

Unit-3

a) Types of linguistic research: Longitudinal -cross -sectional, qualitative -quantitative -mixed method, action research, experimental research. b) Analysing Data – qualitative

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3.0 Objectives

After studying this unit you will be able to

- i. know about types of linguistic research.
- ii. understand the difference between various types of linguistic research.
- iii. be familiar with the various types of data.
- iv. know about the ways of data analysis.
- v. differentiate between qualitative and quantitative data.

3.1 Introduction

Dear students, the previous unit introduced you to the role of theory in literary disciplines. It made you familiar with various aspects of research in literature. Research is a systematic and critical investigation for the discovery of new facts. It is a detailed and careful study of a problem. It is a process of finding out knowledge about something new or about the already known fact. It is based on collected and analysed data. Oxford Advanced Learner's Dictionary defines the term research as, 'a careful study of a subject, especially in order to discover new facts or information about it'. In other words, a research is carried out so as to make available new perceptions into a specific subject, to produce knowledge and thus support in understanding a problem.

Linguistic research means finding something new in or about language. It studies language from a variety of dimensions that occur to a researcher. Any human activity can be comprehended and presented effectively and easily with the help of language. That is why language has been an indispensable tool of human communication and has permeated in all the spheres of human life. In the present unit various types of linguistic research are discussed along with the ways of analyzing data.

3.2 Subject Matter – I

3.2.1 Types of Linguistic Research

Friends, all of you know that linguistics is the scientific study of language. In fact it is a broad area that encompasses major branches like theoretical linguistics and Applied Linguistics. The former covers Phonology, Phonetics, Morphology, Syntax,

Semantics, Pragmatics, Discourse Analysis and the later includes Sociolinguistics, Psycholinguistics, Computational linguistics, Stylistics, Historical linguistics, Comparative linguistics and many others. Research in these areas has always been very innovative and productive. Let us consider the major types linguistic research:

3.2.1.1 Longitudinal Research

The term, ‘Longitudinal research’ is used to describe a variety of studies conducted over a period of time. A longitudinal research involves examining the same subjects repeatedly to identify and distinguish the changes that may occur over a period of time which may be as short as a few weeks or months and as long as many years. In fact, longitudinal research is a type of observational research in which the researcher does not interfere with the subjects. The researcher can study changes or developments in the subjects because the longitudinal research extends beyond a single moment in time.

Quite often, the word, ‘developmental’ is employed in relation with longitudinal researches which are specifically about the features of human growth. Longitudinal researches are frequently used to study age-related changes in how people think, feel, and act. For instance, a longitudinal research can be used to study how the strategies that children use to remember things change as they grow up. This can be done by choosing a single group of children over a period of several years and testing their memory strategies when they were 3, 7 and 13 years of age.

Longitudinal research is defined in terms of both the data and the design that are employed in the research. In a longitudinal study i) data are collected for two or more distinct time periods; ii) the subjects or cases analyzed are the same (taken from the same population) or are comparable from one period to the next; and iii) the analysis involves some comparison of data between periods.

Longitudinal researches are a type of correlational studies. Furthermore, there are three main types of longitudinal studies:

1. Panel study: A panel means a group of individuals. A panel study is a type of longitudinal research in which data is collected from the same individuals repeatedly over a period of time to study changes or progress. It involves sampling a group of individuals at specific intervals for an extended period and is used to study individual habits. In linguistics it can be used to track the language teaching and learning strategies used by people over a period of time.

2. Cohort study: It is a powerful tool for conducting research in human population. In a cohort longitudinal study the sample share a defining characteristic such as birth year, geographical area, etc.

3. Retrospective study: It involves observing past events by analyzing historical information such as performances or records during earlier period. It can be used to study cognitive and language skills in a group of people over a period of time.

Longitudinal research is carried out for two primary purposes: i) to describe patterns of change, and ii) to explain casual relationships. Although these two aims are interrelated, they do not always coincide because the researcher may obtain precise information about the temporal order of events without detecting any casual connection between these events.

Advantages and Disadvantages of Longitudinal Research:

Longitudinal studies have some advantages and disadvantages which are discussed below:

Advantages:

1. Longitudinal researches are a type of correlational research in which researchers observe and collect data on a number of variables without trying to influence those variables. In this way, longitudinal studies provide unique insights which cannot be obtained in any other way.
2. Longitudinal study is also an observational study, in which data is gathered from the same sample repeatedly over an extended period of time. It is useful in observing phenomena related to development and lifespan.
3. Longitudinal study can last from a few years to even decades depending on what kind of information needs to be obtained. The benefit of conducting longitudinal study is that researchers can make notes of the changes, make observations and detect any changes in the characteristics of their participants. One of the important aspects here is that longitudinal study extends beyond a single frame in time. It helps to establish a proper sequence of events occurred and allows the researcher to insight into cause-and effect relationships.
4. Longitudinal studies can also be done with a few participants.

Disadvantages:

Longitudinal studies suffer several disadvantages:

1. Longitudinal research tends to be expensive and time-consuming than other types of studies because the researcher is obliged to wait for growth data to accumulate; therefore they need substantial commitment and resources to be effective. As longitudinal studies repeatedly observe subjects over a period of time, any potential insights from the study can take duration to be discovered.
2. There is the difficulty of sample mortality. Inevitably during the course of a long-term study, subjects drop out, are lost or decline further cooperation. Such attrition makes it unlikely that those who remain in the study are as representative of the population as the sample that was originally drawn. Sometimes attempts are made to lessen the effects of sample mortality by introducing aspects of cross-sectional study design, that is, topping up the original cohort sample size at each time of retesting with the same number of respondents drawn from the same population. The problem here is that differences arising in the data from one survey to the next may then be accounted for by differences in the persons surveyed rather than by genuine changes or trends.
3. A third difficulty has been termed testing effect. Time and again, repeated interviewing results in an undesired and confusing effect on the actions or attitudes under study, influencing the behaviour of subjects, sensitizing them to matters that have hitherto passed unnoticed, or stimulating them to communication with others on unwanted topics.
4. Longitudinal studies can suffer from the interaction of biological, environmental and intervention influences.
5. Longitudinal research poses considerable problems of organization due to the continuous changes that occur in students, staff, teaching methods and the like. Such changes make it highly unlikely that a study will be completed in the way that it was originally planned.

Longitudinal research has traditionally been associated with the quantitative research which aims at providing statistical pictures of wider social trends. In such studies societies are studied from the social structure downwards rather than from the

individual or personal network upwards. Recently, however, there has been a move in the social science to make longitudinal qualitative research more prominent. Interplay of the temporal and cultural dimensions of social life, offering a bottom-up understanding of how people move through time and craft the transition processes are the unique features of such studies. Thus, the qualitative move offers us a close-up of the fabric of real lives as opposed to the quantitative long shot. The focus is on the plot and detailed story lines of the key actors rather than the grand vistas of the epic picture. Longitudinal research is generally undertaken in medicine and economics, along with related social or medical science fields.

As far as longitudinal research in linguistics is concerned, it is useful in studying how teachers change and grow over their careers, changes in teachers' professional satisfaction over the years, patterns of teacher retention and drop-out, the impact of teachers on their students over time, and the influence of pre-service and /or in-service teacher education on teachers. It is also useful in exploring the linguistic development in children, how children acquire a second or foreign language, second language vocabulary and syntax development in children over time, and the influence of their mother-tongue on the second language learning.

In a nut shell, a longitudinal study is a type of correlational research. Researchers undertake it to find and report data from several variables over an extended period. The main goal of this type of research is to discover how unrelated variables interact with or affect background variable, which often requires researchers to observe one group for longer periods.

3.2.1.2 Cross-sectional Research

Cross-sectional study is an observational research study where data is collected as a whole to study a population at a single point in time to examine the relationship between variables of interest. It is descriptive. In other words, cross-sectional research is the study of a group of different individuals or subjects at a single point in time. It produces a snapshot of a population at a particular point in time. In cross-sectional research details about an event or phenomenon are collected once, and once only, for each subject or case studied. Subsequently, it offers an instant, but static, photograph of the process being studied. The cross-sectional research is of one-off nature which makes such studies easier to organize and cheap. It has the advantage of immediacy. It offers instant results. A national census is a representative sample of

the population consisting of individuals of different ages, different occupations, different educational and income levels, and residing in different parts of the country, is interviewed on the same day. It is the perfect example of the cross-sectional study. If a longitudinal research studies vocabulary development in students, the researcher would compare a measure of first-grade students' vocabulary skills in 2010 with one when they were fourth-grade students in 2013 and seventh-grade students in 2016. On the other hand a researcher employing cross-sectional study would compare the vocabulary skills of a sample of children from grades 1, 4, and 7 in 2016. In cross-sectional research designs time is not considered as one of the study variables. Researchers collect data that cannot be directly observed, but instead are self-reported, such as opinions, attitudes, values, and beliefs. The purpose often is to examine the characteristics of a population. Cross-sectional data can be collected through self-administered questionnaires, through interviews, and from individuals, groups, organizations, or other units of analysis. As cross-sectional data are collected at one point in time, researchers typically use the data to determine the frequency distribution of certain behaviours, opinions, attitudes, or beliefs.

As it has been mentioned earlier, cross-sectional study is a type of observational study. In this kind of research a researcher collects data from many different individuals at a specific point in time. Researchers can use these studies to analyse several characteristics, such as income, gender, age, at once. In addition, they give an indication of the prevailing characteristics in a population and can provide information about what is currently happening in the population. Consequently, cross sectional studies can provide a snapshot of a population or society at a specific moment. Actually, cross-sectional research is the opposite of longitudinal research. The cross-sectional research is used to analyse the characteristics in a society or community. It is also helpful in collecting preliminary data for further research. However, it cannot analyse cause-and-effect relationship between variables.

Salient features of Cross-sectional Research:

We discussed above that a cross-sectional research allows researchers to compare different variables at the same point in time. It is commonly used in studies in psychology, education and social science. Cross-sectional research is descriptive. It relies on observation. It means, in cross-sectional research, researchers just find and record information that exists; instead of changing variables to test causation. Some of the salient features of cross-sectional research are as below:

1. A researcher, in cross-sectional research, records information about the participants without changing or manipulating the natural environment in which they exist.
2. The cross-sectional research can compare different samples at one given point in time. For instance, a researcher wants to understand the relationship between the medium of instruction in schools and the students' level of English syntax acquisition, he/she might want to choose two groups of students studying in the same grade, one group from an English medium school and the other, a Marathi medium school and compare them.
3. The researcher at this point in time can create subsets for gender and family background, but cannot consider students' earlier acquisition levels because this would be outside the given parameters for cross-sectional studies.
4. Cross-sectional research allows the study of many variables at a given time. Researchers can look at age, gender, income, and other variables in relation to medium of instruction and students' level of English syntax acquisition at a very little or no additional cost involved.
5. Nonetheless, there is one disadvantage to cross-sectional study, this type of study is not able to provide a definitive relation between cause and effect relation (a cause and effect relationship is one where one action (cause) makes another event happen (effect), for example, without proper exposure, a student might mispronounce English words.)
6. The cross-sectional study offers a snapshot of a single moment in time. It doesn't consider what happens before or after. Hence, in the example stated above it is difficult to know if the students had a better/worse level of English syntax acquisition or if the activity helped them to predict about the samples' level of English syntax acquisition.

Advantages and Disadvantages of Cross-sectional Research:

Advantages: The cross-sectional research has the following advantages:

1. The cross-sectional data can be highly effective in testing the relations between two variables. These data are also useful in examining a research model that has been proposed on a theoretical basis.

2. The cross-sectional studies enable researchers to collect information very quickly
3. The cross-sectional research is not time consuming. It does not take much time.
4. In the cross-sectional studies multiple variables can be observed at once.
5. The cross-sectional research is a helping hand to further study

Disadvantages: The cross-sectional research suffers the following disadvantages:

1. The principal limitation of cross-sectional data is that they usually do not allow the testing of causal relationships, except when an experiment is embedded within a cross-sectional survey. Cross-sectional data are not also appropriate for examining changes over a period of time.
2. The cross-sectional research cannot determine cause-and-effect relationships
3. As the cross-sectional research studies the data at a specific point in time, it cannot observe development over a period of time.

Similarities and Differences between Longitudinal and Cross-sectional Research:

Similarities:

1. Both longitudinal and cross-sectional researches are observational research studies in which the participants are observed in their natural environment without any alternation.
2. In both studies the researcher does not interfere with subjects.

Differences:

In spite of the above similarities, there are typical differences between both these forms of study. Let us analyse the differences between cross-sectional study and longitudinal study considering various factors such as time, sampling, result, cause and effect relationship, time and cost:

- i) Longitudinal research is called correlation research, whereas cross-sectional research is called descriptive research. In longitudinal studies information is collected from the same instance across time, while in cross-sectional studies, data is gathered from several samples simultaneously.

- ii) Longitudinal studies are conducted over time, while cross-sectional studies are conducted at a single moment. Longitudinal studies give an extended investigation of the problem. In contrast, cross-sectional studies provide a picture of the state of affairs.
- iii) In a longitudinal study, participants are involved throughout the investigation; however, in cross-sectional research, participants are only required once for the study's aim.
- iv) In longitudinal research just one variable is considered to be investigated throughout time. However, cross-sectional designs enable researchers to compare multiple factors such as age, sex, gender, and income at a single moment in time. Longitudinal research can provide information about what is happening over time. On the other hand, a cross-sectional study may give information on the current state and what is occurring at the present moment.
- v) Longitudinal analysis can develop and demonstrate cause and effect. On the other hand, cross-sectional research provides no information and cannot establish a cause-effect link. In longitudinal studies, researchers can discover developments or changes in the features of a target population at both the group and individual levels. On the contrary, in cross-sectional studies, they are unable to do so.
- vi) Cross-sectional research requires less time than longitudinal research, while longitudinal research needs more time than cross-sectional studies. Cross-sectional studies are less expensive and more cost-effective than longitudinal investigations. Information from longitudinal research can be used to make conclusions or figure out how variables are related, but the data from cross-sectional studies are insufficient for definite judgments about the importance of any connection between variables.

Let us see examples of a longitudinal research and cross-sectional research about language learning process to help you understand these studies better:

A longitudinal study on language learning process might produce a sample of participants between the ages of 06 and 13, and researchers could record their language learning tendencies and the influencing factors during 07 years. At set intervals, the researchers could check in with the sample group to observe how their language learning progresses. The researchers then can continue to check in with the

sample group through the end of the study's duration. The information in the report could help them analyse how the process of language learning of the individuals changed over time and what factors might have contributed to the changes.

A cross-sectional study might examine the language learning process of different groups of people. The study could have several samples of people, who researchers group by age. The study might also include other factors, such as gender, family background, medium of instruction at school, type of exposure to language. Researchers might determine several conclusions from the data, such as if a certain group was more likely to learn language which factor was more likely to influence the process of learning.

3.2.1.3 Qualitative Research

Educational research has three major research paradigms which tend to bring a slightly different view or perspective to what we study. They are quantitative research, qualitative research, and mixed research.

Qualitative research is a research methodology that places primary importance on studying small samples of deliberately chosen individuals. It does not attempt to control contextual factors, but rather seeks to understand things from the informants' points of view through a variety of methods. It creates a rich and thorough picture of the phenomena under study. In qualitative research there is less emphasis on statistics and more on an interest in the individual and his/her immediate context. In this way, qualitative research is synthetic or holistic. It means it views the separate parts as a coherent whole. It is heuristic with little or no control and manipulation of the research context, and uses data collection procedures with low explicitness as discovers or describes the patterns or relationships. Qualitative research is deep-rooted in a number of different disciplines, mainly anthropology, sociology, and philosophy, and is now used in almost all fields of social science inquiry, including applied linguistics. It is the main example of hypothesis-generating research. That is, once all the data are collected, hypothesis may be derived from those data. The ultimate goal of qualitative research is to discover phenomena such as patterns of behaviour not previously described and to understand them from the perspective of participants in the activity.

