

**Learning Materials for**  
**ITP1031 – RESEARCH METHODS**  
**A compilation of Lectures/Activities**



**COLLEGE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**  
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## *Disclaimer*

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# Fundamentals of Research

# 1

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## *Key Terms:*

- Action Research
- Research
- IS Research
- Systematic
- Controlled
- Critical
- Design

## *Overview:*

- This section addresses the questions of why researches are importance in our day to day living.
- Topics such as the meaning, objectives, structure, characteristics, types and qualities of good research will be the focus of this chapter.



## *Learning Outcomes:*

After studying this chapter, the students shall be able to:

1. explain what research is;
2. discuss the objectives of research, and characteristics of a good research;
3. discuss the structure of good research; and
4. identify the different types of researches;
5. compare research from design.



## *Introduction*

Research results informed an action, proved a theory, and contribute to developing knowledge in a certain field of study. Research studies and scientific research are being conducted in order to provide results that will help with social, professional and scientific evolution. Gathering data and information and analyzing them is the only way for a researcher to come to a conclusion. The process of conducting a research study starts by focusing on tested instincts and ideas. With the collection of all the necessary information, the results can come fast either positive or negative.

The increasing voluminous amount of data in every second from different sectors of society compels researches to be done in Information Systems field. This chapter discusses the fundamental concepts of research.

### **1.1. Meaning of Research**

Research is a systematic, controlled, empirical and critical investigation of hypothetical propositions on relations involving natural phenomena

- Systematic – the researcher must follow rules, principles and procedures in doing it.
- Controlled – researcher know the variables or factors he is to investigate and manipulate.
- Critical – researcher should be careful in observation, recording analyzing and interpreting information he gathers.
- Research is not a haphazard activity. A researcher should use his senses (seeing, hearing, smelling, tasting and touching) since they are tools for observation.

### **1.2. Objectives of Research**

The major aim of any type of research is to find out the reality and facts which is unknown, and which has not been exposed. Although each research activity has its own reason, the objectives of research can be grouped into the following categories:

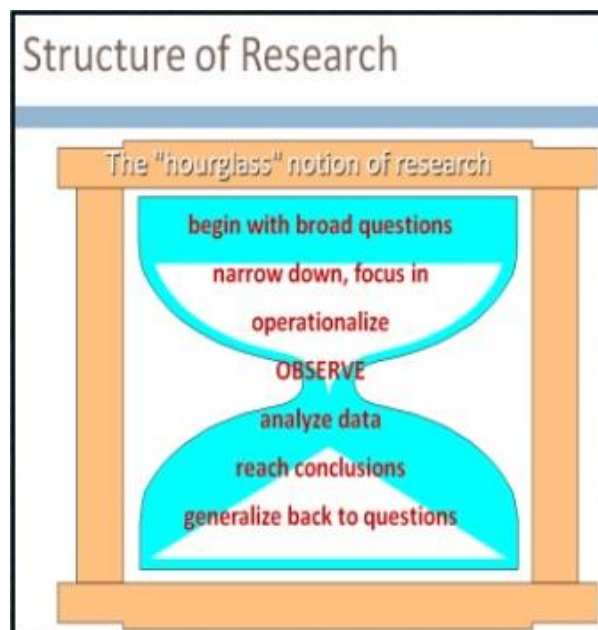
1. To achieve skillfulness with a trend or to get novel opinions into it (research with this objective can be termed as exploratory or formulative);
2. To find out the characteristics of a particular character, condition or a grouping (research with this objective can be termed as descriptive research);
3. To establish the relationship with which something occurs or with which it is related with something else (research with this objective are known as diagnostic research);
4. To test a hypothesis of a reasonable liaison between different variables (this type of research can be grouped into hypothesis-testing research).

### **1.3. Characteristics of Research**

The following are the characteristics of research:

1. Empirical. Research is based on direct observation. A researcher can work on problem that can be addressed through observation.
2. Logical. Research involves reasoning and valid procedures. Researchers have confidence on their findings because they are based on orderly procedures. A researcher makes conclusions based on findings (inductive) and explains his findings based on existing theories (deductive).
3. Cyclical. A researcher who completes a study presents his findings and suggests further studies on aspects of the problem that were not addressed by his research. A research starts with a problem, works on the problem and makes generalization from which another problem may arise.
4. Analytical. Research applies analytical procedures in gathering and analyzing data.
5. Critical. Research requires careful and precise judgement in analysis and making generalizations (e.g. a researcher uses specific level of confidence, say 0.05 level, 0.01 level in accepting or rejecting the null hypothesis).
6. Methodical. Research is conducted using methods and techniques that are appropriate to the research problems or objectives.
7. Replicable. The design and procedure of a study can be replicated or repeated to arrive at more conclusive results (e.g. a replication could be done through experimental research to find out the adaptability of crops to different locations; in social science researches, replication studies are done to determine the results of a study in another place involving another group of subjects).

### **1.4. Structure of Research**



### 1.5. Types of Research

1. **Survey:** This is used to obtain data about practices, situation views at one point in time through questionnaire or interviews
2. **Case Study:** this involves an attempt to describe relationships which exist in reality
3. **Simulations:** This involves copying the behavior of a system and is used in situations where it is difficult to solve problems analytically. It typically involves the introduction of random variables. It has a problem of making the data collected enough to resemble reality.
4. **Subjective/argumentative research:** This is used for generating new theories and ideas which can subsequently be tested. It is subject to research bias. It is unstructured and subjective form of research.
5. **Action research:** This is the most useful form of research. It involves application in which the researcher attempts to develop results or obtain solutions of practical value to the people with
6. whom the researcher is working and at the same time developing theoretical knowledge.

