**Unit: 5**

**Analysis and Data Interpretation**

4.1. Processing of data, Analysis of data – qualitative and quantitative analysis. 4.2. Testing of Hypothesis – statistical inferences, interpretation and generalization of quantitative data.

**Analysis of data**

The data collected from various sources through the use of different tools and techniques generally comprise of numerical figures, ratings, narratives, responses to open ended questions, quotations, field notes etc. in research usually two types of data:

1. Qualitative Data and
2. Quantitative Data

The nature of data depends mostly upon the type of tool or technique used by researchers in their collection. Some data are collected in the form of numerical figures (quantitative) and some are in the form of symbols or narrations or verbal (qualitative).

**Qualitative Data Analysis**

Qualitative data analysis is the array of processes and procedures whereby a researcher provides explanations, understanding and interpretations of the phenomenon under study on the basis of meaningful and symbolic content of qualitative data. It provides ways of discerning, examining, comparing and contrasting and interpreting meaningful patterns and themes. Meaningfulness is determined by the specific goals and objectives of the topic at hand wherein the same set of data can be analyzed and synthesized from multiple angles depending on the research topic. It is based on the interpretative philosophy. Qualitative data are subjective, soft, rich and in-depth descriptions usually presented in the form of words. The most common forms of obtaining qualitative data include semi-structured and unstructured interviews, observations, life histories and documents. The process of analyzing is difficult rigorous.

**Principles of Qualitative Data Analysis** These are as follows;

1. Proceeding systematically and rigorously (minimise human error).
2. Recording process, memos, journals, etc.
3. Focusing on responding to research questions.
4. Identifying appropriate level of interpretation suitable to a situation.
5. Simultaneous process of inquiry and analysis.
6. Seeking to explain or enlighten.
7. Evolutionary/emerging

**Characteristics of Qualitative Data Analysis**

According to Seidel, the process has the following characteristics:

1. **Iterative and Progressive**: The process is iterative and progressive because it is a cycle that keeps repeating. For example, if you are *thinking* about things, you also start *noticing new things* in the data. You then *collect* and *think* about these new things. In principle the process is an infinite spiral.
2. **Recursive**: The process is recursive because one part can call you back to a previous part. For example, while you are busy collecting things, you might simultaneously start *noticing* new things to *collect*.
3. **Holographic:** The process is holographic in that each step in the process contains the entire process. For example, when you first noticethings, you are already mentally *collecting* and *thinking* about those things.

**COMPONENTS OF QUALITATIVE DATA ANALYSIS**

According to Miles and Huberman, following are the major components of qualitative data analysis:

1. **Data Reduction**

"Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written up field notes or transcriptions. Data in themselves do not reveal anything and hence it is not necessary to present a large amount of unassimilated and uncategorized data for the reader's consumption in order to show that you are "perfectly objective".

In qualitative analysis, the researcher uses the principle of selectivity to determine which data are to be singled out for description. This usually involves some combination of deductive and inductive analysis.

The process of data reduction starts with a focus on distilling what the different respondents report about the activity, practice or phenomenon under study to share knowledge. The information given by various categories of sample is now compared – such as the information given by experienced and new teachers or the information given by teachers, principal, students and/or parents about central themes of the research. In setting out these similarities and dissimilarities, it is important not to so "flatten" or reduce the data that they sound like close-ended survey responses. The researcher should ensure that the richness of the data is not unfairly and unnecessarily diluted.

1. **Data Display**

Data display provides "an organized, compressed assembly of information that permits conclusion drawing..." A display can be an extended piece of text or a diagram; chart or matrix that provides a new way of arranging and thinking about the more textually embedded data.

1. **Conclusion Drawing and Verification**

Conclusion drawing requires a researcher to begin to decide what things mean. He does this by noting regularities, patterns (differences/similarities), explanations, possible configurations, causal flows, and propositions. This process involves stepping back to consider what the analyzed data mean and to assess their implications for the questions at hand. Verification, integrally linked to conclusion drawing, entails revisiting the data as many times as necessary to cross-check or verifies these emergent conclusions.