Qualitative approach is primarily based on the multiple meanings of individual experience, meanings socially and historically constructed, with intent of developing

a theory or pattern. It also uses strategies of inquiry such as narratives, phenomenologies, ethnographies, grounded theory studies, or case studies.

Qualitative research is used to describe what is seen locally and sometimes to come up with or generate new hypotheses and theories. It is used when little is known about a topic or phenomenon and when one wants to discover or learn more about it. Furthermore, it is commonly used to understand people's experiences and to express their perspectives.

Qualitative researchers time and again view human behavior as being fluid, dynamic, and changing over time and place, and they usually are not interested in generalizing beyond the particular people who are studied. In qualitative research, different groups are said to construct their different realities or perspectives, and these social constructions, reciprocally, influence how they "see" or understand their worlds, what they see as normal and abnormal, and how they should act.

Qualitative research uses a wide- and deep-angle lens, examining human choice and behaviour as it occurs naturally in all of its detail. Qualitative researchers do not want to intervene in the natural flow of behaviour. They study behaviour naturalistically and holistically and try to understand multiple dimensions and layers of reality, such as the types of people in a group, how they think, how they interact, what kinds of agreements or norms are present, and how these dimensions come together holistically to describe the group. For instance, if a qualitative researcher wants to study the social climate and culture of a highly successful school, he would spend a great deal of time studying the many aspects of the school to come up with an analysis of how the school operates and for whom and why it is successful.

The salient characteristics of qualitative research are as follows:

i) **Rich description:** The qualitative researchers often aim to make the provision of careful and detailed descriptions as opposed to the quantification of data through measurements, frequencies, scores, and ratings.

ii) **Natural and holistic representation:** Qualitative researches intend to study individuals and events in their natural settings. The qualitative researchers tend to be more interested in presenting a natural and holistic picture of the phenomena being studied, rather than attempting to control and manipulate contextual factors through the use of laboratories or other artificial environments. So as to capture a

sufficient level of detail about the natural context, such studies are generally conducted through an intense and prolonged contact with the research setting.

iii) **Few participants:** Qualitative researchers are less concerned about issues of generalizability, so they are likely to work more intensively with fewer participants. Qualitative research concentrates on describing, understanding, and clarifying a human experience and therefore qualitative studies are directed at describing the aspects that make up an idiosyncratic experiences rather than determining the most likely, or mean experience, within a group. Hence, qualitative research, at least in theory, is not concerned with how representative the respondent sample is or how the experience is distributed in the population. Instead, the main goal of sampling is to find individuals who can provide rich and varied insights into the phenomenon under investigation. This goal is best achieved by means of some sort of purposive sampling.

iv) **Emic perspective / participant or insider point of view:** Qualitative researchers intend to understand phenomena in terms of the meanings people attach to them, i.e., to adopt an emic perspective, or the use of categories that are meaningful to members of the speech community under study. An emic perspective requires one to recognize and accept the idea of multiple realities. Documenting multiple perspectives of reality in a given study is crucial to an understanding of why people think and act in the different ways they do. Emic perspectives can be distinguished from the use of etic perspective (or researcher or outsider point of view), which is an outsider's understanding of a culture or group that is not their own. Etic perspectives are more common in quantitative research.

v) **Cyclical and open-ended processes:** Qualitative research is often process-oriented or open-ended, with categories that emerge. The research often follows an inductive path that brings with it a few supposed concepts, followed by a gradual adjustment and narrowing of focus. Preferably, qualitative researchers enter the research process with a completely open mind and without setting out to test preconceived hypotheses. This means the research focus is narrowed down only gradually and the analytic categories and concepts are defined during, rather than before, the process of the research. Thus, qualitative researchers tend to approach the research context with the purpose of observing whatever may be present there, and letting further questions emerge from the context.

vi) **Possible ideological orientations:** A qualitative researcher may consciously take ideological positions. Qualitative research is sometimes described as critical, as in this type of research the researcher may have particular social or political goals. For instance, critical discourse analysis is a form of qualitative research. It is a program of social analysis that critically analyses discourse, which means ‘language in use’, as a means of addressing social change;

vii) **Interpretive analysis:** Qualitative research is basically interpretive. It means that the research outcome is finally the product of the researcher’s subjective interpretation of the data. Numerous alternative interpretations are possible for each data set, and as qualitative studies use relatively limited standardized instrumentation or analytical procedures, in the end it is the researcher who will choose from them. The researcher is essentially the main measurement device in the study. Accordingly, in qualitative research, the researcher’s own values, personal history, and position on characteristics such as gender, culture, class, and age become integral part of the inquiry; and

Qualitative research works with a wide range of data including recorded interviews, various types of texts (e.g., field notes, journal and diary entries, documents, and images (photos or videos). During data processing most data are transformed into a textual form (e.g., interview recordings are transcribed) because most qualitative data analysis is done with words.

To qualitative researchers, it is important to “get close” to their objects of study through participant observation, so that they can experience for themselves the subjective dimensions of the phenomena they study. The researcher in qualitative research becomes the instrument of data collection. Rather than using a standardized instrument or measuring device, the qualitative researcher asks the questions, collects the data, makes interpretations, and records what is observed. The qualitative researcher continually tries to understand the people he or she is observing from the participants’ or natives’ or actors’ viewpoints. This is the concept of “empathetic understanding.”

Advantages and Disadvantages of Qualitative Research:

Qualitative research has many advantages. Some of them are listed below:

- i) Qualitative research has exploratory nature. It does not rely too much on previous literature.

- ii) It enables the researcher to work on complex situations.
- iii) Qualitative research aims to answer why questions. This is of a great help to researchers in looking for deep understanding of a phenomenon and in doing further research so as to broaden our understanding.
- iv) Qualitative research is a longitudinal research. It is used in applied linguistics dynamically.
- v) Qualitative research is more flexible for researchers to change or adjust when things go wrong and it enables the researchers to capitalize on the changes and produce exciting results.
- vi) Qualitative research has the guarantee for the validity and reliability as it needs to collect multiple data in a long period of time.

The disadvantages of qualitative research can be:

- i) Qualitative research is time consuming as it involves a great deal of data collection and analysis which can require an extended period of time to complete. It also requires additional time to arrange interviews and focus-groups.
- ii) Qualitative research is highly subjective as it relies on the interpretation and analysis of observations which can be difficult to study objectively. Similarly, the biases of the researcher can influence the results of the study.
- iii) Qualitative research can be expensive as it involves the cost of traveling for data collection.
- iv) Qualitative research can be difficult to analyse because the data is frequently subjective and open to interpretation.
- v) Qualitative research can lead to inaccurate results because of the subjective nature of the data. Furthermore, the researcher's own biases can affect the results of the study.

3.2.1.4 Quantitative Research

Quantitative research is a powerful tool for the researchers looking to collect empirical data about their topic of study. Quantitative research collects numerical data, which is then analysed using statistical methods to identify patterns,

relationships, and trends. It studies large groups of randomly selected participants. It manipulates variables within the participants' immediate environment, and determines whether there is a relationship between the manipulated (independent) variable and some characteristic or behaviour of the participants (the dependent variable). Quantitative research uses statistical procedures to determine whether the relationship is significant—and when it is significant, the results are typically generalized to a larger population beyond the immediate group of participants. The quantitative research is systematic, rigorous, focused, and tightly controlled. It involves precise measurement and producing reliable and replicable data that is generalizable to other contexts. It is the main example of hypothesis-testing research, which begins with a question or hypothesis to be investigated through data quantification and numerical analyses.

Quantitative research assumes that cognition and behavior are highly predictable and explainable. Most quantitative researchers try to identify cause-and-effect relationships that enable them to make probabilistic predictions and generalizations.

Quantitative research frequently uses a “narrow-angle lens” because the focus is on only one or a few causal factors at the same time. Quantitative researchers attempt to hold constant the factors that are not being studied. This is often accomplished under laboratory conditions in which an experimenter randomly assigns participants to groups, manipulates only one factor, and then examines the outcome. For example, a researcher might first randomly assign research volunteers to two groups. Random assignment makes the two groups very similar. Then the researcher might expose one group to a new teaching method and another group to a different teaching method, treating the two groups similarly during the study except for the research-manipulated difference in teaching method. The researcher then examines which group learns the most and attributes the difference in learning to the teaching method received. The researcher is able to make a causal attribution because the two groups were similar at the start of the experiment and the only factor they differed on was which teaching method they received.

Quantitative researchers attempt to operate under the assumption of objectivity. They assume that there is a reality to be observed and that rational observers who look at the same phenomenon will basically agree on its existence and its characteristics. They try to remain as neutral or value-free as they can, and they attempt to avoid human bias whenever possible. In a sense, quantitative researchers

attempt to study the phenomena that are of interest to them “from a distance.” For example, standardized questionnaires and other quantitative measuring tools are often used to measure carefully what is observed. In experiments, researchers frequently use random assignment to place participants into different groups to eliminate the possibility of human bias while constructing the comparison groups. In judging results, statistical criteria are used to form many conclusions.

Quantitative research generally reduces measurement to numbers. In survey research, for example, attitudes are usually measured by using *rating scales*. The following 5-point agreement scale is an example:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

The interviewer or questionnaire provides a statement, and the respondents reply with one of the five allowable response categories. After all respondents have provided their answers, the researcher typically calculates and reports an average for the group of respondents. Let us say, for example, that a researcher asks a group of teachers for their degree of agreement with the following statement: “Teachers need more training in the area of child psychopathology.” The researcher might then calculate the average response for the whole group, which might be 4.15 based on a 5-point scale. The researcher might also determine whether the ratings vary by years of teaching experience. Perhaps the average agreement for new teachers is 4.5, and the average for teachers with 5 or more years of experience is 3.9. As you might guess, quantitative data are usually analyzed by using statistical analysis programs on a computer.

Quantitative research can be classified into one of the two broad research categories: experimental research, and non-experimental research.

The salient characteristics of quantitative research are as follows:

- i) **Use of numbers:** True to its name quantitative research is mainly concerned with numbers which can be both advantageous and disadvantages for researchers. Numbers are powerful. The quantitative research expects the researcher to have precise definitions of the content and the boundaries of the variables s/he

uses and exact descriptors for the range of values that are allowed within the variable.

ii) **Deduced categorization:** The Quantitative research needs specification of the categories and values needed to be done prior to the actual study, as the use of numbers already dominates the data collection phase. For instance, if respondents are asked to choose figures in a questionnaire item, they need to know exactly what those figures represent, and in order to make sure that each respondent gives their numerical answer based on the same understanding, the definitions and value descriptors need to be explicit.

iii) **Importance to variables in place of cases:** Quantitative researchers are more interested in the common features of groups of people in place of individuals. Consequently, its focus of attention is the study of variables that capture these common features and which are quantified by counting, scaling, or by assigning values to categorical data. The aim of all the various quantitative methods is to identify the relationships between variables by measuring them and often also manipulating them. Hence, specifying the relationships amongst variables is the significant feature of quantitative research.

iv) **Use of Statistics and the language of statistics:** This is certainly the most salient feature of quantitative research. Statistical analyses can range from calculating the mean of several figures on a pocket calculator to running complex multivariate analyses on a computer. As statistical analysis is an indispensable part of quantitative research, the language of quantitative research has much of the statistical terminology and quantitative vocabulary. The unique quantitative language augments further power to the quantitative paradigm of the quantitative research.

v) **Standardized procedures to assess objective reality:** Quantitative methodology has actually gone a long way towards standardizing research procedures to ensure that they remain stable across investigators and subjects. This independence of idiosyncratic human variability and bias has been equated with objectivity by quantitative researchers. The quantitative research aims to remove any individual-based subjectivity from the various phases of the research. This is achieved by developing systematic canons and rules for every facet of data collection and analysis.

vi) **Quest for generalizability and universal laws:** This quest for generalizability includes numbers, variables, standardized procedures, statistics, and scientific reasoning. The quantitative research has the ultimate quantitative quest for facts that are generalizable beyond the particular and add up to wide-ranging, ideally universal, laws.

Advantages and Disadvantages of Quantitative Research:

Let us now discuss some advantages and disadvantages of Quantitative research. The advantages are:

- i) Quantitative research has objectivity. A researcher will draw a conclusion without considering his or her own experience and can put aside his or her biases.
- ii) Quantitative research focuses on facts and verifiable information, which makes it more valid and reliable. It is basically prepared to capture numerical information so as to study a fact. It is very helpful for producing data points and to identify the key roots of certain sample behaviours.
- iii) Quantitative research enables the researcher to study a larger sample size for any hypothesis, so as to reach an accurate generalized conclusion.
- iv) Quantitative research enables the researcher to collect data quickly through experiments, surveys and interviews which leads toward a useful conclusion. It is a straightforward process of implementation.
- v) Quantitative research uses a randomized process to collect information. The collected data is unbiased and the factual results are supplied through statistical analysis of the information.
- vi) Anonymity is a merit of quantitative research. This feature makes the quantitative research useful for data collection as the participants are more likely to share honest perspectives when they are assured that their personal information will not be disclosed and their feedback will not be used only as a screening tool and an identifying trademark.

Disadvantages of Quantitative Research:

Quantitative research has following disadvantages:

- i) Quantitative research incurs high cost. It is costly to create the new data through surveys. Quite often there is a need to hire individuals for collecting and analysing the data. It can also be expensive to access massive databases and secure secondary data.
- ii) The results of the quantitative research can be without explanation. They are open to subjective interpretation. There is no doubt that quantitative data can show trends in data and correlations between variable, but it cannot explain why the correlation exists. The results cannot be correctly interpreted, if numbers are not given their full context or were gathered in an incorrect or misleading way.
- iii) It is more difficult to create testing models. In quantitative research there is need to pay careful attention to research design, as results can be invalidated due to even one unintentional error.
- iv) Quantitative research requires more time. There is a need to plan the sources of research and then do research in parts which requires a lot of time.
- v) Quantitative research requires large data as actions cannot be performed on small data.

Differences between Qualitative and Quantitative Research:

The term qualitative and quantitative were originally introduced to denote in antagonistic standpoint. So the difference between qualitative and quantitative research is often considered very significant. The difference has led scholars to talk about paradigm wars in which qualitative and quantitative research are seen as aggressive and incompatible sides. Many researchers describe themselves as either qualitative or quantitative. This idea is linked to what are seen as the different underlying philosophies and worldviews of researchers in the two paradigms. Subsequently, the following differences can be listed between qualitative and quantitative research:

- i) Qualitative research is viewed as being subjectivist, while quantitative view is described as being realist or sometimes positivist.

- ii) The qualitative research categorizes the world with emergent and flexible verbal coding. On the contrary, the quantitative research uses predetermined numerical category system.
- iii) Qualitative research perceives the individual diversity by focusing on the unique meaning carried by individual organisms. On the other hand, quantitative research perceives the individual diversity by using large samples to settle any individual idiosyncrasies.
- iv) In qualitative research analytical data is considered by relying on the researcher's individual sensitivity, while in quantitative research analytical data is considered by relying on the formalized system of statistics.
- v) Qualitative research primarily follows the exploratory scientific method. On the other hand, the quantitative research approach primarily follows the confirmatory scientific method because its focus is on hypothesis testing and theory testing. Pure quantitative research relies on the collection of quantitative data. Quantitative researchers consider it to be of primary importance to state one's hypotheses and then test those hypotheses with empirical data to see if they are supported.

