

METHODS OF DATA ANALYSIS AND THEIR TOOLS IN SOCIAL SCIENCE

Dr. G. P. Meena
Professor & Dean
School of Agriculture
University of Technology, Jaipur (Rajasthan)

Data analysis is the process of evaluating data using analytical and statistical tools to discover useful information and aid business decision making. It is the process of inspecting, cleaning, transforming, and modelling data with the objective of discovering useful information, arriving at conclusions, and supporting the decision making process.

Le Compte and Schensul “data analysis is a process used by researchers for reducing data to a story and interpreting it to derive insights”. It is a process where a large chunk of data is reduced into smaller fragments which make sense.

According to Marshall and Rossman, “data analysis is messy, ambiguous, and time consuming, but a creative and fascinating process through which a mass of collected data is brought to order, structure and meaning”.

Kerul defined that, “studying the organized material in order to discover inherent facts. The data are studied from as many as possible to explore the new facts”.

Simply it can be say that, the data analysis and interpretation is a process representing the application of deductive and inductive logic in the research and data analysis. Data analysis is the most crucial part of any research. Data analysis summarizes collected data. It involves the interpretation of data gathered through the use of analytical and logical reasoning to determine patterns, relationships or trends. There are a several data analysis methods including data mining, text analytics, business intelligence and data visualization.

Purpose of Data Analysis:

The following are the main purposes of data analysis

(i) *Description*: It involves a set of activities which is a first step in the development of most fields. A researcher must be able to identify a topic about which much was not known and researcher must be able to collect data and convince others about its importance.

(ii) *Construction of Measurement scale*: The researchers should construct a measurement scale. All numbers gathered by measuring instruments can be placed into one of four categories:

(a) Nominal: The number serves as nothing more than label

(b) Ordinal: Such numbers are used to designate an ordering along some dimensions such as from less to more, from small to large, from sooner to later.

(c) Interval: the interval provides more precise information than ordinal one. By this type of measurement the researchers can make exact and meaningful decisions.

(d) Ratio scale: It has two unique characteristics, the interval between points can be demonstrated to be precisely the same and the scale has a conceptually meaningful zero point.

(iii) *Generating empirical relationships*: Another purpose of analysis of data is identification of regularities and relationships among data. The researcher has no clear idea about the relationship which will be found from the collected data. If the data were available in details it will be easier to determine the relationship. The researcher can develop theories if he is able to recognize pattern and orders of data. The pattern may be showing association among variables, which may be done by calculating correlation among variables or showing order, precedence or priority. The derivation of empirical laws may be made in the form of simple questions relating one interval or ratio scaled variable to a few others through graph method.

(iv) *Explanation and prediction*: Generally knowledge & research are equated with the identification of causal relationships and all research activities are directed to it. But in many fields the research has not been developed to the level where causal explanation is possible or valid predictions can be made. In such a situation explanation and prediction is construct as enabling the values of one set of variables to be derived given the values of another.

How is data analysis performed?

Data analysis is a part of a longer process of deriving business intelligence. The process includes one or more of the following steps:

1. *Defining objectives*: Any study must begin with a set of clearly defined business objectives. Much of the decisions made in the rest of the process depends on how clearly the objectives of the study have been stated.
2. *Posing questions*: An attempt is made to ask a question in the problem domain. For example, do red sports cars get into accidents more often than others?
3. *Data collection*: Data relevant to the question must be collected from the appropriate sources. In the example above, data might be collected from a variety of sources including DMV or police accident reports, insurance claims and hospitalization details. When data is being collected using surveys, a questionnaire to be presented to the subjects is needed. The questions should be appropriately modeled for the statistical method being used.
4. *Data wrangling*: Raw data may be collected in several different formats. The collected data must be cleaned and converted so that data analysis tools can import it. For example, we may receive DMV accident reports as text files, insurance claims from a relational database and hospitalization details as an API. The data analyst must aggregate these different forms of data and convert into a form suitable for the analysis tools.
5. *Data Analysis*: This is the step where the cleaned and aggregated data is imported into analysis tools. These tools allow to explore the data, find patterns in it, and ask and answer what if questions. This is the process by which sense is made of data gathered in research by proper application of statistical methods.
6. *Drawing conclusions and making predictions*: This is the step where, after sufficient analysis, conclusions can drawn from the data and appropriate predictions can be made. These conclusions and predictions may then be summarized in a report delivered to end users.

Functions of Data Analysis:

The following are the functions of data analysis –

1. Examining the statement of the problem of the available data
2. Examining each hypothesis of the problem.
3. Study of the data before data analysis
4. Analyse the data through statistical calculations
5. Analyse the data through it is about research problem
6. Analyse the data in terms of significant tables that the available data permits for the analysis of data.

Benefits of Data Analysis:

Data analysis helps in structuring the findings from different sources of data.

Data analysis is very helpful in breaking a macro problem into micro parts.

Data analysis acts like a filter when it comes to acquiring meaningful insights out of huge data set.

Data analysis helps in keeping human bias away from the research conclusions with the help of proper statistical treatment.

Types of Data Analysis:

There are four types of data analysis which are described below:

- Descriptive analysis
- Diagnostic analysis
- Predictive analysis
- Prescriptive analysis
- *Descriptive Analysis:* The first type of data analysis is descriptive analysis. It is at the foundation of all data insight. It is the simplest and most common use of data. Descriptive analysis answers the “what happened” by summarizing past data.
- *Diagnostic Analysis:* Diagnostic analysis takes the insight found from descriptive analytics and drills down to find the cause of that outcome. Researchers make use of this type of analytics as it creates more connections b/w data and identifies patterns of behaviour.
- *Predictive analysis:* Predictive analysis uses the data have summarized to make logical predictions of the outcomes of events. This analysis relies on statistical modeling, which requires added technology and manpower to forecast. It is also important to understand the forecasting is only an estimate; the accuracy of predictions relies on quality and detailed data.
- *Prescriptive analysis:* It is the frontier of data analysis, combining the insight from all previous analyses to determine the course of action to take in a current problem or decision. It utilizes state of the art technology and data practices.

