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# Topic ► What is 1 Research?

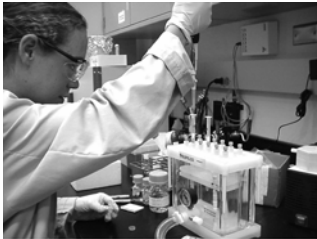
## LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Define what is research;
2. Identify what research is not;
3. Describe at least eight research characteristics; and
4. Explain the seven steps involved in research process.

## ► INTRODUCTION

(a)



(b)



(c)



**Figure 1.1(a):** A scientist performing research in a lab

**Figure 1.1(b):** A student researching for information in a library

**Figure 1.1(c):** A person with his computer doing research work

The word “research” is often used in our everyday speech to cover a broad range of meanings. This may cause confusion to some of us, where it does not portray its actual meaning and sometimes comes with the intention to deceive. The claim that years of research has produced high quality product is misleading and simply the clever use of a catchword to get the attention of the public.

Do you know that research is also not merely information gathering according to Leedy (1974)? We must differentiate between true research approach and the accumulation of facts.

In this topic, we will discuss in more detail about the meaning of research. Then in section 1.2, we will look at what research is not. We will discuss the characteristics of research in section 1.3. Finally in section 1.4, we will learn about the 7 steps involved in the research process.

## 1.1 DEFINITION OF RESEARCH

Let us just look at the following definition of research.

Research is a systematic process of information (data) **acquisition** and **analysis** in order to increase understanding about a phenomenon we are interested in or concerned about.

People often use a systematic approach when they collect and interpret information to solve problems in their daily lives. It is a scientific method of collecting information about the hypothesised relations between phenomena. For example, you might be interested to perform a research in order to find out/investigate if there is a relationship between user interface reliability and performance of search engine.

John Dewey (1933) highlighted the scientific method as he listed down the following steps. Table 1.1 summarises the steps taken in scientific method.

**Table 1.1:** Steps in Scientific Method

No	Steps	Method
1	<b>Hypothesis formulation</b>	A statement about the relationship between two or more theoretical entities
2	<b>Testing the hypothesis</b>	Design a study or framework to examine whether the relationships between the entities are as hypothesized
3	<b>Data collection</b>	Process of collecting and preparing data pertaining to the study
4	<b>Accept / Reject</b>	Decide to <b>accept</b> or <b>reject</b> the hypothesis

The purpose of using a scientific method is to enable researchers or students to describe the relations between factors; to predict what might happen; to control (when variables are manipulated, does it lead to certain cause or condition) and to explain the investigated phenomena.

## 1.2 WHAT RESEARCH IS NOT

Earlier, we have looked at the definition of research. In order for us to better understand what research is, probably it would be helpful for us to look at what research is not.

(a) **Research is not merely information gathering**

A typical example would be a student who claims that he or she went to library to do research and learned a lot about information security. This student has been given the idea that research means going to the library to get information or to glance at a few facts. This may be **information discovery**: it may be learning **reference skills** but it certainly is not research.

(b) **Research is not a mere transportation of facts from one location to another**

Research is not locating or transporting information from one source to another source. Such activity is of course more realistically called fact discovery or fact transportation. It missed the essence of research and the interpretation of data.

- (c) **Research is not merely rummaging for information**  
Rummaging, whether through one's personal records or at the public or college library, is not research. It is more accurately called an exercise in self-enlightenment.
- (d) **Research is not a catchword used to get attention**  
Research is not branding or "catchword" to get public attention for products or services. Example: A company using the phrase "years of research has produced this high quality product," is simply demonstrating the clever use of a catchword.



