

The Necessity of Logic in Research Methodology

May Zin Oo*

Abstract

Research Problem of this paper is Why Logic is a necessary factor in doing research work? It is because if a researcher has knowledge of logic, his or her thinking becomes more critical and effective in doing research work. In this research paper descriptive method and evaluative method are used. The principle of reliability is used for this paper. This paper can contribute to the more understanding the important role of logic in doing research.

Keywords: (1) logic (2) quantitative research (3) qualitative research

Introduction

The title of research is "The necessity of logic in Research Methodology". The research question is why logic is necessary in doing a research work. Because the two research methods are based on inductive and deductive logic. For this reason, logic and research methodology are related.

If a researcher has knowledge of logic, his or her thinking becomes more critical and effective in doing research work. Logic is a study of reasoning to distinguish good reasoning from bad, or better from worse. Logic is both an art and a science. As a science logic investigates, develops, and systematizes principles and methods that can be used to distinguish between correct and incorrect reasoning. Logic is going from premise to a conclusion. When study of logic, it needs to get clearer on what logic is and its importance. It also needs to learn some concepts such as induction, deduction, validity, the principle of analogy, the purpose of definition, and fallacies that are central to the study of logic.

Logic is a branch of philosophy. The Philosopher's reasoning must also be related to the facts of our experience. Philosopher tried to articulate and sharpen our ordinary belief, attitudes, and assumptions about the world, and then to see, through the used reason. Thus philosopher's primary tool is reason. Moreover reason is an important part of everyday life. Logic as a branch of philosophy is a study reason. If there is no knowledge of logic, there will be lack of tools needed to understand and evaluate philosophical reasoning. Moreover, there is often speaking of logical argument as contrasted with an illogical argument. A researcher with knowledge of logic is a person who can make logical arguments. In fact, a research is made up of logical arguments.

Then, there are two kinds of research methodology, they are quantitative and qualitative. In philosophical terms quantitative approach is called Logical positivism. Quantitative research is used widely in social sciences such as psychology, sociology, anthropology, and political science. In a quantitative study the methodology chapter usually contains the following sections: introduction, research design, population and sample, sampling procedures, instrumentation, data collection procedure, data analysis, and limitations. Qualitative researchers are concerned primarily with process, rather than outcomes or products. Qualitative researchers are interested in meaning – how people make sense of their lives, experiences, and their structures of the world. The qualitative researcher is the primary instrument for data collection and analysis.

* Lecturer, Department of Philosophy, Maubin University, Myanmar

Some scholars said that “Research” means to find out something we do not know. This answer is both too wide and too narrow. There are a lot of things that we do not know that we could find out. A research needs (1) careful definition of terms, (2) unbiased collection of information, (3) meticulous statistical treatment and (4) careful summarizing to get a balanced description. If a research work is descriptive, it is an answer of ‘what’ question. It can be considered as ‘intelligence-gathering’.

In fact, research goes beyond description. It requires analysis. It looks for explanation, relationships, comparisons, predictions, generalization and theories. In this case, it needs to answer the ‘Why’ questions. The information is used for the purpose of developing understanding by comparison, by relating to other factors, by theorizing and testing the theories. Hence, it can be said that research means to find out “what” and “why” questions through descriptive and analytical method.

In addition, a good research is to obtain valid argument and sound generalizations. This is the most efficient way of applying understanding in a wide variety of appropriate situations. The way of generalizations can best be established is through the development of explanatory theory. It is indeed the application of theory that turns intelligence- gathering into research. It helps overcome the biases inherent in each method. In conclusion, the researcher should consider a hybrid approach to obtain the unity of quantitative and qualitative approach. Blending these two approaches generally allows greater depth of understanding and insight than what is possible using just one approach.

1. The Meaning of Logic

Logic is not the study of how people do reason, but how they should reason. The study of logic is the study of methods and principles used in distinguishing correct from incorrect reasoning. The person who has studied logic is more likely to reason correctly than one who has never thought about the general principle involved in that activity. There are several reasons for this. First of all, the proper study of logic will approach it as an art as well as a science. In the second place, a traditional part of the study has been the examination and analysis of fallacies, or incorrect method of reasoning. The study of logic gives a researcher certain techniques, certain easily applied method for testing the correctness of any reasoning. This knowledge is valuable because when mistakes are easily detected they are less likely to be made.

