UNIT 5 FUNDAMENTAL, APPLIED AND ACTION RESEARCH

Structure

5.0 OBJECTIVES

After reading this Unit you will know:

- the essentials of scientific methods of research;
- theory, terminology and working of the spiral of scientific method as proposed by S.R. Ranganathan;
- about the two main streams of research: basic and applied research;
- the definition, purpose and technique of action research;
- what is social (survey) research and what is its importance; and
- different approaches to some research methods, namely, descriptive, comparative, exploratory and diagnostic.

5.1 INTRODUCTION

This is a composite Unit to cover and explain different aspects and methods of research. These are some assorted topics not necessarily having any common thread running through them. Some methods, such as spiral of scientific method are purely theoretical while others such as action research come from other fields but have the possibility of their applications to library and information systems.

5.2 SCIENTIFIC METHOD

The term seems misleading as every objective and verifiable method to discover new knowledge is always scientific in nature. Any new knowledge is valid only if it is discovered by scientific method. Commonly it means the methods used by the (pure and applied) scientists in their research, laboratory work and writings. Essentially any method of objective research, which attempts to investigate cause-effect relations between two entities, is scientific one. Research methodology, if it does not use the scientific method is not research at all. It means the other methods of research namely, survey, descriptive, case study, historical and of course the experimental method, are essentially scientific methods. Methods of research in social sciences and humanities are also scientific. Commonsense but rational approach used by a layperson in solving day-to-day problems is research. This could be best-applied scientific method to life and society. That is why it is rightly said by a philosopher that every man is a scientist. A crime investigator getting clues from the crime sites coupled with circumstantial evidence can easily reach the criminals. So a systematically and rigorously organised objective method of observation and co-relation of cause-effect between two entities is a scientific method. It is a standardised procedure for generalisation of data to formulate theories or to solve a problem.

Steps in Scientific Method

- Identification and formulation of the problem based on preliminary observations or data; or by doing an exhaustive literature survey on a topic.
- Formation of hypothesis, which requires lot of imagination and fertility of mind. (If it is a status or descriptive research then there is no need of any hypothesis).
- Collection of data, information or verbal opinions by any means (described in survey research)
- Collation, tabulation and classification of data and drawing of inferences in light of the general theory.
- Generalisation of facts and testing of hypothesis, and formulation of a further theory.

Objectivity or verifiability of the data or method is the rule of the game. Everything is transparent and open to questioning. The aim is to discover or create new knowledge, or to correct the existing facts or theories; or to generate a theory of cause-effect relation between two variables. Research may also be undertaken to generate information for decision making or solving a local problem. It may be warned that on the surface research, which seems a mechanical and straight process, in reality is complex, complicated and confusing requiring lot of hard work and ingenuity.

5.3 S. R. RANGANATHAN'S SPIRAL OF SCIENTIFIC METHOD

To demonstrate that librarianship is a science S.R. Ranganathan (1892-1972) in the second edition of his classic *Five laws of library science* (1957) added a chapter entitled "Spiral of Scientific Method" to silence or convince the skeptics of the scientific nature of library science discipline. It is an overview and visual presentation of the method of science, which he says, moves like a spiral. That is it moves clockwise in a circle yet keeps moving onto new places. It means science is always progressive scaling new heights and discovering new knowledge. It accounts for the continuous growth of knowledge.

5.3.1 Structure of the Spiral

To show each sequential step and their movement the spiral is divided into four quadrants by two lines perpendicular to each other intersecting at the centre. This also results in four cardinal points.

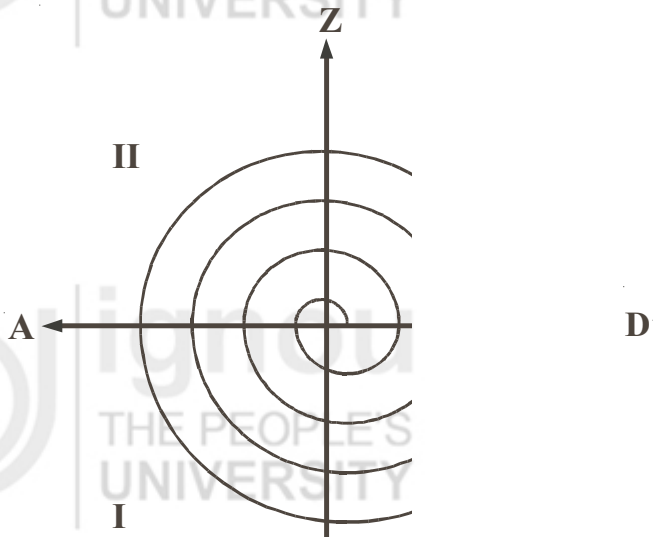

Fig. 5.1: Spiral of Scientific Method

- The spiral moves forward in clockwise direction.
- Lowest end of the vertical line is called nadir – literally means the lowest point.
- Upper end of the vertical line is called Zenith –the highest point.
- Left end of the horizontal line is called Ascendency i.e., going upwards.
- Right end of the horizontal line is called descendent – means going downwards.

