
UNIT 9 QUANTITATIVE METHOD OF ENQUIRY*

Structure

- 9.0 Objectives
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9.0 OBJECTIVES

After studying this Unit, you will be able to understand:

- To learn the history and traditions of qualitative research,
- To acquaint oneself with the theories and paradigms of quantitative research,
- To learn about the types of quantitative research,
- To study the various world-views and perspectives related to quantitative research,
- To develop acquaintance with the research strategies of quantitative research,
- To learn about methods of data collection and analysis in quantitative research,
- To learn the research designs closely associated with quantitative research, and
- To identify the basic experimental and non-experimental designs related with quantitative research.

9.1 INTRODUCTION

In quantitative research, the presumed assumptions are tested by setting up a tentative statement or hypothesis that is either supported or nullified. The test is done through data collected, which finally decides the fate of the hypothesis. One of the most commonly used design is the experimental one where behaviors or attitudes of the respondents are adjudged both before and after the experiment. An objective measurement with a high quality of reliability and validity is designed to collect the data. Finally, the information is analyzed by using statistical procedures and hypothesis testing (Creswell pp. 49).

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In this scenario, the researcher tests a theory by specifying narrow hypotheses and the collection of data to support or refute the hypotheses. An experimental design is used in which attitudes are assessed both before and after an experimental treatment. The data are collected on an instrument that measures attitudes, and the information is analyzed using statistical procedures and hypothesis testing. Quantitative research gained ground mainly in the nineteenth and twentieth century when it was found to be lingering back on post-positivist perspective, an approach found generously in the discipline of psychology. Different strategies were seen to be applied in this form of research, chief among which were true experiments and quasi experiments. Different definitions have been offered for quantitative research, especially by scholars like Cohen and Creswell, Borg and Gall. According to Borg and Gall (1989), the main purpose of quantitative research is to investigate causal relationships between variables. Statistical data collection is initiated through adequate selection of observed behaviors of samples. The data analysis is usually done in numerically objective form. Quantitative research is considered to be objective, precise, systematic, causal and far wider in range. This is in contrast to qualitative research which is more subjective, concentrated, and dense and carried on a small number of subjects. In this sense, it is far more appropriate when working within a wider periphery. In some cases, quantitative research gives far better results while in others, qualitative research may yield more effective results. This depends on the qualities of the research that may go with a particular bunch of research questions and a specific kind of research scenario. This brings us to investigating the specific characteristics of the quantitative research, to be discussed in the next section.

9.2 CHARACTERISTICS OF QUANTITATIVE RESEARCH

There are certain characteristics of quantitative research, to be discussed below:

- Quantitative research tends to present observations in terms of integers or digits and even some times tends to manipulate the data for the sake of its effective representation. It often does so to give a precise and apt explanation of the observations duly recorded.
- Another common character of quantitative research is its tendency to engage more of empirical methods and statements.

The data so collected are analyzed mostly in the numerical order, therefore the nature of the research is mostly objective, precise, in-effectual. The sample size involved in such research is quite large (*Babbie: 1989, Bogdan and Biklen: 1989*).

- The techniques applied for gathering data in quantitative research are many. These mostly include interviews, questionnaires and experimental research. Both collection and analysis of data can be done either in quantitative or qualitative way. However, numerical data is collected and analysis is done through mathematically based models steeped in statistical techniques. There are certain limitations in this context, as not all data found around us exist in the form of numerical data. Therefore, it becomes necessary to design instruments that can convert numerical data into proper qualitative data to suit our purpose. Qualitative data like attitudes and behaviors obviously do not naturally exist as quantitative data but must be converted into qualitative

ones by designing instruments like questionnaires or tests. This way enables us to translate qualitative data into quantitative ones, the cornerstone of quantitative research.

