

Review

Systematic analysis and interpretation of collected data for a research study: A practical methodological framework for writing research report

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Two basic data sources required for research studies have been secondary and primary. Secondary data collection helps the researcher to provide relevant background to the study and are, in most cases, available for retrieval from recorded sources. Primary data collection requires the researcher to venture into the field where the study is to take place; armed with the relevant instruments - questionnaire, interview schedules or arranged meetings with the selected population - to solicit the necessary information. Data collected assist the researcher to answer the research questions and address the research problem. The collection, treatment, analysis and interpretation of both secondary and primary data combine to make the researcher produce a report. This paper proposes to present a systematic methodological application where data collected for a research study can be conveniently treated, analysed and interpreted. Attempt to present the collected primary data in both quantitative and qualitative spheres will be made so that researchers who use either method or both are able to apply them confidently.

Key words: Research study, researchers, data, analysis, statistics.

INTRODUCTION

In any kind of research study, researchers collect a large amount of disjointed data by using the most appropriate data collection methods and techniques (Fitz-Gibbon and Morris, 1987; Morris et al., 1987; Patton, 1987). Qualitative and quantitative approaches lend themselves for application (Bryman, 2004). The choice of a methodology or multiplicity of methods for a research study has also been a major problem, especially, to beginning researchers (Boaduo, 2005, 2006). Some researchers prefer to use either a single method or a multiplicity of them, usually referred to as triangulation. Data can be statistically treated, analysed and interpreted. However, most analysis and interpretation apply the qualitative approach because it does not demand

elaborate mathematical treatment and analysis.

It is very important to consider the levels of methodological dimensions in a research study. These enable the researcher to identify the most relevant and applicable methodological paradigms that will lead to the successful completion of the study. Mouton (1999) believes that methodological paradigms – for instance those related to qualitative, quantitative and participatory action – are not merely collections of research methods with their applicable techniques. They include certain assumptions and values regarding their choice and use under specific circumstances (Figure 1). According to Boaduo (2005, 2006), at the level of a research where the researcher has to make a choice concerning methods