While the description of qualitative research stands in contrast with that presented for quantitative research, it should be understood that quantitative and qualitative approaches are not polar opposites. It should also be kept in mind that, as it is not the case, that certain methods such as questionnaires, interviews, tests are inherently either qualitative or quantitative. Questionnaire results, for example, can be analysed quantitatively by determining what percentage of respondents answered in a particular manner, or qualitatively, by examining in detail the exact responses individuals provided and using them to triangulate other data from those same participants. It is the researcher's approach to the data collection and analysis task that may be considered qualitative or quantitative—not the methods themselves.

In short, qualitative research is perceived to represent a flexible and highly context-sensitive micro-perspective of the everyday realities of the world, whereas quantitative research is seen to offer a structured and highly regulated way of achieving a macro-perspective of the overarching trends in the world. Although the two paradigms represent two different approaches to empirical research, they are not

necessarily exclusive. They are not extremes but rather form a continuum that has led to an emerging third research approach, i.e., mixed methods research.

3.2.1.5 Mixed Methods Research

Mixed research is commonly called mixed methods research also. It utilizes a combination of quantitative and qualitative concepts and approaches to understand the world more fully. Mixed researchers understand positive value in both the quantitative and the qualitative views of human behavior. They view the use of only quantitative research or only qualitative research as limiting and incomplete for many research problems.

It is a research approach for collecting, analysing, and mixing quantitative and qualitative data at some stage of the research process within a single study in order to understand a research problem more completely. A researcher, using mixed methods research, collects both numeric information through closed-response items on questionnaires and text information from face-to-face interviews, picture descriptions, and so on to produce better solutions to research problems. The term, mixing means that the data or the findings are integrated and/or connected at one or several points within the investigation. Mixed methods research does not aim to substitute qualitative or quantitative approaches but, rather, to combine both approaches in creative ways that use the strengths of each within a single study. Research work is strengthened by mixing methods in ways that minimize weaknesses or ensure that the weaknesses of one approach do not overlap significantly with the weaknesses of another.

Mixed methods research utilizes notation systems. The most commonly accepted notation system used in mixed methods designs, uses a plus sign (+) to indicate that the data collection and analysis of methods occur at the same time. An arrow (→) shows that data collection and analysis occur in sequence. The weight or importance of the methods within the study should be denoted by using uppercase letters for prominence and lowercase letters to indicate less dominant methods. There are no specific rules that determine appropriate proportions of qualitative and quantitative research in a mixed methods study. Some researchers use parentheses to indicate methods that are embedded within other methods. The notation system rules are shown below:

- i) Weighting priority QUAL + QUAN (both are equally important)

- ii) QUAN + qual (quantitative approach is dominant)
- iii) QUAL + quan (qualitative approach is dominant)
- iv) Timing QUAN → Qual (quantitative collection or analysis occurs first followed by qualitative collection/analysis)
- v) QUAL → Quan (qualitative collection or analysis occurs first followed by quantitative collection/analysis)

Mixing QUAL (quan) QUAN (qual): Mixed methods research operates as per procedures for collecting, analyzing, and mixing quantitative and qualitative data in a study. It is based upon three main characteristics:

a) timing, b) weighting, and c) mixing.

a) Timing refers to the sequence or order of the implementation of the quantitative and qualitative data collection and analysis procedures in the study when one phase builds on another. The two possible timing options include:

- i) sequentially—collecting and analyzing the data one after the other (quantitative → qualitative, or qualitative → quantitative); or
- ii) concurrently—collecting and analyzing both quantitative and qualitative data at the same time (quantitative + qualitative).

b) Weighting refers to the relative importance or priority given to each type of data. The two possible weighting options include giving equal weight to the quantitative (QUAN) and qualitative (QUAL) data, or giving one type greater emphasis—to quantitative data (QUAN + qual) or qualitative data (QUAL + quan). When making the weighting decision, there are a number of things to consider:

- i) What is more strongly emphasized in the purpose statement, exploration (qualitative), or prediction (quantitative)?
- ii) Which data collection process, quantitative or qualitative, is most central to the study?
- iii) Which data analysis procedures, quantitative or qualitative, are more sophisticated, complex, and discussed more extensively when the study is presented?

c) Mixing refers to how the two methods, quantitative or qualitative, are combined within the study. It is an essential component of mixed methods research. Mixing quantitative and qualitative data can occur at different stages in the

study: during the data collection, the data analysis, or the interpretation of results.

Deciding on how to mix depends on the purpose of the study, its design, and the strategies used for data collection and analysis. If the purpose of the study is to explain quantitative results that were obtained first, qualitative data can be collected after quantitative data by interviewing or administering an open-response questionnaire to a small number of participants, based on these quantitative results. Mixing here occurs at two points: i) when selecting participants for interview and creating interview questions grounded in the statistical results connecting the quantitative and qualitative phases, and ii) at the interpretation stage of the study, when discussing the results from the two phases.

If the purpose of the study is to develop a closed-response questionnaire or survey grounded in the views of the participants, first qualitative data is collected through interviews and then the questionnaire is developed; then quantitative data is collected using this questionnaire. Mixing here occurs while analyzing the qualitative data for codes and themes and transforming them into questionnaire items and scales.

If the purpose of the study is to compare the quantitative and qualitative results, both quantitative and qualitative data are collected and analyzed separately. Mixing here occurs at the data interpretation stage, when the results from two data sets are compared.

Salient features of mixed methods research:

Mixed methods research has several features. Some of them are listed below:

- i) Mixed methods research collects and analyses both qualitative and quantitative data.
- ii) The procedure of mixed methods research is prepared within philosophical worldviews or theoretical lenses.
- iii) Mixed methods research uses research designs that suit the research question.
- iv) It involves the integration (mixing/merging/embedding) of the qualitative and quantitative data.
- v) Mixed methods research implicates meticulous processes while using the qualitative and quantitative data.

Advantages and disadvantages of mixed method research:

Mixed method research has several advantages. The most important ones are:

i) **Increasing the strengths while eliminating the weaknesses:** The main attraction of mixed method research has been the fact that by using both qualitative and quantitative approaches researchers can bring out the best of paradigms, thereby combining qualitative and quantitative research strength. This is further augmented by the potential that the strengths of one method can be utilized to overcome the weaknesses of another method used in the study.

ii) **Multi-level analysis of complex issues:** It has been suggested that the researchers can gain a better understanding of a complex phenomenon by converging numeric trends from quantitative data and specific details from qualitative data. Words can be used to add meaning to numbers and numbers can be used to add precision to words. It is easy to think of situations in applied linguistics when the researchers are interested at the same time in both the exact nature (i.e., qualitative) and the distribution (i.e., quantitative) of a phenomenon (e.g., why do some teenage boys consider modern language learning girlish and how extensive is this perception. Mixed methods research is particularly appropriate for such multi-level analyses because it allows investigators to obtain data about both the individual and the broader societal context.

iii) **Improved validity:** Mixed methods research has a unique potential to produce evidence for the validity of research outcomes through the convergence and correlation of the findings. Indeed improving the validity of research has been at the heart of the notion of triangulation. Corresponding evidence obtained through multiple methods can also increase the generalizability of the results.

iv) **Reaching multiple audiences:** A welcome benefit of combining qualitative and quantitative methods is that the final results are usually acceptable for a larger audience than those of a monomethod study would be. A well-executed mixed method study has multiple selling points and can offer something to everybody, regardless of the paradigmatic orientation of the person.

Disadvantages of mixed methods research:

Mixed methods research has the above advantages. However, it has also a number of disadvantages.

- i) It is difficult for a single researcher to carry out both quantitative and qualitative research.
- ii) It is difficult to have equal skill sets in both methods, and especially if data are collected simultaneously, there is a great time commitment.
- iii) The researcher must be able to understand the complexities of both approaches so as to make wise decisions about how they can appropriately be mixed.
- iv) Conducting a mixed methods study is likely to be more expensive than using a single approach.
- v) Quantitizing and qualitzing data can have its own problems. Also, interpreting conflicting results may be difficult.

Mixed methods designs:

Most frequently used mixed methods designs are embedded design, explanatory design, exploratory design, and triangulation design.

Embedded design:

It is used when a researcher requires to answer a secondary research question that needs the use of different types of data within a traditional quantitative or qualitative research design. This can be achieved by embedding one type of data collection and analysis within the design associated with another type of data. A researcher, for instance, may need to embed qualitative data within a quantitative experimental design and will conduct qualitative interviews during the research study to understand the reasons for certain participants' behaviours. More rarely, a researcher may embed quantitative survey data within a traditionally qualitative case study to help describe the broader context in which a case is situated. Unlike the TRIANGULATION DESIGN, the embedded design has a predominant method (quantitative or qualitative) that guides the research study.

Embedded design gives importance to the predominant method, quantitative or qualitative, that guides the project and within which another method is embedded. The mixing of the quantitative and qualitative data occurs either at the data analysis stage if the data is collected concurrently, or at the interpretation stage if the two types of data are collected sequentially. The quantitative and qualitative data analysis in this design is conducted separately because they seek to answer different research

questions. A sequential or concurrent design model could be utilized for the structure of the report as per the timing of data collection.

The embedded design has some advantages: i) It is useful for a researcher to prepare the study on a design that is well known (e.g., a case study). ii) The embedded design enables a researcher collect the two types of data at the same time. However, it has some disadvantages also: i) It might sometimes be challenging to integrate the quantitative and qualitative results because the two methods are used to answer different research questions. But, due to the nature of the questions, researchers can present the two sets of results separately.

Explanatory design

It is used to a great extent in applied linguistics research. True to its name it involves explanation. Qualitative results are explained, refined, clarified or extended with the help of qualitative findings. Quantitative and qualitative data are collected and analysed in sequence: first quantitative data is collected and analysed, and then qualitative data. Conducting follow-up qualitative interviews of representative or extreme cases to more deeply explore quantitative results would be typical example of this design.

Quantitative data is characteristically focused in this design because the quantitative data collection represents the major aspect of this mixed methods data collection process. Moreover, the quantitative data also comes first in the sequence. In this design the two methods are mixed at two stages in the research process: first, while developing the qualitative interview protocol and choosing the participants for in-depth exploration of the quantitative results; and second, while integrating the results from both quantitative and qualitative phases at the interpretation and discussion stage of the study. The data analysis usually has several options. A researcher might follow up on extreme or representative cases from the quantitative analysis, or explain the quantitative results elaborately.

The explanatory design has a typical sequential structure: first the quantitative data collection and analysis is described; then the description of the qualitative data collection and analysis is done. How the two phases were connected in the research process might be discussed in a separate section in the report. A researcher, during the discussion of the study results, explains how the qualitative findings assisted to elaborate or extend the quantitative results.

The explanatory design is advantageous as its two separate phases make it straightforward and reasonably easy to implement for beginners in research. The sequential nature of the design also makes it simple to describe and report on. However, compared to a straightforward quantitative study, an explanatory design study may need more time for completion.

Exploratory design

When a researcher requires first to explore a topic using qualitative data before measuring or testing it quantitatively, he/she uses the exploratory design of the mixed methods research. The exploratory design is mostly used for studying a topic which has been little explored, so there is little information about the relevant constructs and how to measure important variables. This design involves first the collection and analysis of the qualitative data and then the quantitative data is collected and analysed. The researchers begin to explore a topic by collecting qualitative data to help identify principal themes and possibly generate a theory. After that they collect quantitative data to examine the initial qualitative results, such as to test a theory or to develop a measurement instrument such as a questionnaire or survey.

In contrast to the explanatory design, the exploratory design gives importance to the qualitative data, as it offers the foundation for the quantitative exploration of the topic. The qualitative and quantitative methods are mixed while developing the quantitative survey items based on the qualitative data analysis and also while comparing the quantitative results with initial qualitative findings. Using the qualitative themes and categories to develop the quantitative measurement instrument is the most prevalent approach for data analysis. While writing up the research, a researcher first reports the qualitative data collection and analysis and then explains the development of the instrument. After that, the quantitative data collection and analysis are discussed, and in the end the overall results of the study are offered.

The exploratory design is advantageous to researchers. The two-phase nature of the exploratory design makes it straightforward for a researcher to design, implement, and report on. But, like in the explanatory design, implementing the two separate phases of the study can take too much time. Furthermore, it is not easy to develop a measurement instrument. Cautious procedures must be used to ensure that it is grounded in the qualitative results—that it is not constructed from common

sense or theory, but based upon the qualitative data collected—and that it is tested for reliability and validity.

Triangulation design:

It is the most common mixed methods research design in which quantitative and qualitative data are collected simultaneously. For example, a researcher conducts both questionnaires and focus-groups at the same time with the same participants, and then he/she compares the quantitative and qualitative results. Quantitative and qualitative data are often collected using a questionnaire that has closed-ended (quantitative) and open-ended (qualitative) response items. Triangulation design is best suited when a researcher wants to collect both types of data at the same time about a single phenomenon, in order to compare and contrast the different findings to produce well-validated conclusions.

Triangulation design gives importance to either quantitative or qualitative data, or equally to both. The mixing of the two methods occurs either at the data analysis stage or during the interpretation of the results from the two components of the study. There are a lot of options for data analysis. The most widespread approach is to compare the quantitative results and qualitative findings to confirm or cross-validate the findings from the entire study. Another commonly used strategy is to change qualitative data into quantitative data by counting codes, categories, and themes (called quantifying), or quantitative data into qualitative data through cluster or factor analysis (called qualifying) in order to compare it directly with another data set or include it in the overall analysis. The reporting structure of the triangulation design differs from the sequential explanatory and exploratory designs. A researcher presents the quantitative and qualitative data collection and analysis in separate sections, but combines the interpretation of the quantitative and qualitative findings into the same section, to discuss whether the results from both study components converge or show divergence.

The triangulation design has some advantages. The first is that it typically takes less time to complete than the sequential explanatory and exploratory designs. The second advantage of the triangulation design is that it can result in well-validated and substantiated findings because it offsets the weaknesses of one method with the strengths of another method.

However the triangulation design has two major disadvantages: First, it requires a lot of effort, as well as expertise, to collect and analyse two separate sets of data simultaneously; and second, it is sometimes technically difficult to compare different quantitative and qualitative data sets, especially if the two sets of results do not converge.

Let us have an idea of the basic difference in qualitative, quantitative, and mixed research reports. Qualitative research reports are usually longer, and they are written in narrative form, describing what was found, especially from the insider perspectives of the people in the group being studied. This report is more interpretative, as the researcher attempts to understand and portray the lives and experiences and language of the research participants. Qualitative journal articles are frequently 15–20 pages long, and the results of qualitative research are often published in the form of books or monographs rather than journal articles. In contrast, quantitative reports include many numbers and results of statistical significance testing which are explained later. The reports are commonly reported in journal articles ranging from 10 to 15 pages. Mixed research might follow the quantitative style or the qualitative style or, more frequently, might use a mixture of the styles.

3.2.1.6 Action Research

The action research is also referred to as practitioner research, teacher research, teacher-as-researcher. It is an on-the-spot procedure prepared to deal with a concrete problem located in an immediate situation. This is a step-by-step process which is constantly monitored over varying periods of time and by a variety of mechanisms such as observation, interview, questionnaire, diary study, and discourse analysis, so as to translate feedback into modifications, adjustments, directional changes, redefinitions, as necessary, so a lasting benefit to the on-going process itself is brought about. Action research tries to bring about change, specifically in local educational contexts. It usually identifies and explores an issue, question, dilemma, gap, or puzzle in your own context of work. As it involves the processes of systematically collecting, documenting, and analyzing data, it is also research. Action research is participatory and collaborative as teachers work together to examine their own classrooms.

