Ordinal Scale

The ordinal scale functions on the concept of the relative position of the objects or labels based on the individual's choice or preference.

For example, At Amazon.in, every product has a customer review section where the buyers rate the listed product according to their buying experience, product features, quality, usage, etc.

The ratings so provided are as follows:

- 5 Star – Excellent
- 4 Star – Good
- 3 Star – Average
- 2 Star – Poor
- 1 Star – Worst

Interval Scale

An interval scale is also called a cardinal scale which is the numerical labelling with the same difference among the consecutive measurement units. With the help of this scaling technique, researchers can obtain a better comparison between the objects. *For example;* A survey conducted by an automobile company to know the number of vehicles owned by the people living in a particular area who can be its prospective customers in future. It adopted the interval scaling technique for the purpose and provided the units as 1, 2, 3, 4, 5, 6 to select from. In the scale mentioned above, every unit has the same difference, i.e., 1, whether it is between 2 and 3 or between 4 and 5.

RATING SCALE

Rating scale is defined as a closed-ended survey question used to represent respondent feedback in a comparative form for specific particular features/products/services. It is one of the most established question types for online and offline surveys where survey respondents are expected to rate an attribute or feature. Rating scale is a variant of the popular multiple-choice question which is widely used to gather information that provides relative information about a specific topic.

Researchers use a rating scale in research when they intend to associate a qualitative measure with the various aspects of a product or feature. Generally, this scale is used to evaluate the performance of a product or service, employee skills, customer service performances, processes followed for a particular goal etc. Rating scale survey question can be compared to a checkbox question but rating scale provides more information than merely Yes/No.

Types of Rating Scale

Broadly speaking, rating scales can be divided into two categories: Ordinal and Interval Scales.

An ordinal scale is a scale the depicts the answer options in an ordered manner. The difference between the two answer option may not be calculable but the answer options will always be in a certain innate order. Parameters such as attitude or feedback can be presented using an ordinal scale.

Background

A rating scale is a method that requires the rater to assign a value, sometimes numeric, to the rated object, as a measure of some rated attribute

Types of rating scales

All rating scales can be classified into one of these types:

1. Numeric Rating Scale (NRS)
2. Verbal Rating Scale (VRS)
3. Visual Analogue Scale (VAS)
4. Likert

5. Graphic rating scale
6. Descriptive graphic rating scale

Some data are measured at the ordinal level. Numbers indicate the relative position of items, but not the magnitude of difference. Attitude and opinion scales are usually ordinal; one example is a Likert response scale:

Statement

e.g. "I could not live without my computer".

Response options

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Some data are measured at the interval level. Numbers indicate the magnitude of difference between items, but there is no absolute zero point.

A good example is a Fahrenheit/Celsius temperature scale where the differences between numbers matter, but placement of zero does not.

Some data are measured at the ratio level. Numbers indicate magnitude of difference and there is a fixed zero point. Ratios can be calculated. Examples include age, income, price, costs, sales revenue, sales volume and market share.

More than one rating scale question is required to measure an attitude or perception due to the requirement for statistical comparisons between the categories in the polytomous Rasch model for ordered categories.

In terms of Classical test theory, more than one question is required to obtain an index of internal reliability such as Cronbach's alpha, which is a basic criterion for assessing the effectiveness of a rating scale and, more generally, a psychometric instrument.

Rating scales used online

Rating scales are used widely online in an attempt to provide indications of consumer opinions of products. Examples of sites which employ ratings scales are IMDb, Epinions.com, Yahoo! Movies, Amazon.com, BoardGameGeek and TV.com which use a rating scale from 0 to 100 in order to obtain "personalised film recommendations".

In almost all cases, online rating scales only allow one rating per user per product, though there are exceptions such as *Ratings.net*, which allows users to rate products in relation to several qualities. Most online rating facilities also provide few or no qualitative descriptions of the rating categories, although again there are exceptions such as *Yahoo! Movies*, which labels each of the categories between F and A+ and BoardGameGeek, which provides explicit descriptions of each category from 1 to 10. Often, only the top and bottom category is described, such as on *IMDb*'s online rating facility.

Validity

Validity refers to how well a tool measures what it intends to measure. With each user rating a product only once, for example in a category from 1 to 10, there is no means for evaluating internal reliability using an index such as Cronbach's alpha.

It is therefore impossible to evaluate the validity of the ratings as measures of viewer perceptions. Establishing validity would require establishing both reliability and accuracy (i.e. that the ratings represent what they are supposed to represent). The degree of validity of an instrument is determined through the application of logic/or statistical procedures. "A measurement procedure is valid to the degree that if measures what it proposes to measure."

Another fundamental issue is that online ratings usually involve convenience sampling much like television polls, i.e. they represent only the opinions of those inclined to submit ratings.

Validity is concerned with different aspects of the measurement process. Each of these types uses logic, statistical verification or both to determine the degree of validity and has special value under certain conditions. Types of validity include content validity, predictive validity, and construct validity.

Sampling

Sampling errors can lead to results which have a specific bias, or are only relevant to a specific subgroup. Consider this example: suppose that a film only appeals to a specialist audience—90% of them are devotees of this genre, and only 10% are people with a general interest in movies. Assume the film is very popular among the audience that views it, and that only those who feel most strongly about the film are inclined to rate the film online; hence the raters are all drawn from the devotees. This combination may lead to very high ratings of the film, which do not generalize beyond the people who actually see the film (or possibly even beyond those who actually rate it).

Qualitative description

Qualitative description of categories improve the usefulness of a rating scale. For example, if only the points 1-10 are given without description, some people may select 10 rarely, whereas others may select the category often. If, instead, "10" is described as "near flawless", the category is more likely to mean the same thing to different people. This applies to all categories, not just the extreme points.