 **Steps of Qualitative Data Analysis**

The Logico-Inductive process of data analysis is as follows;

* 1. Analysis is logico-inductive.
	2. Data are mostly verbal.
	3. Observations are made of behaviours, situations, interactions, objects and environment.
	4. Becoming familiar with the data.
	5. Data are examined in depth to provide detailed descriptions of the setting, participants and activity (describing).
	6. Coding pieces of data.
	7. Grouping them into potential themes (classifying) which are identified from observations through (reading / memorizing).
	8. Themes are clustered into categories.
	9. Categories are scrutinized to discover patterns.
	10. Explanations are made from patterns.
	11. Interpreting and synthesizing the organized data into general written conclusions or understandings based on what is observed and are stated verbally (interpreting).
	12. These conclusions are used to answer research questions.

**STRATEGIES OF QUALITATIVE DATA ANALYSIS**

Some of these are as follows:

1. **Analytical Induction**

Analytic induction is the research logic used to collect, develop analysis and organise the presentation of research findings. It refers to a systematic and exhaustive examination of a limited number of cases in order to provide generalisations and identify similarities between various social phenomena in order to develop ideas. Its formal objective is causal explanation.

According to Katz, "Analytic induction is a research logic used to collect data, develop analysis, and organize the presentation of research findings.

In analytical induction, definitions of terms are not identified/determined at the beginning of research. They are rather, considered hypotheses to be tested using inductive reasoning. It allows for modification of concepts and relationships between concepts aimed at representing reality of the situation most accurately.

**Steps in the analytical Induction**

According to Cressey, the steps of analytical induction process are as follows:

1. A phenomenon is defined in a tentative manner.
2. A hypothesis is developed about it.
3. A single instance is considered to determine if the hypothesis is confirmed.
4. If the hypothesis fails to be confirmed, either the phenomenon is redefined or the hypothesis is revised so as to include the instance examined.
5. Additional cases are examined, and if the new hypothesis is repeatedly confirmed, some degree of certainty about the hypothesis is ensured.
6. Each negative case requires that the hypothesis be reformulated until there are no exceptions.
7. **Constant Comparison**

Constant comparison is a central part of grounded theory. Newly gathered data are continually compared with previously collected data and their coding in order to refine the development of theoretical categories. The purpose is to test emerging ideas that might take the research in new and fruitful directions.

In the case of far out comparisons, the comparison is made with cases and situations that are similar in some respects but quite different in others and may be completely outside the study. For example, still thinking about parental help, we might make a comparison with the way teachers help students. Reflecting on the similarities and differences between teaching and parental relationships might suggest other dimensions to parental help, like the way that teachers get paid for their work but parents do not.

1. **Triangulation**

 According to Berg and Berg, triangulation is a term originally associated with surveying activities, map making, navigation and military practices. In each case, there are three known objects or points used to draw sighting lines towards an unknown point or object. Usually, these three sighting lines will intersect forming a triangle known as the triangle of error. Assuming that the three lines are equal in error, the best estimated place of the new point or object is at the centre of the triangle.

The word triangulation was first used in the social sciences as metaphor describing a form of multiple operationalisation or convergent validation.

Campbell and Fiske were the first to apply the navigational term triangulation to research. The simile is quite appropriate because a phenomenon under study in a qualitative research is much like a ship at sea as the exact description of the phenomenon in a qualitative research is unclear. They used the term triangulation to describe multiple data collection strategies for measuring a single concept. This is known as data triangulation. According to them, triangulation is a powerful way of demonstrating concurrent validity, particularly in qualitative research.

Triangulation is an approach to research that uses a combination of more than one research strategy in a single investigation. Triangulation can be a useful tool for qualitative as well as quantitative researchers. The goal in choosing different strategies in the same study is to balance them so each counterbalances the margin of error in the other. Used with care, it contributes to the completeness and confirmation of findings necessary in qualitative research investigations.

**Choosing Triangulation as a Research Strategy**

Qualitative investigators may choose triangulation as a research strategy to assure completeness of findings or to confirm findings. The most accurate description of the content comes from a combination of all three individuals' descriptions. Researchers might also choose triangulation to confirm findings and conclusions. Any single qualitative research strategy has its limitations. By combining different strategies, researchers confirm findings by overcoming the limitations of a single strategy. Uncovering the same information from more than one vantage point helps researchers describe how the findings occurred under different circumstances and assists them to confirm the validity of the findings.