Action research is a common term for a family of related methods that share some important common principles. The most important tenet concerns the close link between research and teaching as well as the researcher and the teacher. It is conducted by or in cooperation with teachers for the purpose of gaining a better understanding of their educational environment and improving the effectiveness of their teaching. In this way, central characteristics of action research are the enhancement of practice and the introduction of change into the social enterprise. Traditionally, the teacher-researcher link was taken so seriously in this area that only research done by the teacher himself/herself was considered action research proper. However, after it was realized that it is often unrealistic to expect teachers to have the expertise to conduct rigorous research, scholars started to emphasize the collaboration between teachers and researchers. This collaboration can take several forms, from the researcher owning the project and co-opting a participating teacher to real collaboration where researchers and teachers participate equally in the research agenda. The language teachers might reflect on their treatment of new students and decide that intervention (i.e., the independent variable or treatment) would be appropriate. The nature of appropriate intervention might be apparent to the teacher, or it may be necessary to wait for a new intake, keep a journal and record lessons in order to build up a picture of the ways in which induction is handled in class. Analysis of this might reveal very prescriptive teacher-centered approaches that are not conducive to building a classroom community, so the teacher might develop a set of more appropriate strategies for achieving this end. These strategies could then be implemented with the next intake and their success evaluated on the basis of journals, recordings, and perhaps interviews.

Practical action research and participatory action research are two main types of action research. It is also possible to have variations and combinations of these two types.

Practical action research:

It aims to deal with a specific problem within a classroom, school, university, or other community. Practical action research can be carried out in a variety of settings, such as educational, social service, or business locations. Its primary purpose is to improve practice in the short term as well as to inform larger issues. It can be conducted by individuals, teams, or even larger groups, keeping the intentions of the research clear and specific.

Participatory Action Research:

Participatory action research is also known as collaborative research as it is a collaborative approach to research that offers people the means to take systematic action in an effort to resolve specific problems. Participatory action research encourages consensual, democratic, and participatory strategies to encourage people to examine thoughtfully problems affecting them. Further, it encourages people to formulate accounts and explanations of their situation, and to develop plans that may resolve these problems.

Advantages and Disadvantages of Action Research:

Action research is usually carried out through collaboration with the community, teachers, and students. It involves classroom-based inquiries on various topics relevant to the stakeholders. Accordingly, it has the following advantages:

Advantages of Action Research:

- i) It is beneficial to both students and teachers for their professional development which results from collaborative action work.
- ii) It improves the culture adopted in the school.
- iii) It improves personal and professional values of the teachers, including their self-esteem, self-efficacy, and collegiality.
- iv) It empowers teachers to make and implement their decisions, which improves their working knowledge and status, which are essential to the success of the students. The teachers plan, organize, and nurture relationships in the school.
- v) Action research raises development of skills pertaining to critical thinking, problem solving, collaboration, and ethical decision making.
- vi) It improves the status of the teachers through collective participation.
- vii) Action research encourages the development of a community of learners and develops educational leaders and excellent researchers.

Disadvantages of Action Research

There are several obstacles in action research. These obstacles obstruct data collection, participation, and analysis of findings. Some of the disadvantages of action research are as given below:

- i) Action research is frequently carried out in hurry; therefore it is problematic to keep the strictness of the research.
- ii) As the results of action research have to be obtained quickly, it has limited time.
- iii) It is generally done by classroom teachers who are not trained in research methodology.
- iv) If there is researcher with the teacher involved in action research, it causes anxiety among teachers as researchers ill-treat them for the lack of critical thinking and research knowledge.
- v) Researcher's bias influences data collection, analysis and interpretation because researchers themselves are interested parties in the research process.
- vi) The findings of action research are typically only applicable to the specific classroom being researched. The results may vary in other classrooms.

3.2.1.7 Experimental Research

Experimental research is also known as experimental study. It is a type of quantitative research used by the experimenters to manipulate certain stimuli, treatments, or environmental conditions and to observe how the condition or behaviour of the subject is affected or changed. In fact, experimental research is a scientific method used to carry out research using two variables: independent and dependent. Independent variables can be manipulated to apply to dependent variables and the effect is measured. This measurement generally happens over a significant period of time to establish conditions and conclusions about the relationship between these two variables. The results of experimental research can be used to determine correlations between the variables applied and their effects on each group.

Experimental research is extensively used in education, psychology, social sciences and physical sciences. It is based on observation, calculation, comparison and logic. Researchers collect quantitative data and perform statistical analyses of two sets of variables. In experimental research necessary data is collected to focus on facts and support sound decisions. It is useful in establishing cause-and-effect relationships between the independent and dependent variables.

The following are salient characteristics of experimental research:

Salient Characteristics of Experimental Research:

In an experimental research design the hypothesis is at the core. Researchers propose a tentative answer after defining the problem and then test the hypothesis to either confirm or disregard it. The following are salient characteristics of experimental research:

- i) The dependent variables are manipulated; on the other hand the independent variables are exerted on dependent variables as an experimental treatment. Extraneous variables are variables generated from other factors that can affect the experiment and contribute to change. Researchers try to reduce the influence of these variables by randomization, making homogeneous groups and applying statistical analysis techniques.
- ii) Researchers intentionally operate independent variables on the subject of the experiment. This is known as manipulation
- iii) Once a variable is manipulated, researchers observe the effect an independent variable has on a dependent variable. This is a key for interpreting results.
- iv) A researcher may want multiple comparisons between different groups with equivalent subjects. They may replicate the process by conducting sub-experiments within the framework of the experimental design.
- v) Experimental research is effective in laboratory as well as non-laboratory settings. It helps in predicting events in an experimental setting. It generalizes variable relationships so that they can be implemented outside the experiment and applied to a wider interest group.

Types of Experimental Research Design

Experimental research designs can be classified as per the key elements associated to how researchers carry out each experiment. There are three different types of experimental research design. They are: pre-experimental design, True experimental design, and quasi-experimental design which are determined by the way a researcher assigns subjects to different groups.

1. Pre-experimental research design:

Pre-experimental research design is the most basic style of experimental research. It is an observation approach in which researchers observe a group or various groups to study the effect of an independent variable on the dependent variable to cause change. It is a simple form of experimental research so there is no control group. It is further classified into three sub-division:

i) **One-shot case study research design:** In this study one dependent variable is considered. In other words, the researchers subject a single group to a stimulus and test them at the end of the application. This design enables the researchers to collect results for performance by individuals or entities subject to the stimuli being tested. As this study is carried out considering what probably caused the change, it becomes a post-test study.

ii) **One-group pre-test-post-test design:** This design is the combination of both pre-test and post-test studies. In this type of research, researchers use a test both before and after the application of the stimuli. Researchers are given a comparison of performance with and without application to make judgements about the effects of the stimuli on the subjects.

iii) **Static-group comparison design:** This research involves studying two groups by subjecting one to treatment while the other remains static. Testing occurs at the end of the process where the differences between both the groups are observed. This is a practical design but it lacks in certain areas of true experimental research.

2. True Experimental Research Design:

This design is main method of applying untested research to a subject. It depends on statistical analysis to approve or disregard a hypothesis. This is an accurate design that can be conducted with or without a pre-test on a minimum of two dependent variables assigned randomly so as to take out any potential for bias in creating study groups to provide more reliable results. True experimental research design is further classified into three types:

i) **Post-test-only control group design:** It involves random division of participants into two groups: experimental and control. Only the experimental group is treated and the control group is not treated. However, researchers observe and

post-test both the groups to draw a conclusion from the difference between the groups.

ii) Pre-test-post-test control group design: Under this structure, two groups are randomly assigned subjects. Both groups are presented. The experimental group is treated and both groups are post-tested to measure how much change happened in each group. Researchers can observe changes in performance for the non-control group and determine if any changes happened due to participants taking the same test two times. The design also enables researchers to check if the control group has also changed. The researchers can use this to make adjustments as required while analysing the data.

All in all, it can be observed that true experimental research design should have a variable to manipulate a control group and random distribution.

iii) Solomon four-group design: It is the most comprehensive design for an experimental research project. It is a combination of the Post-test-only control group design and Pre-test-post-test control group design. Subjects are randomly selected and assigned to four groups. Two groups are tested using each of the previous methods the Post-test-only control group and Pre-test-post-test control group designs. In this design there is a comprehensive set of data with multiple ways of differentiating between groups which can enhance abilities of researchers to draw conclusions based on the resulting data.

3. Quasi-experimental design:

It is similar to true experimental research. Researchers can apply quasi-experimental design the way true experimental research does. However, a quasi-experimental study lacks randomization when assigning participants to groups. This normally happens because of rules that prevent researchers from applying random allocation in some settings.

Advantages and Disadvantages of Experimental Research

Experimental research works the best method to test a theory for it is helpful in making predictions about a subject and drawing conclusions. It provides researchers with more information when making professional decisions, which might enable them to complete better actions. The following are some of the advantages of experimental research:

- i) Experimental research is carried out within a controlled setting. Consequently, It enables researchers to have a stronghold over variables and collect desired results.
- ii) It has broad application across fields. Researchers can use it to gain key information across a variety of professional fields.
- iii) Experimental research is an efficient method of gaining information on a topic and its results are usually specific and actionable.
- iv) Experimental research can be used to improve the standard of academics across institutions by testing student knowledge and teaching methods before analysing the result to implement programs.
- v) Experimental research is a foundational part of many types of analysis. It is the ideal starting point to collect data and lay a foundation for conducting further research and building more ideas.
- vi) Experimental research is helpful in identifying cause and effect of a hypothesis, which can be further analysed for in-depth ideas.
- vii) Findings from the results of Experimental research are usually applicable to similar situations and ideas.
- viii) Social scientists often use experimental research design to study and test behaviour in humans and animals.
- xi) The subject does not affect the effectiveness of the result of experimental research.

Disadvantages of Experimental Research:

Though experimental research is a scientific method, it has a few disadvantages which are listed below:

- i) As experimental research depends on controlling variables, human error is a matter of concern. Wrong implementation invalidates the validity and conclusion of the research.
- ii) Experimental research is time-consuming and expensive.
- iii) The results of experimental research are not descriptive and participants can register biased responses.

- iv) Experimental research can produce wrong conclusions due to removal of peripheral variables.

Check Your Progress –I

Q. A. Fill in the blanks and complete the sentences:

1. research is used to describe a variety of studies conducted over a period of time.
2. is the study of a group of different individuals / subjects at a single point in time.
3.research offers a snapshot of a single moment in times.
4.is commonly used to understand people’s experiences and to express their perspectives.
5. The main goal of sampling in qualitative research is to
6.perspective in research is an outsider’s /researcher’s understanding of a culture or group that is not their own.
7. Critical discourse analysis is aresearch.
8.is main measurement device in qualitative research.
9. Statistical analysis is an indispensable part of theresearch.
10. Its focus of facts and verifiable information makes quantitative research more
11. The aim of theresearch is to combine both the qualitative and quantitative approach creatively within a single study.
12. The explanatory design characteristically focuses thedata.
13.research empowers teachers to make and implement their decisions.

B) Answer the following questions in a word/ phrase/ sentence.

1. What are the types of longitudinal research?
2. What kind of longitudinal research is used to study cognitive and language skills in a group of people over a period of time?

3. In which longitudinal study the sample share a defining characteristics such as birth year, geographical area, etc
4. What are the two primary purposes of longitudinal research?
5. What is the disadvantage of cross-sectional study?
6. What is emic perspective in research?
7. What is research outcome in qualitative research?
8. What is the empathetic understanding?
9. What is the aim of quantitative research?
10. How is individual based subjectivity removed from the quantitative research?
11. What is weighting in mixed methods research?

3.3 Subject Matter-II

3.3.1 Analysing Data

Data:

Students, in the earlier section we have discussed the types of linguistic research, their salient features, advantages and disadvantages and subtle differences in them. Now let us consider data analysis in research. However, before we discuss the ways of analysing data it is necessary to put some light on the concept of 'data'.

The word, 'data' is plural form of a Latin word, '*datum*'. It is a plural form but singular or plural in construction. Data means information collected in a research study. Data may be oral and recorded onto audio and/or videotapes. Data in a written form may be in the form of essays, test scores, diaries, or check marks on observation schemes. In the age of computer, data may appear in electronic format and both audio and visual form. Different approaches are required for the statistical analysis of different kinds of data. So let us see data analysis and how it is done with different kinds of data.

Data analysis:

Data analysis is a process in research. It involves reducing stored data collected in research to a manageable size, developing summaries, looking for patterns, and

performing statistical analysis. Basically as per the research types there are two types of data: qualitative data and quantitative data.

Qualitative data is usually in the form of words. It includes descriptions, observations, impressions, recordings, and the like. For instance, responses to open-ended questions on a survey, the transcript from an interview or focus-group session, notes from a log or diary, or field notes. Qualitative data can be collected from many people, a few individuals, or a single case.

Actually, it is a very personal process. Researchers engaged in qualitative research accept that participants are influenced by participating in the research process. They might also admit that researchers bring their own preferences and experience to the project. If we ask two researchers to analyse a transcript, they may produce very different results. This may happen due to the difference in their subjects of study or because of their different political or methodological outlooks or stances. That is why qualitative methods are criticised by some researchers as ‘unscientific’ or ‘unreliable’. This happens frequently as researchers who have quantitative backgrounds try to assign their methods and processes to qualitative research. However, such activities bring no results.

As far as quantitative data is concerned it is generally in the form of numbers that researchers analyse using various statistical procedures. For it the issues of validity and reliability are important. Researchers here try to show that the methods chosen by them are effectively successful in what they claimed to measure. They want to confirm that their measurements are stable and consistent and without error-bias. Even verbal data, such as compositions written by high school students, would be converted through the scoring process to a numerical form. The analysis of the numerical data in quantitative research provides evidence that supports or fails to support the hypothesis of the study. Univariate analysis, bivariate analysis, and multivariate analysis are used for analysis of quantitative data, as per the number of variables under investigation.

This clearly shows that the two approaches are very different, so they should be treated differently. Different appropriate ways are used to analyse qualitative and quantitative data. As far as qualitative data is concerned, it might be analysed as the research goes on. The analysis of the qualitative data is constantly refining and changing in the light of evolving results. The researcher has to organize and

categorize or code the large mass of data so that it can be described and interpreted. Although the qualitative researcher does not deal with statistics, analysing qualitative data is not easy. It is a lengthy, time-consuming and meticulous process.

On the other hand, analysis of the quantitative data can be performed at the end of the data collection process. Moreover, statistical software is used when the quantitative data is accumulated through a large survey. In this type of analysis the data input process can be lengthy and painstaking. But, once this has been done the statistical software make the analysis easy, quick and efficient. The software packages produced graphs, pie charts and tables can be used for the final report of the research study.

3.3.1.1 Qualitative Data Analysis:

As it has been mentioned earlier, the qualitative data might be analysed as the research progresses. To make it more easy and effective, it is useful to prepare an interview summary form or a focus-group summary form and complete it as soon as possible after the end of each interview or focus-group and attach them to the research records. This form contains practical details about the time and place, the participants, the duration of the interview or focus-group, and details about the content and newly developing subjects. The form is helpful in reminding researchers about the contact and at the time of data analysis it is useful.

Qualitative data analysis can be of different types. The research topic, the researcher's personal preferences and the time, equipment and finances available to him or her determine the selection of the type of data analysis. Qualitative data analysis is without typical rigid rules and procedures as it is a personal process, where researcher can use whatever that is suitable. It is for this reason that each type of analysis is best illustrated through examples.