The above issues are compounded, when aggregated statistics such as averages are used for lists and rankings of products. User ratings are at best ordinal categorizations. While it is not uncommon to calculate averages or means for such data, doing so cannot be justified because in calculating averages, equal intervals are required to represent the same difference between levels of perceived quality. The key issues with aggregate data based on the kinds of rating scales commonly used online are as follow:

- Averages should not be calculated for data of the kind collected.
- It is usually impossible to evaluate the reliability or validity of user ratings.
- Products are not compared with respect to explicit, let alone common, criteria.
- Only users inclined to submit a rating for a product do so.
- Data are not usually published in a form that permits evaluation of the product ratings.

More developed methodologies include Choice Modelling or Maximum Difference methods, the latter being related to the Rasch model due to the connection between Thurstone's law of comparative judgement and the Rasch model.

RANK ORDER SCALES

A Rank Order scale gives the respondent a set of items and asks them to put the items in some form of order.

The measure of 'order' can include such as preference, importance, liking, effectiveness and so on.

The order is often a simple ordinal structure (A is higher than B). It can also be done by relative position (A scores 10 whilst B scores 6).

Example

Please write a letter next to the four evening activities below to show your preference.

Use A for your most preferred activity, B for the next preferred, then C for the next and then D for the least preferred.

- Staying in and watching television
- Going bowling
- Going out for a meal
- Going to a bar with a friend

Discussion

Sorting of ordinal data can be done in several ways:

- *Priority sorting* looks for the most important first, then the next most important and so on.
- *Block sorting* sorts items in to sub groups and then sorts the sub-groups (this is more important, that is less important — then sort the 'more important' group).
- *Score sorting* gives an absolute score to each item.
- *Pairwise sorting* compares pairs of items, moving the more important item higher or giving it a higher score.
- *Q-Sorting* is done by writing items on cards (Q-cards) and asking the subject to place these in order.
- *Swap-sorting* uses pairwise comparison on cards or Post-It Notes in a vertical column, swapping each pair in turn until the whole column is in order.

Rank order items are analyzed using Spearman or Kendall correlation.

ATTITUDE SCALES

The term scaling is applied to the attempts to measure the attitude objectively. Attitude is a resultant of number of external and internal factors. Depending upon the attitude to be measured, appropriate scales are designed. Scaling is a technique used for measuring qualitative responses of respondents such as those related to their feelings, perception, likes, dislikes, interests and preferences.

Types of Scales

Most frequently used Scales

1. Nominal Scale
2. Ordinal Scale
3. Interval Scale
4. Ratio Scale

Self Rating Scales

1. Graphic Rating Scale
2. Itemized Rating Scales
   a. Likert Scale
   b. Semantic Differential Scale
   c. Stapel's Scale
   d. Multi Dimensional Scaling
   e. Thurston Scales
   f. Guttman Scales/Scalogram Analysis
   g. The Q Sort technique

Four types of scales are generally used for Marketing Research.

Nominal Scale

This is a very simple scale. It consists of assignment of facts/choices to various alternative categories which are usually exhaustive as well mutually exclusive.

These scales are just numerical and are the least restrictive of all the scales. Instances of Nominal Scale are - credit card numbers, bank account numbers, employee id numbers etc.

It is simple and widely used when relationship between two variables is to be studied. In a Nominal Scale numbers are no more than labels and are used specifically to identify different categories of responses. Following example illustrates -

Ratio Scale

Ratio Scales are not widely used in Marketing Research unless a base item is made available for comparison.

In the above example of Interval scale, a score of 4 in one quality does not necessarily mean that the respondent is twice more satisfied than the respondent who marks 2 on the scale.

A Ratio scale has a natural zero point and further numbers are placed at equally appearing intervals. For example scales for measuring physical quantities like - length, weight, etc.

MODIFIED SCALES

In recent years, numerous measurement scales have been developed to assess attitudes, techniques, and interventions in a variety of scientific applications (Meneses et al. 2014). Measurement is a fundamental activity of science, since it enables researchers to acquire knowledge about people, objects, events, and processes. Measurement scales are useful tools to attribute scores in some numerical dimension to phenomena that cannot be measured directly. They consist of sets of items revealing levels of theoretical variables otherwise unobservable by direct means (DeVellis 2003).

A variety of authors have agreed that the scale development process involves complex and systematic procedures that require theoretical and methodological rigor. According to these authors, the scale development process can be carried out in three basic steps.

In the first step, commonly referred as "item generation," the researcher provides theoretical support for the initial item pool. Methods for the initial item generation can be classified as deductive, inductive, or a combination of the two. *Deductive* methods involve item generation based on an extensive literature review and pre-existing scales (Hinkin 1995). On the other hand, *inductive* methods base item development on qualitative information regarding a construct obtained from opinions gathered from the target population—e.g., focus groups, interviews, expert panels, and qualitative exploratory research methodologies. The researcher is also concerned with a variety of parameters that regulate the setting of each item and of the scale as a whole. For example, suitable scale instructions, an appropriate number of items, adequate display format, appropriate item redaction (all items should be simple, clear, specific, ensure the variability of response, remain unbiased, etc.), among other parameters.

In the second step, usually referred to as the "theoretical analysis," the researcher assesses the content validity of the new scale, ensuring that the initial item pool reflects the desired construct. A content validity assessment is required, since inferences are made based on the final scale items. The item content must be deemed valid to instill confidence in all consequent inferences. In order to ensure the content validity, the researcher seeks other opinions about the operationalized items. The opinions can be those of expert judges (experts in the development scales or experts in the target construct) or target population judges (potential users of the scale), enabling the researcher to ensure that the hypothesis elaborated in the research appropriately represents the construct of interest.

