

M.SC CHEMISTRY-II

SEMESTER-III

RESEARCH METHODOLOGY (ELETIVE)

UNIT-1

INTRODUCTION

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Scientific Research Methodology

UNIT-I: INTRODUCTION

Research is a process by which one acquires dependable and useful information about a phenomenon or a process. It may be broadly defined “as a systematic inquiry towards understanding a complex social phenomenon or a process”. It follows the scientific approach to gain knowledge. Research is a special endeavour, which involves systematic and critical investigation towards increasing the stream of knowledge. Research is the systematic process of collecting and analysing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested.

The objectives are:

(i) Formulative Research

When the idea of research aims to gain familiarity with a phenomenon or to acquire new insight into it, in order to formulate a more precise problem or to develop a hypothesis, exploratory is formulative research. It is also known as exploratory research. The main theme of this objective is the discovery of ideas and insights. The survey of concerning literature gives the problem research in formulating research

(ii) Descriptive Research

Descriptive research studies are those studies which are concerned with describing the characteristics of a particular experiment to be carried out. This portrays accurately the characteristics conditions of the experiment. It can answer what, when, where, when and how questions, but not why questions. A descriptive research design can use a wide variety of research methods to investigate one or more variables.

(iii) Diagnostic Research

To determine the frequency with which experiment occurs is diagnostic research. The diagnostic research focuses on estimating the sensitivity and specificity of individual diagnostic tests, their predictive values, and other parameters of interest

(iv) Hypothesis-Testing Research.

To test a hypothesis of a causal relationship between variables is been implemented. Hypothesis testing is used to assess the intensity of a hypothesis by using sample data. The test provides evidence concerning the possibility of the hypothesis, given in the data.

Principles of research are

- (i) It relies on empirical evidence.
- (ii) It utilizes relevant concepts.
- (iii) It is committed to only objective considerations.
- (iv) It presupposes ethical neutrality.
- (v) It results into probabilistic predictions.
- (vi) The methodology is made known.
- (vii) Aims at formulating scientific theories.
- (viii) To develop critical and creative thinking skills
- (ix) Purpose clearly defined.

Problems of research

1. Uncontrollable variables

2. Human tendencies
3. Time and money
4. Lack of computerization
5. Lack of scientific training in the methodology of research
6. Insufficient interaction between university research departments and business establishments
7. Lack of confidence on the part of business units to give information
8. Lack of code of conduct
9. Difficulty of adequate and timely secretarial assistance
10. Poor library management and functioning
11. Difficulty of timely availability of published data.
12. Ignorance
13. Research for the sake of research-limited practical utility though they may use high sounding business jargon.

Selection of research problem

A. Internal Criteria.

1. Interest is considered the most important of the factors which guide the formulation of a research problem. As research processes oftentimes require a lot of hard work and are usually time-consuming, it helps if the researcher chooses a topic which interests and challenges him/her. Otherwise it might become difficult for the researcher to develop and

sustain necessary levels of perseverance and motivation. Interest in a problem is often driven by the researcher's educational background, experience, outlook and sensitivity

2. Expertise.

This refers to the competence of the researcher to design and undertake research enterprise (including data acquisition, data analysis, etc.). Mere interest in a problem is not enough. A researcher must have expertise (or be competent) to plan and carry out a study of the problem. He/she must possess adequate knowledge of the subject-matter, relevant methodology and statistical procedures.

3. Researcher's own resource:

In the case of researcher-funded research, consideration of researcher's own financial capacity is quite pertinent. If it is beyond researcher's financial capability, researcher may not be able to complete research work, except he/she gets supported financially. Time as a resource is more important than finance. Research is a time consuming process; hence the ability to allocate sufficient time to a given research should be properly considered when formulating the problem.

4. Data availability:

If the research title needs collection of information (journal, reports, proceedings) before finalising the title, it is important to ensure that these are materials available and in the relevant format.

5. Relevance:

It is important to always choose a topic that suits one's interest and profession. It is necessary to ensure that one's study adds to the existing body of knowledge. Of course, this will help to sustain interest throughout the research period.

6. Ethics:

In formulating the research problem, one should consider some ethical issues as well. Sometimes, during the research period, the study population might be adversely affected by some questions. In ICT, some scenarios might occur especially research related information security, which might concern certain authorities. Therefore, it is always good to identify ethics-related issues during the research problem formulation itself.

7. Researchability of the problem:

The problem should be researchable, i.e., amenable for finding answers to the questions involved in it through the scientific method.

8. Novelty of the problem:

The problem must have novelty. There is no use of wasting one's time and energy on a problem already studied thoroughly by others.

9. Importance and urgency:

Problems requiring investigation are unlimited, but available research efforts are very much limited.

10. Facilities:

Research requires certain facilities such, as well equipped library facility, suitable and competent guidance, data analysis facility, etc. Hence the availability of the facilities relevant

to the problem must be considered. Problems for research, their relative importance and significance should be considered.