Four sections thus formed by the interesting lines are called quadrants. First quadrant is on lower-left side (i.e. South-West). Moving clockwise this way the fourth quardrant is on the lower-right (i.e. South-East).

5.3.2 Working of the Spiral

At the nadir is the problem to be solved. In this first quadrant (called empirical phase) data is collected empirically and the problem may be refined further. Data may be collected by any means described in section 3.2 of the unit on descriptive research. In experimental method the data is collected by means of many meters, scopes and other instruments. Data may be qualitative or quantitative. In the second quadrant (called hypothesis phase) the data is collected, tabulated, classified and analysed. It is known as data processing. From the analysed data cause-effect inferences are drawn or state-of-the-art i.e. ground situation is assessed. Here hypothesis is drawn by using inductive logic and intuition. In the third quadrant (called deductive phase) laws are deduced with the help of deductive logic. The fourth quadrant is also known as the verification phase. Here the laws formulated in the third quadrant are tested and verified; and further some higher generalisation may be drawn. Statistical techniques may be used for verification and to support or disprove the hypothesis. Chart from Pandey S.K. Sharma is reproduced with certain modifications:

Table 5.1: Ranganathan's Spiral (Source: Sharma, 1990)

Quadrant	Span/Situation	Phase of Research	Method/Tool
I	N –A South-West	Empirical	Experience and ob servation/ literature survey
II	A-Z North-West	Hypothesizing	Intitution & Imagi nation
III	Z-D North-East	Deductive	Intellection/ Logic/ Statistics
IV	D-N South-East	Verification	Applications/ Math ematics

The spiral is not anyhow to do it method but a highly generalised and overview of the research process as observed from a distance. This mostly pertains to research in a major discipline rather than to any individual research problem. In actual practice there cannot be clear dividing lines, as the researcher has to run to and fro many times during the lengthy and mazy process. This however proves that scientific method is equally applicable to social problems. This is to say that scientific method is objective transparent, replicable to solve problems by discovering new information than any specific area of application. Any knowledge discovered by this procedure is scientific. Librarians have successfully applied this method to create library and information science as proved by Pierce Butler in 1930s.

5.4 TYPES OF RESEARCH

Traditionally on the basis of immediate purpose research is of three types:

- Basic Research
- Applied Research
- Action Research

5.4.1 Basic Research

This is also known as pure, fundamental or even theoretical research. It is research for knowledge sake; aim is new knowledge irrespective of any use at the moment of discovery. There may not be any immediate need or application of the new knowledge thus produced; nor it is conducted for any immediate gain or problem solving. It may be done out of curiosity, or to build a theory. Greatest research experiments and expeditions fall in this category of research. Why the man went to moon? In our field the five laws of library science by S. R. Ranganathan were formulated as a theoretical research. It is mostly conducted in academic and related research centres.

5.4.2 Applied Research

Research conducted to solve any immediate problem of theory or practice at hand is known as applied research. It is of practical nature. Example are "Action research" "Case Studies", "Clinical Research", "Research and Development", popularly known as R&D. Most of the research in industry, business, military and government departments is of applied or practical nature. For example,

- To design a system to record the receipt of periodicals and to automatically send reminders when due for more than a month.
- To diagnose the very low use of a certain collection in a library.
- To find solution to the decreasing space problems in libraries in 1960s.

Library and information management is a fertile field for applied research.

Pure versus Applied Research

Whatever be the motive or nature of research the demarcation between the two is superficial, illusory and temporary, if at all it is there. History of science shows that no fast line can be drawn between the two for a longer time. If knowledge is power as Francis Bacon (1561-1626) said long ago, then all knowledge is utilitarian. Both the basic and applied research employs the same methods and techniques.