In the last step, psychometric analysis, the researcher should assess whether the new scale has construct validity and reliability. Construct validity is most directly related to the question of what the instrument is in fact measuring—what construct, trait, or concept underlies an individual's performance or score on a measure. This refers to the degree to which inferences can be legitimately made from the observed scores to the theoretical constructs about which these observations are supposed to contain information. Construct validity can be assessed with the use of exploratory factor analysis (EFA), confirmatory factor analysis (CFA), or with convergent, discriminant, predictive/nomological, criterion, internal, and external validity. In turn, reliability is a measure of score consistency, usually measured by use of internal consistency, test-retest reliability, split-half, item-total correlation/inter-item reliability, and inter-observer reliability (DeVellis 2003). To ensure construct validity and reliability, the data should be collected in a large and appropriately representative sample of the target population. It is a common rule of thumb that there should be at least 10 participants for each item of the scale, making an ideal of 15:1 or 20:1.

DIFFICULTIES IN SCALING

In our daily life we are said to measure when we use some yardstick to determine weight, height, or some other feature of a physical object. We also measure when we judge how well we like a song, a painting or the personalities of our friends. We, thus, measure physical objects as well as abstract concepts. Measurement is a relatively complex and demanding task, specially so when it concerns qualitative or abstract phenomena. By measurement we mean the process of assigning numbers to objects or observations, the level of measurement being a function of the rules under which the numbers are assigned.

It is easy to assign numbers in respect of properties of some objects, but it is relatively difficult in respect of others. For instance, measuring such things as social conformity, intelligence, or marital adjustment is much less obvious and requires much closer attention than measuring physical weight, biological age or a person's financial assets. In other words, properties like weight, height, etc., can be measured directly with some standard unit of measurement, but it is not that easy to measure properties like motivation to succeed, ability to stand stress and the like. We can expect high accuracy in measuring the length of pipe with a yard stick, but if the concept is abstract and the measurement tools are not standardized, we are less confident about the accuracy of the results of measurement.

CONCLUSION

Scaling techniques provide a clear picture of the product life cycle and the market acceptability of the products offered. It facilitates product development and benchmarking through rigorous market research.

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The Research Report

Research reports are recorded data prepared by researchers or statisticians after analyzing information gathered by conducting organized research, typically in the form of surveys or qualitative methods.

Reports usually are spread across a vast horizon of topics but are focused on communicating information about a particular topic and a very niche target market. The primary motive of research reports is to convey integral details about a study for marketers to consider while designing new strategies. Certain events, facts and other information based on incidents need to be relayed on to the people in charge and creating research reports is the most effective communication tool. Ideal research reports are extremely accurate in the offered information with a clear objective and conclusion. There should be a clean and structured format for these reports to be effective in relaying information.

A research report is a reliable source to recount details about a conducted research and is most often considered to be a true testimony of all the work done to garner specificities of research.

Components of Research Reports

Research is imperative for launching a new product/service or a new feature. The markets today are extremely volatile and competitive due to new entrants every day who may or may not provide effective products. An organization needs to make the right decisions at the right time to be relevant in such a market with updated products that suffice customer demands.

The details of a research report may change with the purpose of research but the main components of a report will remain constant. The research approach of the market researcher also influences the style of writing reports. Here are seven main components of a productive research report:

- Research Report Summary: The entire objective along with the overview of research are to be included in a summary which is a couple of paragraphs in length. All the multiple components of the research are explained in brief under the report summary. It should be interesting enough to capture all the key elements of the report.
- Research Introduction: There always is a primary goal that the researcher is trying to achieve through a report. In the introduction section, he/she can cover answers related to this goal and establish a thesis which will be included to strive and answer it in detail. This section should answer an integral question: "What is the current situation of the goal?". After the research was conducted, did the organization conclude the goal successfully or they are still a work in progress – provide such details in the introduction part of the research report.
- Research Methodology: This is the most important section of the report where all the important information lies. The readers can gain data for the topic along with analyzing the quality of provided content and the research can also be approved by other market researchers. Thus, this section needs to be highly informative with each aspect of research discussed in detail. Information needs to be expressed in chronological order according to its priority and importance. Researchers should include references in case they gained information from existing techniques.

- Research Results: A short description of the results along with calculations conducted to achieve the goal will form this section of results. Usually, the exposition after data analysis is carried out in the discussion part of the report.
- Research Discussion: The results are discussed in extreme detail in this section along with a comparative analysis of reports that could probably exist in the same domain. Any abnormality uncovered during research will be deliberated in the discussion section. While writing research reports, the researcher will have to connect the dots on how the results will be applicable in the real world.
- Research References and Conclusion: Conclude all the research findings along with mentioning each and every author, article or any content piece from where references were taken.

MEANING AND PURPOSE OF A REPORT

According to the commonly known definition of report writing, a report is a formal document that elaborates on a topic using facts, charts, and graphs to support its arguments and findings.

Any report—whether it's about a business event or one that describes the processes of various departments in a company—is meant for a particular type of audience.

But why do you think your manager wants you to create a report? One simple answer is: an elaborate report prepared with evaluated facts helps solve complex problems. When managers come across certain business situations, they ask for comprehensive and well-thought-out reports that can help them design business plans.

Elements Of Report Writing

Once you have an idea about what a report is, the next step is to understand how you can write one.

There are different types of reports, and each has a specific structure, usually known as 'elements of the report'.

While we tell you what the elements of report writing are, if you want detailed guidance, you can go for Harappa Education's Writing Proficiently course that talks about the popular PREP (Point of starting, Reason, Evidence, and Point of ending) model of report writing.

Every report starts with a title page and a table of contents, after which come the main sections–the executive summary, introduction, discussion, and conclusion.

Executive Summary

Do you remember summary writing for English class during school days? You were asked to read a story or passage and write a summary, including the important takeaways.

That's exactly what you are expected to do in a report's executive summary section. This section presents a brief overview of the report's contents. You should present the key points of the report in this section.

