1. Articles in Magazine, Newspapers, Journals etc.

a. Single author

Citation: Name of the author, Year of publication.

Eg.: Kurian, 2005

In Bibliography:

Surname, Initials. Year. Title of the article. *Name of the Paper/Magazine*. Issue details.

Eg.:

Kurian, P. 2005. Pani varunna Kaalam (Mal.). *Malayala Manoarama Daily*. 2005 March 3.

b. Two author

Citation: Name of the first author and Name of the second author, Year of Publication

Eg.: Thomas and Mathew, 2005.

In Bibliography:

Surname of the first author, initials. and surname of the second author, initials. Year. Title of the article. *Name of the Magazine*. Year and Month of the issue. Page Numbers.

Eg.:

Thomas, K. and Mathew, V. K. 2005. Drought and Dam: A story from Narmada. *The Hindu Survey on Environment*, *2005*. Pp. 34-40.

2.Books

a.Single author book

Citation: Name of the author, Year of publication.

Eg.: Induchoodan, 1996.

In Bibliography:

Surname, Initials. Year. (Edition). *Title of the Book*. Name of the Publisher, and address (Only place).

Eg.:

Induchoodan, 1996. (3rd edn.). *Keralathile Pakshikal* (Mal.). Kerala Sahithya Acdemi, Thrissur.

b. Two author

Citation: Name of the first author and Name of the second author, Year of Publication

Eg.: Collins and Lappierre, 1986.

Introduction

Investigatory Projects are an integral part of present day curriculum. It provides an opportunity for a student to explore a topic in greater depth. A practical study involving powers of observation and experimentation will lead to the development of student's scientific skills. He or she may even discover previously unknown facts and put forward new theories.

What is a student project?

Project is a task set as an educational exercise which requires students to do their own ***research*** and present the results.

The word *'research'* is formed of *'re'* and *'search'*, which means *search again*, or *to search for new facts* or *to modify older ones* in any branch of knowledge. As per dictionary meaning it is a careful critical inquiry into subject to discover facts or principles by persistent investigation. In short, it is an organized inquiry in search for facts.

Hence research constitutes a method for the discovery of truth and the creation of new knowledge.

Scientific Method

The term *'Scientific Method"* denotes the principles that guide research and experimentation processes, and also the philosophic bases of those principles. The Scientific method is based on such concepts as *objectivity of approach* to and *acceptability of the results* of scientific study. Objectivity indicates the attempt to observe things as they are, without falsifying observations to accord with some preconceived worldview. Acceptability is judged in terms of the degree to which observations and experimentations can be reproduced.

Steps of Scientific Method

Whatever the aim of their work, scientists use the same underlying steps to organize their research:

1. They make detailed observations about objects or processes, either as they occur in nature or as they take place during experiments;
2. They collect and analyze the information observed; and
3. They formulate a hypothesis that explains the behavior of the phenomena observed.

2. Limiting the Problem

This is the process of shaping the study in relation to the selcted topic. The researcher should find answers on *what, how, why, when,* and *where* questions on the problem. This can be done through fixing the ***aim*** and ***objectives*** of the project.

Aim: Broad purpose, most probably indirect implication, that proposed through the project.

Objectives: Specific targets identified for the study through the projects.

3. Searching Resources (Review of Literature)

Before initiating the processes of a project the investigator should make an attempt to collect all available information regarding the selected topic. This will help the investigator to get a clear idea on the *basics of the topic, various types of studies* and *topic of related researches going on, methods used by other researchers* and it makes the *background of the present study*.

Review can be done with books, journals, standard magazines, news papers etc. Electronic documents in CDs or available on internet also can be used.

All references should be cited properly in the relevant part in ***'review of literature'***. While you reading note down the following details in this regard:

The name of the author/s, year of publication, Title of the Book and address of publishers should be noted in the case of books.

For journals note the name of author/s, title of the article, journal/ magazine/ newspaper name, volume, issue number and year of publication.

4.Selection of Methods

Selection of suitable method is an important task. Methods should be *objective* (logically sound) and can be *reproduced* (acceptability). Decide first whether the study would involve field study or lab study or both.

Sampling

Sampling is the simple and easiest way of experimentation especially for a student project. *Sampling* is a method of research in which researchers collect data from *a small portion* (*sample*) of the whole in the expectation and hope that what is found in that portion applies equally to the rest of *the population* (*the whole*). It is not good enough, *though*, to assume that findings for the sample will be replicated in the rest of the population. Hence one should take extreme care in selecting samples. There are a variety of techniques for sampling such as random sampling, systematic sampling, convenience sampling, voluntary sampling, purposive sampling *etc*.