Moreover experience has shown that only line between the two is of time. What today seems purely theoretical having no direct use (thus dubbed useless by some) may find many applications tomorrow. Look at the history of many discoveries and inventions. X-ray's discovery was accidental and had no use then; now its practical applications are in thousands in every walk of life. Telephone and movies were invented not out of any necessity but for curiosity, if not fun. Thomas Alva Edison could never have thought that invention of moving pictures will bring a revolution to influence the society, and a billion dollar film industry would be based on it. They are an integral part of our culture now. Even the most basic laws such as Newton's laws underpin all astronomical, aeronautical and space expeditions and research. Every research from laboratory ultimately reaches the industry later or sooner. At home we can say the same about the five laws of library science. In the words of Professor Pauline Atherton (Cochrane) these laws put knowledge to work. Every theory finds applications that is why it is paradoxically said that the theory is the most applied knowledge just as every action originates from the thinking in mind i.e. thought is the mother of all actions. Distinction is also hazy in the sense there is always an interaction and alteration of theory and practice. Many problems for theoretical research emerge from practical failures. Similarly a practical research may generate a new theory or modify the existing one. Whatever be its source knowledge is always utilitarian, ultimately.

Self Check Exercise

1) Define the features of scientific method of research.

2) Explain the movement of research enquiry in the spiral of scientific method.

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of the Unit.

.....

.....

.....

.....

5.4.3 Action Research

Developed in 1930s in education, action research is a form of interpretive research to study human actions and social practices with the participation of the researcher. It is an applied research, which is focused on immediate application, not to develop any theory for general applications. Emphasis is on a local problem, which involves the researcher and takes the librarian to jointly seek and find a solution to a library problem. For example, the problem could be as simple as "How to improve upon the existing

circulation of periodicals among the research scientists in the research institution." Its purpose for our field may be to improve library management and use; and ultimately to improve the skill of the librarian i.e. to change the ways to do things more effectively. It requires identification of practices that need change to meet the needs of the changing use pattern of libraries or meeting new demands of users and to take better decisions. Simply speaking it is common sense and good management, and not any genuine research.

It is applied research whose aim is to provide practical benefits to the client. The researcher is expected to do so methodologically, it is cyclic research to solve problems and generate new knowledge simultaneously. Majola J.H. Oosthaizen gives the following equation and diagram to show its nature:

Action research = Action + Research (knowledge generated). It is to bring out progressive and incremental improvement in practice as it goes through different cycle after cycle.

Characteristics: Action research is usually focussed on a single situation, say on a single library:

- It is carried out in a series of cycles one improving upon the previous.
- It is mostly reflective and audit like or evaluative.
- It is concerned with real practice to examine if the practice needs change.
- In each cycle a hypothesis is proposed, tested and next action is planned.
- Method is refined in each cycle by using different method of observation and interpretation.
- It involves many people such as informants, interpreters, planners, administrators and researchers – the list is not exhaustive. Therefore, it also requires communication skills and conflict management. Each cycle may use a different method. In such case the action research may take the following form:

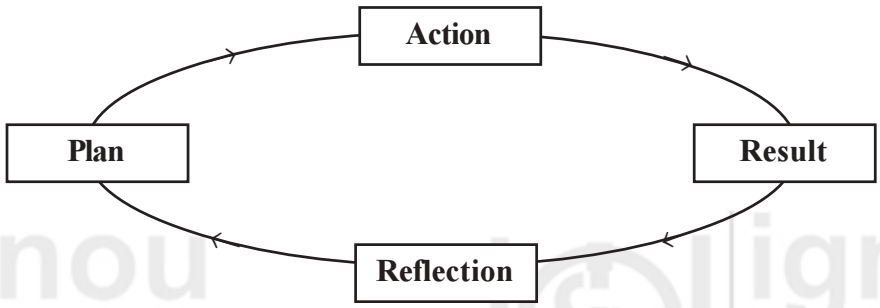

Fig. 5.1: The Cycle of Action Research

- It is like a heuristic method as the next action is based on the previous result. It is not any series of pre-planned methods as it happens in other types of research methods.

Techniques: Techniques used range from interviewing, Delphi, face to face dialogue, dialectics, evaluation and feedback analysis. It is a shared vision. To conclude, it is a methodology that is concerned with knowledge and improvement of human action to develop theory and solution in a cyclic manner based on practical experiences. There is no pre conceived plan or stable pattern as the next action emerges from the previous one.

Self Check Exercise

3) Define action research and the technique it employs.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

.....

.....

.....

.....

.....

.....