But why is it important to write an executive summary at the start of the report?

Firstly, the summary will help readers better understand the purpose, key points, and evidence you are going to present in the report. Secondly, readers who are in a hurry can read the summary for a preview of the report.

Here are some specifics that will help you write a clear and concise summary:

- Include the purpose of your report and emphasize conclusions or recommendations.
- Include only the essential or most significant information to support your theories and conclusions.
- Follow the same sequence of information that you have used in the report.
- Keep the summary length to 10-15% of the complete report.

- Try not to introduce any new information or point in summary that you haven't covered in the report.
- The summary should communicate the message clearly and independently.

Introduction

The introduction section should:

- Briefly describe the background and context of the research you have done.
- Describe the change, problem, or issue related to the topic.
- Define the relevant objectives and purpose of the report
- Give hints about the overall answer to the problem covered in the report.
- Comment on the limitations and any assumptions you have made to get to the conclusion.

Discussion

This section serves two purposes:

- It justifies the recommendations.
- It explains the conclusions.

While you are writing the discussion section, make sure you do the following:

- Present your analysis logically.
- If needed, divide the information under appropriate headings to improving readability and ease of understanding.
- Explain your points and back up your claims with strong and evaluated evidence.
- Connect your theory with real-life scenarios

TARGET GROUP IN REPORT WRITING

Definition of a Target Audience

A target audience is the person or group of people a piece of writing is intended to reach. In other words, it is important for a writer to know who will be reading his or her writing. This audience is the person or group of people the writer is aiming for or trying to reach. When a writer knows the target audience, he or she will shape both the purpose and tone of the writing to match the audience's needs and, sometimes, expectations.

Choosing an Audience

When students write papers for academic purposes, they sometimes make the mistake of thinking that the teacher is actually the audience. Although the teacher reads and grades the paper, it is better to think of the other students in the class as the actual audience, or maybe the general population at large. When students think of teachers as their target audience, they tend to write less interesting papers!

Decide exactly what you want to do for your audience

Unless catering to a target audience is a central objective, your document may lack some of the fundamentals of good document design. Spending the time deciding exactly what you want to do for your audience, rather than simply delivering information, will help you fine-tune the content and the design of your document.

Problems caused by not understanding your target audience

Common writing problems often reflect that a writer has not thoroughly considered who their audience is or what they need. For example:

- providing too much, or not enough, detail or background information
- providing too much detail on unrelated sub-topics or on a well-known topic
- using the wrong language or unfamiliar terminology
- assuming the audience's level of interest in, or understanding of, the topic.

One common mistake in science and academic writing is assuming your audience will know your topic nearly as well as you do. The problem with this assumption is that crucial background information and explanation of fundamental concepts may be omitted. Authors of research papers will often make this assumption deliberately if they are writing about a specialised topic. Yet even in these cases, it is not a good habit to omit important background information and project details that are necessary for the reader to understand the context of the research.

CONTENTS OF A REPORT

The purpose of the table of contents is to give an overview of the subject matter and the structure of the report, so that readers can easily jump to a specific part of the text containing the information they need. The structure of the table of contents needs to be logical and transparent.

Formatting a table of contents

- Use "Contents" as a header for the table of contents.
- Use the correct indentation: main titles (Contents, Introduction, Conclusion and Appendices) should be left-aligned and titles of sections should be indented from the left margin. For each additional level, you should set an additional indent.
- Ensure your table of contents is structured in an orderly fashion. Make sure that titles or headings are as significant as possible.
    - o Divide all subjects in subtopics, but take into account that each subtopic could belong to only one subject of a higher level. Please note that each subtopic should have at least one other subtopic at the same level.
    - o Arrange all subtopics in a systematic manner, using a unique criterion.
    - o Use parallel structure for headings at the same level:

FORMAT OF THE RESEARCH REPORT

Comments On The Sections Of A Research Report

Significance of the Problem: Comment on why this question merits investigation.

Purpose: What is the goal to be gained from a better understanding of this question?

Statement of the Hypothesis: In one statement (not a question) declare the question which is investigated and the expected results. (For a null hypothesis, no difference is predicted.)

Assumptions: Explain everything that is assumed in order for the investigation to be undertaken.

Limitations: Explain the limitations that may invalidate the study or make it less than accurate.

Definition of Terms: Define or clarify any term or concept that is used in the study in a non-traditional manner or in only one of many interpretations.

Ethical Considerations: Discusses the ethical issues related to the study and explains the processes and status of the review by the Institutional Review Board.

Budget: Outlines and discusses the budget for the study. This is usually only in the proposal.

Proposed Timeline: Outlines the expected schedule for beginning and ending each part of the research project and may illustrate with a Gantt Chart. This is usually only in the proposal.

Review of Related Literature: Gives the reader the necessary background to understand the study by citing the investigations and findings of previous researchers and documents the researcher's knowledge and preparation to investigate the problem.

Design of the Study: Gives the reader the information necessary to exactly replicate (repeat) the study with new data or if the same raw data were available, the reader should be able to duplicate the results. This is written in past tense but without reference to or inclusion of the results determined from the analysis.

Description of the Research Design and Procedures Used: Completely explain step-by-step what was done.

Sources of Data: Give complete information about who, what, when, where, and how the data were collected.

Sampling Procedures: Explain how the data were limited to the amount which was gathered. If all of the available data were not utilized, how was a representative sample achieved?

Methods and Instruments of Data Gathering: Explain the procedures for obtaining the data collected. Include the forms or manner by which it was recorded.

Statistical Treatment: Explain the complete mathematical procedures used in analyzing the data and determining the significance of the results.

Analysis of Data: Describe the patterns observed in the data. Use tables and figures to help clarify the material when possible.

Summary and Conclusions: This section condenses the previous sections, succinctly presents the results concerning the hypotheses, and suggests what else can be done.