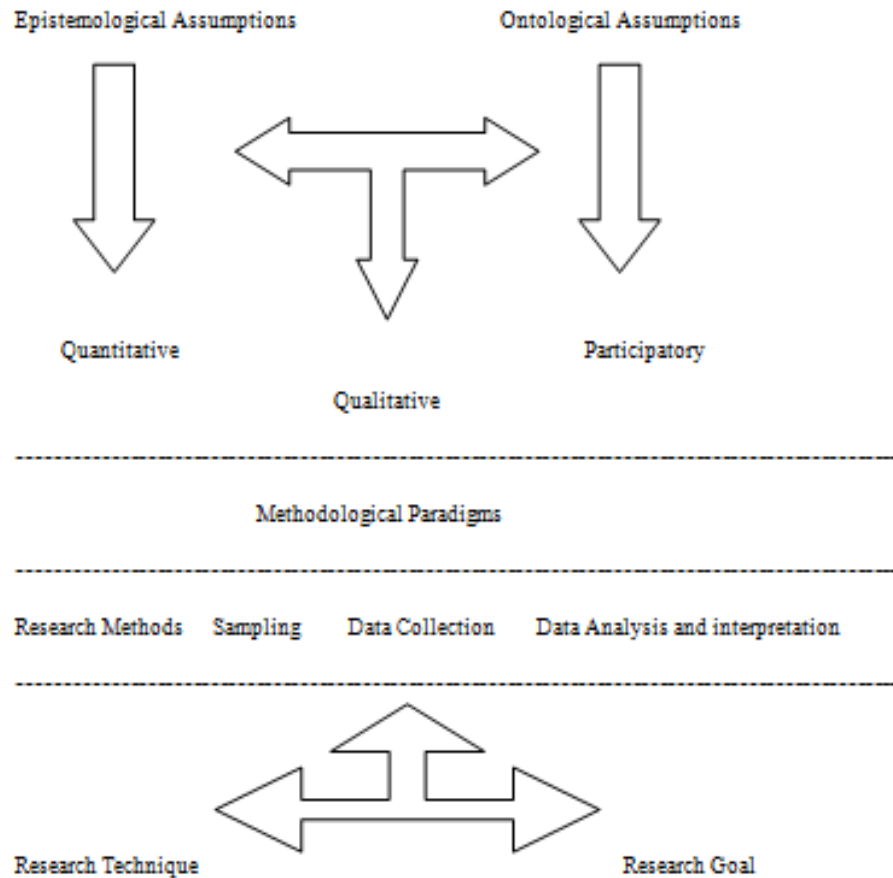


Figure 1. Levels of methodological paradigmatic dimensions. Source: Mouton (1996) with modifications by the author of article.

for the study, the researcher has to encounter both the actual applicable methods and techniques and the underlying philosophy regarding their use in the study. The philosophy will include theory of when and why to choose and apply, for instance, qualitative rather than quantitative method; and the awareness of the limitations of equally applicable and relevant various methods.

According to Boadou (2005, 2006), the relevance of methodological paradigms pertains to the emphasis placed, with respect to the fact that:

- 1) Research methods and techniques are task specific and the task is often defined by the research goal.
- 2) Different research studies use different research paradigms, methods and techniques because they have different objectives.
- 3) The research paradigms, methods and techniques must be appropriate, relevant and applicable for the task under study.
- 4) The research paradigms, methods and techniques should apply to all the aspects of the research study, which are sampling, questionnaire, interview schedule design, data treatment, analysis and interpretation.

Data and data sources

Data, according to many authors are series of observations, measurements, facts and information that are required to be collected, systematically organised, treated, analysed and interpreted to provide the research report (Neuman, 2000; Fits-Gibbon and Morris, 1987; Wiersma, 2000; Gay and Airasian, 2000; Bryman, 2004; Baker, 1999; Miles and Huberman, 1994). The term can be used as a singular or plural (Collins English Dictionary, 2004). Data can be numerical or non-numerical forms of information and evidence that have been carefully gathered according to rules or established procedures (Neuman, 2000). Data can be grouped into qualitative and quantitative. Technique, method or strategy, applicable to particular data collection is always used in a research study. However, it is possible that a multiplicity of techniques, methods or strategies can be used in the collection of data. In all research studies the data that are to be collected should be relevant and contribute towards finding answers to the research questions that help to solve the research problem.

It is important to indicate that the technique, method or

strategy for data collection can be grouped into two categories. These are quantitative (collecting data in the form of numbers, especially statistical data) and qualitative (collecting data in the form of words or pictures). What needs to be taken into account is that some techniques, methods and strategies are more effective and efficient when addressing specific kind of research questions or topics. However, it takes knowledge and skill, practice and creativity to match a research question to an appropriate data collection technique, method or strategy (Patton, 1987; Fitz-Gibbon and Morris, 1987).

Data and measurement

A research report stands on the quality of the facts and data on which it is based. It is important to indicate that an excellent research design and a very representative sample are not sufficient to ensure good results if the analysis rests on incorrect data. The importance of constructing an appropriate and accurate instrument for measuring and collecting data is absolutely necessary. The different scales of measurement depend on the type of research and the type of data being collected. Through data collection, the researcher comes into direct contact with other human beings. It is of prime importance, therefore, that attention is drawn to some ethical considerations concerning the rights of the participants (Bless and Higson-Smith, 2004).

Facts are empirically verifiable observations. Data consists of measurements collected as a result of scientific observations. Furthermore, data are facts expressed in the language of measurement (Henerson et al., 1987). In the light of this, measurement is used in a general sense. One can measure the intensity of an attitude, perception or feeling. For instance, a person's view on an educational reform could be positive, negative or neutral. The fact that this person takes a definite position towards an issue in education becomes data once it is expressed in a measurement (Herman et al., 1987). Data therefore, can be classified according to the way in which it was collected or in terms of its intrinsic properties (Miles and Huberman, 1994; Bless and Higson-Smith, 2004).