- Quantitative research is that form of research that uses empirical methods as well as statements, most of which are numerically represented and applied in nature. An empirical statement represents the true picture of the situation as it is there instead of imposing an idyllic situation.
- Quantitative research measures social reality in some form or the other, but usually in a precise, objective and integral shape. Qualitative research investigates those dimensions of life which are not suitable for qualitative or subjective analysis. It is a field of enquiry in its own right, one which refuses to tread the line of other more relative or interpretative methods of enquiry. While qualitative research is more relaxed and lenient in data collection and analysis, quantitative researches are far more stringent and rigid in laying down the steps and stages in conducting this forms of research. Unlike qualitative research, quantitative research is not open and contextual in their line of thought but are rather more planned, strategic and to the point, this makes quantitative researches steeped with more limitations and obstructions restricting its easy and unhindered application. This brings us to investigate briefly the characteristic differences between the qualitative and quantitative researches to better appreciate the qualities of the quantitative research.

9.3 DIFFERENCES BETWEEN QUALITATIVE AND QUANTITATIVE RESEARCH

There are serious differences between the two researches in terms of orientations or tendencies of their explanations. Qualitative research intends to explain the inferences in terms of individual units. This is to say, qualitative researches tend to split up each phenomenon into individual cases to facilitate the mode of explanation. A core goal of qualitative research is the explanation of outcomes in individual cases. For example, qualitative researchers attempt to identify the causes of World War-I, exceptional growth in East Asia, the end of the Cold War, the creation of especially generous welfare states, and the rise of neo-populist regimes. A central purpose of research is to identify the causes of these specific outcomes for each and every case that falls within the scope of the theory under investigation.

Cite: Mahoney, James, and Gary Goertz. "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research." *Political Analysis* 14, no. 3 (2006): 227-49. <http://www.jstor.org/stable/25791851>.

9.4 STAGES OF QUANTITATIVE RESEARCH

Though there are differences of many kinds between the qualitative and the quantitative research, there are still some phases which are common for both quantitative and qualitative research (*Rubin & Babbie, 2010*). Such common inter-phases include problem formulation, design of the study, data collection, data processing, data analysis, interpreting the findings and writing the research report. Each of these stages are quintessential for both qualitative and quantitative

research. However, there are characteristic elements that are typical of quantitative and qualitative researches respectively. Therefore, though these stages of research process are similar for both forms of research, there are characteristic differences between them. This calls for the typical essence of quantitative and qualitative research. For now, let us concentrate on the specific phases of quantitative research.

Problem Formulation in Quantitative Research

In this very first phase of quantitative research, the research question is usually posed. The questions are emboldened through the use appropriate concepts. Concepts are used and refined to make them capture the crux of the research question.

Problem formulation is a tricky step in quantitative research where we pose questions to assess the mood of the entire setting. It is necessary that research questions are lucid enough to be comprehensive for the respondents. Research questions before being posed are always screened for their practicality and their feasibility of implementation. Followed after this episode is the critical review of literature which may be quite rigorous and exhaustive. This is a very welcome step for the deductive quantitative studies, for it is the right time to specify the hypothesis and variables, which will soon be followed by conceptualization and operationalization. While quantitative deductive studies start with the hypothesis, inductive qualitative studies, on the other hand, wait and observe, and let the hypothesis emerge by themselves (*Rubin & Babbie, 2010:56*).

Conceptualization in Quantitative Inquiry

The concepts that the researcher has in mind while conducting an investigation is called a variable. The concepts are mental pictures that ranges from attributes easily observable like gender, height, blood group to social attributes difficult to observe like level of confidence, mental health, prejudice and discrimination etc. Such concepts turn into variables as their degree or quantum varies across the continuum. Individuals are likely to manifest different degrees of attributes as their social characteristics, experiences and exposures change with age and situations. In many quantitative studies, researchers try to find a relationship between two or more variables. By relationship, we simply mean that a change in one variable is likely to usher change in another variable (*Babbie, 78:2010*). Such an anticipatory relationship is called a hypothesis. Therefore, a hypothesis is a tentative and assumed statement that pre-supposes that modifications in one variable is likely to instigate changes in other variables.