**Types of Triangulation**

1. Data Triangulation : Time, Space, Person
2. Method Triangulation : Design, Data Collection
3. Investigator Triangulation
4. Theory Triangulation
5. Multiple Triangulations. Which uses a combination of two or more triangulation techniques in one study.
6. **Data Triangulation**

According to Denzin (1989) there are three types of data triangulation:

1. time,
2. space, and
3. Person.
4. **Time Triangulation**

Here, the researcher/s collect data about a phenomenon at different points in time. Triangulations of data analysis in cross sectional and longitudinal research is an example of time triangulation.

1. **Space Triangulation**

It consists of collecting data at more than one site. At the outset, the researcher must identify how time or space relate to the study and make an argument supporting the use of different time or space collection points in the study. By collecting data at different points in time and in different spaces, the researcher gains a clearer and more complete description of decision making and is able to differentiate characteristics that span time periods and spaces from characteristics specific to certain times and spaces.

1. **Person Triangulation**

According to Denzin, person triangulation has three levels, viz., aggregate, interactive and collective. It is also known as combined levels of triangulation. Here researchers collect data from more than one level of person, that is, a set of individuals, groups, or collectives. Researchers might also discover data that are dissimilar among levels. In such a case, researchers would collect additional data to resolve the incongruence. According to Smith, there are seven levels of ‘person triangulation’ as follows:

1. The Individual Level.
2. Group Analysis: The interaction patterns of individuals and groups.
3. Organizational Units of Analysis: Units which have qualities not possessed by the individuals making them up.
4. Institutional Analysis: Relationships within and across the legal (For example, Court, School), political (For example, Government), economic (For example, Business) and familial (For example, Marriage) institutions of the society.
5. Ecological Analysis: Concerned with spatial explanation.
6. Cultural Analysis: Concerned with the norms, values, practices, traditions and ideologies of a culture.
7. Societal Analysis: Concerned with gross factors such as urbanization, industrialization, education, wealth, etc.
8. **Methods Triangulation**

Methods triangulation can occur at the level of design or data collection.

* 1. **Design Level Triangulation**

 Methods triangulation at the design level has also been called between-method triangulation. Design methods triangulation most often uses quantitative methods combined with qualitative methods in the study design. There is simultaneous and sequential implementation of both quantitative and qualitative methods. Theory should emerge from the qualitative findings and should not be forced by researchers into the theory they are using for the quantitative portion of the study. The blending of qualitative and quantitative approaches does not occur during either data generation or analysis. Rather, researchers blend these approaches at the level of interpretation, merging findings from each technique to derive a consistent outcome. The process of merging findings "is an informed thought process, involving judgment, wisdom, creativity, and insight and includes the privilege of creating or modifying theory”. lf contradictory findings emerge or researchers find negative cases, the investigators most likely will need to study the phenomenon further. Sometimes triangulation design method might use two different qualitative research methods. When researchers combine methods at the design level, they should consider the purpose of the research and make a logical argument for using each method.

* 1. **Data Collection Triangulation**

Methods triangulation at the data collection level has been called within-method triangulation. Using methods triangulation at the level of data collection, researchers use two different techniques of data collection, but each technique is within the same research tradition. The purpose of combining the data collection methods is to provide a more holistic and better understanding of the phenomenon under study. It is not an easy task to use method triangulation; it is often more time consuming and expensive to complete a study using methods triangulation.

1. **Investigator Triangulation**

Investigator triangulation occurs when two or more researchers with divergent backgrounds and expertise work together on the same study. To achieve investigator triangulation, multiple investigators each must have prominent roles in the study and their areas of expertise must be complementary. All the investigators discuss their individual findings and reach a conclusion, which includes all findings. Having a second research expert examine a data set is not considered investigator triangulation. Use of methods triangulation usually requires investigator triangulation because few investigators are expert in more than one research method.

1. **Theory Triangulation**

Theory triangulation incorporates the use of more than one theory in the analysis of the same data set. In qualitative research, more than one theoretical explanation emerges from the data. Researchers investigate the utility and power of these emerging theories by cycling between data generation and data analysis until they reach a conclusion.

1. **Multiple Triangulation**

It uses a combination of two or more preceding triangulation techniques in one study.

**Reducing Bias in Qualitative Data Analysis:**

Bias can influence the results. The credibility of the findings can be increased by:

1. **Using multiple sources of data.**

Using data from different sources helps in cross-checking the findings. For example, combine and compare data from individual interviews with data from focus groups and an analysis of written material on the topic. If the data from these different sources point to the same conclusions, the findings are more reliable.