Field studies

Select the suitable mode of study. If the study includes a survey using structured questionnaire or interview consider the following aspects:

The **survey** should cover adequate sample size, not less than fifty. The questionnaire should contain apt, well-designed questions and a minimum of twenty questions is essential to cover a topic. Special care should be taken to record the full name and address of interviewer in each sheet. The day, date and time of the interview, locale, and a brief description of the situation are also essential information.

Field Observations

The study area and study period should be fixed before beginning observations. In most cases the optimum size of the study area is 1-2 acres. If it is related to houses or buildings select 10-20 houses according to your convenience. For compa rison studies always select equal number of samples.

Meticulous planning is an unavoidable step in the conduct of any field observation studies. Proper recording of data is also essential. Data should be collected in a fixed frequency and regularity. The date, time, place and other features of special interest should be noted. In case of observation of time factor (of a person spend in a queue) or number of visits (of a bird to a tree) keep vigilant on accuracy.

Field Experiments

Sometimes small experiments are required in the field in order to collect data. In such cases make a list of equipments/ instruments required, time schedule of experiments and frequency of measurements.

Laboratory Studies

The experiments which would be conducted in a laboratory should be designed properly. The requirements (chemicals, equipments, and other items) should be prepared in advance. Plan a work schedule with fixed time period. Depending on the methods selected the work schedule and expense will vary.

5. Designing the study

After selection of methods, before carrying out experiments and other data collection procedures, the whole processes should be planned with a fixed time schedule. This time wise programme schedule is termed as ***"Protocol".***

A 200-page book should be kept as ***"Log book"*** to note down and record everyday events and programmes. It is just like a 'personal diary' which records all events with respect to the project including even conversations or feelings. However, the data collected should be recorded in another book. Teacher guides should sign the log book after checking the entries, twice in a week.

A suggested Protocol for a Minor Project

Study Period: One month

Day 1.	Topic identification *(background discussions and reading are necessary)*
Day 3.	Setting aim and objectives *(after preliminary readings on the topic, and discussing with teacher guide and others)*
Day 4.	Prepare work schedule. Collection of required materials for conducting experiments.
Day 6.	Reading : to prepare 'Review of literature". *(This should be done simultaneously with other activities; You should find time to visit other libraries or browse on net or to meet an expert).*
Day 10.	Starting of Experiments. *(If possible both field and lab simultaneously).*
Day 12.	Submission of first draft of review of literature to the teacher guide.
Day 18.	Submission of final draft of Review of literature.
Day 20.	Completing experiments.
Day 21.	Data tabulation and analysis.
Day 22.	Completing statistical analysis.
Day 24.	Writing methodology, discussion, and introduction.
Day 25.	Finalsing conclusion. Preparation of graphs, charts, photo plates etc.
Day 26.	Senting matter for DTP *(typing and lay-out)*
Day 28.	Correcting first proof.
Day 29.	Correcting final proof. Arranging in the proper order.
Day 30.	Binding and submitting for approval.

Note: This is a general outline. Depending on the topic and selected methods schedule may change. Programmes like photography should be done as and when required.

the analysis of numerical data, and ***probability***, which calculates the likelihood that any particular event will occur.

4. Formulating a Hypothesis

Once an experiment has been carried out and data collected and analyzed, scientists look for whatever pattern their results produce and try to formulate a hypothesis that explains all the facts observed in an experiment. In developing a hypothesis, scientists employ *methods of induction* to generalize from the experiment's results to predict future outcomes, and *deduction* to infer new facts from experimental results.

Formulating a hypothesis may be difficult for scientists because there may not be enough information provided by a single experiment, or the experiment's conclusion may not fit old theories. Sometimes scientists do not have any prior idea of a hypothesis before they start their investigations, but often scientists start out with a working hypothesis that will be proved or disproved by the results of the experiment.

If a hypothesis is borne out by repeated experiments, it becomes a ***theory***— an explanation that seems to consistently fit with the facts.

Student Project-Steps

1.Identification of a topic (Problem)

The identification of a topic for the study is the first task. The topic of the research project is usually termed as ***'Problem"*** or ***'Research Problem'***.

Consider the following questions in the selection of a topic:

- How much choice you have
- Your motivation
- Regulations and Expectations
- Your subject of interest or field of study
- Previous examples of research project
- The size of your topic
- The time you have available
- The cost of research
- The resources you have available
- Your need of support
- Access issues
- Methods of researching

The problem should be selected on the basis of your own answer to these questions.

1.Making Observation

A scientist begins an investigation by observing an object or an activity. *Observation* typically involves one or more of the human senses—hearing, sight, smell, taste, and touch.

Scientists typically use tools to aid in their observations. For example, a microscope helps view objects too small to be seen with the unaided human eye, while a telescope views objects too far away to be seen by the unaided eye. Thorough observation leads to the identification of the ***'Problem'***.

