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Quantitative, Qualitative Or Mixed Methods Research : Which Research Paradigm To Use ?

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Abstract

Research students usually encounter great difficulties in setting up a viable research project mainly because, on the one hand they lack familiarity with the philosophical underpinnings of the three research paradigms: quantitative, qualitative or mixed methods research and on the other hand , they do not associate the corresponding research types with these paradigms : experimental, non experimental for the former, interactive or non interactive for the second and explanatory or exploratory for the latter , in addition to the importance of triangulation in any research study. These paradigms determine not only the formulation of the research problem and the associated research questions or hypotheses but also and more importantly, the sampling procedure as well as the selection of the appropriate research tools and the way the collected data are analysed and discussed. This survey of the major paradigms in educational research and their implications for the design of any research study will hopefully provide students with the necessary guidance to approach their research project with more confidence et more efficiency.

Key words: educational research - inductive - deductive - quantitative - qualitative - mixed methods - experimental - positivism - empiricism - rationalism – triangulation

1. Introduction

The aim of this paper is to clarify the conceptual research frameworks with which postgraduate students in educational research work but which they are often confused about. Educational research has been defined differently by various researchers. Travers quoted in Koul (1984:5) says that it is "an activity directed towards the development of an organized body of scientific knowledge about the events with which educators are concerned", while Ary et. al. (1972:21) define it as "the way in which one acquires dependable and useful information about the educative process." For Ali (1996:1), it is seen as "... those activities or processes which allow one to systematically test and/or obtain a body of information, data or knowledge about teaching/ learning or conditions which affect teaching and learning."

These definitions of educational research point at some important concepts: reliability of the information and its scientific nature and the fact that what is being investigated should be of interest to educators and can be carried out within or outside the educational institution such as primary, secondary or tertiary levels. Also implicit in these definitions is the fact that educational research shares the same characteristics of scientific research: it employs scientific methods to find out how teaching and learning can be improved, the conditions under which knowledge can be tested and verified and the conditions under which they should

occur. The scientific method is defined by Bhattacherjee, (2012:15) as a standardized set of techniques for building scientific knowledge, such as how to make valid observations, how to interpret results, and how to generalize those results. The scientific method allows researchers to independently and impartially test pre-existing theories and prior findings, and subject them to open debate, modifications, or enhancements.

It is thus of paramount importance for research students to grasp the fundamentals of these issues since the latter determine the choices they have to make at all stages of their research which invariably include the following: the choice of a research paradigm, the construction of the research tools, the nature of the data to be collected, the procedure used for their analysis, and ultimately, the nature of the conclusions they can draw. They must be aware that all existing research frameworks are the reflection and the result of shifts in scientific thought which can be traced back to the debate among the Greek philosophers, such as Plato, Aristotle, and Socrates during the 3rd century BC as to how new knowledge is acquired. These philosophers challenged earlier explanations based on theological tenets and argued that the world can be understood more accurately either through our senses, the empiricist view, or through a process of systematic logical reasoning called rationalism which views reason as the source of knowledge. Subsequent shifts in scientific thought, as we shall see, will lead to new perceptions as to how knowledge can be derived from, leading thus to new research paradigms.

A clear understanding of the philosophical foundations of research will undoubtedly help research students opt for and justify the choice of a particular paradigm. According to Chalmers ,a paradigm (1982:11) is "made up of the general theoretical assumptions and laws, and techniques for their application that the members of a particular scientific community adopt", and for Willis (2007:8) it is "a comprehensive belief system, world view, or framework that guides research and practice in a field".

Such understanding will hopefully help students make the appropriate choices about :

(1) Their research question(s) or hypotheses

(2) the type of research instruments to be used,

(3) the steps involved in the collection of the data, and ultimately

(4) the procedure used for the analysis and discussion of the collected data.