5.5 APPROACHES TO RESEARCH

Research approaches are research methods as distinguished from research techniques. Methods are: Descriptive, Comparative, Exploratory, Diagnostic, Experimental and Historical. These approaches to research are applicable in different situations depending upon the problem. In some cases a combination of two or more approaches may be used. In this section we will study the definition, nature techniques and application of these methods especially in library and information field.

5.5.1 Descriptive Research

It is a sort of survey research at a given time to study, understand and report the status of a current situation. In simple words it is concerned with answering the questions. What, Who, When and Where.

It is to collect data by simple or common sense techniques then collate and tabulate it. In a descriptive research hypothesis formation and testing may or may not be involved. In library science in India most of the research is of descriptive type, e.g.:

- A survey of reference service in children libraries in Tamil Nadu.
- A survey of the reading habits of housewives in Dakshin Karnataka.
- A survey of the information needs of geo-scientists in CSIR laboratories.

Its techniques are direct observation and measurement, or through a questionnaire, or interview. Its stages are:

1) Area of research is conceived broadly.
2) Literature research is done to know the work already done, problems being faced and to concisely formulate the problem.
3) What is to be surveyed is clearly demarcated.
4) Data is collected, collated, tabulated, and inferred.
5) Conclusion is drawn, and reporting is done.

The method is not as simple or straight as it looks.

5.5.2 Comparative Research

In essence it is another survey type of research describing two or more entities of the same nature, which are compared and contrasted in terms of certain predefined parameters. Motive may be to isolate best features and shortcomings of each entity under comparison.

The ultimate aim is to compare, contrast and design an idea, system or plan having the best available features after correcting the shortcoming of others. The comparison is mostly descriptive.

For comparison the two entities must belong to the same class. For example, we can make a comparative study of public libraries in two or more cities. Not much purpose will be served by comparing a public with an academic or industrial library. It will be absurd to compare classification with circulation.

Uses and Limitations: Comparative research is an applied research, which may lead to improvement of the existing systems under comparison, and may help create a model having best of both the worlds. Comparison leads to better understanding and acquaints you of different models and perspectives. In social life it helps to increase tolerance of other viewpoints or methods. Comparative religion has played a great role in social peace and harmony. In our field S.R. Ranganathan's classic Prolegomena to library classification (1967) makes a comparative study of some library classifications to propose an ideal theory of classification. Regarding limitations, it is often said that comparison are odious. Every entity exists in different environment, and its features may not work outside of that, no good drama could be created by comparing Bernard show with Shakespeare or for that reason even with Kalidas.

Self Check Exercise

4) Define comparative research and its uses in society.

Note: i) Write your answer in the space given below.

ii) Check your answer with the answers given at the end of the Unit.

.....

.....

.....

.....

5.5.3 Exploratory Research

Research cannot be done in one go as a single piece. Before a project is undertaken finally, it is always wise to explore the possibility of its successful conclusion. In many cases an idea or problem may initially strike as very interesting to pursue. But soon after starting, the researcher may feel struck due to many reasons as mentioned below:

- dearth of literature and other guiding sources;
- lack of data; and
- serious problem in quantifying or measuring data.

In such situations the researcher simply gropes in the dark. Formally or informally viability of the problem first conceived has to be explored. Exploration may be mental, silent or visible. It is matter of commonsense otherwise researcher may be plunging in the dark, and running the risk of wasting time and money. It is a safeguard against the future failure and frustration.

Before the use of scientific method it is essential to make an exploratory study of the situation. At this stage the researcher has absolute freedom to run his imagination wild, unchecked and move seemingly aimlessly. It is then to follow some seemingly gainful leads exercising ingenuity and some concrete evidence of leading the exploratory research

to some fruitful and tangible conclusion. Indeed, the researcher has to be very judicious. Apart from checking the viability, exploratory research provides more ideas, and alternative techniques. At that stage the problem may be modified. It thus helps to make the problem more concrete, concise and formally worded to finalise and proceed to the real investigation. That is why it is also known as formulative studies. It is to pave the way, see what is there than to predict. A research investigation is a constant process of reformation and alteration, a sort of heuristic approach, till one arrives at some problem for pursuit.

Steps

It should undergo the following steps:

1) Preliminary review of literature;
2) Consulting colleagues and experts to make use of their experience and wisdom;
3) Let the problem brew or mature in mind for sometime;
4) Make some rudimentary studies by survey or experimental method and identify the variables;
5) Cultivate only insights into the hypotheses; do not test them or prove them; and
6) Delimit the area, if required.