11. Feasibility:

A problem may be a new one and also important, but if research on it is not feasible, it cannot be selected.

12. Usefulness and social relevance:

The study of the problem should make a significant contribution to the concerned body of knowledge or to the solution of some significant practical problem. It should be socially relevant.

13. Research personnel:

Research undertaken by professors and by research organizations require the services of investigators and research officers. But in developing countries, research has not yet become a prospective profession. Hence talented persons are not attracted to research projects.

The selection of a research problem is based on the key criteria of: (1) interest; (2) expertise; (3) data availability; (4) relevance and; (5) ethics.

Survey of scientific literature

The general purposes of the review are to:

1. Help you define and limit the problem you are working on
2. Help you place your study in an historical perspective
3. Help you avoid unnecessary duplication

4. Help you evaluate promising research methods

5. Help you relate your findings to previous knowledge and suggest further research.

A literature review or survey is an organised write up showing previous work done concerning a research topic or question in your field. The aim of a literature review is to show your reader (e.g. your supervisor) that you have read and that you have a good grasp of the main published work concerning a particular topic or question in your field. This work may be in any format, including online sources. It may be a separate assignment, or one of the introductory sections of a report, dissertation or thesis. In the latter cases in particular, the review will be guided by your research objective or by the issue or thesis you are arguing and will provide the framework for your further work.

It is very important to note that your review should not be simply a description of what others have published in the form of a set of summaries, but should take the form of a critical discussion, showing insight and an awareness of differing arguments, theories and approaches. It should be a synthesis and analysis of the relevant published work, linked at all times to your own purpose and rationale.

Primary sources are original works like research, paintings, plays, interviews, statistical tables, diaries, letters, etc. The author is the writer/creator of the original work. Most disciplines publish their original research in journal articles. These articles are considered primary sources.

Secondary sources are critiques, descriptions or reviews of original works. This includes critiques of play, review articles that discuss somebody else's original research, etc. Secondary sources are written by someone other than the author of the original work.

Primary Sources	Secondary Source
Archives	Criticism and Interpretion
Conference Papers	Dictionaries
Correspondence	Directories
Dissertations	Encyclopedias
Diaries	Government Policy
Interviews	Guide to Literature
Lab Notebooks	Handbooks
Notes	Law & Legislation
Patents	Monographs
Proceedings	Moral & Ethical Aspects
Studies or Surveys	Political Aspects
Technical Reports	Reviews
Theses	Social Policy
	Tables

Citation Index

Selective Coverage

SCI does not attempt to cover all publications in the sciences. Its coverage is limited to about 3600 journals, plus some books and conference proceedings.

Journals are selected based on citation statistics — “impact factor.”

This approach indexes the most important journals, but can leave gaps, especially in new areas of research.

Automated Indexing

ISI has automated its indexing process to a large extent. This speeds up processing of documents, but limits its depth.

SCI contains no subject indexing as such, though some electronic forms add author and keywords for greater subject access.

Citation Searching

Eugene Garfield took the concept of citation searching from legal literature and applied it to the sciences.

If Paper A cites Paper B, then it shares some subject matter with Paper B.

It allows you to trace research forward from a given paper.

It avoids the limitations of subject terms.

Source Index

1. Author names are listed by last name and initials ONLY. This can cause confusion with common last names.
2. Handling of compound names and names transliterated from other alphabets is not always consistent.
3. Journal names are highly abbreviated, using ISI's own abbreviations.
4. The Source Index also includes a Corporate Index, listing articles by the company or institution at which they were produced.
5. The primary index is geographic, arranged by state or country, then city, then institution.
6. The Corporate Name index refers you to the city of the institution so you can cross back to the Geographic Index.
7. Corporate indexing can be haphazard.
8. SCI's subject index indexes only words from the title of the article.
9. If a given term appears in several documents, then co-terms from the titles are listed below to subdivide the main heading. Very common or uninformative terms may not appear as primary terms, but may be used as co-terms.

Terms which frequently go together may be listed as a hyphenated phrase, e.g. amino-acid or magnetic-resonance.

Citation Index

Cited articles are listed by the name of the first author only. Then, beneath that, by year, then cited journal, volume and page. Multiple articles citing the same paper are listed

alphabetically by author's name. Minimal info is given, for citing article title, go to the Source Index.

“In press” publications appear before specific cited papers.

“Anonymous” publications are grouped together.

Patent

A patent is the granting of a property right by a sovereign authority to an inventor. A patent provides the inventor exclusive rights to the patented process, design, or invention for a certain period in exchange for a complete disclosure of the invention.

Patents play an important role in the chemical enterprise, both as a means for protecting the fruits of research and development from unauthorized use by competitors and as a major component of the chemical literature.

To be patentable an invention must be, among other things, new, innovative, better or cheaper or different to anything that has been done before. You should search to ensure that your idea has never been done before. This is referred to as 'prior art or novelty searching.