Formats for analysis:

Qualitative data includes a transcript prepared by a researcher from an interview or focus-group. It can be a series of written answers on an open-ended questionnaire prepared by the researcher. It also includes field notes or memos prepared by the researcher during the investigation. If the researcher prepares memos and notes as he/she starts to collect data, they keep the researcher conscious about significant points in the data. While analysing the transcripts or questionnaires the researcher can analyse the memos and notes. It is very necessary for a researcher to present

his/her data in a format so as to get it analysed easily. The following are some formats for analysis of qualitative data:

1. The qualitative continuum

A continuum is a continuous series of things, in which each one is only slightly different from the things next to it, but the last is very different from the first. It is something that keeps on going, changing slowly over time. The qualitative continuum enables a researcher to arrange the data in a series. It is beneficial for the researcher to think of the different types of qualitative data analysis as positioned on a continuum. The following table shows qualitative data analysis continuum:

Highly Qualitative	Combination	Almost Quantitative
e.g. thematic and comparative analysis	e.g. discourse and conversation analysis	e.g. content analysis
Reflexive intuitive takes place throughout data collection	Uses a combination of reflexivity and counting	Code and count mechanical can be left until end of data collection

Table 1. Qualitative data analysis continuum (from Dawson, 2009, p. 119)

It can be seen from the above table that the highly qualitative things are at the one end. They are reflective types of analysis. On the other hand, it is seen from the analysis continuum that on the other end are those things which treat the qualitative data in a quantitative way, by counting and coding data.

Data analysis tends to be an on-going process, taking place throughout the data collection process, for those at the highly qualitative end of the continuum. The researcher thinks about and reflects upon the emerging themes, adapting and changing the methods if required. For instance, a researcher develops a schedule and conducts group focus three times. However, during the second group focus, if the researcher observes that the participants are raising issues that the researcher has not thought about previously. Then the researcher refines the group focus schedule to include these issues for the next group focus. This data analysis performed with qualitative continuum. The researcher has thought about what has been said, analysed the data and developed the new schedule accordingly.

2. Thematic analysis

Thematic analysis refers to the process of analysing data by theme. In this analysis researchers read through a set of data and look for patterns in the meaning of the data to find themes. This is a highly inductive type of analysis. The themes are developed from the data. They are not forced upon the data by the researcher. In thematic analysis, the data collection and analysis take place simultaneously. The researcher's subjective experience is at the centre of comprehending the data. The researcher's background reading can be helpful to explain an emerging theme. Let us see an example to understand the process of thematic analysis:

A researcher is interested in finding out what some people think about the New National Education Policy. The researcher plans a focus-group with some social club members; in which the researcher notices that some members know the New National Education Policy clearly. The researcher finds that the remaining members of the club had very little idea. This is called immediate, on the spot analysis.

Then the researcher discusses the issue with the focus-group and learns that the members who know about the New National Education Policy are either teachers or they are close relatives or friends of teachers. This is called the emergence of theme. Accordingly, the researcher decides to interview people who are not related to teachers either as relatives or friends, so as to learn what they know about the New National Education Policy.

3. Comparative analysis

It is closely connected to thematic analysis. Qualitative comparative analysis is a set-based theory. Its goal is to search for the similarity and difference among the units of analysis. Comparative analysis is used to compare and contrast data from different people. The researcher continues the process up to the point when no new issues arise. Quite often comparative analysis is used with thematic analysis in the same project. Let us see an example to understand the process of comparative analysis:

A researcher finds out that people who are closely related to teacher know clearly about the New National Education Policy than those who are not related to teachers. The researcher feels that both the issues are a matter of concern. Firstly, the

researcher wants to find out how the people who have clear idea about the New National Education Policy are related to teachers. Secondly, the researcher wants to find out how the people, who are not related to teacher, know about the New National Education Policy.

The researcher then can develop a scale showing relation of people with teachers and perception about the New National Education Policy by interviewing many people and comparing and contrasting the data from each transcript. The scale shows the range from close relation with teacher such as a spouse, parents, children, close friends, distant relatives and no relation of the interviewee with a teacher.

After putting each interviewee on the scale, the researcher refers to the transcripts to find out clues about how their perceptions have been made. Simultaneously, the researcher refers to existing research literature which addresses the issue of influences on personal perception to see if this would give him further insight into what was arising from his data.

After this process, if the researcher finds that data is missing or something which has been mentioned cannot be understood, he/she would conduct another interview until he feels that analysis and understanding are complete.

4. Content analysis

It is a research technique extensively employed to analyse content and its features. Using content analysis researchers code by content. It is useful in quantifying qualitative information by sorting data and comparing different parts of information to summarize into useful information. Further, researchers use content analysis to determine the presence of certain words, themes, or concepts within some given qualitative data. The content can differ from simple words, text, and pictures to social media data, books, journals and websites.

Content analysis enables researchers to quantify and analyse the presence, meanings, and relationships of such certain words, themes, or concepts in such contents. It can be used for open-ended questions which have been added to questionnaires in large quantitative surveys. This enables the researcher to work systematically through each transcript assigning codes, which may be numbers or words, to specific characteristics within the text and to quantify the responses. Computer-aided text analysis has made content analysis widely popular. Content analysis can be done precisely and fast because of the easy availability of electronic

messages. The following example will be helpful to understand the process of content analysis.

A researcher pursuing research on state of girl-students in conventional higher education observes that availability of college, parents financial position, parents education background and attitude of society towards women education can be very important. The researcher assigns code numbers to these issues and after that the researcher studies each transcript and writes the code number above the related part if any of these issues are found in there. Of course, these issues are significant and the researcher discusses them in every interview, even with other stakeholders of higher education.

However, the researcher also observes that there are many other issues related to higher education of girls, like purpose of girls taking conventional higher education, girl-students' desire to take conventional higher education, marriage of girl-students, output of girls' conventional higher education. These are not considered earlier by the researcher.

As each new issue is mentioned, the researcher ascribes another code and goes back to previous transcripts to see if it has occurred but has been missed during the initial analysis. This makes the researcher to refer back to the transcripts several times. But by the end of the study the researcher performs a complete analysis of the data.

5. Discourse analysis

After considering the formats for qualitative data analysis like the qualitative continuum, thematic analysis, comparative analysis and content analysis, it is necessary to consider discourse analysis in qualitative research.

Qualitative research data, as mentioned earlier, is collected through interviews, focus-groups, diaries, open-ended questionnaires, social media or other documents. Researchers often try to understand the issues by listening to what people say and how they say that. And in this way, discourse analysis can be an essential format for qualitative data analysis.

In fact, discourse analysis is a crucial methodological approach in qualitative research for analysing texts. Researchers make interpretations based on both the details of the material itself and on contextual knowledge.

Discourse is language in use. It is the complete communication system used by people. Discourse includes not only written, verbal and non-verbal communication but also the wider social concepts that underpin what a word or expression means and how it changes. For instance, the use of a particular word or term by some people shows their upbringing and familial-social-educational background.

Discourse analysis in qualitative research considers patterns of speech, such as how people talk about a particular subject, what metaphors they use, how they take turns in conversation, and so on. The discourse analysts take speech as a performance. To them, speech performs an action rather than describes a specific state of affairs or specific state of mind. Consequently, discourse analysis plays a significant role in qualitative data analysis because language is not just a way of communication but it shows who we are, what we do, our beliefs and the socio-cultural and contextual power dynamics we live in. An example of discourse analysis is given below:

A researcher wants to study about the socio-cultural power dynamics presented in the novel, 'Untouchable' by Mulk Raj Anand. Accordingly, he reads the novel minutely paying attention to the incidents of exercise of power dynamics in the novel. After listing the occasions of physical ill-treatment given to the untouchables by the upper class people, the researcher studies the patterns of speech using discourse analysis.

The researcher closely studies how the upper class people abuse the untouchables though they are not guilty. The researcher also understands the vicious hierarchy of caste system through the characters of Bakha, Chota, Ramcharan, Ramanand, Lachman, and Pandit Kali Nath. The attitude of people belonging to Islam and Christianity is also studied extensively.

The researcher records variety of facets of caste as reflected in the novel. The final report contains large amounts of transcript to illustrate the points the researcher has raised.

The processes of qualitative data analysis

The above formats clearly show that qualitative data analysis involves different processes as listed below:

The researcher is required to think about the data from the moment he/she starts to collect the information.

The researcher should judge the value of his/her data, especially coming from doubtful sources.

The researcher should interpret the data as the research progresses, so as to understand what is going on.

In the end, the researcher should undertake the mechanical process of analysing the data.

3.3.1.2 Quantitative Data

Students, after studying different formats for qualitative data analysis, let us consider a complex topic, i.e. quantitative data analysis which includes terms like mean, median, mode, standard deviation, correlation and regression.

To begin with, let us see what quantitative data analysis is. To be simple, quantitative data analysis means analyzing data that is number-based. It also means conversion of data into numbers without losing any meaning. For example, data in mode of variables which refer to persons, places, things, or phenomena that researchers are trying to measure in some way. Variables, in other words, are features that can be measured and that can assume different values, such as place of birth, grades obtained at school, weight, height, age, income, gender, language, and others. Such variables could be converted into numbers without losing meaning. For instance, if 'citizenship' is category-based variable, then 'India' could equal 1, USA 2, France 3, etc.

Purposes of Quantitative Analysis:

Quantitative analysis can be used:

1. to measure differences between groups. e.g. level of foreign language acquisition.
2. to assess relationships between variables. e.g. acquisition of foreign language and exposure to foreign language.
3. to test hypothesis in a scientifically rigorous way. e. g. a hypothesis about the impact of medium of instruction on foreign language acquisition.

As quantitative data analysis is all about analyzing numbers, statistics becomes an indispensable part of it. There are several methods of statistical analysis varying from simple basic calculation, such as averages and medians to more advanced analyses like correlations and regressions.

Furthermore, there are two main branches of statistical methods: 1. Descriptive statistics and 2. Inferential statistics. To understand the difference between these branches of statistics, you need to understand the difference between two important statistical concepts of population and sample. 'Population' in statistics refers to the entire group of whatever a researcher intends to research. Population can be the entire group of people, animals, organizations, or whatever a researcher is interested in researching. For instance, if a researcher is researching teachers of English in Maharashtra, then population would be all teachers of English in Maharashtra.

On the other hand, 'sample' means a smaller group of accessible people (or members of population) whose data is actually collected by a researcher. To be simple the population is the entire group of people a researcher is interested in and the sample is the subset of the population.

The descriptive statistics describes or investigates the sample. On the contrary, the inferential statistics aims to make predictions or draw conclusions about the population on the basis of the findings within the sample.

The descriptive statistics describes the researcher's data set. It is helpful in understanding the details of sample. It tells about the shape of the data after a researcher understands the attributes of his/her sample. On the other hand, inferential statistics is used to make predictions about differences between groups, for instance English vocabulary development differences between students in English medium schools and students in Marathi medium schools. Similarly, it makes predictions about relationships between variables, for instance, the status of women as reflected in novels of Hindu women writers and Muslim women writers. The inferential statistics is also used for hypothesis testing.

As far as the scope of the present unit is concerned, it would be reasonable to enable the students to understand the fundamental concepts of descriptive statistics, viz., mode, median, mean, and standard deviation.

Linguistic research often involves testing to study various linguistic aspects. The tests are evaluated so as to assess the performance of test takers who obtain the

scores. These scores are used to describe the abilities of the test takers. The appropriate use and precise description of the scores is useful in making inferences and decisions. Descriptive statistics is very useful in understanding the performance of test takers in better ways as the procedures for calculating descriptive statistics provide basis for all of the other statistical procedures.

Descriptive statistics are calculated for two purposes, such as: 1) to provide a precise way to describe the characteristics of a score distribution. 2) to provide the basis for further statistical analyses for investigating relationships and differences among different score distributions, for estimating the reliability of the score, and for interpreting scores in meaningful ways.

The score distribution involves certain steps:

1. To obtain a raw score. This is unordered listing of scores for a test. Here the scores are listed as per the student ID or roll number as it is shown in the following table:

Student ID	Score
1	25
2	16
3	27
4	41
5	38
6	41
7	28
8	35
9	31
10	41
11	40
12	33
13	18

14	20
15	19
16	19
17	18
18	35
19	26
20	23

Table 3.1 Unordered listing of scores for test-I

2. **To order scores from the highest to the lowest.** This is ordered listing of scores. It is helpful to find the highest and lowest scores. The following table exemplifies this step:

Student ID	Score
4	41
6	41
10	41
11	40
5	38
8	35
18	35
12	33
9	31
7	28
3	27
19	26
1	25

20	23
14	20
15	19
16	19
17	18
13	18
2	16

Table 3.2 Ordered listing of scores for test-I

3. **Frequency distribution.** Frequency is the number of times a particular event or outcome occurs. It is symbolized by (f). e. g. the number of times a score occurs in the data is the score's frequency. Frequency distribution or frequency count is created by counting the frequency of every score in the data. This means frequency is nothing but a count of the number of cases in a particular category. It facilitates visual inspection of the distribution. Here scores are grouped according to how many times each score occurs or according to the frequency of occurrence of the scores. Frequency distribution shows how scores are ordered. The grouping of scores is helpful when we have a large number of scores to describe. It is helpful to group scores into classes or intervals. The following table shows the frequency distribution of grouped scores:

Score	Frequency
x	f
41	3
40	1
38	1
35	2
33	1
31	1
28	1

Score	Frequency
27	1
26	1
25	1
23	1
20	1
19	2
18	2
16	1
Total	20

Table No. 3.3 Frequency distribution of grouped scores for test-I

4. Score Intervals.

To group the scores into classes or intervals is helpful when there is a large number of scores to describe. For instance, if there are 400 test takers obtaining scores between 7 to 98, the score interval can be estimated by dividing the score range by the number of intervals to be used. The number of intervals is typically around ten. The score range is obtained by using the equation: high score minus low score. In the connection with the above example the score range is $98-7=91$.

While grouping scores into score intervals, researchers should make score intervals exhaustive. The score intervals should include all the scores that occur in the distribution. Similarly, score intervals should be mutually exclusive. It means they should not overlap. e.g. 28-32 and 32-36 cannot be score intervals because a score of 32 would be included in both intervals. Usually, intervals are of equal width across the score range. The number of intervals depends on the number of scores and numbers of test takers that get each score. Very narrow and very wide score intervals are avoided. The following table shows frequency distribution of grouped scores with score intervals:

Score Interval	Frequency
60 or more	05
56-60	06
51-55	20
46-50	20
41-45	32
36-40	26
31-35	31
26-30	30
21-25	19
16-20	21
11-15	02
10 or less	03
Total	215

Table No. 3.4 Frequency distribution of grouped scores

Furthermore, score distributions can also be presented graphically. The ways to represent score distributions graphically are as discussed below:

Ways to represent score distributions graphically:

Primarily the graphical display of score distributions is used to determine how close a particular score distribution is to a normal distribution. In this way, graphic displays can be helpful in interpreting test results. The common ways of graphic displays are:

1) Histograms or bar charts:

Histogram is used extensively in many areas to represent distributions of numbers. It is a graphic display with vertical and horizontal axes or lines. The frequency of occurrence of a given score is displayed as a bar along axes. Usually spaces are left between the bars to display discrete or categorical data like

frequencies or percentages of occurrence in different groups or categories. However, to display continuous data like test scores the bars are usually displayed as touching each other. In a histogram the length/height of a bar is determined by the size of the frequency of occurrence.