Such steps may help researchers to follow and discard many ideas and problems which may not materialise in the long run. Negative power is a forceful aid to lead researchers to the right problem. It is important to consider that it is an initial step in a long and tedious research process. Exploratory research is simply to untangle and pave the way; or to map the way for future safe and uninterrupted travel to reach the destination without going astray or stumbling at roadblocks.

5.5.4 Diagnostic Research

It is a fact-finding aspect of clinical practice. It represents the most typical and simple problem solving strategy. Its method includes screening to attain insights into the problem. It consists of the following phases:

- Emergence and identification of the problem;
- Diagnosis of its roots and causes;
- Formulation of possible ways to treat the problem; and
- Suggesting a possible solution.

Data Collection: Diagnosis can yield data in four major ways:

1) Case history or interviews;
2) Clinical observation;
3) Informal testing; and
4) Formal standardised testing.

Case study/Interview: Here the purpose is to understand the life cycle of an individual with focus on the problem and other life events that have influenced not only the individual but the whole family and previous generation. The unit of study may be a person, family, commune or an institution. Adequate data is required for clarifying, sorting and resolving controversial issues.

It requires a skillful but sensitive interview to elicit maximum data without offending the client.

Clinical Observation: It is observation of behavior by formal or informal methods. Diagnostic tests provide a microscopic view of the component of some areas of performance. Collected data is employed for causal thinking. By manipulating causes we can vary dependent variables. This method is mostly applied in psychology and other behavioural sciences. In library science it can be used to study the reading habits, bibliotherapy, and user behaviour in the library.

5.5.5 Social Research

Social research or surveys are a kind of assessment and evaluation studies to gather data from a large number of cases at a particular time. It is not concerned with individuals as individual but as a part of a large whole. It is cross-sectional. Each statement in the survey portrays a prevailing condition at a given time. These are large or wholesale in nature; huge and vast in size. Purpose is to discover occurrence, distribution and interrelationships of sociological, economic or attitudinal variables in a large segment of population. The scope of surveys can be widened to include economic, religious, anthropological or habitual; or to study the distribution of economic activities. In analysing political, social or economic or consumer preferences or attitudes data is to draw a picture of the conditions prevailing or emerging at that time. It requires expert and careful planning, accurate analysis and imaginative interpretation of the huge mass of data.

Social survey has been made since the beginning of the last century. For example, Alfred Kinsey made two separate but comprehensive surveys of American male and female sexual behaviour of 12,000 respondents each time. These two reports are still considered classic surveys.

These surveys have now been extended to what are called opinion and exit polls to predict the results of general elections. In many cases these surveys make remarkably accurate prediction of the results. These have now also been extended to market and consumer surveys. Business houses now make a survey of consumer preferences regarding particular consumer goods before producing and launching them in the market. Such a type of research has contributed significantly in understanding social attitudes, preferences, traits opinions and composition of a community.

There is no reason these surveys cannot be extended to library surveys. Librarians conduct (social) surveys of the information needs of a particular professional segment of society. These include large-scale survey of libraries, their collection, client services, and technical procedures.

Reading habits of people are a joint field for surveys by librarians, educationist, and literacy experts.

Method

Social research can be conducted by personal interviews, door-to-door surveys, and oral opinions or by mailed (electronic or postal) questionnaires. These are quite extensive and expensive. Even a small error in sampling may lead to wrong results thus making a negative impact. These require astute planning careful conducting, accurate processing and imaginative interpretations. For this purpose, apart from the researchers you need a very informed and aware population of respondents who understand the question

and their responsibility for correct answer.

Self Check Exercise

5) Write brief notes on Diagnostic method of Research.

6) What are social surveys; how these can be applied to library studies?

Note: i) Write your answers in the space given below.

ii) Check your answers with the answers given at the end of the Unit.

.....

.....

.....

.....

.....

.....

5.6 SUMMARY

In this unit we studied that scientific method is any objective, transparent and repeatable method to discover new knowledge. Every research is essentially scientific. S.R. Ranganathan's spiral of scientific method is a visual picture of the four phases of research, namely, Empirical (data collection) Hypothesising (Inductive logic), Deductive (Deduction of laws) and Verification (Testing of results). Basic research is to discover laws or for simply new addition to knowledge. Applied research is for immediate problem solving. But ultimately distinction is temporary and not real. Every pure or basic research after some time becomes practical. And quite often some theory or laws emerge from practical or applied research. Action research is a sort of applied research to improve prevailing practices. It is conducted jointly by the researcher and the practitioner. Descriptive research is a survey and spatial description of an entity or situation. Comparative method is again descriptive of two or more entities of similar nature to discover their similarities and differences. Aim may be to produce a model. Exploratory research is a preliminary or rudimentary work to gauge and study the viability and pre-test the successful conclusion of research. Diagnostic research is mostly of clinical nature to find facts and to know the root causes of a problem. Social research means longitudinal surveys of a large social segment to study conditions, habits, preferences, attitudes and opinions. Social research can contribute significantly in planning and policy making. It is also useful for market surveys and opinion polls.