Restatement of the Problem: This is a short reiteration of the problem.

Description of the Procedures: This is a brief reiteration of important elements of the design of the study.

Major Findings: The final results from the analysis are presented, the hypothesis stated, and the decision about the rejection or the failure to reject the hypothesis is given.

Conclusions: Comments about the implication of the findings are presented.

Recommendations for Further Investigation: From the knowledge and experienced gained in undertaking this particular study, how might the study have been improved or what other possible hypotheses might be investigated?

End Notes: These are like footnotes but are located at the back rather than the bottom of each page. These would include all of the references for all works cited in the Review of Related Literature or any other sections of the report as well as the references for quotations, either direct or indirect, taken from other sources, or any footnote comments that might have been included. These are listed in numeric order as presented in the text.

Report Format

There is no one best format for all reports. Format depends on several relevant variables. One must employ a suitable format to create desirable impression with clarity. Report must be attractive. It should be written systematically and bound carefully. A report must use the format (often called structure) that best fit the needs and wants of its readers. Normally, following format is suggested as a basic outline, which has sufficient flexibly to meet the most situations.

Research report is divided into three parts as:

I. First Part (Formality Part):

- (i) Cover page
- (ii) Title page
- (iii) Certificate or statement
- (iv) Index (brief contents)
- (v) Table of contents (detailed index)
- (vi) Acknowledgement
- (vii) List of tables and figures used
- (viii) Preface/forwarding/introduction
- (ix) Summary report

II. Main Report (Central Part of Report):

- (i) Statement of objectives
- (ii) Methodology and research design

(iii) Types of data and its sources
(iv) Sampling decisions
(v) Data collection methods
(vi) Data collection tools
(vii) Fieldwork
(viii) Analysis and interpretation (including tables, charts, figures, etc.)
(ix) Findings
(x) Limitations
(xi) Conclusions and recommendations
(xii) Any other relevant detail

III. Appendix (Additional Details):
(i) Copies of forms used
(ii) Tables not included in findings
(iii) A copy of questionnaire
(iv) Detail of sampling and rate of response
(v) Statement of expenses
(vi) Bibliography – list of books, magazines, journals, and other reports
(vii) Any other relevant information

Key Considerations/Factors

While preparing research report, following issues must be considered:

(i) Objectives
(ii) Type of problem/subject
(iii) Nature and type of research
(iv) Audience or users of research work
(v) Size of report
(vi) Form of writing – handwritten, typed, or computerized.
(vii) Time and cost
(viii) Language

(ix) Contents of report

(x) Order of contents

(xi) Number of copies

(xii) Format – type and size of paper; lengths width, and depth of report; and pattern of writing including paragraph, indent, numbering, font size and type, colouring, etc.

(xiii) Binding (for soft, and, particularly, for hard copy) – type, quality of material, colour, etc., related issues.

QUALITIES OF GOOD RESEARCH REPORT

Simplicity

The language shall be as simple as possible so that a report is easily understandable. Jargons and technical words should be avoided. Even in a technical report there shall be restricted use of technical terms if it has to be presented to laymen.

Clarity

The language shall be lucid and straight, clearly expressing what is intended to be expressed. For that the report has to be written in correct form and following correct steps.

Brevity

A report shall not be unnecessarily long so that the patience of the reader is not lost and there is no confusion of ideas. But, at the same time, a report must be complete. A report is not an essay.

Positivity

As far as possible positive statements should be made instead of negative ones. For example, it is better to say what should be done and not what should not be done.

Punctuation

Punctuations have to be carefully and correctly used otherwise the meaning of sentences may be misunder-stood or misrepresented.

Approach

There are two types of approaches: (a) Per-son—When a report is written based on personal enquiry or obser-vations, the approach shall be personal and the sentences shall be in the first person and in direct speech, (b) Impersonal—When a report is prepared as a source of information and when it is merely factual (e.g. a report on a meeting), the approach shall be impersonal and the sentences shall be in the third person and in indirect speech.

Readability

The keynote of a report is readability. The style of presentation and the diction (use of words) shall be such that the readers find it attractive and he is compelled to read the report from the beginning to the end.' Then only a report serves its purpose. A report on the same subject matter can be written differ-ently for different classes of readers.

Accuracy

A report shall be accurate when facts are stated in it. It shall not be biased with personal feelings of the writer.

Logical Sequence

The points in a report shall be arranged with a logical sequence, step by step and not in a haphazard manner. A planning is necessary before a report is prepared.

Proper Form

A report must be in the proper form. Some-times there are statutory forms to follow.

Presentation

A report needs an attractive presentation. It depends on the quality of typing or printing as well as quality of paper used. Big companies make very attractive and colourful Annual Reports.

PLANNING OF THE REPORT

The planning report describes what is to be done, how and when it is to be carried out. The planning report includes a specification of the aim, a description of how the work is to be carried out and an implementation schedule; in other words, the planning report answers the questions what, how and when.

The planning report consists of the following chapters:

Background

This chapter describes the background behind the issue to be investigated, i.e. a short description of the company's situation and why they want the assignment carried out. Note that this is not the background to why you are carrying out the degree project.

Aim

The aim is a brief description of the assignment and its intended outcome.

Limitations

This chapter describes what issues will not be dealt with in the work.

Specification of issue under investigation

The issue should be specified on the basis of the 'Aim' chapter, for example by compiling a number of questions to be answered. Another way is to write a number of statements (hypotheses) which can subsequently be verified or rejected during the course of the assignment.

Methodology

The methodology chapter describes how the work is structured. It includes workflows, design of experiments and use of various data collection methods. Ideally, a methodology chapter should be sufficiently detailed that anyone with certain basic knowledge of the field should be able to carry out the work in the way described in the report and achieve the same results. Describing the methodology is an important factor in enabling the company offering the assignment, to assess whether or not the goal can be achieved as described. It is therefore also important to explain why the chosen methodology offers a reliable outcome.