Researchers collect their own data in the field for the purpose of a particular study; this is called primary data. Data collected in this way should be appropriate to the aims of the research and must always be directed towards answering precisely the questions raised by the researcher in the research proposal which later form the basis of the questionnaires prepared to gather additional primary data (Fitz-Gibbon and Morris, 1987).

Researchers also use data collected by other researchers in relation to other research problems as part of the usual gathering of secondary sources as in the case of population census, or the reports of other

researchers or even in published and unpublished documented sources. Such data broadly constitute secondary data. Generally, the need for secondary data through the activity of literature review is to search and identify information that would enable the researcher find out about what other researchers have done, and they did not do in order to establish a gap lapse; to augment the study under investigation without repeating a study that has been already conducted (Boaduo, 2005, 2006; Bryman, 2004; Bell, 2004; Miles and Huberman, 1994).

Qualitative research and qualitative data

Generally, all data collected for any research study are either quantitative or qualitative. They may refer to essences of the researched – people, objects and situations (Berg, 1989). Miles and Huberman (1994) hold the view that qualitative research is conducted through an intense and prolonged contact with the field or real life situation. According to them these situations are typically normal ones, reflective of the everyday life of individuals, groups, societies and organizations. They further indicate that the researcher's role is to gain holistic (systematic, encompassing and integrated) overview of the context under study; its logic, arrangements, explicit and implicit rules. In this way, the researcher attempts to capture data on the perceptions of local actors from the inside, through a process of deep attentiveness, of empathetic understanding and of suspending preconceptions about the topic under study. The onus of this exposition is that reading through these materials, the researcher may, under special circumstances, isolate certain themes and expressions that can be reviewed with informants during data collection but that should be maintained in their original forms throughout the study.

Jacob (1987) in his research taxonomy lists five major qualitative research traditions. These are ecological psychology, holistic ethnography, ethnography of communication, cognitive anthropology and symbolic interactionism. He uses dimensions including assumptions about human nature and society, the focus (that examines the content at social level) and the methodology (which attend to the research design, data collection and analysis) (Miles and Huberman, 1994).

According to Tesch (1990) the main task of qualitative research is to explicate the ways people in particular settings come to understand, account for, take action and otherwise manage their day-to-day situations. Tesch holds the view that many interpretations can be accorded to the data collected which are more compelling for theoretical reasons or on grounds of internal inconsistency. The contention to this view is that relatively, little standardized instrumentation is used at the outset. In this way, the researcher is essentially the main measurement device in the study to provide appropriate interpretation. This leads to the view that

most analysis is done with words. These words can be assembled, sub-clustered and broken into semiotic segments. They can be organized to permit the researcher to compare and contrast, analyze and bestow patterns upon them making the data intelligible for use and application (Miles and Huberman, 1994). The words chosen for the description are usually based on observation, interviews or documents and according to Atkinson (1991, 1992) are texts constructed by the field worker on the basis of observation and participation. Wolcott (1992) is of the opinion that watching, asking and examining, as the collection of the data proceeds, influence, to some extent, the interpretation given by the researcher because the data collection activities are carried out in close proximity to a local setting for a sustained period of time, usually the duration of the data collection period.

Approaches to quantitative and qualitative data analyses

Fitz-Gibbon and Morris (1987) state clearly that there are three ways in which quantitative statistical techniques can be used in quantitative study. These applications are to:

- i) Describe data;
- ii) Generate hypotheses; and
- iii) Test hypotheses.

In the description of quantitative data there is need to summarize the scores in the collected data, describe them economically and accurately. Statistics used to describe data in this format are descriptive statistics.

In the generation of hypotheses, a large amount of information-like responses from many different kinds of respondents to some questionnaire may be collected. It is ideal to use statistics to identify if there are any patterns in the data to be able to generate hypotheses. Searching through the data for relationships is sometimes tedious but can also mean a successful exploratory data analysis (Tukey, 1977). It is always necessary to recognize the generation of hypotheses and the testing of hypotheses. It is important to realize that the same procedures used to search a set of data for relationships can also be used to test hypotheses to see if there is strong evidence that a relationship is just more than a chance pattern in the data.