It is a convention to represent test scores on the horizontal ('x') axis in histogram and to represent frequencies of occurrence for each score group along the vertical ('y') axis in histogram. However, sometimes the displays of scores and frequencies in histogram are reversed. And the scores are displayed on the vertical axis and frequencies on the horizontal axis. In such a case the bars are kept horizontal. See the following figure:

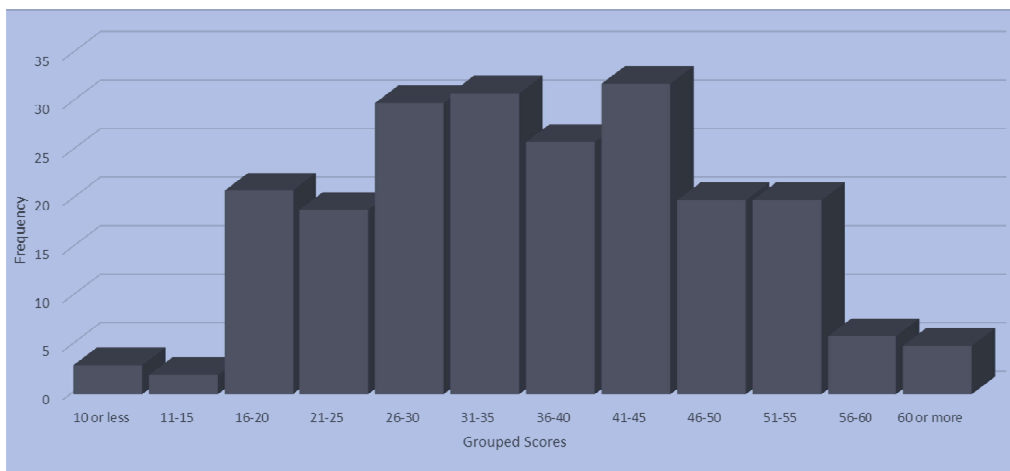


Figure 3.1 Histogram of frequency distribution

2) Frequency polygons:

In frequency polygons the frequencies of occurrence of the various scores are represented by dots rather than by bars. These dots are connected by lines. A frequency polygon is suitable only for continuous data because it represents the data as a continuous scale. It is angular. The frequency polygon is exemplified in the following figure:

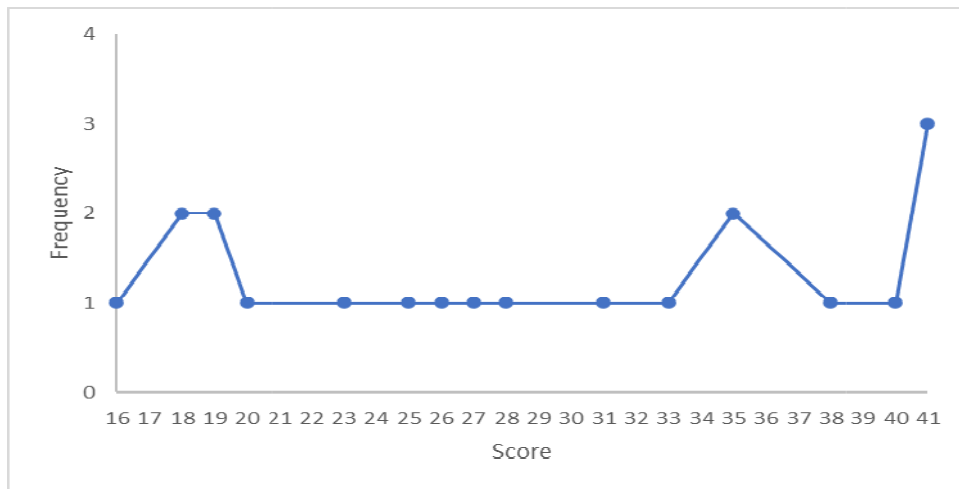


Fig. 3.2 Frequency polygon for distribution Test-I

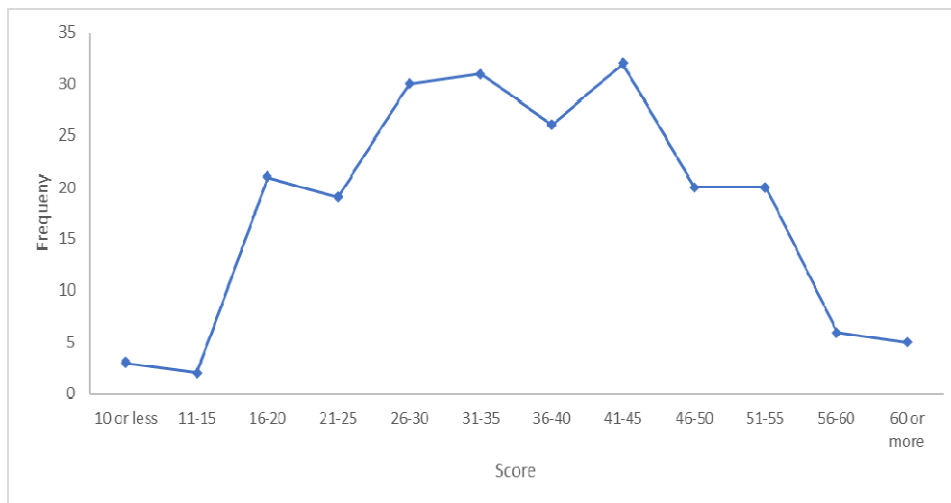


Fig. 3.3 Frequency polygon for score distribution Test-I

3. Box-and-whisker plots:

It is very useful for representing distributions as it includes visual representations of two descriptive statistics, namely – the median and semi-interquartile range of a score distribution. The score distribution in a box-and-whisker plot is displayed in a way that provides information about both the midpoint of the distribution and the relative variability of the scores. A computer program such as SPSS is very useful in obtaining box-and-whisker plots.

Shapes of Score Distribution:

The statistics of mode and range are not adequate for describing most score distributions. Under such circumstances the statistics of shape can be pretty helpful. Score distributions have widely differing shapes or patterns of grouping which are presented in the form of skewness. As the name suggests, skewness shows how symmetrical a range of scores is. Score distributions differ in their degree of peakedness which is called kurtosis in statistics.

Score distribution can be symmetrical in that the distribution of scores to the right of the central score is approximately the same to the distribution of scores to the left. Such a distribution is called normal or mesokurtic distribution. The following figure shows the mesokurtic distribution:

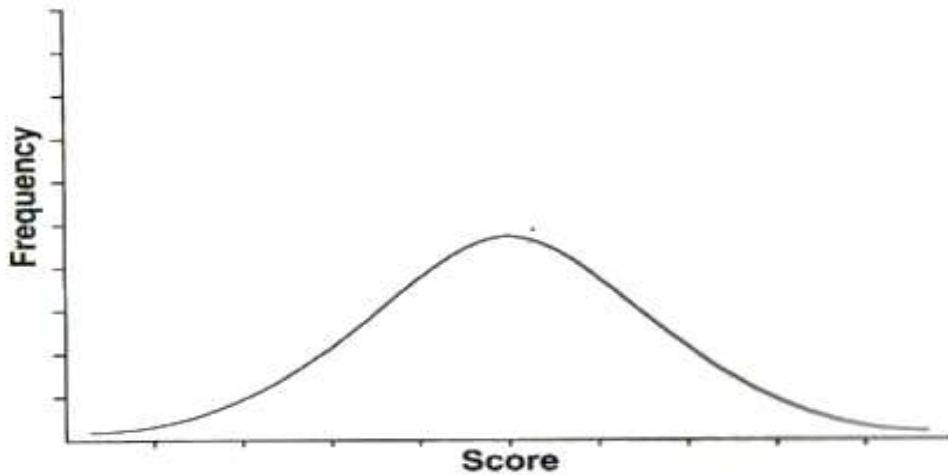


Fig. 3.3 Normal ('mesokurtic') distribution [Taken from Bachman, 2004]

The distribution which is highly peaked is leptokurtic which the following figure exemplifies:

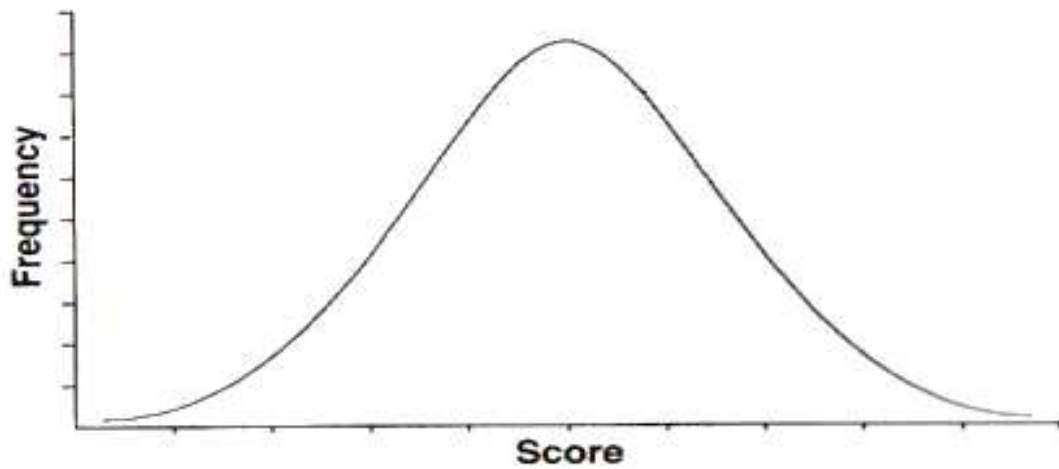


Fig. 3.4 Peaked ('leptokurtic') distribution [Taken from Bachman, 2004]

The distribution which is quite flat is referred to as platykurtic. It is given in the following figure:

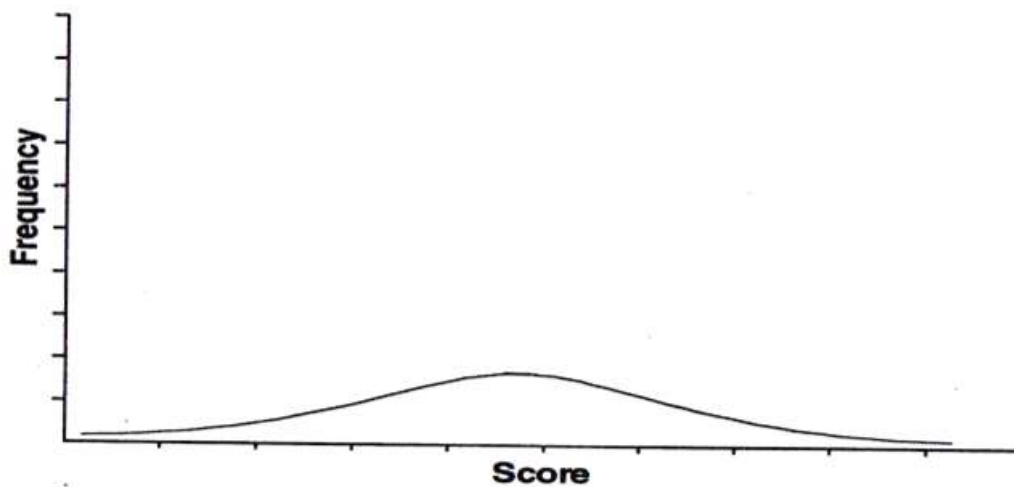


Fig. 3.5 flat ('platykurtic') distribution [Taken from Bachman, 2004]

The scores can also be distributed asymmetrically. In the asymmetrical distributions of scores, the shapes of the upper (the right) and the lower (the left) portions of the distributions are not mirror images. (i.e. they are not exactly the same). They are said to be skewed. The skewed distributions have a peak toward one end of the distribution and a longer tail the other. If the longer tail is at the upper end,

the distribution is positively skewed. The following figure shows the positively skewed distribution:

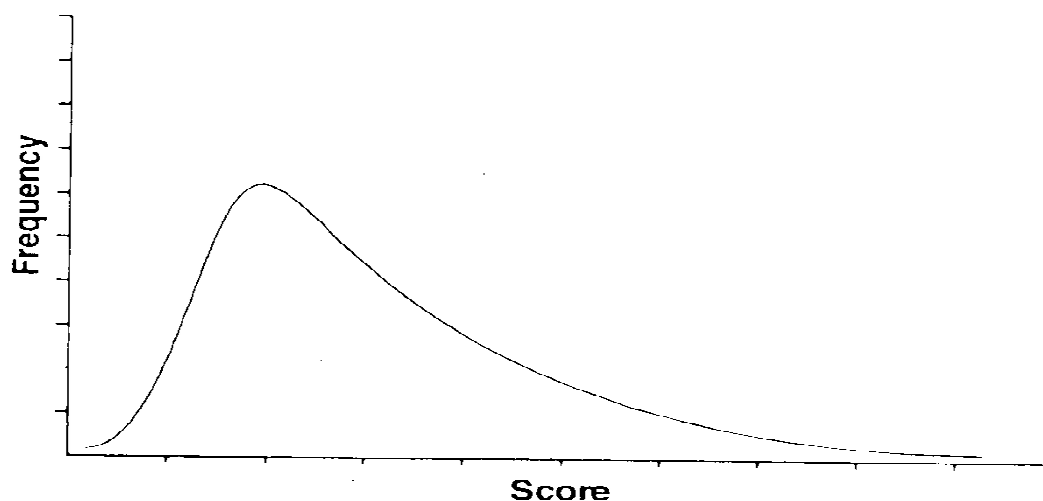


Fig. 3.6 Positively skewed distribution [Taken from Bachman, 2004]

If the longer tail is at the lower end of the distribution, it is negatively skewed distribution which is exemplified in the following figure:

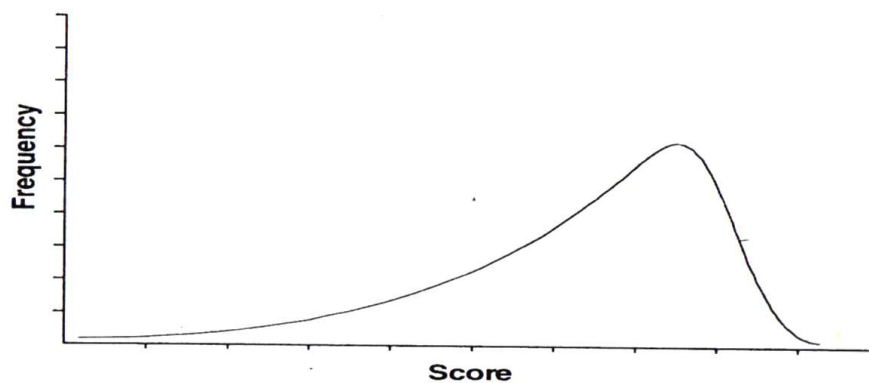


Fig. 3.7 Negatively skewed distribution [Taken from Bachman, 2004]

All the above frequency polygons are unimodal. There is also a bimodal distribution which has two peaks as given in the following figure:

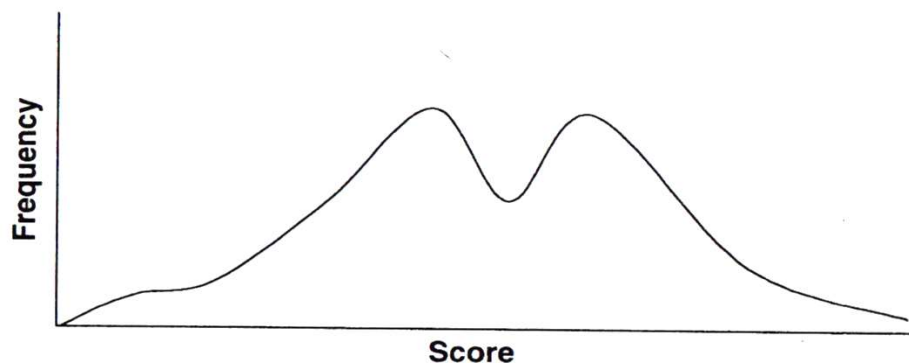


Fig. 3.8 Bimodal distribution [Taken from Bachman, 2004]

Calculating and interpreting descriptive statistics:

The information about the grouping and variability of test scores obtained from a frequency distribution or a graphic display has limitations. These descriptions are neither precise nor concise. Hence, there is a need to use statistics for describing the grouping and variability of scores.