We shall briefly explain how these shifts in scientific thought have occurred and have led to the major shifts in research paradigms and then, we shall show how these shifts have impacted research methods and methodologies. It should be reminded that the term 'method' refers to the various specific tools or ways data can be collected and analysed,

e.g. a questionnaire, interview, checklist, data analysis software etc. According to Willis (2007:14),

The term methodology generally is used to describe several aspects of a study: the design, the procedures for data collection, methods for data analysis, selection of subjects, and details of the specific treatments. According to Collis et al. (2003:55) , methodology refers to the overall approaches & perspectives to the research process as a whole and is concerned with the following main issues:

- Why certain data are collected
- What kind of data were collected
- Where these data were collected
- How they were collected , and
- How they were analysed

2. Research Philosophy: Historical Background

The way in which research is conducted depends on the research philosophy which the researcher adheres to and which will determine the research objective(s) and the research instruments developed and used as well as the quest for the solutions to the problem he is investigating.

Two major research philosophies have dominated the Western tradition. These can be traced back to the debate mentioned earlier between the Empiricists (Inductivists) and the Rationalists (deductivists). These two opposing views follow different ways in explaining how knowledge is acquired: either through inductive reasoning as the Empiricists believed or by reasoning as the Rationalists maintained. Therefore, the Inductive/Deductive distinction can be seen as the first major paradigm in science. Inductive reasoning (or bottom-up process) starts from specific observations or sensory experiences and then develops a general conclusion or theory. For example, I observe that all the elephants I have seen (repeated observations) have a trunk, therefore I conclude that ALL existing elephants, even those I have not seen, HAVE a trunk (conclusion, or generalisation). Whereas deductive reasoning (also known as top-down process) proceeds differently. It begins with a general statement (called the first premise, or theory) followed by a more specific statement inferred from it (the second premise, or the observed phenomenon) and, through logical argument, comes a specific conclusion. For example, I know that all planets orbit around the sun (first premise), a new planet is discovered (second premise), therefore I can conclude that this planet also orbits the sun.

In terms of research methodology, each proceeds differently. The inductive approach will go through the three following steps:

1. Observe the world.
2. Search for a pattern in what is observed.
3. Make a generalization about what is occurring.

and the deductive approach will proceed in three different but opposite steps:

1. State the hypothesis (based on theory or research literature).
2. Collect data to test the hypothesis.
3. Make a decision to accept or reject the hypothesis.

This can be represented in the research wheel below: (Figure 1)

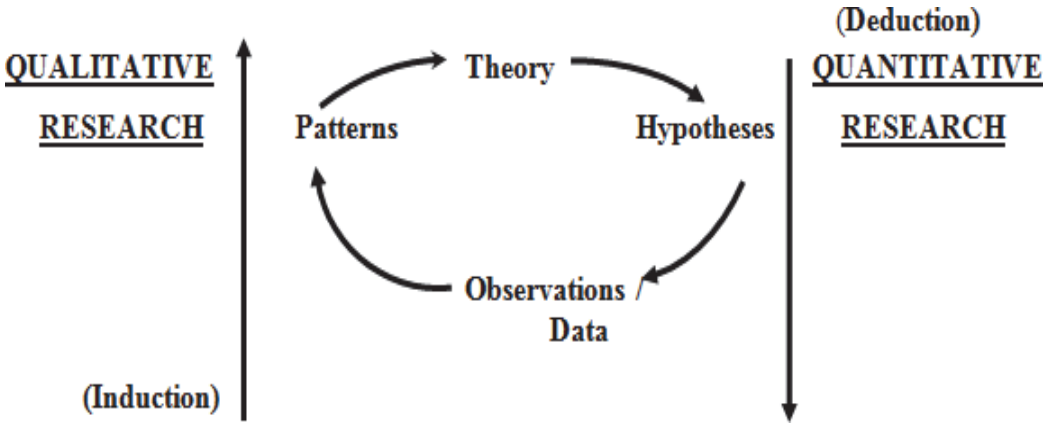

Figure 1: The research wheel (Adapted from Burke, R. and Christensen, L. B., 2015)

There are of course problems with both approaches. For the inductive approach for example, there are three major objections. First, the conclusions the researcher draws depend on observation and it is not clear how many observations are necessary before reasonably drawing conclusions which are pertinent enough to make generalisations. Second, the question is how much control on the situation(s) the researcher has and under what conditions these observations are carried out so that he can draw reliable conclusions, and third, even if our experiences are representative, we may interpret or remember them in a biased, thus subjective manner.