1. **Tracking choices**

The findings of the study will be more credible if others understand how the conclusions were drawn. Keep notes of all analytical decisions to help others follow the reasoning. Document reasons for the focus, category labels created revisions to categories made and any observations noted concerning the data while reading and re-reading the text.

1. **Document the process used for data analysis.**

People often see and read only what supports their interest or point of view. Everyone sees data from his or her perspective. It is important to minimize this selectivity. State how data was analyzed clearly so that others can see how decisions were made, how the analysis was completed and how the interpretations were drawn.

1. **Involving others.**

Getting feedback and input from others can help with both analysis and interpretation. Involve others in the entire analysis process, or in any one of the steps. Have several people or another person review the data independently to identify themes and categories. Then compare categories and resolve any discrepancies in meaning.

**Drawbacks to be avoided:**

1. Do not generalize results. The goal of qualitative work is not to generalize across a population. Rather, a qualitative data collection approach seeks to provide understanding from the respondent's perspective. It tries to answer the question ―why‖. Qualitative data provide for clarification, understanding and explanation, not for generalizing.
2. Choose quotes carefully. Use of quotes can not only provide valuable support to data interpretation but is also useful in directly supporting the argument or illustrate success. However, avoid using people's words out of context or editing quotes to exemplify a point. Use quotes keeping in mind the purpose for including quotes. Include enough of the text to allow the reader to decide what the respondent is trying to convey.
3. Respect confidentiality and anonymity when using quotes. Even if the person's identity is not noted, others might be able to identify the person making the remark. Therefore, get people's permission to use their words.
4. Be aware of, state and deal with limitations. Every study has limitations. Presenting the problems or limitations encountered when collecting and analyzing the data helps others understand the conclusions more effectively.

**Quantitative Data Analysis**

The quantitative data collected through the administration of various tools on selected sample or samples are raw. These data need to be organized, tabulated, analyzed and interpreted for drawing sound conclusions and valid generalizations.

**Processing of Data/Organization of Quantitative data**

Processing of data includes:

1. **Editing**

Editing of data is a process of examining the collected raw data to detect errors and omissions and to correct these when possible. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as completed as possible and have been well arranged to facilitate coding and tabulation.

There are two types of editing they are:

1. *Field Editing:* It consists in the review of the reporting forms by the investigator for completing what the latter has written in abbreviated/ illegible form at the time of recording the respondent’s responses. This sort of editing must be done as soon as possible after the interview, preferably on the very day or on the next day.
2. *Central Editing:* It should take place when all forms or schedules have been completed. This type of editing implies that all forms should get a thorough editing by a single editor in a small study and by a team of editors in case of a large inquiry. Editor may correct the obvious errors such as an entry in the wrong place, missing replies by determining proper answer by reviewing the other information in the schedule etc.
3. **Coding**

Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration.

1. **Classification**

Most research studies result in a large volume of raw data which must be reduced into homogeneous groups if we are to get meaningful relationships. Data having common characteristics are placed in one class and in this way entire data get divided into a number of groups or classes. Depending upon the nature of the phenomena involved classification are of two types.

1. Classification according to attributes: Here data are classified on the basis of common characteristics which can either be descriptive (such as literacy, sex, honesty etc.) or numerical (such as weight, height, income etc.)
2. Classification according to class intervals: Here the entire data is divided into a number of groups or classes or what are usually called class intervals.
3. **Tabulation**

Tabulation is the process of summarizing raw data and displaying the same in compact form for further analysis. Tabulation is orderly arrangement of data in columns and rows.

Tabulation is essential because of the following reasons.

1. It concise space and reduces explanatory and descriptive statement to a minimum.
2. It facilitates the summation of items and he detection of errors and omissions.
3. It facilitates the process of comparison.
4. It provides the basis for various statistical computations.

**Principles of tabulation of data**

1. The table should be numbered.
2. The title of the table must be brief and self explanatory.
3. The  heading   of   columns  or  rows  should  be  clear  and  concise

Example: Height in cm, weight in Kg ,age in years etc..

1. The data must be presented according to size and importance.
2. If percentages or averages are to be compared they should be placed as closely as possible.
3. The table should not be too large or too small.
4. Class intervals should be the same throughout the table except in case of age.