Statistical Calculations /Tools:

The researcher will have to use either descriptive statistics or inferential statistics for the purpose of the analysis.

(i) The descriptive statistics may be on any of the following forms:

- a) Measures of central Tendency: These measures are mean, median, mode, geometric mean & harmonic mean. In behavioural statistics the last two measures are not used, which of the first three will be used in social statistics depends upon the nature of the problem.
- b) Measures of variability: these measures are range, mean deviation, quartile deviation and standard deviation. In social statistics the first two measures are rarely used. The use of standard deviation is very frequently made for the purpose of analysis.
- c) Measures of Relative Position: These measures are standard scores (z or T scores), percentiles and percentile ranks. All of them are used in descriptive statistics.
- d) Measures of Relationships: These measures are co-efficient of correlation, partial correlation and multiple correlation. All of them are used in educational statistics for the analysis of data. However, the use of rank method is more in comparison to Karl pearson method.

(ii) The inferential statistics may be in any one of the below forms:

- a. Significance of difference b/w means: It is used to determine whether a true difference exists b/w population means of two samples.
- b. Analysis of variance: The Z or t tests are used to determine whether there was any significant difference b/w the means of two random samples. The F test enables the researcher to determine whether the sample means differ from one another to a greater extent than the test score differ from their own sample means using the F statistics.
- c. Analysis of Co-variance: It is an extension of analysis of variance to test the significance of difference b/w means of final experimental data by taking into account the correlation b/w the dependent variable and one or more co-variates or control variables and by adjusting initial means differences in the group.
- d. Correlation Method: Either of two methods of correlation can be used for the purpose of calculating the significance of the difference b/w co-efficient of correlation.
- e. Chi-square test: It is used to estimate the likelihood that some factor other than chance accounts to the observed relationship. In this test the expected frequency and observed frequency are used for evaluating chi-square.
- f. Regression Analysis: For calculating the probability of occurrence of any phenomenon or for predicting the phenomenon or relationship between different variables regression analysis is done.

ANOVA TEST (ONE WAY CLASSIFICATION)

The F-test was developed by R.A. Fisher. The object of the test is to find out whether the two independent estimates of population variance differ significantly or whether the two samples be regarded as drawn from the normal population. F-test is based on ratio of variance. The variance represents rows and columns and degree of freedom. It also represents how row and column affect. The ANOVA single factor simply ratio of variance, the average variation with the average of the average.

Data collection is followed by the process of data analysis and interpretation. It is one of the most important parts of research study. The data is analyzed using various statistical tools to interpret the results of the study. It is extremely important to analyze the data collected by the right statistical tool as this will affect the accuracy of the results that are interpreted for study. A wide range of statistical tools are interpreted for study, available and used to analyze data that is collected for research purpose, various type of statistical tools used for analysis of data includes: mean, mode, median, dispersion, standard deviation, Excel and other spreadsheet program

distributions and descriptive statistics – mean and percentage, correlation and regression techniques and statistical software packages – SAS, SPSS & Stata.

The data hence is interpreted with the help of statistical tool such as frequency distribution, average, observed time, normal time, standard time, percentage, graph, comparative approach, index values for MOST, TMU for MOST and time study & MOST technique, MS office – MS-word, MS-excel and chi-square test.

In every research work, it is essential to collect factual material or data unknown or untapped so far. They can be obtained from many sources, direct & indirect. It is necessary to adopt a systematic procedure to collect essential data. Relevant data adequate in quality & quantity should be collected. They should be sufficient, reliable and valid. For checking new, unknown data required for the study of any problem you may use various devices, instruments, apparatus and appliances. For each and every type of research we need certain instruments to gather new facts or to explore new fields. The instruments thus employed as means for collecting data are called tools.

The selection of suitable instruments or tools is of vital importance for successful research. Different tools are suitable for collecting various kinds of information for various purposes. The research worker may use one or more of the tools in combination for his purpose. Research students should therefore familiarize themselves with the varieties of tools with their nature, merits and limitations. They should also know how to construct and use them effectively. The systematic way and procedure by which a complex or scientific task is accomplished is known as the technique. Techniques are the practical method, skill or art applied to a particular task. So, as a researcher we should aware of both the tools & techniques of research.

The major tools of research in education can be classified broadly into the following categories:

(A) Inquiry forms

- Questionnaire
- checklist
- score card
- schedule
- Rating scale
- Opinionnaire
- Attitude scale

(B) Observation

(C) Interview

(D) Sociometry

(E) Psychological tests

- Achievement test
- Aptitude test
- Intelligence test
- Interest inventory
- Personality measures etc.

RATING SCALE:

Rating scale is one of the enquiry forms. Form is a term applied to expression or judgement regarding some situation, object or character. Opinions are usually expressed on a scale of values. Rating techniques are devices by which such judgement may be quantified. It is very useful device in assessing quality, specially when quality is difficult to measure objectively. For example, “How good was the performance?” is a question which can hardly be answered objectively. Rating scales record judgements or opinions and indicates the degree or amount of different degrees of quality which are arranged along a line in the scale. For example – How good was the performance?

Excellent, Very good, Good, Average, Below average, Poor, Very poor.

This is the most commonly used instrument for making appraisal. It has a large variety of forms and uses. Typically they direct attention to a number of aspects or traits of the thing to be rated and provide a scale for assigning values to each of the aspects selected. They try to measure the nature or degree of certain aspects or characteristics of a person or phenomenon through the use of a series of numbers, qualitative terms or verbal descriptions.