The need for hypothesis testing arises in a research study from the fact that researchers always work with limited data especially population sampled for the study; and hope to be able to generalize from small samples to larger samples. Researchers usually do this by drawing inferences from small samples and the statistics used to do this are referred to as inferential statistics. Statistics gives researchers some reassurance in quantitative data analysis; there may not be proof or certainty in their

application (Fitz-Gibbon and Morris, 1987).

Miles and Huberman (1994) view the line of enquiry in qualitative study as “human activity or text – as a collection of symbols expressing layers of meaning”. For Dilthey (1911, 1977) and the phenomenologists Maykut and Morehouse (1994), the way to qualitative enquiry leads to deep understanding of the subjects of the enquiry. There is practical understanding of meanings and actions. To the social interactionists, interpretation comes via the understanding of group actions and interactions (Dey, 1993). They argue that they have their own understandings, convictions, conceptual orientations and are members of a particular culture at a specific historical moment. More importantly, they are affected by what they hear and observe in the field unnoticed. However, in both cases there is an inevitable interpretation of meanings for the social actors and the researcher. It is important to note that in deciding what to leave, what to highlight, what to report first and last, what to interconnect and what main ideas are important in collected data for a study, analytic choices are made continuously (Yin, 1994).

General steps in data analysis and interpretation

Yin (1994) stresses that to interpret data collected for a research study it is important to use meaningful categories to organise them in order to get precise measure of the variables concerned. Generally, problems of analysis and interpretation are pervasive in any research study which data in any category is considered (Mason, 1994; Strauss, 1993). Again in any research study, numbers (statistical data) are not enough (Boadou, 2006). To make these quantitative numbers reasonable and useful, they have to refer to concepts established through qualitative analysis (Bryman and Burgess, 1994). While quantities are powerful because of the complex mathematical operations they permit, they mean nothing or mean very little if at all, in themselves unless they are based on meaningful conceptualization. In other words, social or scientific research based on quantitative data without qualitative data would not connect and interact well with the world. Therefore, data obtained through the instruments selected for a research study must be grouped (or categorized), analysed and interpreted in a generally or specifically acceptable manner making the findings revealed by the data and the recommendations made, based on the findings as applicable and relevant to practitioners and the public for articulation. In the analyses of data collected for a qualitative research study, two kinds of descriptions are used: These are “thin” and “thick” (Geertz, 1973; Denzin, 1978; Delamont, 1992). The “thin” descriptions merely state facts while the “thick” descriptions include information about the context of the act, the intentions and the meanings that organise the action and its subsequent evolution (Boadou, 2006;

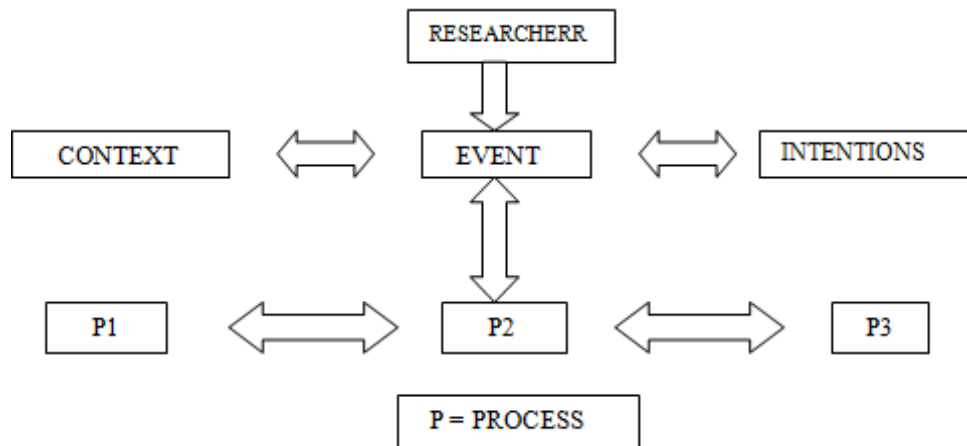


Figure 2. Three aspects of description in qualitative analysis. Source: Boaduo (2006).