2. Conducting Experiments

Scientists typically apply their observation skills to an experiment. An ***experiment*** is any kind of trial that enables scientists to control and change at will the conditions under which events occur. It can be something *extremely simple*, such as heating a solid to see when it melts, or *something highly complex*, such as bouncing a radio signal off the surface of a distant planet. Scientists typically repeat experiments, sometimes many times, in order to be sure that the results were not affected by unforeseen factors.

Most experiments involve real objects in the physical world, such as electric circuits, chemical compounds, or living organisms. However, with the rapid progress in electronics, computer simulations can now carry out some experiments instead. If they are carefully constructed, these simulations or models can accurately predict how real objects will behave.

3. Data Collection and analysis

During an experiment, scientists typically make measurements and collect results as they work. This information, known as ***data***, can take many forms. *Data* may be a set of numbers, such as daily measurements of the temperature in a particular location or a description of side effects in an animal that has been given an experimental drug. Scientists typically use computers to arrange data in ways that make the information easier to understand and analyze.

Data may be arranged into a ***diagram*** such as a graph that shows how one quantity (body temperature, for instance) varies in relation to another quantity (days since starting a drug treatment). A scientist flying in a helicopter may collect information about the location of a migrating herd of elephants in Africa during different seasons of a year. The data collected may be in the form of geographic coordinates that can be plotted on a map to provide the position of the elephant herd at any given time during a year.

Scientists use ***mathematics*** to analyze the data and help them interpret their results. The types of mathematics used include ***statistics*****,** which is

Report Format

The preparation of the final report is equally important to the experimentation and analysis part. The final report of a scientific investigation especially done for an academic purpose is usually termed as **thesis** or **dissertation**. Dissertation is a long essay on a particular subject, especially one written for a doctorate or similar degree or any acdemic programme. *Thesis* (Statement or theory put forward and supported by arguments) is the term for *dissertation* in Arabic dialects.

A suggested format for student projects is given below:

I. The preliminary Sections (Front matter)
- a. Title page
- b. Certificate by the Supervising Teacher
- c. Declaration by the student
- d. Acknowledgement
- e. Table of contents
- f. List of figures (If more than one figures)
- g. List of Appendices (If more than one Appendix)

II. Abstract

III. Main body
1. Introduction
2. Review of Literature
3. Methodology
4. Results and Observation
5. Discussion
6. Conclusion and Recommendations

IV. References / Bibliography

V. Appendix

I M R A D — **The Scientific organisation of a paper (thesis)**

Guidelines for Reference / Citation

The source of references can be given in the text as citation and full details should be given in the Bibliography at the end of the thesis. The citation with text usually contains the surname of the author/s and the year of the publication. Different patterns of citation and referencing is given in the next page:

⇨

Student Projects

A PRACTICAL GUIDE

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2005 June

In Bibliography:

Surname of the first author, initials. and surname of the second author, initials. Year. *Title of the Book.* Name and address of the Publisher..

Eg.:

Collins, L. and Lappierre, D. 1986. *Freedom at Midnight*. Orient Longman.

c. More than two author

Citation: Name of the first author *et al*., year.

(*et al*., = *and his co-workers* or *simply so on*)

Eg. Green *et al*., 1996.

In Bibliography:

Surname of the first author, Initials., Surname of the second author, Initials., Surname of the third author, initials., and surname of the fourth author, initials. Year. (Edition). *Name of the Book.* Publishers Name and place.

(Names of all authors (even if it seven or above!) should be given)

Eg.:

Green, N.P.O., Stout, G.W., and Taylor, D.J. 1996. (2nd Edn). *Biological Science*. Cambridge Low Price Edition.

d. Edited Book

Citation: Name of the author of the chapter, Year of Publication of the book

Eg.: Thomas, 1997.

In Bibliography:

Surname of the author, Year of Publication of the book. (edn.). Title of the Chapter. In:surname of the Editor (Ed.). Title of the Book. Name and addres of the Publishers.

Eg.:

Thomas, S. 1997. Global Environmental Issues. In: Kurian, P. (Ed.). *Environmental Science.* Fresh leaf Publications, Kottayam.

Note: Name of books and Journals should be italicised while printing and underline when you are writing.

For further Reading:

Hawkins, C. and Sorgi, M. 1987. *Research:How to plan, Speak, and Write about it.* Narosa Publishing House, Delhi.

Madhavappanicker, P.R. Sastram Pravarthanamanu: Kuttikalkku Project Cheyyuvanoru Sahayi (Mal.). Kerala Sastra Sahithya Parishad, Thruvananthapuram.

VanCleave, J. 1995. *A+ Projects in Biology: winning Experiments for Science Fairs ans Extra Credit.* Pustak Mahal, Bombay.

(This is a series of books available on all subjects)

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Student Projects

A PRACTICAL GUIDE

**Guidelines on Student Projects
for Schools and Colleges**

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