5.7 ANSWERS TO SELF CHECK EXERCISES

1) Scientific method of research is basic to any research. It implies that research follows a systematic and organised approach to conducting research. Data collection is done to establish relations between variables and explain the cause and effect relation. It is further generalised to develop theories.

2) The Spiral of Scientific method is divided into four quadrants. The lowest point is called nadir where lies the problem to be solved. In the first quadrant, data collection is done followed by classification, tabulation and analysis of data in the second quadrant. The cause- effect relations are established in the second quadrant and hypotheses are drawn using inductive logic. In the third quadrant deductive logic is

used to formulate laws. These laws are verified in the fourth quadrant and further generalizations are done.

3) Action research is applied research done to immediately improve upon an existing situation. Mathematically stated, action research = action + research (knowledge generated). It is useful for libraries where research needs to be done to improve upon the existing services for the benefit of users.

4) Comparative research is a survey research comparing two entities, phenomena, or processes with a view two design and provides a new one having the best features of the two compared. In social life, it helps to create an understanding of different viewpoints. Comparative religion is one of the examples that have helped to create an understanding and respect towards different religions.

5) Diagnostic research is a problem solving study involving pinpointing the reasons for the problem and suggesting solutions for the same. The steps involved in it are:

   1) Emergence and identification of the problem.
   2) Diagnosis of its roots and causes.
   3) Formulation of possible ways to treat the problem.
   4) Suggesting a possible solution.

6) Social surveys are descriptive cross- sectional studies done to know the present status of the different aspects of the society. These may cover sociological, economic, political, religious, anthropological, or attitudinal aspects. These may be done in libraries also to present, and evaluate the status of libraries. It may be with regard to the collection, services, staff, or users, etc.

5.8 KEYWORDS

Action Research : A type of practical and collaborative research to improve a method of practice.

Applied Research : Distinguished from basic or pure research, any research undertaken to solve immediate or practical problems.

Basic Research : Distinguished from applied research, any research undertaken purely for sake of knowledge without any immediate gain or use.

Comparative Research : A type of descriptive research to compare two or more similar entities to highlight similarities and differences. Ultimate utility may be to prepare a model with best features.

Data Processing : The act of collating, tabulating, classifying and drawing inferences from the gathered data.

Descriptive Research : A spatial survey of an entity or a family of entities to study the existing status and state-of-the art.

Diagnostic Research : A type of clinical method to investigate the root causes of a problem.

Exploratory Research : A rudimentary or preliminary work to study the viability of the research problem for its successful

completion and useful results.

Nadir : The lowest point on the spiral of scientific method where the problem for research is identified and formally formulated.

Quadrant : One of the four equal sectors or areas into which the spiral of scientific method is divided. There are in all four quadrants produced by two intersecting lines drawn through the centre of the spiral. In each quardrant an important phase of research is completed.

Scientific Method : Any objective, transparent and repeatable method based on direct and systematic observation of phenomena to study cause-effect relation between two or more variables.

Social Research : Large scale social surveys from a large number of cases to discover the distribution and interrelationships of social and attitudinal variables.

Spiral of Scientific Method : A visual path of the research process through its various phases starting from data collection to formulation of theory.

Zenith : Highest point in the spiral of scientific method.

5.9 REFERENCES AND FURTHER READING

Best, John W. (1978). *Research in Education, 3rd ed.* New Delhi: Prentice-Hall of India. Pp.119-121.

Krishan Kumar (1992). *Research Methods in Library and Information Science*. New Delhi: Vikas. Pp. 90-105.

Kumar, P.S.G. (2004). *Research Methods and Statistical Techniques.* Delhi: B.R. Publishing. Pp. 243-249.

Sharma, Pandey S.K. (1990). *Universe of Knowledge and Research Methodology.* Delhi: Ken Publications. Pp.109-121.

Williamson, Kirsty. (2000). *Research Methods for Students and Professionals: Information Management and Systems*. Wagga Wagga, NSW, (Australia): Charles Sturt University. Pp.141-158.