Charles, 1995; Soltis, 1990). In most circumstance in a research study, qualitative analysis aims to provide thorough descriptions of the collected data to make them meaningful to readers and practitioners (Dey, 1993). Figure 2 represents the three aspects of description in qualitative analysis namely context, intention and process.

From this perspective, the analysis becomes intertwined and moves into an iterative spiral from data to classifying – describing – and connecting to an account of what the data revealed. This is represented in Figure 3. By doing this, the context of the data, intention and process of the research study and the complete classification of the data have been given the attention they need for the explicit interpretation of the collected data (Boaduo, 2006).

The need to take account of context in a research study is a recurrent theme in qualitative analysis. Context is important in qualitative analysis because it serves as a means of situating action and of grasping its wider social, economic, political, scientific and historical import. This may further require detailed descriptions of their social setting within which action occurs: The relevant social context may be a group, organization, culture, society or a system; the period within which the action takes place; the spatial context and the network of social relationships (Dey, 1993; Boaduo, 2006).

In this study, qualitative analysis aims at describing the world as different observers (researchers) perceive it. The analysis is usually concerned with how actors define situations and explain the motives, which govern their actions. It must therefore, be ensured that this relates to intentions of the actors involved in the final research study report (Dey, 1993; Boaduo, 2006; Stake, 1994; Carspecken, 1996).

Qualitative research often seeks to illuminate the ways individuals or objects interact to sustain or change social situations. Qualitative data therefore, is descriptive of

social relationships and interchange, which unfold in the succession of action and events in which the actors are engaged (Dey, 1993). Data collected can themselves be conceived as interactive process through which the researcher struggles to elicit meaningful interpretation of social action and even becomes participant observer.

In all research studies, analysis follows data collection. The result of the analysis depends on and is modified by the collection and the investigation of further data if required. In this way the researcher becomes a participant in the research project. The interpretations and actions become legitimate object of subsequent analysis by other researchers. Furthermore, information on the researcher's own behaviour and thinking in the form of field notes, memos and diary can become a vital source of data for the overall analysis to augment the final report for the study (Miles and Huberman, 1994). In this way, the process shifts attention from context and intention to action and consequences (Sayer, 1992). In putting together and relating the central characteristics through a reasoned account, description acquires its unity and force. Description, according to Dey (1993) "...tells of a story about the data and uses a range of techniques such as - summarising events, focusing on key episodes, delineating roles and characters, setting out chronological sequence – to construct an illuminating narrative". According to Miles and Huberman (1994) a fairly classic set of analytic sequential move follows this pattern:

1. Affixing codes to a set of field notes drawn from observation or interviews.
2. Noting reflections or other remarks in the margins of the field notes.
3. Sorting and sifting through these materials to identify similar phrases, relationships between variables, patterns, themes, distinct differences between subgroups, and common sequences.

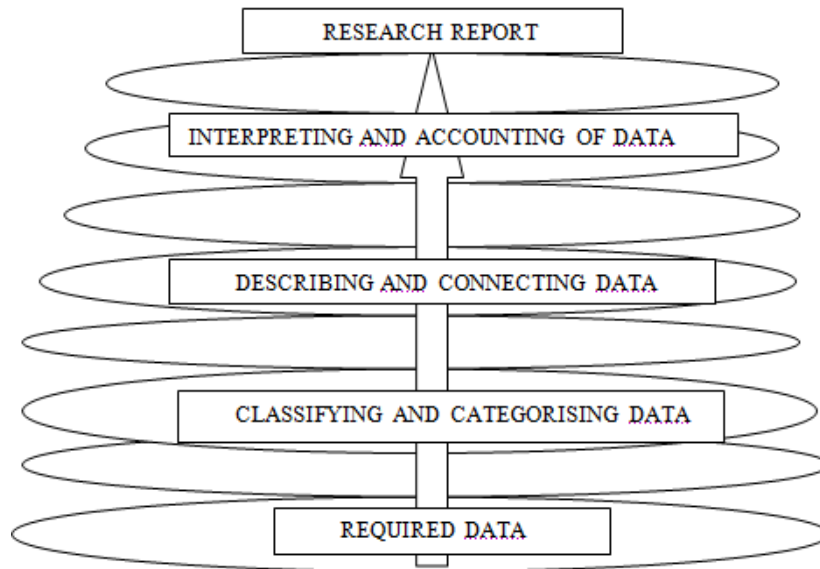


Figure 3. Qualitative analysis as iterative spiral. Source: Boadou (2006).