As for the deductive approach, the major problem resides in its reliance on theories which are speculative answers to a posited problem in the form of a hypothesis which is then tested by observation and experimentation but which, by definition, is falsifiable, thus opening the door to the possibility of a total rejection of the theory on which it was built, requiring therefore a completely new start. In addition, with deductive reasoning, the validity of a conclusion depends very much on the validity of the premise on which it is based. For example, in the past, many conclusions about the movement of the planets were incorrect due to the premise that the earth was the centre of the universe.This debate was revisited after the Renaissance and witnessed a heated dispute between the Rationalists represented by the French philosopher René Descartes (1596–1650) who argued that Reason was the only mode by which one could arrive at truth and assumed that valid knowledge can only be acquired if the correct reasoning process is used, and the Empiricists represented by the British philosophers John Locke (1632– 1704) and David Hume (1711–1776) who argued that experience is the basis for acquiring all new knowledge. It was Locke who put forward the well known formula that each person is born with a tabula rasa (i.e., individuals' minds are blank slates or tablets upon which the environment writes). For these philosophers the origin of all knowledge derives from our senses (sight, hearing, touch, smell, and taste) which then imprint ideas in our brains that then are further worked upon through cognitive processes. However, it must be stressed that both trends were primarily concerned with natural sciences since at that time social sciences had no place as they were subjective and thus, not considered as real sciences.

The next major shift occurred at about the same time with the French philosopher Auguste Comte (1798–1857) who attempted to blend rationalism and empiricism in a new doctrine called positivism, a view which claimed that while theories may be created via reasoning, they are only authentic if they can be verified through observations and measurement. His views were expanded by the sociologist Emile Durkheim (1858-1917) who elaborated the principles of social science positivism which put social sciences in the realm of 'scientific' research. He stated that "the social scientist must study social phenomena in the same state of mind as the physicist, chemist or physiologist when he probes into a still unexplored region of the scientific domain "(Durkheim 1964: xiv). He maintained that the social scientist can adopt the same objectivity in the study of social life as the natural scientist studying natural phenomena. As Strauss & Corbin (1998) point out, positivism emphasizes the importance of conducting social science research in a way that focuses strictly on causal relationships between behaviours and other social phenomena that can be measured or directly observed. Thus, the importance of objectivity which requires the researcher to be unbiased and detached from the phenomenon under study.

As Donatella (2008:21) points out, for the positivists:

> The world exists as an objective entity, outside of the mind of the observer, and in principle it is knowable in its entirety. The task of the researcher is to describe and analyse this reality. Positivist approaches share the assumption that, in natural as in social sciences, the researcher can be separated from the object of his/her research and therefore observe it in a neutral way and without affecting the observed object.

According to Keat and Urry, (1982:112), two of the most significant characteristics of positivist epistemology concern, firstly, the claim that science should focus on only directly observable phenomena, with any reference to the intangible or subjective being excluded as being meaningless; and secondly, that theories should be tested, in a hypothetico-deductive fashion, by their confrontation with the facts neutrally gathered from a readily observable external world.

Such assumptions reflect the strong version of positivism which was exclusively interested in natural sciences excluding thereby all social sciences from their concern. Not all researchers, however agreed with this strong form of positivism. Many advocated an alternative version known as the weak version or the post-positivism view which Phillips (1990:33) sums up as follows:

> ... although the object of our inquiry exists outside and independent of the human mind, it cannot be perceived with total accuracy by our observations; in other words, complete objectivity is nearly impossible to achieve, but still pursues it as an ideal to regulate our search for knowledge.