Types of Variables and Their Mutual Relationships

Variables can be both dependent and in-dependent. A variable that influences others is called **independent variable** while on the contrary, a variable that is being influenced is called a **dependent variable** in the given hypothesis. Usually a good hypothesis follows a few general characteristics such as, it must be crystal-clear and straight –cut such that it can result into many probable results. The hypothesis must not contain any judgmental statement that seems value-loaded and clumsy. It must be easily tested so as to ascertain the outcomes appropriately.

Additional variables may be applied to magnify the relationship between dependent and independent variables. These variables that link up dependent and independent variables are **mediating variables**. For e.g., if we think that

children are more likely to attend schools regularly if given meals at schools, then the given proposal contains three kinds of variables. “Whether children are given any kind of boosts or incentives”, is our independent variable, then “administering meals to students at lunch time” is our mediating variable and “whether student attendance increases or not for this” is our dependent variable. In this way a cause-effect statement can be conceptualized where independent variable stimulates mediating variable which in turn triggers the dependent variable. It is like a chain reaction where one affects the other by turn and the process is perennial. Mediating variables are also known as intervening variables.

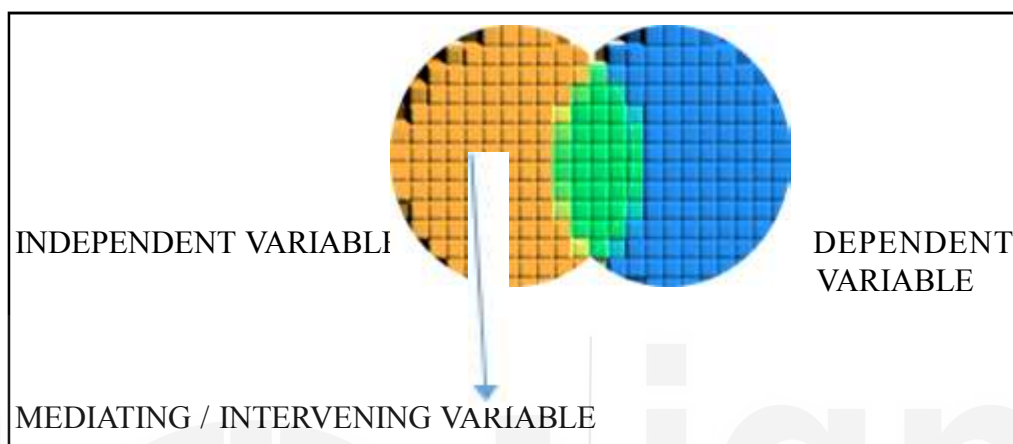


Figure 9.1 : The relation between the variables

Still another category of variable exists that are not affected by the independent variables, but they nevertheless can manipulate the trend of the mutual relationship between the dependent and independent variables, affecting the strength or direction of this relationship. For eg, if we feel that our mediation among the girl students will work and will not be fruitful in case of the male students, then probably “gender” will be taken as a moderating variable. Often the direction of the linkage or relationship between dependent and independent variables, as we say may change once the moderating variables have been taken into account. Thus moderating variables may give us an alternative explanation far away from what we had suggested before. To make it more lucid, let me give you another example, suppose we say that change in the sex ratio (dependent variable) of a district has been possible because of setting up of more schools (dependent variable), but on the contrary we found that adoption of a particular public policy (moderating variable) has brought forward such a transformation. These variables are also called control variables for they are often controlled in a research design. The researcher controls variables in order to examine the hypothesized relationship separately for each category of the control variable (*Babbie, 78: 2010*).

Check Your Progress 1

1) What is a variable? What are its types?

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2) How will you distinguish between mediating and moderate variable?