Method of Obtaining Information

The purpose of this section is to show the readers how you obtained your information. Stating where you obtained your information will help to tell the readers if your research is reliable. Your method will help readers to understand the uses and limitations of your research. A good, descriptive method section will allow anyone else to recreate your experiment exactly and obtain the same result. Be very detailed in the method section and reread it as if you were trying to do this experiment for the first time based on your method section.

Results

The results section is the most valuable part of the report to readers. The whole point of research is to find the results so they need to be conveyed clearly and effectively. A results section may likely contain tables, graphs, text, and pictures. Include anything that is important in showing the reader what was found through research. Do not include extraneous information as it will only clutter the results section. Make sure you check the date of your information, where it comes from, and who the source was. Keep the prose simple and descriptive in this section, leave the analysis of the results for the discussion section.

Discussion

The discussion section is where you interpret your results. Your results section may be nothing but tables and graphs with a few accompanying sentences. Your discussion section is where you make sense of those tables and graphs and explain how they relate to the problem or question the report is trying to research. The discussion also explains what the results mean to the company. In some reports, mainly shorter ones, the discussion and facts sections may be put into one to make reading the report shorter and easier.

Conclusion

The conclusion section explains why the results are important and how they affect the reader. It is a good practice to summarize your facts and restate the problem so the reader clearly understands the importance of your findings. This is your chance to tell the reader how they or the company will benefit from your findings. The conclusion usually does not make recommendations for action but will inevitably get the reader thinking about it.

Recommendation

Here is where you state the purpose of the report and what you want to be accomplished after the readers are done with your report. This section may not be in some reports because the decision to be made may be beyond your knowledge and power.

ORGANISATION OF THE REPORT

An organization report structure is a method of grouping business units for reporting purposes. It provides more flexibility in using low-volume consolidations and FASTR reporting, enabling you to display summary-to-detail income statement information. It also facilitates printing of subtotals and roll-up totals.

You can create hierarchical structures for each business unit and across companies. Each structure can contain multiple levels of parent, child, and grandchild relationships.

For reporting purposes, you can organize the parent-child hierarchies based on structures you define for financial, geographical, or responsibility reporting. Parent-child hierarchies can be as simple or complex as you require.

Report Organization

Reports vary by size, format, and function. You need to be flexible and adjust your report to the needs of the audience. Reports are typically organized around six key elements:

- Who the report is about and/or prepared for
- What was done, what problems were addressed, and the results, including conclusions and/or recommendations
- Where the subject studied occurred
- When the subject studied occurred
- Why the report was written (function), including under what authority, for what reason, or by whose request
- How the subject operated, functioned, or was used

Pay attention to these essential elements when you consider your stakeholders. That may include the person(s) the report is about, whom it is for, and the larger audience of the organization. Ask yourself who the key decision makers are, who the experts will be, and how your words and images may be interpreted. While there is no universal format for a report, there is a common order to the information. Each element supports the main purpose or function, playing an important role in the transmission of information.

PRESENTATION OF A REPORT

Collect information. The first step in writing a presentation report is to obtain data about the subject. It is vital for the person writing the report to obtain as much information about the subject as possible, including statistics and important facts.

Organize the information. After you find a sufficient amount of information, organize it into categories. A presentation speech must be well-organized in order to present the idea or project in a way that the audience can understand.

Determine your objective. Look through the information you have collected and determine the goals for the report. Determine what you would like to accomplish through the report and focus on the main objective. Be very clear when you reveal this in the report.

Consider your audience. Remember who will be reading or listening to the presentation report. Before you begin writing your paper, you must focus on the audience and their expectations and preconceived notions.

Develop an outline. Using all of the considerations described so far, write an outline. Focus on the main messages and objectives of the subject and list each point in an order that is logical.

Write an introduction. A presentation report should have a strong introduction. Take the main idea of the subject and create an interesting and captivating introduction to capture the audience's attention. This might be a claim or a statement; or it might be a legend or a conclusion. Choose something catchy to say and avoid anything that might be long and drawn out or tedious.

Complete the report. Continue by writing the body of the report and wrap it all up with a strong conclusion that ties the together the introduction and the main points of the report.

Use visuals. If you will be presenting the report to an audience, choose some visuals that would assist in getting your message across.

Presentation vs Report Writing: What's the Difference?

The main difference between a Presentation and Report Writing is that a report is usually fairly extensive and gives a detailed account of the information on a particular topic. Whereas, a presentation is mostly a synopsis which highlights the key points that are important for the audience.

Since one of the key objectives of both – a presentation and a report is to give information to its intended audience, people often tend to confuse between the two. So, let's understand the nuances in further detail.

Key Differences between Presentation and Report Writing

In order to make sure that we don't end up creating an incorrect document the next we are tasked with an assignment, it is important for us to understand the differences between a presentation and report writing.

Purpose

As I mentioned earlier, one of the purposes of both a presentation and a report is typically to provide insights or useful information about a certain topic.

However, the purpose of creating a presentation is to share information in a short period of time; usually not more than 15-20 minutes. Thus, it ends up being a synopsis of a topic rather than giving a detailed account on a particular topic.

Report Writing on the other hand goes into the intricacies involved within a particular topic.

For a research oriented report writing, the purpose of the report is often to capture the detailed account for the research conducted including (but not limited to) purpose of the research, methodology adopted for conducting research, observations and findings, discrepancies (if any), and the conclusion.

Writing a report often scientific approach and requires a technical understand of the subject.

Depth of Information

Another difference between a report and a presentation is the depth of information that is shared in the two types of documents.

As mentioned in the previous point, a report goes in great depth capturing the thought behind almost every single action taken by the researcher; thereby giving an in-depth understanding on the topic.