4. Isolating these patterns and processes, commonalities and differences and taking them out of the field in the next wave of data collection if required.
5. Gradually elaborating a small set of generalizations that cover the consistencies discerned in the database, and finally.
6. Confronting those generalizations with a formalized body of knowledge in the form of constructs or theories.

Interpretation and explanation of data are the key responsibilities of the researcher. In all research studies, it is necessary to develop a meaningful and adequate account of what has been researched. The data collected provide the basis of analysis (Burgess, 1982; Tuckman, 1988). The collected data require the development of a conceptual framework upon which the actions or events researched can be rendered intelligible for use or replication (Yin, 1994). To explain is to account for an action. Interpretation requires the development of conceptual tools through which to comprehend the significance of social action and how actions interrelate. Interpretation therefore, makes the analysed data meaningful to practitioners and users.

Classification involves breaking up collected data and then bringing the parts logically together again into related sequence. The data then form the conceptual foundation for a specific analysis. Classification therefore, becomes a familiar process of practical reasoning. Categorising and retrieving data provide the basis for comparison. Redefining categories can produce more rigorous conceptualization. Classification, in all cases, is guided by the research objectives and once data have been classified and categorised; they lead to finding answers to the research problem or creating more

confusing problems for further investigation by other researchers who may find solace in them (Dey, 1993).

Making connections and establishing relationships among data

It is very important to know and understand precisely that data collected for a research study cannot be left as the last resort of what have been found in the field by the researcher. In effect, classification helps to produce an account of analysis that can be adequately interpreted. In all forms of research, concepts are the most significant building blocks of analysis. In this case, the first major task is to make these building blocks and then put them together (Dey, 1993; Boadou, 2006). Connecting concepts is the analytic equivalent of putting mortar between the building blocks (Yin, 1994). Generally, classification lays the foundation for identifying substantive connections. In this way associations between different variables are identified and once the data are classified, regularities, variations and singularities can be isolated and specifically defined (Figures 2 and 3).

Conclusion

A research of any kind is endlessly creative and interpretive. In the research process there is need for problem identification, statement of purpose with the most adequate and relevant critical questions that have to be answered clearly listed. Various sources of literature have to be consulted to be able to identify the "gap lapse" that has to be filled by the study being undertaken. A rationale for the study has to be stated as

well as the provision of the theoretical framework upon which the comprehensive explanation for the whole research event is dependent. The study should be put in a relevant and applicable methodological perspective philosophically. The data collection methods and techniques should be provided by considering the research parameters within which the data required for the study will be collected. A field text has to be created which will comprise field notes, questionnaire and interview schedules, observation and document review. This indexing is the basis for the final report of the study (Boaduo, 2006; Sanjek, 1990; Plat, 1990; Denzin and Lincoln, 1994; Delamont, 1992; Stouthamer-Loeber and Van Kammer, 1995). The notes are based on the field text and recreated as a working interpretation document containing all the initial and subsequent attempts to make sense of what has been learned and found in the field (Boaduo, 2006; Carspecken, 1996). The final research report is produced from the field text (notes, observations, questionnaires, interview and documents) through classification and categorization. The analysis and interpretation should focus on context, intention and process to be able to give a valid interpretation of the data obtained in the field and literature review for the study. The findings listed, the conclusions drawn and the recommendations that the researcher will provide should be based on what the collected data for the study revealed. In a nutshell, this is the essence of making sensible quantitative and qualitative data collected for a research study through the most practical, systematic, relevant and applicable methodological choice and application to produce a professional master piece of a research report.

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