Rating can be obtained through one of three major approaches:

- Paired comparison
- Ranking and
- Rating scales

Paired comparison approach techniques call for a panel of raters to rate every individual in comparison to a standard person. In the ranking approach every single individual in a group is compared with every other individual and to arrange the judgement in the form of a scale. In the rating scale approach which is the more common and practical method rating is based on the rating scales, a procedure which consists of assigning to each trait being rated a scale value giving a valid estimate of its status and then comparing the separate rating into an overall score.

Purpose of Rating scale:

Rating scales have been successfully utilized for measuring the following:

- Teachers performance/ effectiveness
- Personality, anxiety, stress, emotional intelligence etc.
- School appraisal including appraisal of courses, practices and programmes

Useful hints on Construction of Rating scale:

A rating scale includes three factors like:

- (i) The subjects or the phenomena to be rated
- (ii) The continuum along which they will be rated and
- (iii) The judges who will do the rating.

Use of Rating scale:

Rating scales are used for testing the validity of many objective instruments like paper pencil inventories of personality. They are also advantages of the following fields like:

- Helpful in writing reports to parents
- Helpful in filling out admission blanks for colleges
- Helpful in finding out students needs
- Making recommendations to employers

- Supplementing other sources of understanding about the child
- Stimulating effect upon the individuals who are rated.

Limitations of Rating scale:

The rating scale suffers from many errors and limitations like the following:

As you know that the raters would not like to run down their own people by giving them low ratings. So in that case they give high ratings to almost all cases. Sometimes also the raters are induced to be unduly generous in rating aspects which they had to opportunity to observe. If the rater rate is higher side due to those factors then it is called as the generosity error of rating.

The Errors of Central Tendency

Some observers wants to keep them in safe position, therefore they rate near the midpoint of the scale. They rate almost all as average.

Stringency Error

Stringency error is just the opposite of generosity error.

These types of raters are very strict cautious and hesitant in rating in average and higher side. They have a tendency to rate all individuals low.

The Halo Error

When a rater rates one aspects influenced by others is called halo effect. For if a person will be rated in higher side on his achievement because of his punctuality or sincerity irrespective of his perfect answer it is called as halo effect. The biased-ness of the rater effects from one quality to other.

The Logical Error

It is difficult to convey to the rater just what quality one wishes him to evaluate. An adjective or adverb may have no universal meaning. If the terms are not properly understood by the rater and he rates, then it is called as the logical error. Therefore brief behaviour statements having clear objectives should be used.

ATTITUDE SCALE:

Attitude scale is a form of appraisal procedure and it is also one of the enquiry forms. Attitude scales have been designed to measure attitude of a subject or group of subjects towards issues, institutions and group of people.

The term attitude is defined in various ways, the behaviour which we define as attitudinal or attitude is a certain observable set organism or relative tendency preparatory to and indicative of more complete adjustment.

– L.E. Bernard

“An attitude may be defined as a learned emotional response set for or against something.”

– Barr David Johnson

An attitude is spoken of as a tendency of an individual to read in a certain way towards a phenomenon. It is what a person feels or believes in. It is the inner feeling of an individual. It may be positive, negative or neutral.

Opinion and attitude are used sometimes in a synonymous manner, but there is a difference b/w two. You will be able to know when we will discuss about opinionnaire. An opinion may not lead to any kind of activity in a particular direction. But an attitude compels one to act either favourably or unfavourably accordingly what they perceive to be correct. We can evaluate attitude through questionnaire. But it is ill adapted for scaling accurately the intensity of an attitude. Therefore, attitude scale is essential as it attempts to minimize the difficulty of

opinionnaire and questionnaire by defining the attitude in terms of a single attitude object. All items therefore may be configured with gradations of favour order.

I. Purpose of Attitude scale:

In educational research, those scales are used especially for finding the attitude of persons on different issues like:

- Co-education
- Religious education
- corporal punishment
- Democracy in schools
- Linguistic prejudices
- International co-operation etc.

Characteristics of Attitude scale:

Attitude scale should have the following characteristics:

- It provides for quantitative measure on a unidimensional scale of continuum.
- It uses statements from the extreme positive to extreme negative position.
- It generally uses five point scale as we have discussed in rating scale.
- It could be standardised and norms are worked out.
- It disguises the attitude object rather than directly asking about the attitude on the subject.

Examples of Some Attitude scale:

Two popular and useful methods of measuring attitudes indirectly commonly used for research purpose are:

- a) Thurstone techniques of scaled values
- b) Likert's method of summated ratings.

a) Thurstone Technique:

Thurstone technique is used when attitude is accepted as a unidimensional linear continuum. The procedure is simple. A large numbers of statements of various shades of favourable and unfavourable opinion on slips of papers, which a large number of judges exercising complete detachment sort out into eleven piles ranging from the most hostile statements to the most favourable ones. The opinions are carefully worded so as to be clear and unequivocal. The judges are asked not express their opinion but to sort them at their face value. The items which bring out a marked disagreement between the judges in assigning a position are discarded. Tabulations are made which indicate the number of judges who placed each item in each category. The next step consists of calculating cumulative proportions for each item and ogives are constructed.

Scale values of each item are read from the ogives, the values of each item being that point along the baseline in terms of scale value units above and below which 50% of the judges placed the item. It will be the median of the frequency distribution in which the score ranges from 0 to 11.

The respondent is to give his reaction to each statement by endorsing or rejecting it. The median value of the statements that he checks establishes his score, or quantifies his opinion. He wins a score on an average of the sum of the values of the statements he endorse. Thurstone technique is also known as the technique equal appearing intervals.

b) The Likert scale:

The Likert scale uses items worded for or against the proposition with five point rating responses indicating the strength of the respondent approval or disapproval of the statement. This method removes the necessity of

submitting items to the judges for working out scaled values for each item. It yields scores very similar to those obtained from Thurstone scale. It is an improvement over the Thurstone method.

The first step is the collection of a number of statements about the subject in question. Statements may or may not be correct but they must be representative of opinions held by a substantial number of people. They must express definite favourableness or unfavourableness to a particular point of view. The number of favourable or unfavourable statements should be approximately equal. A trial test may be administered to a number of subjects. Only those items that correlate with the total test should be retained.