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Relationships between variables vary in terms of their responses in predicting the linkages. Positive relationships infer a direct relationship between the variables in the sense that they assume a symmetrical relationship such that if one variable changes direction, the other treads the same path. A negative or inverse relationship presumes that the variables will move in opposite direction, such that if one increases, the other will decrease and vice-versa. A curvilinear relationship is one in which the nature of the relationships transforms only at certain levels of the variables. For e.g., some social workers believe that students who are more doubtful towards establishing proper field rapport are the ones who have either taken up substantiated number of field projects or those who have none to their credit. Social workers with this kind of an attitude may hypothesize a u-curve that begins with negative relationship between number of field projects undertaken and degree of doubt about establishing effective field rapport. In other words, disbelief reduces as more field works are conducted and taken up to a certain number of projects, then it increases as more similar projects are undertaken in the due course.

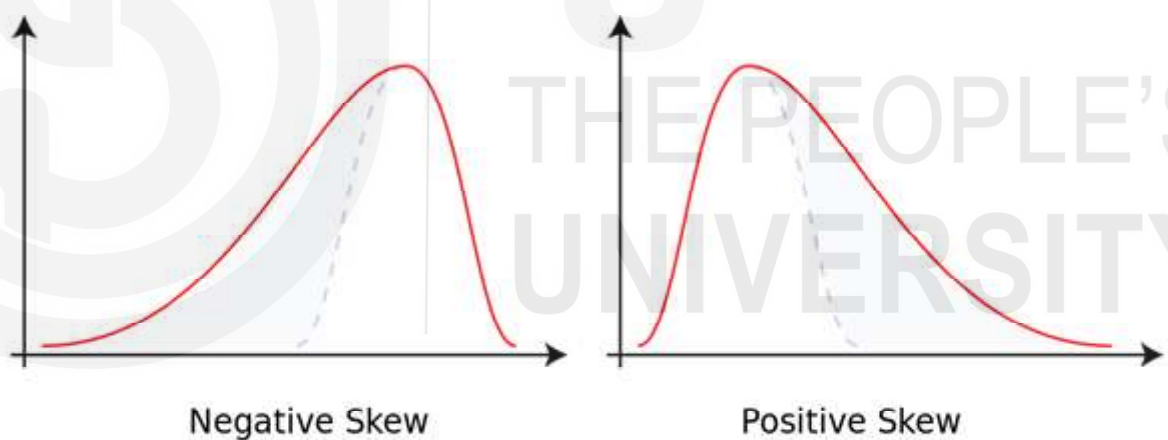


Photo credit: <https://www.intmath.com/differentiation/differentiation-intro.php>

Operational definitions

In quantitative research, operational definitions help us bridge the gap between conceptualization and measurement. We need to operationally define the abstract concepts to smoothen our measurement process in the quantitative research. Operational definitions help translate a concept into an observable unit which can be measured and evaluated. It becomes necessary to process a concept into an operational conceptsuch that it can be turned into an indicator to measure the attributes we seek to observe. Operational definitions are generally different form nominal definitions in the sense that the latter uses only a bunch of words to explain the phenomenon under study without identifying the indicators we seek to study. Operational definitions specify the ways of measuring a variable. We can operationally define abstract variables in numerous ways. One example of

turning social securing into a measurable or operational definition may be to construct a scale or continuum of scores to measure the extent of social security, say among the young female slum dwellers of a migrant community. Another operational definition may be to ascertain whether they are receiving the benefits of those public policies which are due to them. Those who are the beneficiaries of these policies may be categorized as belonging to the lower levels of social security while those with nothing of this kind to their credit are termed as belonging to the higher level of the social security among these slum dwellers. Thus operational definitions show us the path to measure variable.