Logic has frequently been defined as the science of the law of thought. But this definition, although it gives a clue to the nature of logic, is not accurate. In the first place, thinking is one of the processes studied by psychologists.

Logic cannot be “the science of the law of thought”, because psychology is also a science which deals with laws of thought. And logic is not a branch of psychology; it is a separate and distinct field of study. Psychology studies the process of thought .But logic studies the special kind of thinking.¹

The definition of logic is the science of reasoning. Reasoning is a special kind of thinking, in which inference takes place or in which conclusions are drawn from premises. The distinction between correct and incorrect reasoning is the central problem with which logic deals. The Logician’s method and techniques have been

¹. IRVING M. COPI, Professor of Philosophy, The University of Michigan, (1964). *Introduction to Logic*, second edition, The Macmillan Company, New York, p-4.

developed primarily for the purpose of making this distinction clear. The Logicians are interested in all reasoning, regardless of its subject matter, but only from this special point of view.

As a research is a kind of academic writing it must be made up of logical arguments. Corresponding to every possible inference is an argument, and it is with these arguments that logic is chiefly concerned. Arguments represent reasoning in language. An argument, in the logician's sense, is any group of proposition of which one is claimed to follow from the others, which are regarded as providing support or grounds for the truth of that one. The word argument is often used in other senses, but in logic it has the special sense explained.

An argument is not mere the collection of propositions, but has a structure. In describing this structure, the terms "premise" and "conclusion" are usually employed. The conclusion of an argument is the proposition which is affirmed on the basis of the other propositions of the argument, and these other propositions, which are affirmed as providing support or reasons for accepting the conclusion, are the premises of that argument.

Argument consists of just one premise and a conclusion. But some arguments offer several premises in support of their conclusion.¹

A research work is written by arguments, so that logical argument is necessary for a good research.

2. Inductive and Deductive Inference

The distinction between inductive and deductive inference can be grasped quite quickly at an intuitive level by considering a few example. In a deductive argument, the premise must give absolute support for the conclusion. Any argument in which the premises provide anything less than absolute support is by definition and inductive argument.

In deductive argument researchers reason from general to particular, whereas in inductive arguments reason from particular to general. Example of deductive argument is that, all mammals have eyes. Dolphins are mammals. Therefore, dolphins have eyes. In deductive argument, researcher began with the universal statement "all mammals have eyes." And concluded with a particular statement, "dolphins have eyes". All deductions depend upon the logical properties of relations. Hence, the concept of relation is fundamentally important. It does not seem possible to define relation without presupposing notions no less in need of definition. Researchers shall begin with some definitions that will be found useful in the statement of these properties. A system consists of elements standing in certain relations. For example, the solar system is a system consisting of certain elements, the sun, the planets and their satellites, standing in certain relations. A social organization is a system consisting of social classes related in a certain way. In any given system the fact that an element stands in a given relation can be expressed by a proposition. Thus the relative positions of the earth, Jupiter, and the Sun, can be expressed by the proposition. The earth is between Jupiter and the Sun. Given any system, the relation of its elements can be expressed in a set of relate proposition.

The principle of logic provides an instance of propositions that are necessarily true because they are implied by all deductive systems. The necessity of logical principles is nothing but the necessity of constructing systems. The construction of

¹ . Ibid, p-5

such systems may be the expression of the thinking of relational beings. The complete generality of a deductive system is the fact that primitive propositions do not determine a unique set of objects. When such deductive systems can be constructed it becomes possible to develop a part of several abstract sciences at the same time. In this way increase of generality aids the development of science. Induction is the process of generalization. It consists in establishing a general proposition on the ground of particular facts observed. Thus induction is necessary to guarantee the material truth of the universal premise of a syllogism. In induction researchers proceed particular facts to general truths or law. Induction is the process of reasoning by which a researcher proceeds from particular facts observed to the general law which connects them with one another.