The Likert scaling techniques assigns a scale value to each of the five responses. All favourable statements are scored from maximum to minimum i.e. from a score of 5 to a score of one or 5 for strongly agree and so on 1 for strongly disagree. The negative statement or statements opposing the proposition would be scored in the opposite order i.e. from a score of 1 to a score of 5 or 1 for strongly agree and so on 5 for strongly disagree. The total of these scores on all the items measures a respondent's favourableness towards the subject in question. If a scale consists of 30 items, say, the following score values will be of interest:

$30 \times 5 = 150$ Most favourable response possible

$30 \times 3 = 90$ A neutral attitude

$30 \times 1 = 30$ Most unfavourable attitude

It is thus known as a method of summated ratings. The summed up total score of any individual would fall b/w 30 and 150, scores above 90 indicate a favourable and scores below 90 an unfavourable attitude.

Limitations of Attitude scale:

- * An individual may express socially acceptable opinion conceal his real attitude
- * An individual may not be a good judge of himself and may not be clearly aware of his real attitude.
- * He may not have been controlled with a real situation to discover what his real attitude towards a specific phenomenon was.
- * There is no basis for believing that the five positions indicated in the Likert's scale are equally spaced.
- * It is unlikely that the statements are of equal value in 'forness' or 'againstness'.
- * It is doubtful whether equal scores obtained by several individuals would indicate equal favourableness towards a given position.
- * It is unlikely that a respondent can validly react to a short statement on a pointed form in the absence of real life qualifying situation.
- * In spite of anonymity of response, individuals tend to respond according to what they should feel rather than what they really feel.

However, until more precise measures are developed, attitude scale remains the best device for the purpose of measuring attitudes and beliefs in social research.

OPINIONNAIRE

"Opinion polling or opinion gauging represents a single question approach. The answers are usually in the form of 'yes' or 'no'. An undecided category is often included. Sometimes large number of response alternatives it provided."

– Anna Anastasi

The terms opinion and attitude are not synonymous, though sometimes we used it synonymously. We have till now discussed that attitude scale. We have also discussed that attitudes are impressed opinions. You can now understand the difference between opinionnaire & attitude scale, when we discuss about opinionnaire, it is characteristics and purposes. Opinion is what a person says on certain aspect of the issue under consideration.

It is an outward expression of an attitude held by an individual. Attitude of an individual can be inferred or estimated from his statements of opinions.

An opinionnaire is defined as a special form of inquiry. It is used by the researchers to collect the opinions of a sample of population on certain facts or factors the problem under investigation. These opinions on different facts of the problem under study are further quantified, analysed and interpreted.

Purpose:

Opinionnaire are usually used in researches of the descriptive type which demands survey of opinions of the concerned individuals. Public opinion research is an example of opinion survey. Opinion polling enables the researcher to forecast the coming happenings in successful manner.

Characteristics:

- The opinionnaire makes use of statements or questions on different aspects of the problem under investigation.
- Responses are expected either on three point or five point scales.
- It uses favourable or unfavourable statement.
- It may be sub-divided into sections.
- The gally poll ballots generally make use of questions instead of statements.
- The public opinion polls generally rely on personal contact rather than mail ballots.

QUESTIONNAIRE

A questionnaire is a form prepared and distributed to secure responses to certain questions. It is a device for securing answers to questions by using a form which the respondent fills by himself. It is a systematic compilation of questions that are submitted to a sample of population from which information is derived. Questionnaire relies on written information supplied directly by people in response to questions, the information from questionnaire tends to fall into two broad categories: facts and opinions. It is worth stressing that, in practice, questionnaires are very likely to include questions about both facts and opinions.

This method of data collection is quite popular, particularly in case of big inquiries. It is being adopted by private individuals, research workers, private and public organizations and even by governments. In this method a questionnaire is sent (usually by post) to the persons concerned with a request to answer the questions and return the questionnaire. A questionnaire consists of a number of questions printed or typed in a definite order on a form or set of forms. The questionnaire is mailed to respondents who are expected to read and understand the questions and write down the reply in the space meant for the purpose in the questionnaire itself. The respondents have to answer the questions on their own.

According to Barr, Davis and Johnson, “A questionnaire is a systematic compilation of questions that are submitted to a sampling of population from which information is desired.”

According to Goode and Hall, “In general, the word questionnaire refers to a device for securing answers to questions by using a form which the respondent fills in himself.”

A questionnaire should allow us to collect the most complete and accurate data in a logical flow. This is done in order to reach reliable conclusions from what we are planning to observe. A well designed questionnaire should meet the research goal & objectives and minimize unanswered questions a common problem bound to many surveys.

Questionnaires are usually used for collecting data from the respondents through a series of questions and other prompts set by the organization conducting such experiments. Questionnaires are not necessarily statistical data, but they do act as an effective alternative for surveys since they are cheap and can be widely used to reach within people in a short period of time. A questionnaire is a research instrument consisting of a series of questions for the purpose of gathering information from respondents. It can be thought of as a kind of interview. They can be carried out face to face, by telephone, computer or post.

Questionnaire provides 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 population when interviews would be impractical. However, a problem with questionnaire 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.

There are certain issues a researcher should be aware of before resorting to questionnaire technique of data collection. Following are some of the examples:

- a) Is questionnaire the appropriate technique of data collection for this study?
- b) What type of questions should be considered? standardized/closed or open ended?
- c) How many questions should be included in the questionnaire?
- d) In standardized questions, what types of responses should be considered?
- e) Choosing the language of the questionnaire.
- f) What are the aspects of the study that must be covered by the questionnaire?
- g) What elements will be included in the instructions and the covering letters of the questionnaire?
- h) How long should a questionnaire be to justify its purpose?
- i) How ethic and objectivity be observed in the questionnaire?