Check Your Progress 2

- 1) In a study comparing levels of sugar in the diet to diabetes among test subjects, the diabetes would be the _____ variable.
 - Mediating
 - Moderating
 - Dependent
 - Independent
- 2) Operational definitions of variables necessarily claim that ensure that findings are reproducible.
 - True
 - False
- 3) In a study that looked at the effectiveness of a new way of teaching a second language to students, the ability of the students to process and learn a new language would be considered a _____ variable.
 - Moderating
 - Mediating
 - Dependent

Correct answers:

1. Dependent, 2. True, 3. Mediating.

Levels of Measurement

Variables in a quantitative research design can be operationally defined upto four levels of measurement such as nominal, ordinal, interval and ratio. At the nominal level, variables are explicated in terms of clear and precise categories which are mutually exclusive. At the ordinal level, we move up to a notch higher where we can rank-order our variables without of course knowing how much is the difference between the subsequent categories. In the interval level, we can obtain the difference between the categories with ease. Lastly, we come to the ratio level where we have true zero point such that frequencies can be easily determined. We must remember that the hierarchy of measurement we are talking of is ascending in character such that as we move up we carry forward all the qualities from bottom to the top. The lowest level has only its own distinct character but the one above it has not only its own character but also the one it inherited from its predecessor. In this way the top-most layer is the most powerful one as it carries all the characters of its predecessors.

Nominal	Ordinal	Interval	Ratio
Runner ID	Order Finished	Time of Day Finished	Race Time
238	1	10:10	2:30
143	2	10:20	2:40
14	3	10:25	2:45
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.	.	.	.
.	.	.	.
301	450	20:20	12:40

Photo credit: <http://giscommons.org/chapter-2-input/>

9.5 MEASUREMENT ERROR IN QUANTITATIVE RESEARCH

As we have seen above, in quantitative research, operational definitions most often serve to fill the gap between conceptualization and measurement. However, we must be careful to the risks borne by the vulnerable nature of the measurement process, which itself can become the hot bed of measurement errors. In fact, measurement processes are a rich source of such errors, about which the researchers must be cautious from the very beginning. The two most common sources of measurement errors most cited in quantitative research are systematic error and the random error. The two errors are discussed below:

Systematic errors, are the recurrently happening errors that are consistently directed in the same direction. Systematic errors are usually caused by a problem which remains perennially present throughout the course of the quantitative enquiry. On the other hand, **Random errors** are abrupt changes or statistical fluctuations, directed in any way, and often detected in the measured data, usually caused by the shortcomings of the measurement apparatus used for the research. It might also be the case that such errors spring out because of the researcher's incapacitated handling of the research tool to bring about a consisted nature of findings over repeated usage. To make thematter precise, we present for you below, a table of the summary:

Source of research	Type of the research error	Instance	Ways of prevention
Quantitative	Systematic	The digital weighing machine you use reads 85 kilo grams, which is not your real weight. (because it	Systematic errors are very difficult to handle. Its detection and analysis requires a

		was not properly calibrated during the research process or because of its natural wear and tear, it is not functioning well).	lot of time. Diagnosing systematic error is quite a tedious task.
Quantitative	Random	We measure the body mass of a child three times using the same machine, and we get different values each time: 08.46 g, 08.42 g, 08.45 g	We need to take more data. Random errors can be detected by statistical analysis and can be minimized by averaging a large number of readings.

Now we shall come to the different approaches which are usually carried out while initiating a quantitative research. The approaches and the typologies have been discussed below so as to aid your comprehension.

9.6 APPROACHES TO QUANTITATIVE RESEARCH: EXPERIMENTAL AND NON - EXPERIMENTAL RESEARCH

Various approaches are used in quantitative social research, and they are commonly used in sociological parlance. These approaches can be bifurcated into two compartments widely, such as experimental research designs and non-experimental research designs. Let us get a short description of these two approaches and the research designs subsumed under them.