The key assumptions of this position are summed up by Phillips & Burbules (2000:121):

1. Knowledge is conjectural : absolute truth can never be found. Thus, evidence established in research is always imperfect and fallible. It is for this reason that researchers

state that they do not prove a hypothesis; instead, they indicate a failure to reject the hypothesis.

2. Research is the process of making claims and then refining or abandoning some of them for other claims more strongly warranted.

3. Data, evidence, and rational considerations shape knowledge.

4. Research seeks to develop relevant, true statements, ones that can serve to explain the situation of concern or that describe the causal relationships of interest.

5. Being objective is an essential aspect of competent inquiry; researchers must examine methods and conclusions for bias.

The post positivists paved the way for the inclusion of social sciences in the realm of science and see social science research as fundamentally the same as natural science research; it assumes that social reality is made up of objective facts that the researcher can precisely measure and use statistics to test causal relationships. However, while the positivists will favour a hypothetico-deductive procedure which advocates quantitative measurement, the post positivists will follow an inductive procedure advocating qualitative assessment. These two research frameworks will establish the two major paradigms in research, i.e. quantitative, usually associated with natural sciences, and qualitative, mostly associated with social sciences. A more comprehensive account of the major characteristics of qualitative and quantitative approaches is given in Table 1 below.

In addition to these two major paradigms, one must also mention a third one, mostly used in social sciences and particularly in educational research, which blends the characteristics of both paradigms, i.e. the mixed methods research which will be discussed in more detail later.

It must be kept in mind however, that irrespective of the nature of the research (qualitative, quantitative or mixed) for a research study to qualify as 'scientific research', it must obey the canons of the scientific method which involves the following steps:

(1) Definition of the research problem and the research constructs

(2) Review of concepts, theories and previous findings

(3) Statement of the Hypothesis or the Research Question(s)

(4) Description of the research design in terms of research tools, sampling procedure etc.

(5) Collection of the relevant data

(6) Analysis of the data

(7) Discussion of the results and testing of the hypothesis (or answering the research question(s)).

3. Research Paradigms and Types of Studies

We shall now turn to discussing the implications that each paradigm has for the design of the various types of research studies in educational research. (This is summarised in Figure 2 below, while Figure 3 lists the criteria to be used for identifying the various types of research,

and Table 4 lists all the research instruments which can be used in all three paradigms and for ensuring triangulation).

Quantitative Research Studies :

Creswell (2003:4) defines quantitative research as a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured typically on instruments, so that numbered data can be analyzed using statistical procedures.

Criteria	Qualitative Research	Quantitative Research
Purpose	To understand & interpret social interactions.	To test hypotheses, look at cause & effect, & make predictions.
Group Studied	Smaller & not randomly selected.	Larger & randomly selected.
Variables	Study of the whole, not variables.	Specific variables studied
Type of Data Collected	Words, images, or objects.	Numbers and statistics.
Form of Data Collected	Qualitative data such as open- ended responses, interviews, participant observations, field notes, & reflections.	Quantitative data based on precise measurements using structured & validated data
Type of Data Analysis	Identify patterns, features, themes.	Identify statistical relationships.
Objectivity and Subjectivity	Subjectivity is expected.	Objectivity is critical.
Role of Researcher	Researcher & their biases may be known to participants in the study, & participant characteristics may be known to the researcher.	Researcher & their biases are not known to participants in the study, & participant characteristics are deliberately hidden from the researcher (double blind studies).
Results	Particular or specialized findings that is less generalizable.	Generalizable findings that can be applied to other populations.
Scientific Method	Exploratory or bottom–up: the researcher generates a new hypothesis and theory from the data collected.	Confirmatory or top-down: the researcher tests the hypothesis and theory with the data.
View of Human Behavior	Dynamic, situational, social, & personal.	Regular & predictable.
Most Common Research	Explore, discover, & construct.	Describe, explain, & predict.
Focus	Wide-angle lens; examines the breadth & depth of phenomena.	Narrow-angle lens; tests a specific hypothesis.
Nature of Observation	Study behavior in a natural environment.	Study behavior under controlled conditions;
Nature of Reality	Multiple realities; subjective.	Single reality; objective.
Final Report	Narrative report with contextual description & direct quotations from research participants.	Statistical report with correlations, comparisons of means, & statistical significance of findings.