1) Descriptive statistics of grouping:

There are three statistics used for describing the grouping of the scores in a distribution: mode, median, and mean. They are used for describing test scores. They provide a basis for reporting, interpreting reliability of test scores. They also provide a basis for investigating the validity of the uses of test scores. Let us see them one by one:

A) Mode: It is a statistic of grouping. It is the first indicator of grouping. It is the most frequently occurring score in distribution of scores. It just shows which score in the distribution occurs most often. To be simple mode is the score in the distribution which has the highest frequency. e.g. In the distribution of scores – 2,3,4,4,6,8, and 10, the mode is 4. Such a distribution is called unimodal as it has one score as the mode. Similarly, in the distribution in the Table 3.3 above, the mode is 41.

When a distribution has two scores with the highest frequency, it is called a bimodal distribution, as it has two modes. e.g. In the distribution of scores like 2, 3, 4, 4, 4, 6, 7, 8, 8, 8, 9, 10, 11, 12, and 13, 4 and 8 are the modes of the distribution. The following figure shows the bimodal distribution:

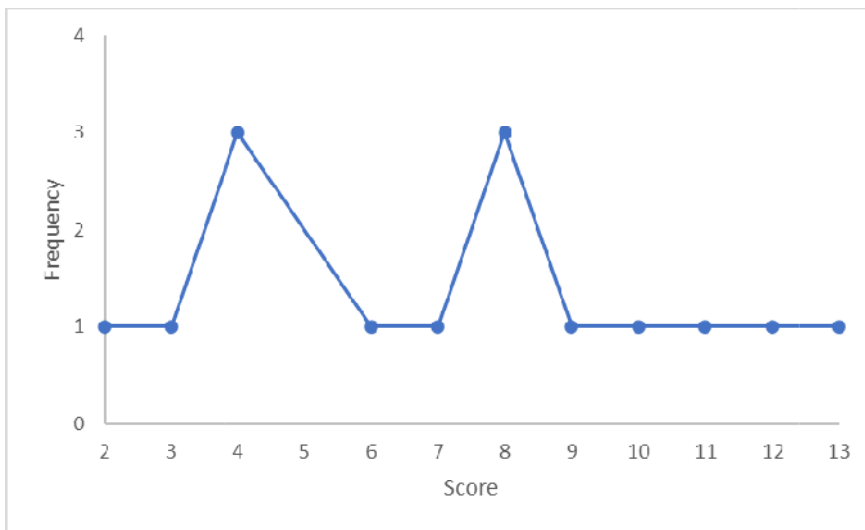


Fig. 3.9 A bimodal distribution

Modes of a distribution can be graphically presented as peaks in the distribution. a unimodal or normal distribution has only one peak. A bimodal distribution has two separate peaks, each showing relatively high frequency scores. If the frequencies of all scores are similar, the distribution is called rectangular or flat. The following figure shows the same.

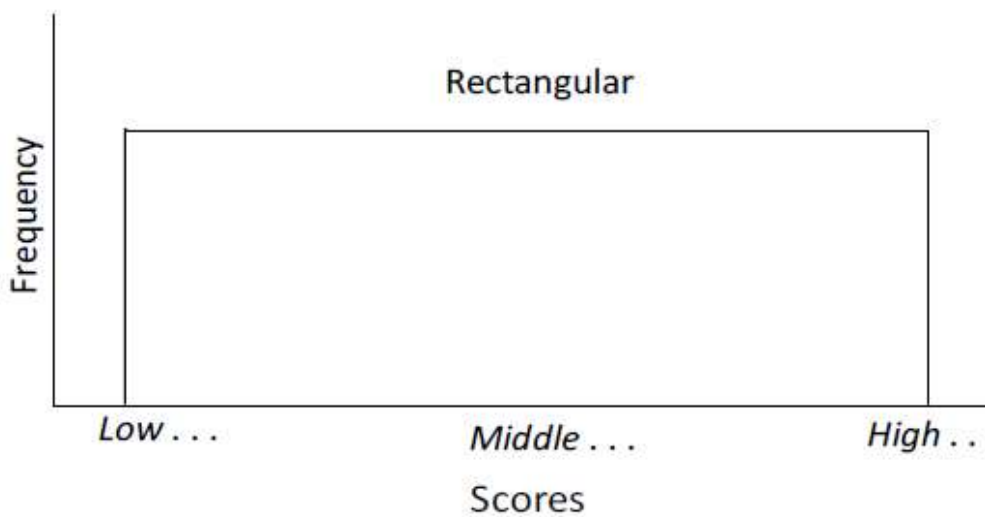


Fig. 10. A rectangular distribution [Taken from Tavakoli,2012]

Sometimes the term, antimode is used to indicate the opposite of mode. Antimode corresponds to a local minimum frequency.

If the numbers we are describing constitute a nominal scale, the mode is the appropriate indicator of grouping. Though test scores are relatively rarely nominal, sometimes numbers are used to represent other variables like sex, native language or group as in particular class or section in multisection course. Mode is the proper indicator of grouping for such variables. In such cases, the mode is sometimes reported as a percentage of total frequency.

However, the mode has two likely limitations:

- 1) If there are more than two modes, the data cannot be summarized. A rectangular distribution might be obtained in the most extreme case.
- 2) The mode does not take into account any scores other than the frequent score(s). Consequently, the mode may not accurately summarize the location of most scores in the distribution.

B) The Median:

The median is the second indicator of grouping. It is a measure of central tendency. The median is the middle value or score of a distribution of scores. It is just another name for the score at the 50th percentile. If the scores are rank-ordered, the median is the score that falls in the middle.

In other words median is the point in the distribution above which exactly half of the scores occur and below which the other half occur. The median is determined by counting the frequencies. The scores are arranged from the lowest to the highest. In the distribution of an odd number of scores, the score in the middle position is the appropriate median. For instance, for the eleven scores – 2, 3, 4, 4, 5, 6, 7, 8, 9, 10, and 11, the sixth score is in middle position. So the median is the score of ‘6’. Actually, as mentioned earlier, the median is the score at which 50% of the distribution falls below and 50% falls above.

However, in the distribution of an even number of test takers, it may be found that the middle point occurs between two different scores in the distribution, depending on whether the researcher begins with the lowest score and count up or with the highest score and count down. In such cases, the median is midway between these two scores. For example, for the twelve scores- 2, 7, 9, 11, 12, 12, 15, 26, 34,

45, 47, 49, the middle scores are at position 6 (the score of 12) and position 7 (the score of 15). The average of 12 and 15 is 13.5. Consequently, the median is 13.5. This means if there is an even number of test takers, the median may be a score that does not actually occur in the distribution.

Now let us see the median location, a term that is closely associated with the median. The median location of N number is defined as follows:

$$\text{Median location} = \frac{N+1}{2}$$

Thus, for 7 numbers (Number of test takers) the median location = $(7+1)/2=4$, which simply means that the median is the fourth number in an ordered series. When there are 14 numbers, the median location = $(14+1)/2=7.5$. Here the median falls between and is the average of the seventh and eighth numbers.

The median is the proper indicator of grouping for scores that are ordinaly scaled. Usually the ordinaly scaled scores in language measurement are derived from ratings of samples of language, such as compositions or oral interviews. Ordinal scales provide information about how the scores are ordered, and the median, being the middle score in the distribution, tells us what point in the distribution the scores tend to group. In this way, the median is beneficial if primary interest of a teacher is in describing the relative ordering of students with respect to each other. Furthermore, the median is less sensitive to extreme scores (outliers) than the mean and this makes it a better measure than the mean for highly skewed distributions, whether these are of ordinal or interval scaled scores. Calculating the median still overlooks some information in the data because it reveals only the frequency of scores in the lower 50% of the distribution, without considering their mathematical values or considering the scores in the upper 50%.

C) The Mean $\bar{X} = \frac{\Sigma X}{N}$

The Mean is the third indicator of grouping. It is commonly used in describing score distributions. It is the average score of the distribution. To calculate the mean, firstly a researcher has to add up or sum (Σ) the test scores (X) to get the sum of all the scores (ΣX). After that, the mean (\bar{X}) is obtained by dividing this sum (ΣX) by the number of test takers (N). Thus, the equation to calculate mean is: $\bar{X} = \frac{\Sigma X}{N}$

Where \bar{X} - (read as X-bar) is the symbol for the mean

Σ - is the summation sign (sum)

X - scores

ΣX - pronounced as 'sum of X' (means 'to find the sum of the scores')

N - total number of scores.

Let us consider an example, the seven test takers have obtained the scores- 3, 4, 5, 6, 8, 11, and 12, the sum of these scores $\Sigma X=49$, and N is 7. Thus, $\bar{X}=49/7=7$. This equation is suitable for limited scores.

When there are large numbers of test takers with many test takers obtaining the same score, a slightly different equation is applicable. In this situation each score is multiplied by its frequency (f) to obtain the total for each score (fx). Then all these totals are summed to obtain the sum of the entire test scores (' Σfx '). Lastly, this sum is divided by the number of test takers (Σf) and in this way the mean is obtained. The following equation is the summary of the above procedure:

$$\bar{X} = \frac{\Sigma fx}{\Sigma f}$$

This equation is the statistical definition of the mean. It should be noted that the equations $\bar{X} = \frac{\Sigma X}{N}$ and $\bar{X} = \Sigma fx / \Sigma f$ are equivalent, as $\Sigma X = \Sigma fx$ and $N = \Sigma f$. For example, the following table exemplifies the calculation of the mean of a score distribution:

X	f	fX
41	3	123
40	1	40
38	1	38
35	2	70
33	1	33
31	1	31
28	1	28
27	1	27
26	1	26

25	1	25
23	1	23
20	1	20
19	3	57
18	1	18
16	1	16
Sum (Σ)	20	595

Table 3.5 Calculation of the mean of a score distribution

$$\bar{X} = \Sigma fx / \Sigma f = 595/20 = 29.7$$

The \bar{X} is supposed to be a comprehensive measure as it takes into account each and every score obtained in the group. No data is lost. In this way any scores which somehow do not seem to fit in with the rest of the group's performance are included in the calculation. It can be seen from the above example that the mean is the centre of a distribution because it is at an equal distance from the scores above and below it. In this way, the half of the distribution that is above the mean balance with the half of the distribution that is below the mean.

Normally the mean is used to describe a distribution of scores that are continuous. The mean can also be obtained of a particular kind of categorical data of individual testing. The scores on individual test items that are scored as either right (1) or wrong (0) constitute a dichotomous distribution. Normally the mean of such scores is calculated so as to better understand how these items function. The mean of a set of a dichotomous (0, 1) scores is proportion symbolized by 'p'. In other words, a proportion 'p' is the mean of the dichotomous variable. For example, if there were 100 test takers. 75 of them responded to a given item right and 25 of them responded to it wrong. The sum of the test takers' scores on this item would be 75. If the sum of scores is divided by the total number of test takers (100), an average or proportion is obtained: $75/100=0.75$.

Properties of the mean: According to Bachman (2004), the mean has following properties-

- 1) The sum of the deviations around the mean (\bar{X}) always equals zero, regardless of the shape of the distribution. For example, in the skewed sample of 2, 3, 6, 9, and 20, the mean (\bar{X}) is 8, which produces deviations of -6, -5, -2, +1, and +12, respectively. The sum of these deviations is zero.
- 2) The mean is the only indicator of central tendency that is defined algebraically, that is by an equation – ($\bar{X} = \Sigma X/N$). This means that the value of the mean changes in predictable ways, if all the scores in a distribution change in the same way. Thus, if a constant (i.e. the same number) is added or subtracted from every score in a distribution, the mean will be changed by that amount. And the transformed deviation scores, based on the new mean will still sum to zero. This shows that such transformation does not change the first property of the mean.

Moreover, even if each score in distribution is multiplied or divided by a constant, the mean will equal the original mean multiplied or divided by that constant, respectively.

All the transformations are order preserving, which means that they do not affect the order of the scores in the distribution. This kind of transformation is called linear transformation because if the raw scores are plotted against the transformed scores in a two-dimensional grid, they would form a straight line. Linear transformations do not change either the order of the scores or the shape of the score distribution. They are very useful to make raw scores more interpretable.

Limitations of the Mean: As per Tavakoli (2012), the mean has some limitations:

The mean is excessively affected by extreme items. A couple of very high- or very lowscoring subjects in a relatively small group could displace this average measure to the left or the right of the middle ground because it must balance the entire distribution. This starting can be observed with the symmetrical distribution containing the scores 1, 2, 2, 2, and 3. The mean is 2, and this accurately describes most scores. However, adding the score of 20 skews the sample. Now the mean is pulled up to 5. But most of these scores are not at or near 5. As this illustrates, although the mean is always at the mathematical centre, in a skewed distribution, that centre is not where most of the scores are located. In this way, when the distribution is abnormal, it is improbable that the mean would be a safe measure of group tendency; it may not coincide with the actual value of an item in a series, and it may

lead to wrong impressions, particularly when the item values are not given with the average. Such a problem can be solved by using the median to summarize a skewed distribution.

Interpreting Indicators of grouping:

The mode, median, and mean are the indicators of grouping. Their relationships are subject to types of distributions. If it is a single mode (unimodal) or perfectly symmetrical distribution, the mode, median and mean will be the same.

This is not the case in asymmetrical or skewed distributions. In a negatively skewed distribution low scores have the smallest frequencies and high scores have the highest frequencies. On the other hand, in a positively skewed distribution the high scores have the lowest frequencies. In a negatively skewed distribution the mean will be lower than the median and the mode, which is shown in the following figure:

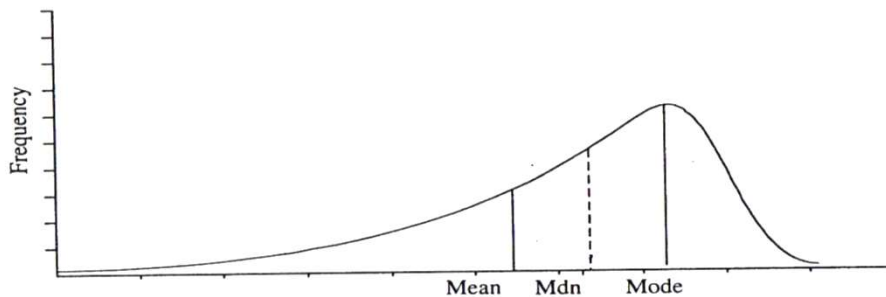


Fig. 3.11 Mode, median and mean in a negatively skewed distribution [Taken from Bachman, 2004]

On the other hand, in a positively skewed distribution the mean will be higher than the median and mode as shown in the following figure:

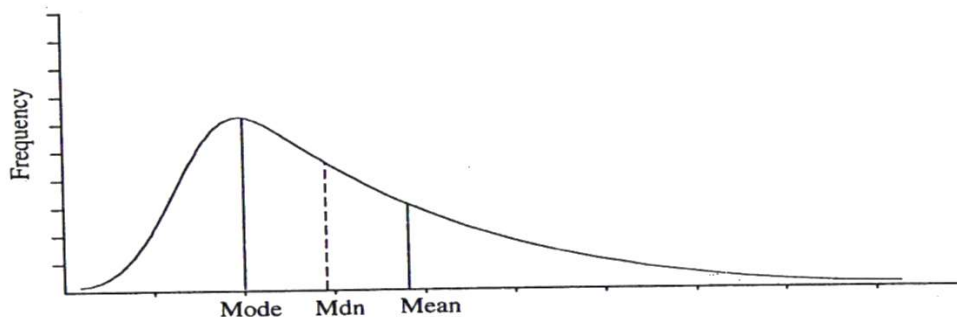


Fig. 3.12 Mode, median and mean in a positively skewed distribution [Taken from Bachman, 2004]

It can be seen from the figures 3.11 and 3.12 that in negatively skewed distributions the tail is at the low score end and the mean is lower than the mode and the median. On the contrary, in positively skewed distribution, the tail is at the high score end, and the mean is higher than the mode and the median.