Purpose

The purpose of the questionnaire is to gather information from widely scattered sources. It is mostly used in cases where one can not readily see personally all of the people from whom he desires responses. It also used where there is no particular reason to see them personally.

Characteristics of a Good questionnaire:

1. It deals with an important or significant topic.
2. Its significance is carefully stated on the questionnaire itself or on the covering letter.
3. It seeks only that data which cannot be obtained from the sources like books, reports and records.
4. It is short as possible, only long enough to get the essential data.
5. It is attractive in appearance, neatly arranged and clearly duplicated or printed.
6. Directions are clear and complete, important terms are clarified.

7. The questionnaire is objective, with no cues, hints or suggestions.
8. Questions are presented in a order from simple to complex.
9. Double negatives, adverbs and descriptive adjectives are avoided.
10. Double barrelled questions or putting two questions in one question are also avoided.

Criteria of Evaluating a questionnaire

- It should provide full information pertaining to the area of research
- It should provide accurate information
- It should have a decent response rate
- It should adopt an ethical stance, and
- It should be feasible

Types of Questionnaire:

The following are the types of questionnaire:

1. **Structured Questionnaire:** A structured questionnaire is that one which has pre-determined questions with answers. The respondent only tick the correct answers in short term “yes” or “no”. It is also called pre-coded, closed restricted and categorical questionnaire. The questions will be administered uniformly, without any changes in the same order to all the respondents. Structured questionnaire forms consists of different types

a. **Open-ended questionnaire:** This type of questionnaire carries questions designed to permit free response by the respondent. There is no restriction on the respondent while providing information.

b. **Close-ended questionnaire:** This type of questionnaire consists of questions which carry fixed alternative answers, so that the respondent chooses the appropriate answers within the alternative answers provided. This type of questionnaire restricts the freedom of the respondent.

c. **Mixed type of questionnaire:** This questionnaire is a combination of both, the open and close-ended questions.

d. **Pictorial questionnaire:** If questions are in the form of pictures, cartoons, paintings and sketches then it is called pictorial questionnaire.

e. **Questionnaire of facts, attitudes and opinions:** If the questionnaire is in the form of targeting respondents responses which could be opinions, attitudes or facts, then it is called questionnaire of facts, attitudes and opinions.

2. **Un-structured questionnaire:** Un-structured questionnaire is that in which pre-determined questions are given but have no answers. These answers are to be structured by the respondents. Open questions are given for the respondents to give answers. In such type of questionnaire, interview b/w the researcher and respondents or face to face conversation takes place, such type is also called open-ended, unrestricted or non-categorical questionnaire.

3. **Hand delivered questionnaire:** This is a type of questionnaire in which the investigator himself go to the field and hand over the pre-written questions to the respondents. They only tick mark the correct answers in front of the investigator. It is also called direct questionnaire because the researcher directly distributes the questionnaire among the respondents.

4. **Mailed questionnaire:** Most of the researchers use that type of questionnaire. In that type the respondents are living in far-flung areas at a distance & the questionnaire is sent to them by post; they fill it and return back

to the researcher or concerned department. A particular guide line or instruction list is attached to the questionnaire for the respondents guidance.

Advantages of Questionnaire:

1. Questionnaires are less expensive compared to other methods of data collection because, as one could see, while the questionnaire goes to the respondent through mail/post and the researcher does not go individually to the respondents.
2. Secondary, possibility of getting data within a fixed time period is more.
 3. The respondent feels convenient & answers the questions according to his own convenience; as such this method is a convenient method.
 4. This technique offers greater assurance of anonymity.
 5. Questionnaires help to avoid bias or error caused by the presence or attitudes of the researchers.
 6. It is stable, consistent and uniform measure without variation.
 7. It offers a considered and objective view on the issue, since respondents can consult their files, subjects and preference to answer rather than talk on the issue.
 8. It is not affected by problems of no-contact by researchers with respondents.

Disadvantages of Questionnaire:

1. Low rate of return of the duly filled in questionnaire; bias due to non-response is often indeterminate.
2. It can be used only when respondents are educated and cooperative.
3. The control over questionnaire may be lost once it is sent.
4. There is inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been despatched.
5. There is also a possibility of ambiguous replies or omission of replies altogether to certain question; interpretation of omission is difficult.
6. It is difficult to know whether willing respondents are truly representative.
7. This method is likely to be the slowest of all.
8. It do not offer opportunities for motivating the respondent to participate in answering the questions.

Before using this method, it is always advisable to conduct pilot study (pilot survey) for testing the questionnaire. In a big enquiry the significance of pilot survey is felt very much. Pilot survey is in the replica and rehearsal of the main survey. Such a survey, being conducted by experts, brings to the light the weaknesses (if any) of the questionnaire and also of the survey technique. From the experience gained in this way, improvement can be effected.

CHECKLIST

A checklist is a type of informational job aid used to reduce failure by compensating for potential limits of human memory and attention. It helps to ensure consistency and completeness in carrying out a task. A basic example is “to do list”. A more advanced checklist which lays out tasks to be done according to time of a day or other factors. The checklist consists of a list of items with a place to check or to mark yes or no.

Purpose

The main purpose of checklist is to call attention to various aspects of an object or situation, to see that nothing of importance is overlooked. For example, if you have to go for outing for a week, you have to list what things you have to take with you. Before leaving home, if you will check your baggage with the list there will be less chance of forgetting to take any important thing like toothbrush etc. It ensures the completeness of details of the data. Responses to the checklist items are largely a matter of fact, not of judgement. It is an important tool in gathering facts for educational surveys.

Uses

Checklists are used for various purposes. As we have discussed that we can check our requirements for journey, Birthday list, performing for passport, submitting examination forms or admission forms etc. In every case, if we will check before doing the work, then there is less chance of overlooking any important thing. As it is useful in our daily life, it is also useful in educational fields in the following way:

- To collect acts for educational studies, survey.
- To record behaviour in observational studies.
- To use in educational appraisal studies of school, buildings, property, plan, text book, instructional procedures and outcomes etc.
- To rate the personality.
- To know the interest of the subjects also Kuder’s interest inventory & strong’s interest blank are also checklists.