### ACTIVITY 1.1

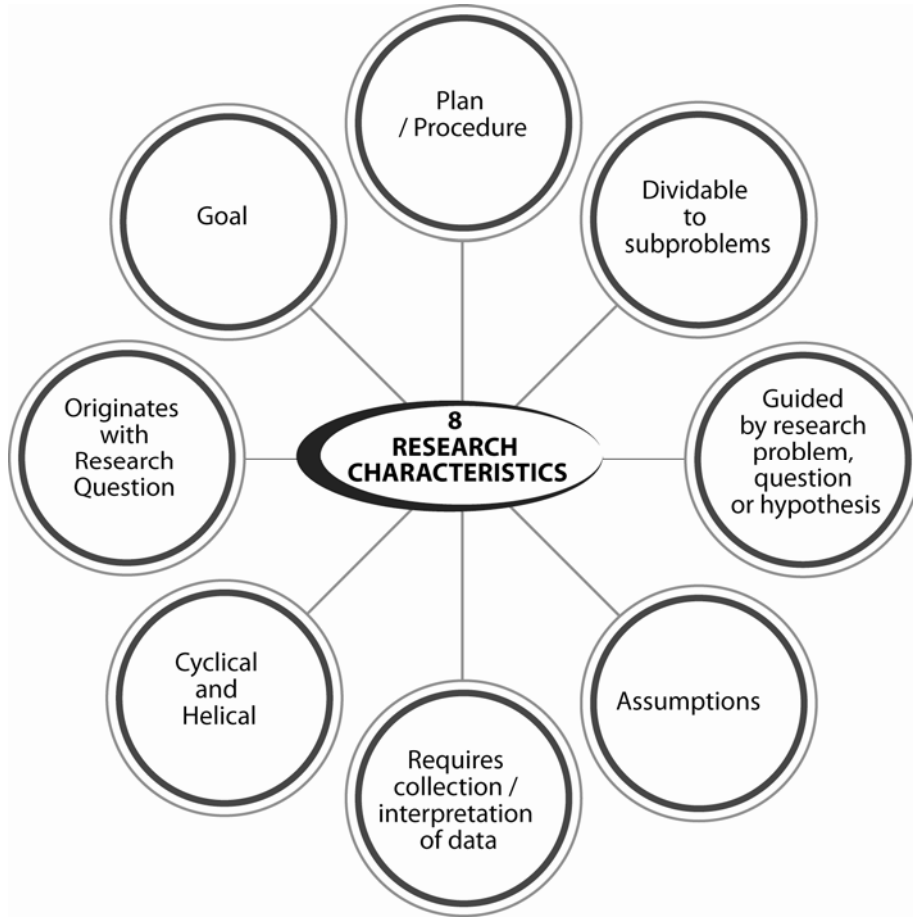
Identify the different ways in which the word "research" has been used in the statements above.

## 1.3 RESEARCH CHARACTERISTICS

Research is a procedure by which we attempt to find systematically and with the support of demonstrable fact. This will eventually lead to the answer to a question or the resolution of a problem. Research has eight distinct characteristics:

- Research originates with a question or problem in the mind of the researcher;
- Research requires a clear goal;
- Research requires a specific plan or procedure;
- Research usually divides the principal problem into more manageable subproblems;
- Research is guided by the specific research problem, questions or hypothesis;
- Research accepts certain critical assumptions;
- Research requires the collection and interpretation of data in an attempt to resolve the problem that initiated the research; and
- Research is, by its nature, cyclical or more exactly helical.

Figure 1.2 clearly lists out the 8 research characteristics.



**Figure 1.2:** Eight research characteristics



**SELF-CHECK 1.1**

1. Define research in your own words.
2. Recall the eight characteristics of research.

## 1.4 THE RESEARCH PROCESS

A research process is a step-by-step procedure taken in developing your research content or paper. The process involves identifying, locating, assessing, analysing, and then developing and expressing your ideas. For many beginning researchers and graduate students, identifying a research problem could be difficult. There are some cases of graduate students who have completed their coursework requirement but face difficulties at the thesis stage and they never graduate. It would be an ideal practice that students start looking for problem definition and identification very much earlier so that they can explore them throughout their coursework.

Where and how does one find research problems in ICT? Our daily life, tasks, lifestyle and career are seamlessly linked with information and communication technologies. They are all around us. Networking, communication systems, computer systems, information security and software engineering are abundant with unsolved problems and challenges. More often than not, a researcher could have started with a general statement or a confused notion of a research problem. Not to worry, as this is part of the complexity and nature of the entire research process. Generally, there are 7 steps involved in the research process. Figure 1.3 is to help you understand the research process better.