A presentation on the other hand picks up key pieces of information and aims to provide very specific details usually in the interest of the available time of the audience.

A typical example of a report would be a corporate annual report which explains the details of actions taken by the organisation and how it performed. This information is shared across multiple paragraphs usually accompanied by a table giving the performance details. Whereas, a presentation of the annual report only summarizes the key points on the performance of the company throughout the year.

Information Delivery

Since a presentation is a piece of summarized information, it requires a person to share additional information while delivering the presentation. A presentation mostly contains visual cues along with a few points on each slide, which is accompanied with a talk given by an individual giving the presentation.

A presentation can be given in-person to a small group of people or even to a few hundred individuals in a large auditorium. Alternatively, a presentation can also be delivered online to several thousands of people across the globe using different softwares.

A report on the other hand doesn't necessarily require to be presented. Since it contains detailed information, it can be independently read by people at their comfort.

Reading a report can take time as it is often spread across several hundreds of pages.

Method of Engaging the Audience

Yet another difference between a presentation and report writing is the manner in which it engages its audience.

A presentation depends upon the skill of the presenter to engage the audience. A person giving a presentation not only needs to make the presentation visually appealing, it also requires the presenter to entertain the audience by means of story-telling and humor (as deemed necessary) while delivering the presentation.

A report on the other hand depends on the capability of an individual to command a language to engage its readers. It needs the person writing a report to have a good grasp of the language in order to describe the information accurately and as briefly as possible while holding the interest of the audience.

In a research study done in order to compare the understanding capability of science students based information consumed in the two formats – Presentation versus Report format, it was observed that students understood the topic better when it was explained through a presentation rather than a report.

Perhaps, one can conclude that presentation is usually more engaging than a detailed report.

STYLE IN WRITING

Types Of Writing Styles

There are four main types of writing: expository, descriptive, persuasive, and narrative. Each of these writing styles is used for a specific purpose. A single text may include more than one writing style.

Expository

Expository writing is one of the most common types of writing. When an author writes in an expository style, all they are trying to do is explain a concept, imparting information from themselves to a wider audience. Expository writing does not include the author's opinions, but focuses on accepted facts about a topic, including statistics or other evidence.

Descriptive

Descriptive writing is often found in fiction, though it can make an appearance in nonfiction as well (for example, memoirs, first-hand accounts of events, or travel guides). When an author writes in a descriptive style, they are painting a picture in words of a person, place, or thing for their audience. The author might employ metaphor or other literary devices in order to describe the author's impressions via their five senses (what they hear, see, smell, taste, or touch). But the author is not trying to convince the audience of anything or explain the scene – merely describe things as they are.

Persuasive

Persuasive writing is the main style of writing you will use in academic papers. When an author writes in a persuasive style, they are trying to convince the audience of a position or belief. Persuasive writing contains the author's opinions and biases, as well as justifications and reasons given by the author as evidence of the correctness of their position. Any "argumentative" essay you write in school should be in the persuasive style of writing.

Narrative

Narrative writing is used in almost every longer piece of writing, whether fiction or nonfiction. When an author writes in a narrative style, they are not just trying to impart information, they are trying to construct and communicate a story, complete with characters, conflict, and settings

Definition of Style

The style in writing can be defined as the way a writer writes. It is the technique that an individual author uses in his writing. It varies from author to author, and depends upon one's syntax, word choice, and tone. It can also be described as a "voice" that readers listen to when they read the work of a writer.

Types of Style

There are four basic literary styles used in writing. These styles distinguish the works of different authors, one from another. Here are four styles of writing:

Expository or Argumentative Style

Expository writing style is a subject-oriented style. The focus of the writer in this type of writing style is to tell the readers about a specific subject or topic, and in the end the author leaves out his own opinion about that topic.

Descriptive Style

In descriptive writing style, the author focuses on describing an event, a character or a place in detail. Sometimes, descriptive writing style is poetic in nature in, where the author specifies an event, an object, or a thing rather than merely giving information about an event that has happened. Usually the description incorporates sensory details.

Persuasive Style

Persuasive style of writing is a category of writing in which the writer tries to give reasons and justification to make the readers believe his point of view. The persuasive style aims to persuade and convince the readers.

Narrative Style

Narrative writing style is a type of writing wherein the writer narrates a story. It includes short stories, novels, novellas, biographies, and poetry.

Short Examples of Style in Sentences

1. If it sounds like I'm writing, then I prefer to rewrite it.
2. (Conversational)
3. "I think it's a good ide,." said Jenny.
4. "You can imagine the outcomes!" retorted Emma, pushing the door open.
5. Reluctantly, Jenny followed.
6. (Narrative)
7. The sunset fills the entire sky with the lovely deep color of rubies, setting the clouds ablaze.
8. (Descriptive)

9. The waves waltz along the seashore, going up and down in a gentle and graceful rhythm, like dancing.
10. (Descriptive)
11. A trip to Switzerland is an excellent experience that you will never forget, offering beautiful nature, fun, and sun. Book your vacation trip today.
12. (Persuasive)
13. She hears a hoarse voice, and sees a shadow moving around the balcony. As it moves closer to her, she screams to see a gigantic wolf standing before her.
14. (Narrative)
15. From the garden, the child plucks a delicate rose, touching and cradling it gently as if it is a precious jewel.
16. (Descriptive)
17. What if you vote for me? I ensure you that your taxes will be very low, the government will provide free education, and there will be equality and justice for all citizens. Cast your vote for me today.
18. (Persuasive)
19. The deep blue color of the cat's eyes is like ocean water on the clearest day you could ever imagine.
20. (Descriptive)
21. The soft hair of my cat feels silky, and her black color sparkles as it reflects sunlight.
22. (Descriptive)
23. This painting has blooming flowers, rich and deep blues on vibrant green stems, begging me to pick them.
24. (Descriptive)
25. Our criminal investigators are famous for recovering clients' assets, as we not only take your cases but represent truly your interests.
26. (Persuasive)

27. Our headache medicines will give you relief for ten hours, with only one pill – and without any side effects. Try it today.
28. (Persuasive)
29. Tax raising strategy is wrong because it will cripple businesses. We should reduce taxes to boost growth.
30. (Persuasive)

CONCLUSION AND GENERALISATION

Conclusion

The last key element of report writing is the conclusion section. Present the conclusion as follows:

- The primary conclusion should come first.
- Identify and interpret the major problems related to the case your report is based on.
- Relate to the objectives that you have mentioned in the introduction.
- Keep the conclusion brief and specific.