Hints on constructing checklist

- Items in the checklist may be continuous or divided into groups of related items.
- Items should be arranged in categories and the categories in a logical or psychological order.
- Terms used in the items should be clearly defined.
- Checklist should be continuous and comprehensive in nature.
- A pilot study should be taken to make it standardized.
- Checklist can be constructed in four different ways by arranging items differently.
 1. In one of the arrangement all items found in a situation are to be checked. For example, a subject may be asked to check (✓) in the blank side of each activity undertaken in a school.
 2. In the second form, the respondent is asked to check with a ‘yes’ or ‘no’ or asked to encircle or underline the response to the given item. For example, (1) Does your school have a house system Yes/No.

3. In this form, all the items are positive statements with check (✓) to be marked in a column at a right. For example (1) The school functions as a community centre ().
4. The periodical tests are held – fortnightly, monthly, quarterly, yearly.

The investigator has to select any one of the format appropriate to his problem and queries or the combination of many as it requires.

Analysis and Interpretation of checklist Data

The tabulation and quantification of checklist data is done from the responses. Frequencies are counted, percentages and averages calculated, central tendencies, measures of variability and co-efficient of correlation computed on and when necessary. In long checklist where related items are grouped together category wise, the checks are added up to give total scores for the category wise total scores can be compared with themselves as with similar scores secured through other studies.

The conclusions from checklist data should be arrived at carefully and judiciously keeping in view the limitations of the tool & respondent.

Merits

- Students can measure their own behaviour with the help of checklist
- Easy and simple to use and frame the tools
- Wanted and unwanted behaviour can be included
- Personal social development can be checked

Limitations

- Only the presence or absence of the ability can be tested
- Yes or no type judgement can only be given
- How much can not be tested through checklist

PSYCHOLOGICAL TESTS

Among the most useful and most frequently employed tools of educational research psychological tests occupy a very significant position. Psychological tests are designed to describe and measure a sample of certain aspects of human behaviour or inner qualities. They yield objective descriptions of some psychological aspects of an individual personality and translate them in quantitative terms. As we have mentioned earlier there are various kinds of psychological tests. The two tests 1) Aptitude tests, 2) Inventories are discussed below.

1) Aptitude Test

“Aptitude tests attempt to predict the capacities or the degree of achievement that may be expected from individuals in a particular activity”. Aptitude is a means by which one can find the relative knowledge of a person in terms of his intelligence and also his knowledge in general.

Purpose

The purpose of aptitude test is to test a candidate's profile. This test helps to check one's knowledge and filters the good candidates. The ability of creativity and intelligence and fastness of the person is performance.

Importance of Aptitude Test

Research data show that individually administered aptitude tests have the following qualities:

- They are excellent predictors of future scholastic achievement
- They provide ways for comparison of a child's performance with others in a same situation
- They provide a profile of strengths and weaknesses
- They assess difference among individuals

Use of aptitude tests

Aptitude tests are valuable in making programme and curricula decisions. In general they have three major uses:

(a) Instructional:

Teachers can use aptitude test results to adapt their curricula to match the level of students or to design assignments for students with abilities widely.

(b) Administrative:

Result of aptitude tests help in determining the programmes for college on the basis of aptitude level of high school. It can also be identifying students to be accelerated or given extra attention, for example and in predicting job training performance.

(c) Guidance:

Result of aptitude tests help counsellors to help parents and students. Parents develop realistic expectations for their child's performance and students understand their own strengths and weaknesses. Intelligence tests are also a kind of aptitude test as they describe and measure the general ability which enters into the performance of every activity and thus predict the degree of achievement that may be expected from individuals in various activities.

Aptitude test, however have proved of great value for research in educational and vocational guidance, for research in selection of candidates for particular course of study or professional training and for research of the complex causal relationship type.

INVENTORY

It is a list, record or catalog containing list of traits, preferences, attitudes, interests or abilities used to evaluate personal characteristics or skills. The purpose of inventory is to make a list about a specific trait, activity or programme and to check to what extent the presence of that ability types of inventories are:

- Interest Inventory
- Personality Inventory

Interest Inventory

Persons differ in their interests, likes and dislikes. Interests are significant element in the personality pattern of individuals and play an important role in their educational and professional careers. The tools used for describing and measuring interests of individuals are called interest inventories or interest blanks. They are self-report instruments in which the individuals note their own likes and dislikes. They are of the nature of standardized interviews in which the subject gives an introspective report of his feelings about certain situations and phenomena which is then interpreted in terms of interests.

The use of interest inventories is most frequent in the areas of educational and vocational guidance and case studies. Distinctive patterns of interest that go with success have been discovered through research in a number of educational and vocational fields. Mechanical, computational, scientific, artistic, literary, musical, social services, clerical and many other areas of interest have been analysed in terms of activities. In terms of specific activities, a person's likes and dislikes are sorted into various interest areas and percentile scores calculated for each area. The area where a person's percentile scores are relatively highest is considered to be the area of his greatest interest, the area in which he would be the happiest and the most successful.

As a part of educational surveys of many kinds, children's interest in reading, in games, in dramatics, in sports, extracurricular activities and in curricular work etc. are studied.

One kind of instrument most commonly used in interest measurement known as strong's vocational interest inventory. It compares the subject's patterns of interest to the interest patterns of successful individuals in a number of vocational fields. This inventory consists of the 400 different items. The subject has to tick mark one of the alternatives i.e. L (for like), I (indifference) or D (Dislike) provided against each item. When the inventory is standardized, the scoring keys and percentile norms are prepared on the basis of the responses of a fairly large number of successful individuals of a particular vocation. A separate scoring key is therefore prepared for each separate vocation or subject area. The subject's responses are scored with the scoring key of a particular vocation in order to know his interest or lack of interest or lack of interest in the vocation in the vocation concerned. Similarly his responses can be scored with scoring keys standardised for other vocational areas. In this way you can determine one's area of vocational interest. Another well-known interest inventories, there are also personality inventories to measure the personality. You can prepare inventories of any ability to measure it.