Appropriate uses of Indicators of Grouping:

The mode is the appropriate indicator of grouping, if the numbers we are describing form a nominal scale. Nominal scales include variables like gender, marital status, sex, native language, college major, blood type and the like. The mode can also provide useful information in description of ordinal or interval scores.

The median is the appropriate indicator of grouping for scores that are ordinally scaled. Language testing, like compositions or oral interview are the most common examples of ordinally scaled scores. Ordinal scales provide information about how scores are ordered and the median, being the middle score in the distribution, informs us at what point in the distribution the scores tend to group.

The mean is the appropriate indicator of central tendency for scores that are intervally scaled. It is the most powerful or informative of the three indicators of central tendency.

D) Standard Deviation:

As mentioned before in the earlier sections, the mode, the median, and the mean are the three indicators of grouping. Similarly, there are three indicators of variability (or what statisticians call ‘dispersion’) that are used to describe score distributions. They are the range, the semi-interquartile range, and the standard deviation.

The range is the difference between the highest and lowest scores. It is determined simply by subtracting the lowest score from the highest score. Hence, the equation is-

$$\text{Range} = X_h - X_l$$

The range is the least descriptive of all the three indicators of variability.

The semi-interquartile range (Q) is the second indicator of variability. It is based on the range of the middle 50% of the test scores. It is useful with ordinal scaled

scores and with highly skewed distributions. The semi-interquartile range is determined first by locating the first and third Quartiles, the way the median is located.

The first quartile (Q1) is the point below which 25% of the scores occur. The third quartile (Q3) is the point below which 75% of the scores occur. The second quartile is the point below which the median (50%) of scores occur.

$$\text{The equation to determine Quartile is : } Q = \frac{Q3-Q1}{2}$$

The standard deviation is the third indicator of dispersion or variability. It is the most widely used measure of variability of a set of data in inferential statistical procedures. The word, 'standard' means typical or average and the word, 'deviation' means the difference between an individual score in a distribution and the average score for the distribution. Hence, standard deviation is the typical or average deviation between individual scores in a distribution and the mean for that distribution.

Here it is necessary to understand the concept of the deviation score, which means the distance between each score in distribution and the mean of that distribution ($X-\bar{X}$). Deviation score indicates the amount the scores deviates from the mean. That is why the process is called standard deviation. For example, if the sample mean is 7, a score of 11 deviates by +4 ($7-11=4$) [The example is mentioned earlier in the mean].

The standard deviation is calculated by taking the square root of the variance. That is the square root of the sum of the squared deviations from the mean divided by the total number of scores (N) if the data set is a population or by N-1 if the data set is a sample. This is done as the variance of a sample is usually less than that of the population from which it is drawn. In other words, dividing the sum by one less than the number of scores provides a less biased estimate of the population variance. In this way, the formula for population standard deviation (σ : the lower case Greek letter sigma) is :

$$\sigma = \frac{\sqrt{\sum (X - \bar{X})^2}}{N}$$

and the sample standard deviation (represented by 's') is

$$\sigma = \frac{\sqrt{\sum (X - \bar{X})^2}}{N-1}$$

Where, X - scores

\bar{X} - mean

N - number of scores.

Σ - sum (or add)

The following table shows the example of the above equation:

X	-	\bar{X}	=	$(X - \bar{X})$	$(X - \bar{X})^2$
35	-	30	=	5	25
35	-	30	=	5	25
34	-	30	=	4	16
32	-	30	=	2	4
32	-	30	=	2	4
31	-	30	=	1	1
30	-	30	=	0	0
30	-	30	=	0	0
30	-	30	=	0	0
29	-	30	=	-1	1
28	-	30	=	-2	4
27	-	30	=	-3	9
26	-	30	=	-4	16
26	-	30	=	-4	16
25	-	30	=	-5	25
$N=15$		$\bar{X}=30$		$\Sigma(X - \bar{X})=0$	$\Sigma(X - \bar{X})^2=146$

Table 3.6 Calculation of Standard Deviation

The above table shows the distribution of a set of scores. The mean of this distribution is 30. Using the same scores and mean, the table shows the steps required to calculate the standard deviation: 1) Line up each score with the mean, 2) subtract the mean from each score, 3) square each of the deviations (differences) from the mean, 4) add up all the squared values, 5) and put the values into the formula and calculate the result.

After applying the formula for population standard deviation:

$$\sigma = \frac{\sqrt{\sum (X - \bar{X})^2}}{N}$$

$$\sigma = 146/15 = 9.73$$

the square root is around 9.73, which is the standard deviation of the population. The formula for computing the sample standard deviation can be applied

$$\sigma = \frac{\sqrt{\sum (X - \bar{X})^2}}{N - 1}$$

$$\sigma = 146/14 = 10.42$$

and the sample standard deviation is 10.42

The above table also exemplifies that adding up the deviations including both the positive and negative values will yield zero. Such a result will usually be obtained as characteristically half of the deviations will be positive (i.e. above the mean) and half will be negative (i.e. below the mean). In this way the positive and negative values will usually add to zero or a value very close to zero. To solve this problem each value is squared as shown in the table under $(X - \bar{X})^2$. Then the resulting numbers can be added with a result other than zero. After the sum of these numbers is divided by N in the averaging process the result is brought back down to a score value by taking its square root. To put another way, the square root is taken to reduce the squaring processes that grow on earlier.

While discussing the shapes of score distribution, it has been made clear that, if the scores are more tightly clustered around the mean, the standard deviation will be smaller as it is in the following figure:

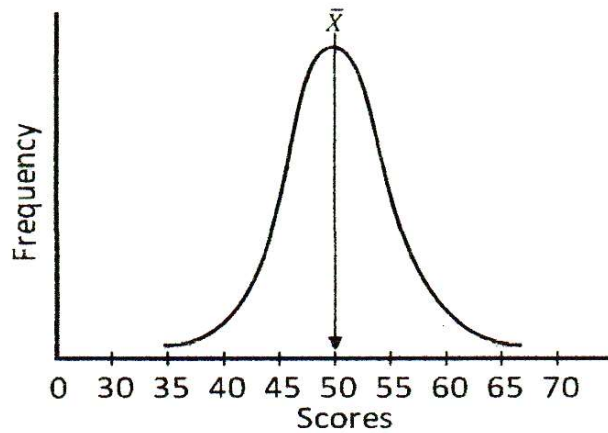


Fig. 3.13 Scores are tightly clustered around the mean [From Tavakoli, 2012]

And if the scores are spread out further from the mean, the standard deviation will be larger as it is in the following figure:

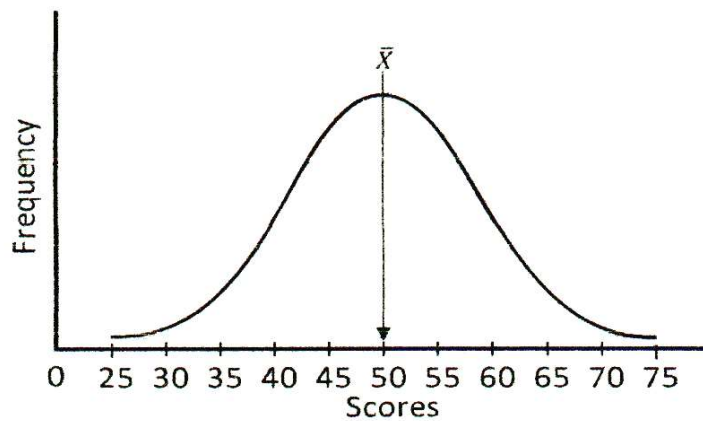


Fig. 3.14 Scores are widely spread from the mean [From Tavakoli, 2012]

The mean of the score distributions showed in the figures 3.13 and 3.14 is the same but their standard deviation is different.

Thus the standard deviation is the appropriate indicator of variability for scores that are intervally scaled. In norm-referenced tests with large numbers of test scores and symmetric distributions, it will typically be found that about two thirds of the scores occur within one standard deviation of the mean. When the standard deviation is divided by the arithmetic average of the distribution, the resulting quantity is

known as coefficient of standard deviation which happens to be a relative measure and is often used for comparing with similar measure of other distributions.

The standard deviation is generally used in research studies. It is considered as a very satisfactory measure of variability or dispersion in a distribution. The important characteristics of standard deviation are as follows:

- 1) The standard deviation gives us a measure of dispersion relative to the mean. This differs from the range, which gives us an absolute measure of the spread between the two most extreme scores (outliers).
- 2) The standard deviation is sensitive to each score in the distribution. If a score is moved closer to the mean, then the standard deviation will become smaller. Conversely, if a score shifts away from the mean, then the standard deviation will increase.
- 3) The standard deviation, like the mean, is stable with regard to sampling fluctuations. If 618 standard error samples were taken repeatedly from populations, the standard deviation of the samples would vary much less from sample to sample than the range. This property is one of the main reasons why the standard deviation is used so much more often than the range for reporting variability.
- 4) The standard deviation can be manipulated algebraically. This allows mathematics to be done with it for use in inferential statistics.

These advantages make standard deviation and its coefficient a very popular measure of the variability or dispersion of a distribution. It is popularly used in the context of estimation and hypothesis testing

3.4 Check Your Progress - II

A) Fill in the blanks and complete the sentences:

1.enables a researcher to arrange the qualitative data in a series.
2.is the highly inductive type of qualitative data analysis.
3. is the subset of population in statistics.
4. Kurtosis is thein the degree of peakedness of score distributions.

5.distribution is a highly peaked distribution.
6. A quite flat score distribution is calleddistribution.
7.is the most frequently occurring score in distribution of scores.
8. Median is thevalue /score of a distribution of scores.
9.is the only indicator of central tendency.
10. The difference between the highest and lowest scores is called the
11. The typical or average deviation between individual scores in a distribution and the mean for that distribution is called the
12.is the amount of the scores deviating from the mean.

B) Answer the following questions in a word/ phrase/ sentence.

1. What is the goal of qualitative comparative analysis?
2. What is population in statistics?
3. What is mesokurtic distribution?
4. What is mean?
5. What is the equation to calculate mean?
6. What is linear transformation?

3.5 Let Us Sum Up

To conclude, this unit in its first section, has discussed the types of linguistic research such as longitudinal, cross-sectional, qualitative, quantitative, mixed method, action, and experimental along with their salient features, advantages and disadvantages. In the second section, the processes of analyzing qualitative and quantitative data have been elaborated with examples.

3.6 Glossary and Notes

Longitudinal research: a study conducted over a period of time

Panel study: a study in which data is collected from the same group of individuals often over a period of time

Cohort study: a study in which a group of people with shared features is studied

Retrospective study: a study involving observation of past events by analyzing historical data

Cross-sectional research: a study conducted at a single point in time

Correlational research: a study investigating relationships between variables without the researcher controlling or manipulating any of them.

Emic perspective: also called an *insider's perspective*, which studies the beliefs, values, and practices of a particular culture from the viewpoint of the people

Etic perspective: an outsider's perspective that studies a culture by just observing it.

Inductive path: a research approach that *begins by collecting data that is significant to the study*.

Focus-group: a research method bringing together a small group (6-8) people to explore and discuss a topic

Variables: characteristics that take on different values

Paradigm: a method, model, or pattern for doing research

Embedded research design: a design for simultaneous collection of qualitative and quantitative data and inclusion of qualitative data in quantitative data

Exploratory research design: a research design which collection and analysis of qualitative data followed by collection and analysis of quantitative data.

Explanatory research design: a research design which involves explanation.

Triangulation design: a design in which quantitative and qualitative data are collected simultaneously.

Solomon four-group design: a combination of post-test-only control group design and pre-test-post-test control group design.

Continuum: a continuous series of things, in which each thing differs slightly from the thing next to it, but the final thing is extremely different from the first.

Constant: (also known as a *control variable*), something that researchers keep the same during an experiment.

Mode: the score in the distribution which has the highest frequency

Mean: the average score of the distribution

Median: the middle value or score of a distribution of scores

Range: the difference between the highest and lowest scores

Population: the entire group about which a researcher wants to draw conclusions

Sample: a subset of the population in a research study.

Target population: *the entire population, or group, that a researcher wishes to study and analyze*

Interpretative analysis: a research methodology that studies the way individuals make sense of their experiences

Narrow-angle lens: Quantitative research focusing on only one or a few causal factors at the same time.

Generalizability: a measure to study the usefulness of the results of a research for a broader group of people or situations

Anonymity: a research process of not linking individual responses with participants' identities

Weighting: relative importance/priority

3.7 Answers to check your progress - I

A) 1. Longitudinal, 2. The cross-sectional research, 3. Cross-sectional, 4. Qualitative research, 5. find individuals who can provide rich and varied insights into the phenomenon under investigation., 6. Etic, 7. qualitative, 8. The researcher, 9. quantitative, 10. valid and reliable, 11. mixed method, 12. quantitative, 13. Action.

B) 1. Panel study, Cohort study, retrospective study, 2. Retrospective study, 3. Cohort study, 4. i) To describe patterns of change and ii. To explain casual relationships, 5. It cannot provide a definitive relation between cause and effect relation., 6. the use of categories that are meaningful to members of the speech community under study., 7. the product of the researcher's subjective interpretation of the data., 8. Researchers trying to understand the people they are observing from the participants', natives', or actors' viewpoints., 9. to identify the relationships between variables by measuring & manipulating them.,

10. by developing systematic canons and rules for every facet of data collection and analysis, 11. The relative importance /priority given to the type of data.

Answers to check your progress - II

- A)** 1. The quantitative continuum, 2. Thematic analysis, 3. The sample, 4. difference, 5. The leptokurtic, 6. platykurtic, 7. Mode, 8. middle, 9. Mean, 10. range, 11. standard deviation, 12. deviation score.
- B)** 1. To search for the similarity and differences among the units of analysis, 2. the entire group of whatever a researcher intends to research, 3. a symmetrical score distribution, 4. average score of the distribution, 5. $\bar{X} = \frac{\sum X}{N}$, 6. The transformation that does not affect the order of the scores in the distribution,

3.8 Exercises

A) Broad answer type questions:

- i) Write a note on the longitudinal research, highlighting its salient features, its advantages and disadvantages.
- ii) What is the cross-sectional research? Explain its characteristics, advantages and disadvantages.
- iii) Write a detailed note on qualitative research.
- iv) Discuss in detail the quantitative research.
- v) Elaborate the mixed methods research in detail.
- vi) Bring out the difference between the Longitudinal research and the cross-sectional research.
- vii) Write a detailed note the qualitative analysis, its formats and processes.
- viii) Discuss in detail the mean.
- xi) Write a note on standard deviation.

B) Write short notes on the following:

- i) Advantages and disadvantages of the cross-sectional research.
- ii) Differences between qualitative and quantitative research

- iii) Three main characteristics of mixed methods research (timing, weighting, and mixing)
- iv) Action research and its types.
- v) Pre-experimental research design
- vi) True experimental design
- vii) The qualitative continuum
- viii) Discourse analysis as format of qualitative analysis
- ix) Mode
- x) Median

3.9 Reference Books

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