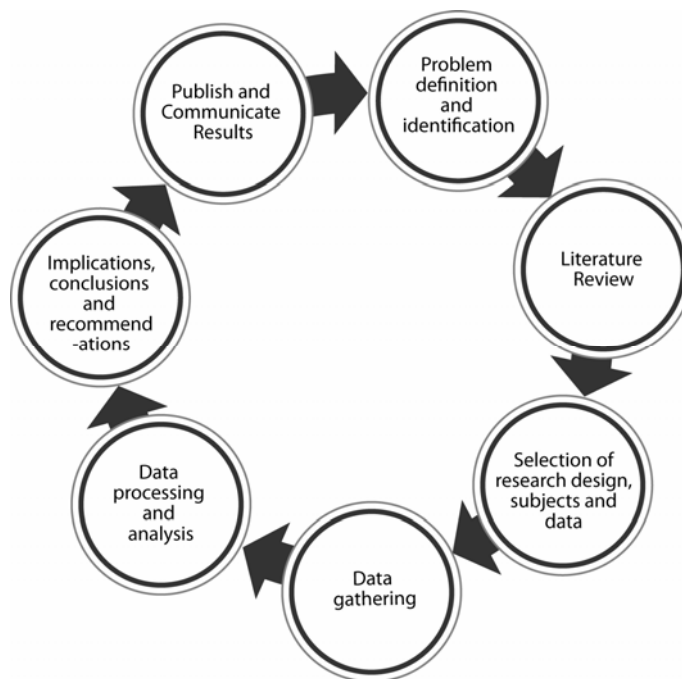


Figure 1.3: Research process

As we can see from Figure 1.3, research process can be divided into seven (7) processes. Let us now look at each of the steps in detail.

(a) **Problem Definition and Identification**



First of all, you need to identify a problem in the ICT field that is close to your interest or maybe closely related to your specialisation. As a student, you should have acquired vast knowledge in your area of interest that is designed for long-term accumulative process.

For example, you are to design and develop a knowledge management framework for best practices of your organisation, qualitative analysis of customer and company's role in e-commerce, implementation of service-oriented architecture in supply chain management and so forth.

(b) **Literature Review**

The scope in ICT is huge and always proven to be expanding rapidly. Therefore, it is important for you to have a proper literature review in your area of study. Literature review can reveal similar investigation and can show and suggest approaches in dealing with similar problems.

For example, if you are interested in exploring web-based database management for specific application, you should start with textbooks in that area or chapters of books related to databases and web-based services. Textbooks could provide fundamental knowledge to start with particular area.

However, journals and thesis could provide critical information as they review the related literature. Journals and thesis can reveal source of data which are never known to you. It could also introduce you to significant research personalities whose research and writings are not known to you. If you are interested in software engineering research, then you should read ACM Transactions on Software Engineering and Methodology and the Elsevier Journal of Systems and Software.



**Figure 1.4:** IEEE Journal, and ACM Online Journal and Elsevier Journal of System and Software stores huge amount of research/conference papers in an online format

Generally, students tend to refer to other popular sources such as magazines and newspapers compared to journals and theses. Journals are presumed to be the original source of information into unexplored area of ICT since technologies in ICT become obsolete rapidly. Thus, the challenge is to extract new ideas and methods that never occurred to you prior to starting your research. Leading edge research in ICT are broad and could always be tracked accordingly in prominent journals such as IEEE Transactions and ACM (refer Figure 1.4).

(c) **Selection of Research Design, Subjects and Data Collection Technique(s)**

Upon deciding the research problem and having a clear idea on the related literature, the next step is to select and plan the research design, subjects, as well as to identify data collection techniques. Research design is crucial as it provides overall structure for the research procedure, the data that a researcher collects and the data analysis that a researcher conducts. It is a plan that would ensure the success of your research by identifying resources, procedures and data, with the goal from the very beginning.



(d) **Data Gathering**

We understand that research design provides the design of the particular research and method of data collection to answer the research question we formulated earlier.