Non-Experimental Research Designs

In this kind of study, none of the variables are tampered with and the research is carried out without any sort of manipulation. The variables are enumerated in their original setup and they not disturbed while conducting this form of research. Three kinds of Non-experimental research are usually observed and these are Descriptive research design, Co-relational research and Causal-comparative research. All of these will be discussed below:

Descriptive Research Design

In this form of research design, the task of the researcher is just to describe and explicate the conditions, settings and the locale of the variables as they occur naturally without disturbing its point of origin. The researcher does the work in tandem with the natural flow of the variables without interfering with its given periphery. No tricks are applied to control this natural flow so as to assess the impact of this manipulation of the variables on the research findings. There can be generally four kinds of descriptive research designs, such as observational research, case study, archival analysis and survey research, which are discussed below:

Observational Research

Observational research (or field research) is a type of correlational or non-experimental type of research where a researcher is engaged in observing a currently occurring behavior. There are different types of observational research, each used according to its relevance and application. These types vary by the degree to which the researcher interferes with the flow of the research and yields control on the set-up in question. Observation can usually be divided in four kinds such as:

- a) **Naturalistic (“non-participant”) Observation:** Here the researcher just observes the functioning of the research subjects with guarded silence without tampering with their pace of functioning. He does not intend to tinker with variables that he wishes to study.
- b) **Participant Observation:** Here the researchers participate in the life-activities of the subjects they intend to study. Studying people in the natural set-up becomes way more possible thorough observation and prolonged participation. A participant observer must have keenness for insightful observations and he should use various methods like interviews, questionnaires and other unobtrusive techniques.

Case Study Research

Case study is a special type of non-experimental research. Here the basic soul of a case study, is that it tries to throw light on a decision or a set of decisions: why they were taken, how they were implemented, and with what result. (*Schramm, 1971*,). The case study is usually preferred while studying contemporary events, especially when the relevant behaviors cannot be controlled. The case study has likeness with historical research, but it stands out for its two resources that it banks on such as collecting evidence from direct observation and systematic interviewing (*Yin, 2003*).

Archival Analysis

An archive is the most important form of a primary historical record. Archival analysis involves discourses resulting out of exchanges with the documents of an archive. “Most archives preserve and provide access to original primary source material” (*Harris, 2017*). An archive is a reservoir of journals, letters, speeches, published writings, physical objects, media snippets, newspaper clippings, radio or television broadcast etc. It provides important data to the researchers who try analyzing an archive with different methodologies that they lay their hands upon.

Survey Research

A survey is a method of collecting data in a systematic way. Survey research is relevant in the context of making a chronicle of the present community or group situations, characteristics of a populace or sample, and the narratives or opinions of the group or community in question (*Guyette, 1983*). There are different kinds of surveys such as cross-sectional survey, which collects information for a sample at one point in time; longitudinal survey, which collects information for a sample at different point in time. Longitudinal survey again has sub-divisions such as the trend study, which samples a general population at more than one points across time. Another division is the cohort study, where a study on a specific population is followed over a period of time. Panel study is yet another sub-

division, where a particular sample of individuals is followed and subsequently studied at different points in time.

9.7 DATA COLLECTION IN QUANTITATIVE RESEARCH: SURVEY RESEARCH

It is time for us to study now the instruments of data collection that we frequently use in survey research. These instruments are important for us because it is through these mediums that we collect the data. These instruments are interview and questionnaire, discussed below:

Questionnaire

The term questionnaire has been coined to refer to a bunch of questions. The questionnaires are given to the respondents, which they are supposed to fill up. The given data give the researcher enough information to analyse. The questions asked can again be of two types, viz. open ended and closed ended. In open ended questions, respondents are asked to fill in their own answers, without giving them any options to choose from. Though open ended questions can be seen in both qualitative and quantitative research, they are mostly significant for quantitative research. In case of the closed-ended questions, the respondent is asked to select their preferred answer from the enlisted answers. They are extremely popular in quantitative research for they help generate more uniform and consistent replies that can be more conveniently analysed. In case of the closed ended questions we must be sure that two most important structured criteria are met while designing these questions, such that the response categories must be made exhaustive. Quite often to satisfy this criteria, researchers use a special category like, 'other'. The other criteria presuppose that the responses categories must be chiseled such that they are mutually exclusive. The respondent must not have to ponder on which category to choose, in other words, categories should not be overlapping or grossly similar. For eg, Hispanics, black and white; because Hispanics can be both black and white. The types of questions have been diagrammatically given below:

Closed-Ended Questions <i>Answered with yes/no or one word answer</i>		Open-Ended Questions <i>Need an explanation</i>	
Advantages	Disadvantages	Advantages	Disadvantages
- fast answer - less complicated - easy to find using internet	- doesn't tell you a lot - you don't have to think which means your not stretching your brain	- learn more by answering these questions - get more detailed information - more specific answers	- can take a long time to answer properly

Source: <https://www.bing.com/images/search?view=detailV2&ccid.>

Guidelines for Framing Questionnaires

There are often certain guidelines to be followed while designing the questionnaire. This is done to ensure that the questionnaire follows a consistent patterns and do not suffer from abrupt discontinuities or breaks. Often this hamper our methods

of data collection and analysis and therefore to prevent this, these common guidelines are followed. Some of them have been discussed below:

Clarify Your Items

This is made to ensure that the questionnaire items are transparent and crystal clear. Researchers often fail to point out clearly the basic crux of the research question. Inability to do so may disturb the direction of the research. Researchers are therefore asked to make the questions as precise as possible so that they are lucid enough for the respondents to grasp.

Avoid Double-Barreled Questions

We often fail to specify our question and end up in confusing our respondents. This happens when the researchers seek responses for a single question but instead, ask them a combine of questions, which the respondents do not know how to answer. As a thumb's rule, whenever we are using 'and' in the question, we should be careful as to whether we are asking a double-barreled question. For eg. If we ask them do you have a friendly relation with your grandparents? It often turns difficult to answer, because they may get along well with their grandmother, but gel quite well with their grandfather. So, what should they answer? questions like this ruffle the respondents, which they find difficult to cope with.

Respondents Must Have Enough Competence

The researchers must be wary that they must ask questions which they are capable to answer. Asking questions without taking into account their general profile, will only generate imaginary answers from the respondents, that will be of little help to the quantitative researchers. For instance, if you ask your respondents, who largely constitute the population of primary school teachers, that whether they regularly bunked classes in their universities, would be quite an absurd question. This would be a misleading question to this target population, many of whom never attended university at all. So asking questions, well within the reach of the respondents, should one of our major priorities.

Questions Must be Relevant Enough

Remember the questions, which you are asking must be relevant to your research question. Topics must be chosen in a way that they are of importance in the current setting. Asking questions about an issue which they do not face in their current situation, will not rouse the respondents. For example, if you ask your respondents from a drought acute area, that what techniques do they apply to trap sunlight, will be a bizarre question for they get ample sunlight throughout the year and will not be much interested in its accruing.

Questionnaire Should not Suffer from Biasness

The way a question is ordered, matters very much. Often the questions are ordered in a way that lead the respondents towards a particular response, this makes the questioned biased. Questions that provoke the respondents to reply in a particular way, must always be avoided while framing a questionnaire. Such questions suffer from innate biasness.

Cultural Sensitivity Matters

Questions must have a sense of cultural sensitivity, this is to say, all respondents may not be comfortable with a single set of questions. They may have inhibition in answering some questions which their counterparts may not. For instance, girls in a liberal society may feel much free to answer tabooed questions which their counterparts in an orthodox society may not. So questionnaire must be made keeping in mind the cultural quotient of the respondents.