             Example for age                  Example for Hb %

< 1 < 6g

1-4 6-8

5-9       9-11

* 1. 12-14
1. Group should be tabulated in ascending or descending order .
2. If certain data is omitted or excluded deliberately, the reason for the same should be given.

Tabulation is the first step before the data is used for analysis or interpretation .By tabulation data becomes simple for statistical analysis.

**Analysis of Quantitative Data**

Analysis of data means studying the organized material in order to discover inherent facts. Statistical techniques have contributed greatly in gathering, organizing, analyzing and interpreting numerical data. The researcher must know the strengths and weaknesses of the statistical methods which he uses so that he may not mislead or be mislead by such methods.

**Statistical Analysis**

Data collected can be analyzed using different statistical tool. A common method of assessing numerical data is known as statistical analysis.

Descriptive statistics like mean, median, mode, standard deviation can be used for describing the properties of the data.

The activity of analyzing data and interpreting data in order to make prediction is known as inferential statistics. Inferential statistics like t-test ,correlation ,ANOVA,ANCOVA etc. can be used for analysis of data.

**Interpretation of data**

**“***Bare data ,objective data ,never determine anything ,They become significant only when interpreted in the light of accepted standards and assumptions and these standard in the  final analysis are not susceptible to scientific determination. In ordinary life one rarely deal with bare facts not with interpretation of facts. The interpretation or evaluation is determined by the purpose to which one relates the facts***”.**

 **-Martz**

Data interpretation is a part of daily life for most of the people .After the data analysis, the researcher himself has to interpret data in the light of the problem. The process of interpretation is essentially the one of stating what the result shows, their meaning and significance, the answer to the original problem. It is a careful, logical and critical examination of the result obtained after analysis keeping in view the limitations of the sample chosen, the tool selected and used in the study, earlier findings, unstudied factors and intervening variables.

**NEED FOR INTERPRETATION**

Through interpretation the researcher can well understand the abstract principle that work beneath his statistical findings, Interpretation leads to the establishment of explanatory concept that serve as a guide for further research studies, it opens new avenues of intellectual adventure and stimulates the quest for more knowledge. Researcher can better appreciate findings only through interpretation ie; why the findings are, what they are, and can make others to understand the real significance of the research findings.

**TECHNIQUIES OF INTERPRETATION**

Interpretation often involves following steps:

1. Researcher must give reasonable explanation of the relation that is found and it must interpret the lines of relationship in terms of the underlying process.
2. Extraneous information if collected during the study must be considered while interpreting the final result, for it may prove to be a key factor in understanding the problem.
3. Consultation will result in correct information and thus will enhance the utility of research results.
4. Researcher must accomplish the task of interpretation only after considering all relevant information.

Interpretations of the data have to be done in terms of objectives, hypothesis, limitation of data and tool, earlier findings, unstudied factors and intervening variables.

**Data Interpretation in terms of objectives, hypothesis, limitation of data and tool, earlier findings, unstudied factors and intervening variables.**

**Interpretation in terms of objectives and hypothesis**

While interpreting the expected result, the researcher must make sure that it is in accordance with the objectives and hypothesis he sets for his study. Researcher should not go beyond his data support. Hypothesis arises out of guesswork and cannot be accepted without testing them for conformation .After the research is completed ,the researcher is in a position to declare his result with certainty .When the results contradicts ,the original hypothesis of the study ,the interpretation and discussion should include the researcher’s reconsideration of the original hypothesis in the light of his findings.

**Interpretation in terms of limitation of tool and data**

Researchers have to make interpretation in terms of the shortcomings because of inadequate tools or sample fluctuation. This makes the study precise.

**Interpretation in terms of earlier findings**

While interpreting data the researcher must be careful about weather this findings go hand in hand with earlier findings that he identified through review. While conducting application research he should make sure that the findings of the present study is in accordance with the theory.

**Interpretation in terms of unstudied factors**

In any educational research, researcher is guided by variables studied during the research progress. The influence of unstudied factor is generally ignored while interpreting the results. Ignoring the unstudied factors is like misinterpreting the actual truth. This is more true in case of experimental or casual-comparative type of research in which the researcher studies a very limited number of variable. For eg; performance of two groups of students taught by a particular methodology and then interpreting the result without considering motivation, mental ability , good study habit etc..