A scientific induction is a real universal proposition based on observation of particular facts in reliance upon the Uniformity of Nature and law of causation. An induction is a proposition as distinguished from a notion or a term. It is the statement of a general truth. An induction is a universal proposition. And an induction is a real proposition. An induction is concerned with material truth. So it must be a real proposition. It is a general proposition based on facts. An induction is based on observation and experiment. Its premises are particular facts. They are not taken for granted but are gathered from observation and experiment. They are from of perception. Hence they are called the material condition of induction.

Generally Logic can be divided into two kinds. They are deductive logic and inductive logic. As generally stated, deduction consists in passing from more to less general truths; induction is the contrary process from less to more general truths. In deduction there is developing the consequences of a law. It must be learnt the meaning, contents, results or inferences, which attach to any given proposition. Induction is the exactly inverse process. Given certain results or consequences, it is required to discover the general law from which they flow. According to Aristotle, Induction certainly started in one sense and individual. For it starts with what it can be perceived with the sense, and only the individual can be perceived. But it may be said that what it is apprehended in the individual is its character or type.

In a certain sense all knowledge is inductive. We can only study the law and relations of things in nature by observation those things. But the knowledge gained from the senses is knowledge only of particular facts.¹

Experience gives a researcher the materials of knowledge. Induction yields a researcher general knowledge. When a researcher possesses such knowledge, in the form of general proposition and natural laws, a researcher can usefully apply the reversed process of deduction to ascertain the exact information required at any movement. In its ultimate foundation, then, all knowledge is inductive- in the sense that it is derived by a certain inductive reasoning from the fact of experience.

Really, deduction is the inverse process of induction. Deductive reasoning may be described as the reverse of generalizing. In deduction, a researcher starts with general law of principle, and then reason out its application to some particular case. It has been found that, in all known cases, all animals with horns and hoofs are non-eaters of flesh. This empirically establishes the general law or principle. Or another deduction may be made by applying the general principle to some extinct animal of

¹ . A.E. MANDER, (1949). *Clearer Thinking, (Logic for Everyman)* Printed and Published in Great Britain by C. A. Watts & Co. limited. 5 & 6 Johnson's Court, Fleet Street, London, E. C. 4, p-114.

which the fossil remains have been discovered. A researcher finds that this extinct animal had horns and hoofs; and therefore we are able to deduce the fact that it was not a flesh-eater. A researcher knows it by “deduction”. In fact, all mathematical reasoning is deductive. Every chemist or engineers who refer to a general formula to solve a particular problem, is using deductive reasoning. Deduction is not from particular facts, but only from general laws and principles.

The argument is valid, however, because if the premise were true the conclusion would follow. A valid argument is one in which, if the premises are true, the conclusion must be true. On the other hand, an argument is invalid if the conclusion does not necessarily follow from the given premises.

The conclusion of sound argument must be true. By definition, a sound argument has to be valid. Therefore all sound arguments are valid and all valid argument must be sound. Only if the conclusion of the argument is justified by the premises, the argument is valid. If the premises do not justify the conclusion, the argument is invalid. Validity or invalidity is only attributed to arguments by which a research work is created and written. For this reason, logic is necessary for research writing.

3. Definition of Quantitative Research

In philosophical terms quantitative approach is called Logical positivism. Inquiry begins with a specific plan. It is called a set of detailed questions and hypotheses. Researchers seek facts and causes of human behavior and want to know a lot about a few variables so differences can be identified. Researchers collect data that are primarily numerical resulting from surveys, tests, experiments and so on. Most quantitative approaches manipulate variables and control the research setting. Quantitative designs include descriptive research, experimental research, quasi-experimental research, causal comparative research and correlational research.

Statistical method is especially useful for looking at relationships and patterns and expressing the patterns with numbers. Descriptive statistics describe the patterns of behaviours, whereas inferential statistics use probabilistic arguments to generalize finding from samples to populations of interest. It should focus on the inferential process when statistics is defined as the theory and method of analysing quantitative data.