Table 1 : Qualitative versus Quantitative Research

Adapted from Johnson, B., & Christensen, L. (2008).

There are two types of quantitative studies: either experimental or non experimental

Experimental studies :

Experimental studies can be either a true experiment, a quasi experiment or a single case study. The latter is very rarely used in educational research because it is concerned with only one subject. However, one must keep in mind that the single-subject study may be seen as a true experiment because it is a long and respected tradition in empirical research particularly in psychology.

According to Kazdin (2003:273), single-subject studies "can demonstrate causal relationships and can rule out or make implausible threats to validity with the same elegance of group research". Similar to other experimental designs, the single subject design seeks to (1) establish that changes in the dependent variable occur following introduction of the independent variable and (2) identify differences between study conditions. For example, an investigation of the effectiveness of two new textbooks using random assignment of teachers and students to three groups – two groups for each of the new textbooks, and one group as a 'control' group to use the existing textbook.

As far as the other two types are concerned, what differentiates a true experiment from a quasi experiment study is the fact that in the former, the researcher can manipulate the variables under stringent and controlled conditions to study the effect or the impact of one variable (the independent, also called predictor variable) on the other variable (the dependent, or outcome variable) to make statements of causality. Furthermore, the participants in the study are randomly assigned (i.e. systematic sampling which is truly representative of the whole population) to an experimental group and a control group.

This type of study (true experiment) offers a high level of control over the elements of the research and gives the possibility for other researchers to replicate the study in the same circumstances whereas in the latter (quasi experiment), although the research is carried out under the same experimental conditions, it nevertheless lacks two important characteristics of the experimental type: (i) the sampling procedure is random, i.e. the participants are chosen randomly within the targeted population without any specific criteria, opening thus the possibility of ending up with an unrepresentative sample and (ii) there is no control group for comparison. Furthermore, in non experimental studies the researcher cannot manipulate variables, he can only observe and interpret what he is looking at. This type of research has weaker validity and poor reliability because the researcher cannot establish cause-and-effect relationships and cannot manipulate the predictor variables. Here are some examples for each type of research:

(i) True experimental :

a) The effect of small classes on instruction

b) The use of intensive mentoring to help beginning teachers develop balanced instruction

c) The comparative effectiveness of personalized instruction versus traditional instruction on the reading skill

(ii) Quasi Experiment

a) Are lectures given in the morning memorized better than when given in the afternoon ?

b) Do teachers' teaching styles play a role in students' motivation for learning ?

Non experimental studies :

These are research studies in which the independent variable is not manipulated by the experimenter either for ethical reasons (for example the impact of smoking on health) or because of their abstract nature (for example age, gender, ethnicity opinions etc.). Non experimental research covers a wide variety of studies, such as (i) descriptive, (iii) causal-comparative, (iii) co relational, (iv) ex post facto research, and (v) surveys

(i) Descriptive research helps the researcher to collect information about conditions, situations, and events that occur in the present. For example:

a) a survey of the physical condition of school buildings in order to establish a descriptive profile of the facilities that exist in a typical school,

b) Attitudes of parents toward lowering the mandatory school attendance age from 16 to 14 years of age

c) How do university teachers spend their time?

d) How do parents feel about a 12-month school year?

