**Topics:**

* Introduction to Research and Scientific Writing
* Research Process

**What is Research?**

 Research is a methodical investigation into a subject in order to discover facts, to establish or revise a theory, or to develop a plan of action based on the facts discovered. It involves a purposive, organized, and planned program of activities that result in the acquisition of new knowledge.

 It is a repetitive search for something previously unknown. It is a never-ending attempt to discover the truth (*H. Caintic et al, 2008*).

**Aims of Research**

1. **Generating new knowledge or information**

The new knowledge or information that researchers obtain in various disciplines contributes to the growth of science. The great amount of information we have today is a product of research conducted all these years.

1. **Finding an application for the new knowledge**

Applications of knowledge also constitute new information.

1. **Verifying existing knowledge**

Researchers are also conducted using more advanced detection and measuring devises to verify previous facts or findings. Scientific principles become verified with time.

1. **Developing the investigator.**

When a person conducts a research, his independent study provides an opportunity for creativity and for making original contributions to scientific knowledge. The researcher may have the chance to review concepts, learn more laboratory techniques, master a particular area of discipline, and appreciate what it means to be a scientist.

**Types of Research**

 The types of research are determined by the aims of the researcher. When a research is conducted solely to come up with new knowledge or to have a fuller understanding of particular subject for its own sake, then it is classified as ***basic research***. However, if the research is done to find an application of the knowledge whether new or old, it is classified as ***applied research***.

**Experimental Research v.s. Descriptive Research**

 Descriptive research describes the state of affairs as it prevails at the time of study (e.g. historical research and taxonomic study).

 Experimental research, in its simplest form, involves comparing two groups on one outcome measure to test some hypothesis regarding causation. For example, if a researcher is interested in the effects of a new medication on headaches, the researcher would randomly divide a group of people with headaches into two groups. One of the groups, the experimental group, would receive the new medication being tested. The other group, the control group, would receive a placebo medication (i.e., a medication containing a harmless substance, such as sugar, that has no physiological effects).Besides receiving the different medications, the groups would be treated exactly the same so that the research could isolate the effects of the medications. After receiving the medications, both groups would be compared to see whether people in the experimental group had fewer headaches than people in the control group. Assuming this study was properly designed (and properly designed studies will be discussed in detail in later chapters), if people in the experimental group had fewer headaches than people in the control group, the researcher could conclude that the new medication reduces headaches.

**Finding a Topic**

People, places, and objects around you are possible sources of your research. The communities where you live are also rich sources of research topics. It would also be helpful to talk to scientists, researchers or teachers by visiting them in their places of work. If this is not possible, you can write to them or read their published articles in the scientific literature. You can also surf the Internet for potential research problems.

**Narrowing the Topic**

**LIFE SCIENCES**

a) **Botany** – Study of plant life – agriculture, forestry, plant taxonomy, plant pathology, plant genetics, algae, etc.

b) **Zoology** – Study of animals – animal genetics, animal ecology, animal husbandry, cellular physiology, histology, animal physiology, etc.

c) **Microbiology** – Biology of microorganisms-bacteriology, virology, protozoology, fungi, bacterial genetics, yeast, etc.

d) **Biochemistry** – Chemistry of life processes – molecular biology, molecular genetics, enzymes, photosynthesis, blood chemistry, protein & food chemistry, hormones, etc.

e) **Medicine and Health** - Study of diseases and health of humans and animals –dentistry, pharmacology, pathology, ophthalmology, nutrition, sanitation, pediatrics, dermatology, allergies, speech and hearing, etc.

f) **Ecology** – branch of biology that studies the relationships between organisms and their total environment.

**PHYSICAL SCIENCES**

a) **Chemistry** – Study of nature & composition of matter and laws governing it – physical & organic chemistry, inorganic chemistry, materials, plastics, fuels, pesticides, metallurgy, soil chemistry, environmental and materials chemistry, plastics, etc.

b) **Physics** – Theories, principles, and laws governing energy & the effect of energy on matter –solid state, optics, acoustics, particles, nuclear, atomic plasma, superconductivity, fluid and gas dynamics, thermodynamics, semiconductors, magnetism, quantum mechanics, biophysics, etc.

c) **Mathematics** – Development of formal logical systems or various numerical algebraic computations and the application of these principles-calculus, geometry, abstract algebra, number theory, statistics, complex analysis, probability.

1. **Computer Science** – Study & development of computer hardware, software engineering, internet networking and communications, graphics (including human interface), simulations/virtual reality or computational science (including data structures, encryption, coding & information theory).
2. **Engineering** – Technology; projects that directly apply scientific principles to manufacturing and practical uses –civil, mechanical, aeronautical, chemical, electrical, photographic, sound, automotive , marine, heating and refrigerating, transportation environmental engineering, etc.
3. **Earth & Space Sciences** – Geology, mineralogy, physiography, oceanography, meteorology, climatology, astronomy, speleology, seismology, geography, etc.
4. **Environmental Science** – Study of pollution (air, water and land) sources and their control.

**GETTING STARTED**

* **Pick Your Topic**: Get an idea of what you want to study.
* **Research Your Topic**: Go to the library or internet and learn everything you can on your topic. Gather existing information on your topic.
* **Organize**: Organize everything you have learned about your topic.
* **Make a Timetable**: Choose a topic that not only interest you, but can be done in the amount of time you have. Use a calendar to identify important dates.
* **Plan Your Experiments**: Once you have a feasible project idea, write the research plan. This plan should explain how you will do your experiments and exactly what it will involve.
* **Consult Your Adviser**: You are required to discuss your research plan with your adviser and other adults to be involved in experimentation.
* **Conduct Your Experiments**: Give careful thought to experimental design. During experimentation, keep detailed notes of every step of the experiment, measurements and observations.
* **Examine Your Results**: Upon completion of the experiments, examine and organize your findings. Did your experiments give you the expected results? If possible, statistically analyze your data.
* **Draw Conclusions**: Which variables are important? Did you collect enough data?

Do you need to conduct more experimentation? If your results do not support your original hypothesis, you still have accomplished successful scientific research.

**The Research Process**

The research process is a cyclic process. Most of the time the conclusion that is reached at the end of an investigation leads to other problems which other researchers may undertake in the future. Opportunities for more inventions and discoveries arise from the cyclic nature of research. Research process comprises a series of steps or actions required for effectively conducting research and for the sequencing of theses steps.

**Steps:**

* Identification of a research problem
* Formulation of a hypothesis
* Review of related literature
* Preparation of a research design
* Actual experimentation
* Data collection, organization and processing
* Analysis and interpretation of processed data
* Formulation of the conclusion