Methodological control is generally accomplished by two procedures that rely on the principle of randomness. One is random sampling. It uses subjects that have “randomly” been drawn from the potential pool of subjects. Hence, each member of the population has an equal chance or known probability of being selected. Random selection of subjects permit the researcher to generalize the results of the study from the sample to the population in question.¹

In fact, many issues and topics can go either. Quantitative strategies also have many relative and strange twisting branches to contend with. Much like its distant relative, quantitative strategies have to be defined in terms of specific outcomes. Not only has it needed to understand the fine points between differences and relationships. It also will need a talking vocabulary about threats to internal and

¹ . Kjell Erik Rudestam Rae R. Newton,(2001).*Surviving your Dissertation* , Sage Publications, Inc. International Educational and Professional Publisher Thousand Oaks, London, New Delhi, p-27.

external validity, robustness of statistical treatment, points of central tendency, standard error of the means, dispersion and deviation, as well as the width of the spread. Then researchers have the added complication of determining whether he or she is using parametric or nonparametric techniques, whether he or she has a true experimental design, a quasi-experimental design. Knowing the language for quantitative studies is an absolute necessity. In terms of analyzing his or her data and presenting his or her findings, a researcher is in better shape with quantitative studies. Therefore Quantitative method based on deductive method.

4. Definition of Quantitative Research

In a quantitative study the methodology usually contains the following sections: introduction, research design, population and sample, sampling procedures, instrumentation, data collection procedure, data analysis, and limitations. A researcher should introduce his or her study's purpose and research questions. A brief description of the problem might also be included. Then, research design in this section states the type of research and design used in the study as well as the relation for your selection. The research design which a researcher selects is based on the purpose and nature of his or her study.

Then, the population and sample (data sources) section includes a description of the individuals who participated in your study and the procedures used to select them. Ideally, an entire population would be used to gather information. However, this is not usually feasible as most groups of interest are either too large or are scattered geographically. When researcher don't have an opportunity to study a total group, select a sample as representative as possible of the total group in which researchers are interested.

Then, sampling is the process of selecting a number of individuals for a study. The individuals represent the larger group from which they were selected. The individual selected which comprises a simple and larger group is referred to as a population. The population is the group of interest to the researcher, the group to which she or he would like the results of the study to be able to generalize.

Then, instrumentation includes a description of all instruments used to collect data questionnaires, interview schedules, observation forms, and so on. Each instrument should be described in detail in the methodology section.

Validity is the degree to which the instrument truly measures what it purports to measure. In other words, can we trust that findings from researcher's instrument are true? Reliability is the degree to which researcher's instrument consistently measures something from one time to another.¹

Then, data collection describes in detail all of the steps taken to conduct researcher's study and the order in which they occurred. It is important that researcher's writing be clear and precise so that other researcher can replicate his or her study. Researcher description should state how and when the data were collected. When to collect data is a critical issue in data collection because it can greatly affect his or her response rate. It is important for researcher to consider the availability of researcher's population. Then, data analysis includes an explanation of how he or she analyzed the data as well as his or her rationale for selecting a particular analysis

¹. Carol M. Roberts, (2004). *Dissertation Journey*, Corwin Press, A Sage Publications company , Thousand Oaks, California, p- 146.

method. If researcher's study is quantities, report the descriptive and inferential statistical tests and procedures researcher used, how they were treated, and the level of statistical significance that guided researcher's analysis. Since statistical tests may vary by research question, researcher should explain his tests and procedures for each question. Therefore Qualitative research method based on inductive method.

Conclusion

A research proposal is an action plan that justifies and describes the proposed study. A research must take the completion of a comprehensive proposal as a very important step in the dissertation process. The proposal serves as a contract between the researcher and his or her dissertation or thesis committee that, when approved by all parties, constitutes an agreement that data may be collected and the study may be completed.

There is no universally agreed upon format for the research proposal. A good proposal contains a review of the relevant literature, a statement of the problem and the associated hypotheses, and a clear delineation of the proposed method and plans for data analysis. An approved proposal means that more than half of the work of the dissertation has been completed. The phases of the research process are with reference to the research wheel. The wheel metaphor suggests that research is not linear but a recursive cycle of steps. The most common entry point is some form of "empirical observation". In other words, the researcher selected a topic from the infinite array of possible topics.