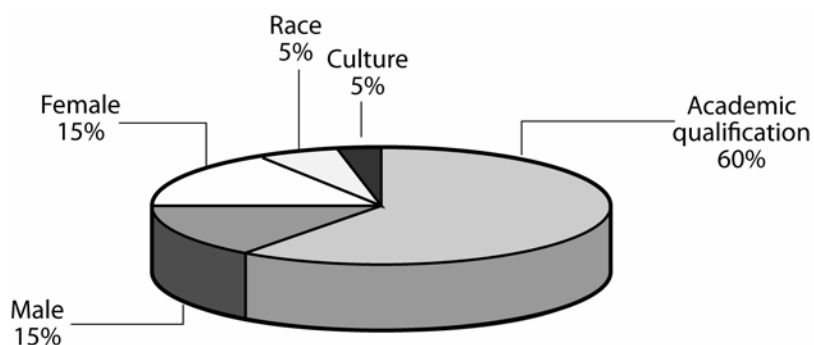
For example, say one of your research questions is to measure the relationship between bandwidth and quality of service in university network. To answer this question you have to collect data on the bandwidth capacity of all network infrastructure within the university area. This can be done by using the existing instrument or by developing software-based network analyser and administering it to samples of network cluster. In this type of data gathering, you will be using quantitative data collection method.

We will discuss the **Quantitative Approach** in detail in the coming topics.

On the other hand, if you are interested in the security and reliability of university network, you may gather data on types of firewall configuration and security attacks faced by the network. For instance, you can propose a new Novell firewall framework with intrusion prevention system, by using structured observation checklist and record all security attack occurrences on the university network. Here, you are using qualitative data collection methods.

For that, we will discuss in detail the **Qualitative** data collection methods in topics to come.

(e) **Data Processing and Analysis**



Typically, in any field research, the data collected need to be analysed and computed in order to provide us with the inferential and interpretation on the studied problem. If the research question involves reasoning the quantitative approach, statistical methods are used in the analysis. The analysed data will be presented in Tables and Graphs. A researcher then

interprets the data in relation to the research questions based on the analysis performed.

On the other hand, for qualitative approach, the information will be coded, justified and presented with valid reasoning.

(f) **Implications, Conclusions and Recommendations**

Implications and conclusions are important justification that every researcher should take note as part of the research process. The novelty of the work, contribution of new knowledge will be seen in the “implications” and “conclusion” parts of the entire research. Recommendations normally highlight a few potential research questions which should be derived at the end of the research process and foster research continuation based on the new findings. Now, we can see clearly why research is said to be helical or cyclical, which means that research begets more research and one can come across additional problems that need resolving after a conclusion is reached.

(g) **Publish and Communicate Results**

Once the findings of the research obtained, it is important for you to communicate with other fellow researchers and practitioners. The obtained results should be published in journals and conference proceedings as those are designed as platform for interested parties to communicate and discuss on the findings.

In the field of ICT, there are few reputable journals like ACM, Elsevier and IEEE Transactions which could serve as a wide-reaching medium to the experts of similar area. If you are a graduate student, you will be most probably communicating your findings in the form of thesis or dissertation. This is an established format for presenting findings of your research in the academic world.



### SELF-CHECK 1.2

How do you go about finding an unexplored area or a research problem in ICT?

## SUMMARY

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- The word “research” has been defined in many different ways and sometimes comes with the intention to deceive
- Research is the systematic process of information (data) **acquisition** and **analysis** in order to increase understanding about a phenomenon that we are interested in or concerned about.
- The purpose of scientific method is to describe, explain, control and predict the related phenomena.
- Research has eight distinct characteristics which explain the nature of research universally.
- ICT research is defined as research that investigates the emergence and usability of information and communication technologies in various fields.
- The seven steps of the research process is a universal guide that is useful for his/her researcher to begin his/her research work.
- Research is always cyclical, meaning that the end outcome obtained from the entire research process can be formulated to become a new research problem. Thus, the process is never ending.
- Some prominent research journal transactions in ICT are ACM, IEEE and Elsevier.

## KEY TERMS

Characteristics of research	Problem identification
Data analysis	Research design
Data collection	Scientific method
Literature review	The research process



## DISCUSSION

1. Write down your definition of research.
2. Discuss some ICT research you have read and come across. [Go to OUM's Digital Library and click on 'ACM' which has a good collection of journals in ICT]
3. List the current scenario or thinking on ICT research in your field of interest.



## REFERENCES

### OUM's Digital Library

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Leedy P. D. & Ormrod J. E. (2001). *Practical research: Planning and design*. New Jersey: Pearson Merrill Prentice Hall.

Mitchell, M., & Jolley, J. (1988). *Research design explained*. New York: Holt, Rinehart and Winston.

**Internet Resources**

Vagner, K. W. (2007). *Introduction to research methods* .[Electronic version]  
<http://psychology.about.com/od/researchmethods/ss/expdesintro.htm>.

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