(ii) Causal-comparative research aims to discover causal relations between variables by observing existing phenomena and then searching through the obtained data in order to identify plausible causal relationships. For example:

a) Effect of birth order on academic achievement

b) The effect of having a working mother on school absenteeism

c) The effect of gender on achievements in learning a foreign language

(iii) Correlational research involves the search for relationships between variables through the use of various measures of statistical association. Examples of correlational studies:

a) an investigation of the relationship between teachers' satisfaction with their job and various factors describing the provision and quality of teacher housing, salaries, leave entitlements, and the availability of classroom supplies.

b) The relationship between intelligence and self-esteem

c) The relationship between anxiety and achievement

(iv) Ex post facto research: Ex-post facto literally means "from what is done afterwards". It focuses first on the effect, then tries to determine possible causes and questions will remain about the effect following the cause, or vice versa. The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening. Example;

a) Why are some groups in the 1st Year more proficient than the other groups in the same year ?

b) Why are some students always late for lectures in the morning ?

(v) Surveys are used to describe the state of view from a large group of people as it exists at present. Simply stated, it is a fact finding investigation. In descriptive research, definite conclusions can be arrived at, but it does not establish a cause and effect relationship. This type of research tries to describe the characteristics of the respondent in relation to a particular product. Examples:

a) 'What are students' opinions regarding their relationship with their professors ?'

b) 'How do students view their ability to do research?'

Qualitative research studies:

Creswell (2003:4) defines qualitative research as a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data.

Qualitative research relies primarily on the collection of qualitative data (i.e., non-numerical or categorical data such as words and pictures etc.), and can be either interactive or non interactive (i.e. whether the researcher is personally immersed in the research or not).

→ **Interactive**

In educational research there is very little room for a personal involvement or immersion of the researcher with the participants of the study, as his role is mostly that of an observer. However, there may be instances where such research can be carried out.

The first of these is phenomenology (i.e., the descriptive study of how individuals experience a phenomenon). In this type of research, the researcher tries to gain access to individuals' life-worlds, which is their world of experience; it is where consciousness exists.

For example:

a) What are students' attitudes towards an uncaring teacher ?

b) What are teachers' attitudes and beliefs towards teaching ?

The second major approach to qualitative research is ethnography (i.e., the discovery and description of the culture of a group of people). Because it is deeply rooted in anthropology, the concept of culture is of central importance in this type of research. In the case of educational research one can study the culture in a classroom. Examples of these would be :

a) How do learners react to cultural differences in foreign language classes ?

b) How do teachers deal with cultural conflicts in their classes?

Non Interactive

Non interactive qualitative studies are mainly concerned with historical analysis or content analysis. In historical analysis, the researcher aims at generating descriptions, and sometimes attempted explanations of conditions, situations and events that have occurred in the past. For example, a study can document (i) the evolution of teacher training programs since the turn of the century, with the aim of explaining the historical origins of the content and processes of current programs, or (ii) the developments in the testing procedures of English in the Baccalaureate exam over the past twenty years.

In content analysis the researcher investigates the content or information and symbols contained in written documents or other communication media (e.g., photographs, movies, song lyrics, advertisements) in a given topic . The researcher identifies a body of material to analyze (e.g., school textbooks, television programs, newspaper articles, etc) and then posits a system for recording specific aspects of its content. Content analysis is a nonreactive method because the researcher did not know about the content beforehand. For example a researcher might be interested in investigating how school violence is reported in the media or how women are represented in school textbooks.

→ **Mixed methods research :**

This research paradigm is used extensively in educational research for its many merits and it is now recognized as the third major research approach along with qualitative and quantitative research. Thus, in mixed methods research investigators use both quantitative and qualitative data because they work to provide the best understanding of a research problem.

Mixed methods research has been defined variously by many researchers. For Janice Morse (2003:191) it is a plan for a scientifically rigorous research process comprised of a qualitative or quantitative core component that directs the theoretical drive, with qualitative or quantitative supplementary component(s. These components of the research fit together to enhance description, understanding and can either be conducted simultaneously or sequentially.

While for Johnson and Onwuegbuzie (2006:49), it is ... the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study or set of related studies.

What these definitions show is that mixed methods research obeys the criteria of scientific rigor and has the advantage of combining complementary strengths and non-overlapping weaknesses from both quantitative and qualitative approaches. This is cautiously summarized by Guba and Lincoln (2005:201) as follows:

Is it possible to blend elements of one paradigm into another, so that one is engaging in research that represents the best of both worldviews? The answer, from our perspective, has to be a cautious yes. This is especially so if the models (paradigms) share axiomatic elements that are similar, or that resonate strongly between them.