OBSERVATION

Observation offers the researcher a distinct way of collecting data. It does not rely on what people say they do, or what they say they think. It is more direct than that. Instead, it draws on the direct evidence of eye to witness events first hand. It is a more natural way of gathering data. Whenever direct observation is possible it is the preferable method to use. Observation method is a technique in which the behaviour of research subjects is watched and recorded without any direct contact. It involves the systematic recording without any direct contact. It involves the systematic recording of observable phenomena or behaviours in a natural setting.

Purpose

The purpose of observation techniques are:

- To collect data directly
- To collect substantial amount of data in short time span
- To get eye witness first hand data in real life situation
- To collect data in a natural setting

Characteristics

It is necessary to make a distinction b/w observation as a scientific tool and the casual observation of the man in the street. An observation with the following characteristics will be scientific observation:

- observation is systematic
- It is specific
- It is objective
- It is quantitative
- The record of observation should be made immediately
- Expert observer should observe the situation
- It's result can be checked and verified

Types of observation

On the basis of the purpose of observation may be of varied type like:

1. *Structured & Unstructured observation*

In the early large stage of an investigation, it is necessary to allow maximum flexibility in observation to obtain a true picture of the phenomenon as a whole. In the early stage, if we attempt to restrict the observation to certain areas, then there we be the risk of overlooking some of the more crucial aspects. As the investigator studies the significant aspects and observes some restricted aspects of the situation to derive more and rigorous generalizations. So in the first stage of observation, the observation is wide and unstructured and as the investigation proceeds observation gets restricted and structured.

2. *Participant and Non-Participant observation*

In participant observation, the observer becomes more or less one of the groups under observation and shares the situation as a visiting stranger, an attentive listener, an eager learner or as a complete participant observer, registering, recording and interpreting behaviours of the group. In non-participant observation, the observer observes through one way screens and hidden microphones. The observer remains aloof from group. He keeps his observation as inconspicuous as possible. The purpose of non-participant observation is to observe the behaviours in a natural setting. The subject will not shift his behaviours or he will not be conscious that someone is observing his behaviours.

The advantages and disadvantages of participant and non-participant observation depend largely on the situation. Participant observation is helpful to study about criminals at least participating with person sometimes. It gives a better insight into the life. Therefore, it has a built in validity test. Its disadvantage is that it is time consuming. As the develops relationship with the members, there is a chance of losing his neutrality, objectivity and accuracy to note things as they are.

Non-participant observation is used with groups like infants, children or abnormal persons. It permits the use of recording instruments and the gathering of large quantities of data, therefore, some researchers feel that it is best for the observer to remain only a partial participant and to maintain his status of scientific observer apart from the group.

Steps of Effective Observation:

As a research tool, effective observation needs effective:

- a) Planning
- b) Execution
- c) Recording, and
- d) Interpretation

a) Planning:

While planning to employ observation as a research technique the following factors should be taken into consideration

- Sample to be observed should be adequate
- Units of behaviour to be observed should be clearly defined
- Methods of recording should be simplified
- Detail instructions should be given to observe if more than one observer is employed to maintain consistency
- Too many variables should not be observed simultaneously
- Excessively long period of observation without rest period should be avoided
- Observers should be fully trained and well equipped
- Records of observation must be comprehensive

b) Execution:

A good observation plan leads to success only when followed with skill and expert execution. Expert execution needs:

- Proper arrangement of special conditions for the subject
- Assuming the proper physical position for observing
- Focusing attention on the specific activities or units of behaviour under observation
- Observing discreetly the length and numbers of periods & intervals decided upon
- Handling well the recording instruments to be used
- Utilising the training received in terms of expertness

c) Recording:

The two common procedures for recording observations are:

- Simultaneous
- Soon after the observation

Which methods should be used depend on the nature of the group, the type of behaviours to be observed. Both the method has their merits and limitations. The simultaneous form of recording may distract the subjects while after observation the observers may fail to record the complete and exact information. Therefore for a systematic collection of data the various devices of recording should be used. They are like – checklist, rating scale & score card.

d) Interpretation

Interpretation can be done directly by the observer at the time of his observation. Where several observers are involved, the problem of universality is there, therefore in such instances the observers merely record his observations and leaves the matter of interpretation to an expert that is more likely to provide a unified frame of reference. It must of course be recognized that the interpreter's frame of reference is fundamental to any interpretation and it might be advisable to insist on agreement b/w interpreters of different backgrounds.

Limitation of Observation

- Establishing validity is difficult
- Subjectivity is also there
- It is a slow and labourious process
- It is costly both in terms of time and money
- The data may be unmanageable
- There is possibility of biasness

These limitations can be minimized by systematic observation as it provides a frame work for observation as which all observers will use.

Advantages of observation

- Data collected directly
- Systematic and rigorous
- Substantial amount of data can be collected in a relatively short time span
- Provides pre-coded data and ready for analysis
- Inter observer reliability is high

However, observation is a scientific technique to the extent that it serves a formulated research purpose, planned systematically rather than occurring haphazardly, systematically recorded and related to more general propositions and subjected to checks and controls with respect to validity, reliability and precision.

INTERVIEW

Interviews are an attractive proposition for the project research. Interviews are something more than conversation. They involve a set of assumptions and understanding about the situation which are not normally associated with a casual conversation. Interviews are also referred as an oral questionnaire by some people, but it is indeed much more than that. In interview data is collected directly from others in face to face contact. As you know, people are happier to write something than to talk with friendly relationship and support, the interviewer can obtain types of confidential information which might be reluctant to put in writing.