**Interpretation in terms of intervening variables**

A basic casual relationship requires only independent and dependent variable. A third type of variable, the intervening variable appears in more complex casual relationships. It shows the link of mechanism between dependent and independent variable. In a sense, the intervening variable act as an independent variable towards the dependent variable.

**Formulating Conclusions and Generalization**

Interpretation is not a routine and mechanical process. It calls for a careful, logical and critical examination of the result obtained after analysis, keeping in view the limitation of the sample chosen, the tool selected and used in this study .In the light of the interpretation of data, the researcher has to use all care and caution in formulating his conclusion and generalization. This final step of research process demands critical and logical thinking in summarizing the findings of the study and comparing them with the hypotheses.

The researcher should not draw conclusions which are inconsistent among themselves or with external realities. The generalizations drawn on the basis of research findings should be in agreement with facts and should not conflict with the known laws of nature. The suggestions for the application of research findings in practical settings and suggestion of problems of further research may also be provided with conclusions and generalizations.

**TESTING OF HYPOTHESIS**

After formulating hypothesis they are subjected to empirical as well as logical testing to prove or disprove the hypothesis. Hypothesis have to be tested of their deduced consequence. Intellectual and disciplined effort is needed for the deduction of consequences. Here the researcher is testing the deduced consequences of hypothesis. Once all  the deduced consequences after testing come out to be true , the hypothesis is confirmed. If some of the consequences are true and some others not, the hypothesis need to be examined afresh.

In order to test hypothesis researcher have to develop necessary data collecting tool, analyse data using proper statistical techniques. In order to test hypothesis, research hypothesis have to be converted into null hypothesis. In hypothesis testing the researcher calculates the chance value with the obtained value .The chance value indicate the maximum possible value.

**Methods of Testing of Hypothesis**

There are three major methods of testing of hypothesis as follows:

1. **Verification:** The best test of a hypothesis is to verify whether the inferences reached from the propositions are consistent with the observed facts. Verification is of two types as follows: (a) Direct Verification by Observation or Experimentation and (b) Indirect Verification by deducing consequences from the supposed cause and comparing them with the facts of experience. This necessitates the application of the principle of deduction.

2. **Experimentum Crucis**: This is known as crucial instance or confirmatory test. When a researcher is confronted with two equally competent but contradictory hypotheses, he needs one instance which explains the phenomenon and helps in accepting any one of the hypotheses. When this is done through an experiment, the experiment is known as Experimentum Crucis‘.

3. **Consilience of Inductions** : This refers to the power which a hypothesis has of explaining and determining cases of a kind different from those which were contemplated in the formation of hypothesis‘. In other words, the hypothesis is accepted and its value is greatly enhanced when it is found to explain other facts also in addition to those facts which it was initially designed to explain.

**Errors in Testing of Hypothesis**

A researcher tests the null hypothesis using some statistical technique. Based on the test of statistical significance he / she accepts or rejects the null hypothesis and thereby either rejects or accepts the research hypothesis respectively.

If the null hypothesis is true and is accepted or when it is false and is rejected, the decisions taken are true. However, error in testing of hypothesis occurs under the following two situations:

1. If the null hypothesis (H0) is true but is rejected and
2. If the null hypothesis (H0) is false but is accepted.

The former is the example of Type I error while the latter is the example of Type II error in testing of hypothesis. Type I error occurs when a true null hypothesis is rejected. It is also known as Alpha (α) error. Type II error occurs when a false null hypothesis is accepted. It is also known as Beta (β) error.

When the sample size N is fixed, if we try to reduce Type I error, the chances of making Type II error increase. Both types of errors cannot be reduced simultaneously. More about this will be discussed in the section on statistical analysis of data.

**How to Make Analysis Objective**

An investigator-analysis the tabulated material with a view to determining inherent facts or meanings.

He breaks down existing complex factors into simpler parts and puts the parts together in new

arrangement for the purpose of interpretation. The investigators make analysis objective by:

* 1. Picking out the essential elements in a problematic situation.
	2. Separating similarities from dissimilarities.
	3. Giving special attention to exceptions.
	4. Arranging data on gently.
	5. Making judgments on adequate data.
	6. Making his sense of logic on sound principles.
	7. Being inventive in the matter of techniques.
	8. Disregarding personal attachment to a hypothesis.
	9. Having good mathematical ability.
	10. Studying data from as many angles as possible to find out new and newer facts.

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