The added advantage of the mixed methods approach is the possibility it offers the research for the triangulation of the data, which Denzin (1978:291) defines as “the combination of methodologies in the study of the same phenomenon”; he outlined four types of triangulation (Denzin: ibid):

(a) data triangulation (i.e., use of a variety of sources in a study),

(b) investigator triangulation (i.e., use of several different researchers),

(c) theory triangulation (i.e., use of multiple perspectives and theories to interpret the results of a study), and

(d) methodological triangulation (i.e., use of multiple methods to study a research problem).

It is therefore of vital importance that research students be aware that the use of a single methodology or the use of a single research instrument does not confer to their study neither great validity nor reliability. Only a multi pronged research design can offer such criteria.

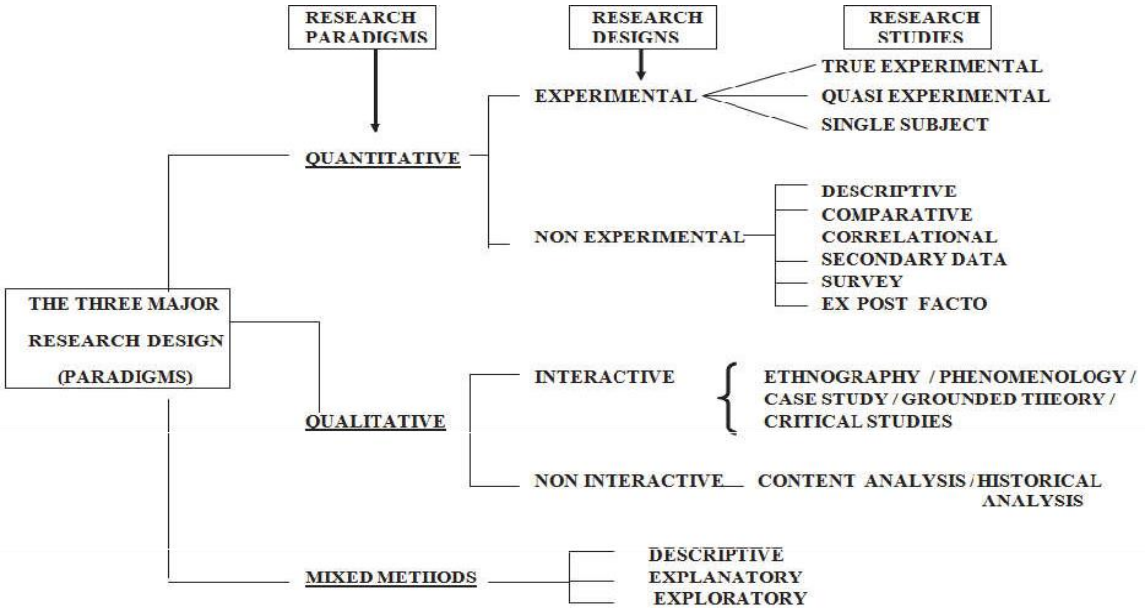

Figure 2 : Research Paradigms, research designs and research studies

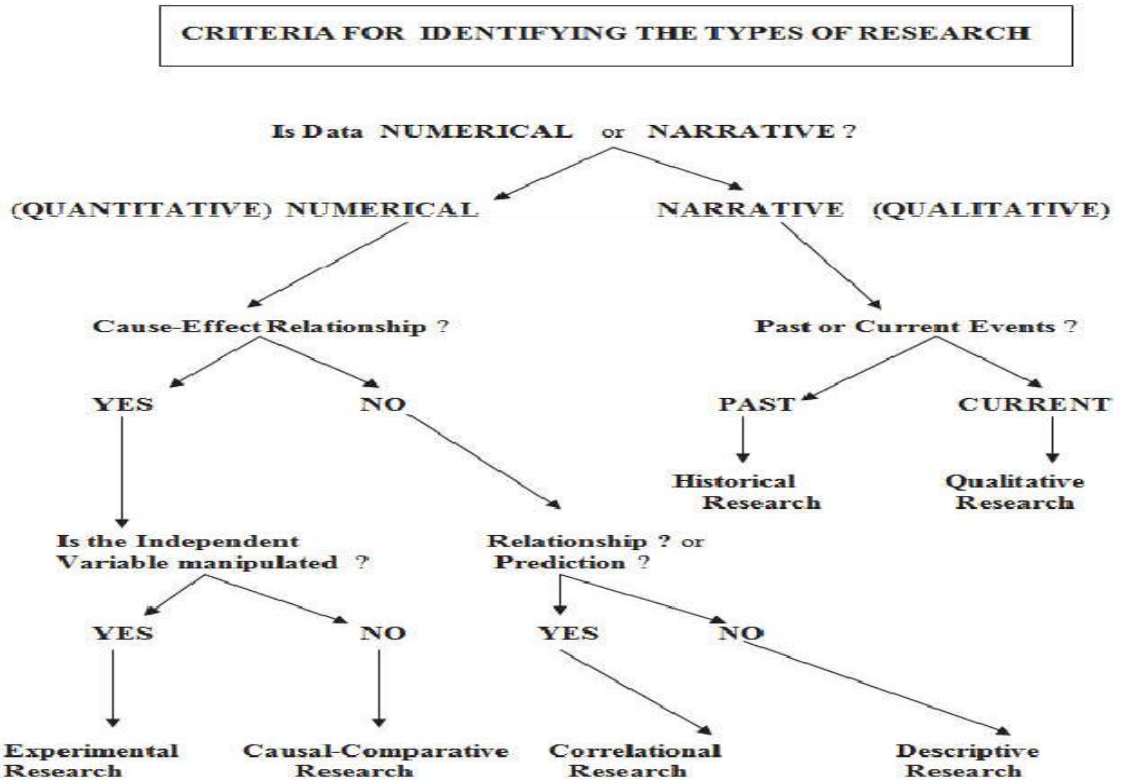

Figure 3: Criteria for identifying the types of research

INSTRUMENTS USED IN EDUCATIONAL RESEARCH

(1) **TESTS** : i.e., these can be either standardized thus, highly valid and reliable or constructed by researchers for specific purposes, skills tests, etc. They can either summative or formative

(2) **QUESTIONNAIRES:** i.e. data collection instrument that are filled out by the targeted participants

(3) **INTERVIEWS** : i.e. face to face interaction with the participants.

(4) **FOCUS GROUPS:** i.e. a small group discussion with a group moderator present to keep the discussion focused.

(5) **OBSERVATION** i.e. looking at what people actually do.

(6) **EXISTING OR SECONDARY DATA** i.e., using data that are originally collected and then archived or any other kind of "data" that was simply left behind at an earlier time for some other purpose.

Figure 4: Research Instruments in educational research

Conclusion

Research is the acquisition of knowledge in a systematic and organised way. However, the routes leading to the discovery of this new knowledge varies according to the philosophical tenets to which the researcher adheres. This is why the research paradigms which determine the existing research methodologies cannot be fully grasped without a thorough understanding of the epistemological issues which underpin each of them. The inductive-deductive debate which has grown into the quantitative-qualitative methodologies is the direct result of evolving beliefs as to what constitutes the most efficient and most reliable way of carrying out a research.

It is true however, that the nature of the data, either natural, social or psychological will direct the researcher to a great extent towards one or another methodology. The frontier between the two is becoming blurred and justifies the resort to a methodology which uses the strengths of the two major paradigms, i.e. a mixed research approach.

As far as educational research is concerned the choice of a methodology depends very much on the nature of the variables being investigated and the more the researcher is aware of the philosophical tenets of the methodology he intends to use the easier the choice of the appropriate research process will be.

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