Therefore, research interviews should be systematically arranged. It does not happen by chance. The interview not done by secret recording of discussions as research data. The consent of the subject is taken for the purpose of interview. The words of the interviews can be treated as 'on the record' and 'for the record'. It should not be used for other purposes besides the research purpose. The discussion therefore is not arbitrary or at the whim of one of the parties. The agenda for the discussion is set by the researchers.

Importance of Interview

Whether it is large scale research or small scale research, the nature of the data collection depends on the amount of resources available. Interview is particularly appropriate when the researcher wishes to collect data based on:

- Emotions, experience and feelings
 - Sensitive issues
 - Privileged information
- It is appropriate when dealing with young children, illiterate, language difficulty and limited intelligence
- It supplies the detail and depth needed to ensure that the questionnaire asks valid questions while preparing questionnaire
- It is a follow up to a questionnaire and complement the questionnaire
- It can be combined with others tools in orders to corroborate facts using a different approach.
- It is one of the normative survey methods, but it is also applied in historical, experimental, case studies.

Types of Interview

Interviews vary in purpose, nature and scope. They may be conducted for guidance, therapeutic or research purposes. They may be confined to one individual or extended to several people. The following discussions describe several type of interviews.

a. Structured Interview

Structured interview involves tight control over the format of questions and answers. It is like a questionnaire which is administered face to face with a respondent, the researcher has a predetermined list of questions. Each respondent is faced with identical questions. The choice of alternative answers is restricted to a predetermined list. This type of interview is rigidly standardised and formal. Structured interviews are often associated with social surveys where researchers are trying to collect large volumes of data from a wide range of respondent.

b. Semi-structured Interview

In semi-structured interview, the interviewer also has a clear list of issues to be addressed and questions to be answered. There is more flexibility in the order of the topics. In this type of interviewee is given chance to develop his ideas and speak more widely on the issues raised by the researchers. The answers are open-ended and more emphasis is on the interviewee elaborating points of interest.

c. Unstructured Interview

In case of unstructured interview, emphasis is placed on the interviewee's thoughts. The role of the researcher is to be as unintrusive as possible. The researcher introduces a theme or topic and then letting the interviewee develop his or her ideas and pursue his or her trails of thoughts. Allowing interviewee to speak their minds is a better way of discovering things about complex issues. It gives opportunity for in depth investigation.

d. Single Interview

This is a common form of semi structured or unstructured interview. It involves a meeting b/w one researcher and one informant. It is easy to manage this type of interview. It is helpful the researcher to locate specific ideas with specific people. It is also easy to control the situation in the part of the interviewees.

e. Group Interview

In the group interview, normally 4-6 people are involved. Here you may think that it is difficult to get people together to discuss matters on one occasion and how many voices can contribute to the discussion during any one interview. But the crucial thing to bear in mind here is that a group interview is not an opportunity for the researcher to question to a sequence of individual, taking turns around a 'table group' is crucial here, because it tells us that those present in the interview will interact with one another and that the discussion will operate at the level of group. They can present a wide range of information and varied viewpoints.

Requirements of a Good Interview

As a tool of research, good interview requires:

- Proper preparation
- Skillful execution, and
- Adequate recording and interpretation

Preparation for interview

The follow factors need to be determined in advance of the actual interview

- Purpose and information needed should be clear
- Which type of interview best suited for the purpose should be decided
- A clear outline and frame work should be systematically prepared
- Planning should be done for recording responses

Execution of the interview

- Rapport should be established
- Desired information should be collected with a stimulating and encouraging discussion
- Recording device should be used without distracting the interviewee

Advantages of interview

Depth interview:

Interviews are particularly good valuable insights based on the depth and in detail. Subjects can be probed issues pursued in investigations followed over a relatively lengthy period.

Insights:

The researcher is likely to gains valuable insights based on the depth of the information gathered and the wisdom of “key informants”.

Equipment:

Interviews require only simple equipment and build on conversation skills which researchers already have.

Information priorities:

Interviews are a good method for producing data based on informant’s priorities, opinions and ideas. Informants have the opportunity to expand their ideas, explain their views and identify what regard as their crucial factors.

Flexibility:

Interviews are more flexible as a method of data collection. During adjustments to the line of enquiry can be made.

Validity:

Direct contact at the point of the interview means that data can be checked for accuracy and relevance as they are collected.

High response rate:

Interviews are generally pre-arranged and scheduled for a convenient time and location. This ensures a relatively high response rate.

Therapeutic:

Interviews can be a rewarding experience for the informant compared with questionnaires, observation and experiments, there is a more personal element to the method and people tend to enjoy the rather rare chance to talk about their ideas at length to a person whose purpose is to listen and note the ideas without being critical.

Disadvantages of Interviews

Irrespective of the above advantages, it has the following disadvantages.

Time consuming:

Analysis of data can be difficult and time consuming. Data preparation and analysis is ‘end loaded’ compared with, for instance questionnaire, which are precoded and where data are ready for analysis once they have collected. The transcribing and coding of interview data is a major task for the researchers which occurs after the data have been collected.

Difficulty in data analysis:

This method produces non-standard responses. Semi-structured and unstructured interviews produce data that are not pre-coded and have a relatively open format.

Less Reliability:

Consistency and objectivity are hard to achieve. The data collected are, to an extent, unique owing to the specific content and the specific individuals involved. This has an adverse effect on reliability.

Interviewers Effect:

The identity of the researchers may affect the statements of the interviewee. They may say what they do or what they believe to do. The two may not tally.

Inhibitions:

The tape recorders or video recorders may inhibit the informant. The interview is an artificial situation where people are speaking for the record and on the record and this can be daunting for certain kind of people.

Invasion of Privacy:

Interviewing can be an invasion of privacy and may be upsetting for the informant.

Resources:

The cost of interviewer's time, of travel and of transcription can be relatively high if the informants are geographically widespread.

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