The first step is a process of inductive logic that culminates in a proposition. The inductive process serves to relate the specific topic to a broader context. These hunches typically are guided by the values, assumptions, and goals of the researcher that need to be explicated. The next step of the research wheel is a developed proposition, which is expressed as a statement of an established relationship. The proposition exists within a conceptual or theoretical framework. It is the role of the researcher to clarify the relationship between a particular proposition and the broader context of theory and previous research. This is probably the most challenging and creative aspect of the dissertation process. A conceptual framework, which is simply a less developed form of a theory, consists of statements that link abstract conceptual frameworks are developed to account for or describe abstract phenomena that occur under similar conditions. A theory is the language that allows us to move from observation to observation and make sense of similarities and differences. Without placing the study within such a context, the proposed study has a "so what" quality. This is one of the main objections to the research proposals of novice researchers: The research question may be inherently interesting but ultimately meaningless. Generally speaking, a research dissertation is expected to contribute to the scholarly literature in the field and not merely solve an applied problem. Thus, identifying a conceptual framework for a research study typically involves immersing oneself in the research and theoretical literature of the field.

The researcher uses deductive reasoning to move from the larger context of theory to generate a specific research question. The research question is the precisely stated form of the researcher's intent and it may be accompanied by one or more specific hypotheses. The first loop is completed as the researcher seeks to discover or collect the data that will serve to answer the research question. The data collection process is essentially another task of empirical observation, which then initiates another round of the research wheel. Generalizations are made on the basis of the

particular data that have been observed (inductive process), and generalizations are tied to a conceptual framework, which then leads to the elucidation of further research questions and implications for additional study.

The research process requires a high level of scholarly writing. Therefore researcher must be to express him or herself logically, clearly, and precisely. The research must be a formal document demonstrating his or her ability to conduct original research that contributes to theory or practice. Although variations exist, typical dissertation consists of chapters that provide background to the topic, a literature review, description of the methodology, findings, conclusions, and recommendations for action and future research. Major steps in the dissertation process include selecting a topic, preparation a prospectus, selecting an advisor and committee members, completing and defending a proposal conducting the research, writing the research paper, participating in the oral defence, making correction, and graduation.

Starting the research paper involves choosing a research topic, conducting a review of the literature, and selecting a methodology. These are not linear processes; they undulate back and forth and often go on simultaneously. Reviewing the literature grounds you in understanding what is known and not known about your study's topic and helps provide the basis for selecting an appropriate methodology. Whatever methodology a researcher must choose, you need to understand the techniques and processes of that particular research.

In conclusion, the researcher should consider a threefold classification of research: exploratory, testing- out and problem-solving, which applies to both quantitative and qualitative research. All research methodology can be classified in to two: quantitative or qualitative. Each has a variety of sub methodologies, or designs, with their own protocol for collecting and analysis data. A hybrid approach is obtained when quantitative and qualitative approaches are used together. Blending these two approaches generally allows greater depth of understanding and insight than what is possible using just one approach. Thus, blending helps overcome the biases inherent in each method.

Acknowledgement

I would like to think Dr. Aung Kyaw (Rector), Maubin University for his permission to propose this paper. Thanks also go to Dr. Ei Ei Khin, Professor and Head of Philosophy Department, Maubin University for her encouragement.

References

- Copi, IRVING M. Professor of Philosophy, The University of Michigan, (1964). *Introduction to Logic*, second edition, The Macmillan Company, New York.
- Copi, IRVING. M (1986). *Informal Logic*, six edition, The Macmillan Publishing Company, division of Macmillan, Inc.
- MANDER,A.E. (1949). *Clearer Thinking, (Logic for Everyman)*, Printed and Published in Great Britain by C. A. Watts & Co. limited. 5 & 6 Johnson's Court, Fleet Street, London,
- Newton, Kjell Erik Rudestam Rae R. (2001). *Surviving your Dissertation*, Sage Publications, Inc. International Educational and Professional Publisher Thousand Oaks, London, New Delhi.
- Roberts, Corol M. (2004). *Dissertation Journey*, Corwin Press, A Sage Publications Company, Thousand Oaks, California.
- Stewart , David / H. Gene Blocker, (1987). *Fundamentals of philosophy* (second edition), The Macmillan Publishing Company, a division of Macmillan, Inc.