Importance of a Good Conclusion

A well-written conclusion provides you with several important opportunities to demonstrate your overall understanding of the research problem to the reader. These include:

1. Presenting the last word on the issues you raised in your paper. Just as the introduction gives a first impression to your reader, the conclusion offers a chance to leave a lasting impression. Do this, for example, by highlighting key points in your analysis or findings.
2. Summarizing your thoughts and conveying the larger implications of your study. The conclusion is an opportunity to succinctly answer the "so what?" question by placing the study within the context of past research about the topic you've investigated.

3. Demonstrating the importance of your ideas. Don't be shy. The conclusion offers you a chance to elaborate on the significance of your findings.
4. Introducing possible new or expanded ways of thinking about the research problem. This does not refer to introducing new information [which should be avoided], but to offer new insight and creative approaches for framing/contextualizing the research problem based on the results of your study.

Types of conclusions for research papers

Depending on your research topic and the style of your paper, you may choose to write your conclusion according to specific types. The following information can help you determine which approach to take when you write your conclusion.

Summarizing conclusion

A summarizing conclusion is typically used for giving a clear summary of the main points of your topic and thesis. This is considered the most common form of conclusion, though some research papers may require a different style of conclusion. Common types of research papers that call for this kind of conclusion include persuasive essays, problem and solution research, argumentative papers and scientific and historical topics.

Externalizing conclusion

An externalizing conclusion presents points or ideas that may not have been directly stated or relevant to the way you presented your research and thesis. However, these types of conclusions can be effective because they present new ideas that build off of the topic you initially presented in your research. Externalizing conclusions get readers thinking in new directions about the impacts of your topic.

Editorial conclusion

In an editorial conclusion, you are presenting your own concluding ideas or commentary. This type of conclusion connects your thoughts to the research you present. You might state how you feel about outcomes, results or the topic in general. The editorial conclusion can work especially well in research papers that present opinions, take a humanistic approach to a topic or present controversial information.

Generalisation

Generalization refers to the extent to which findings of an empirical investigation hold for a variation of populations and settings. The definition of generalization is closely related to the concept of external validity, which concerns whether findings of one particular study can be applied to unexamined subjects and contexts. Some scholars, such as William Shadish and colleagues, argued that construct validity is another type of generalization, which concerns how well the variables operationalized in a study represent the abstract constructs they are supposed to represent. Overall, it is common for researchers to use the term *generalization* to refer to external validity in a broad sense. Generalization pertains to various aspects of a research design, including participants, settings, measurements, and experimental treatments.

Why is this a problem?

The answer lies in the fact that research conducted on WEIRD people is not generalizable. In an ideal world, to test a hypothesis, you would sample an entire population. You would use every possible variation of an independent variable, and be ready to measure every possible dependent variable to get a very accurate understanding of the topic at hand. But in the vast majority of cases, this is not feasible, so a representative group is chosen to reflect the whole population.

Thus, in order to generalize you need to select a sample group that is representative of the whole population.

Representativeness

A high budget research project might take a smaller sample from every school in the country; a lower budget operation may have to concentrate upon one city or even a single school. The key to generalization is to understand how much your results can be applied backwards to represent the group of US children, as a whole. The first example, using every school, would be strongly representative, because the range and number of samples is high. These samples more closely resembles the population they are trying to study. Testing only one school makes generalization difficult and affects the external validity.

You might find that one school generates worse than average results for children using that particular educational program. However, a school in the next town might contain children who do better. The students may be from a completely different socioeconomic background or culture.

Critics of your results will pounce upon such discrepancies and question your entire experimental design. At best, you can now only generalize to that particular school, and cannot legitimately make any conclusions about *all* US school children.

Time effects

Representativeness is not just about the qualities of the population, but those qualities *at a particular time*.

Large sample groups could be gathered from schools all across the US. But if one sample is tested at the beginning of the year and the other group at the end, the groups now differ from one another. Perhaps the latter children perform better simply because they are now slightly older than the former.

Good experiments consider the element of time and design research to minimize its effects.

Sample size

The smaller a sample gets, the less likely it is to be representative. For example, let's say that 1% of all US children would have done extremely well on the educational program. This is 1 in 100 children. If your sample size happens to only be 60 children, your sample may not contain a child who is likely to do very well in the program. Your sample is less representative because it is smaller. Your results will be different depending on whether your sample contains one of these children or not.

Most statistical tests contain an inbuilt mechanism to take into account sample sizes with larger groups and numbers, leading to results that are more significant.

The problem is that they cannot distinguish the validity of the results, and determine whether your generalization systems are correct. This is something that must be taken into account when generating a hypothesis and designing the experiment.

The other option, if the sample groups are small, is to use proximal similarity and restrict your generalization. This is where you accept that a limited sample group cannot represent all of the population.

If you sampled children from one town, it is dangerous to assume that it represents all children. It is, however, reasonable to assume that the results should apply to a similar sized town with a similar socioeconomic class. This is not perfect, but certainly contains more external validity and would be an acceptable generalization.

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