For your easy comprehension, a sample questionnaire is given below:

Sl.	Quality Checks	A	B	C
1.0	Installation			
1.1	Are the fans installed as per the drawings and specifications?	Yes ☐	No ☐	Yes ☐
1.2	Are the fans tagged properly?	Yes ☐	No ☐	Yes ☐
1.3	Are all the equipment in good condition?	Yes ☐	No ☐	Yes ☐
1.4	Are all dampers fully opened?	Yes ☐	No ☐	Yes ☐
1.5	Are all safety rules understood by personnel responsible for operating the equipment?	Yes ☐	No ☐	Yes ☐
1.0	Electrical			
1.6	Proper motor and fan rotation verified?	Yes ☐	No ☐	Yes ☐
1.7	Verify that proper disconnect is located within sight of the unit it controls.	Yes ☐	No ☐	Yes ☐

Picture Source: <https://i.stack.imgur.com/XnVSg.png>

Quantitative Co-relational Research

Co-relational research is a type of non-experimental research where the researcher measures two variables and enumerates the statistical co-relation between them without manipulating or controlling the independent or extraneous variables (Jhangiani, 2015). This is one of the important types of non-experimental research used in social sciences.

Causal-Comparative Research

Causal-comparative research is usually applied to identify cause-effect nexus or to diagnose the impact of differences that was known to have been present between two groups (Tima, 2017). Causal-comparative research is also known as “ex-post facto” research since the researcher intends to know the underlying cause behind the differences that is said to have been present for quite some times. So what the causal comparative research invokes, is the need to study the supposed causal relationship between two contending groups, put on a common platform for comparison. It thus compares a causal relation that was already there from the beginning.

9.8 EXPERIMENTAL RESEARCH

We have so far discussed only the non-experimental research. Let us now have a look at the experimental research. Experimental research is any kind of research conducted with a scientific approach, where a bunch of variables are

kept constant while the other bunch of variables are being measured as the subject of experiments.

Now we come to the next section of the experimental research designs that are quantitative per se, and therefore less used in soft social science practices. Such research designs include post-test only control group design, which perhaps is the simplest of the experimental designs (*Shadish, et al., 2002: 106-107*), where a sample of participants is exposed to a treatment after which the dependent variable is evaluated and measured. (*Kirk, 2013*). The next type of experimental research design is single subject experimental research designs, also known as a single-case research design. It lends us a strategy for recording experimental effects (*salkind, 2010*). Single-case research has been used for quite some purposes like erecting basic dictums of behavior, capture the footprints of specific mediations, and more vitally to develop a body of evidence-based strategies. The staple element of single-case research is the use of each participating respondent (subject) as his or her own experimental control (*ibid, 2010*). Next in this category is the reversal experimental research designs, which are among the family of single-case experimental designs used extensively by behavioral scientists and educators to enumerate the effectiveness of clinical or educational mediations (*Frey, 2018*).

Another prominent research design in this category is the alternating treatment design. It is constituted of rapid and random or semi-random alteration of two or more situations such that each has an approximately equal chance of being present during each measurement opportunity (*Hayes & Blackledge, 2015*). Mention must also be made of multiple-baseline research design, another popular form of research design, especially used in clinical science. These studies usually involve more than one participant, thus acting as SC studies with replication across participants. (*Lobo & Cunha, 2017*). For example, a multiple baseline SC study was used to investigate the effect of an anti-spasticity baclofen medication on stiffness in five adult males with spinal cord injury (*Hinderer et al, 1917*).

Check Your Progress

- 1) What is Quantitative Research?

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- 2) What are Its Characteristics?

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3) How is Problem formulation done in Quantitative Research?

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4) What is Survey?

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5) What are the levels of Measurement?

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9.9 LET US SUM UP

Quantitative research promotes the objective empirical methods as well as statements. Quantitative research focuses to yield unbiased result that can be generalized to larger population. This is done through arrangement of equalizing techniques such as interviews, questionnaires and experimental research. Data is analysed with the help of statistics and hypothesis testing.

Measurement errors in quantitative research such as systematic and random will also be explained along with various approaches.

Various approaches used in quantitative research can be bifurcated in two departments: experimental research designs and non-experimental research design. Finally, coming to go through all the stages of quantitative research is to collect numerical data from group to generalize those results to larger group of people to explain a phenomenon.

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