There are several criteria for the classification of research types these include method of research and goal of research. Research can also be classified by the research method used. However, many research projects use methods from more than one class.

1. **Action Research:** This type of research is mostly essential in applied research where it requires implanting recommended changes to a process, bearing in mind to solve a problem and to carry out research to determine the effectiveness of identified changes. It aims at solving an identified problem based on recommendations made to a process.
2. **Creative Research:** Creative research involves the development of new theories; new procedures and new inventions and is used to some extent in all fields, in contrast to experimental research, creative research is much less structured and cannot always be preplanned. This type of research includes both practical and theoretical research.
3. **Descriptive Research:** This type of research is also called a “case –study research”. It involves studying a specific situation to ascertain whether any general theories may arise out of it whether an existing theory are borne out by specific situations.
4. **Experimental Research:** The cornerstone of science is experimental and creative research. Experimental research is primarily concerned with cause and effect. Here the variables of interest are identified (i.e. the dependent and independent variables) and the researcher seeks to determine the effect of changes in the independent variables on the dependent variable.

5. **Ex-post facto Research:** This is Research “from after the fact” and this type of research typically occurs using data generated from experimental research. While in experimental research, the effect is determined from the cause, here the cause is deduced from the effect.
6. **Expository Research:** This is research based purely on existing information and normally leads to “review –type reports”. It involves reading widely on a field, comparing and contrasting, analyzing and synthesizing all points of view and developing new insights.
7. **Historical Research:** Studies on the past to determine cause-effect patterns. This type of research is often geared towards using past events to examine current situation and to predict future situation. (e.g. stock market forecasting). Data is gathered from primary sources (records made at the time of past events) and secondary sources (records made after the event). (Lodico, Spaulding, & Voegtle, 2010)

### **1.5 Qualities of Good Research**

A good quality research method should lead to:

1. Originality/Novelty
2. Contribution to knowledge
3. Significance
4. Technical soundness
5. Critical assessment of existing work

### **1.6. The Meaning of Design**

*In the area of engineering, design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.*

Thus, in the area of Computing or Information Technology Education (ITE), the term design includes, among others, (1) application development that focuses on software engineering processes or (2) application design that focuses on effective testing procedure or (3) a study on application development processes, in which basic sciences, mathematics and computing are applied to meet the stated needs.

The key word in design is the word “optimum.” Good designs convert and/or uses IT resources optimally to meet the stated needs. It is for this reason why the Commission on Higher Education (CHED) defines the Bachelor of Sciences (BSIT) program as the study of the utilization of both hardware and software technologies in planning, installing, customizing, operating, managing, administering and maintaining IT infrastructure that provides computing solutions to address the needs of an organization. The same is true with the Bachelor of Science in Entertainment and Multimedia Computing (BSEMC). In the BS Information System (BSIS) program, the terminal step for design is when the system, particularly the information system, has



been integrated and implemented in the business processes of an enterprise. Of course, the process will be iterative for the reason that design no matter how carefully crafted and made is not perfect. Considering that the term “Research and Design” are two (2) different terms, the authors humbly submit that the term research is the applicable term for the Bachelor of Science in Computer Science (BSCS) program because the latter is a research-based program and hence, thesis is a requirement. The term design, on the other hand is the applicable term for the BSIT, BSIS and BSEMC programs because these programs require capstone projects.

According to Reeves (1992), everything will be a part of the design process: coding is design, testing, and debugging are parts of designs, and what we typically call software design is still part of design. Software may be cheap to build, but it is incredibly expensive to design. Software is so complex that there are plenty of different design aspects and their resulting design views. The problem is that all the different aspects interrelate (just like they do in hardware engineering). It would be nice if top level designers could ignore the details of module algorithm design. Likewise, it would be nice if programmers did not have to worry about top level design issues, when designing the internal algorithms of a module. Unfortunately, the aspects of one design layer intrude into the others. The choice of algorithms for a given module can be as important to the overall success of the software system as any of the higher-level design aspects.

Reeves further states that there is no hierarchy of importance among the different aspects of a software design. An incorrect design at the lowest module level can be as fatal as a mistake at the highest level. A software design must be complete and correct in all its software builds based on the design will be erroneous.

### **1.7. Research and Design Distinguished**

Ashley Karr (2013) distinguished research and design in this wise, thus:

*To research something is to investigate it systematically. We do this in order to reach new conclusions, establish new facts, and learn as much about the truth as possible. Research also gives us a chance to find problems that we can potentially fix. We research to understand the world.*

*To design something is to create the form and function of an object, system, or interaction. We do this in order to make our experience here on earth (or in space) better, safer, healthier, more comfortable, more fun – and we can create solutions to the problems we found during our research. We design to change the world.*

*Simply stated, we research to explain WHY THINGS happen; we design in order TO MAKE THINGS HAPPEN.*

## **1.8. Research and Design Distinguished**

The American Society for Engineering Education (2006) explains the difference between research and designs in this wise, thus:

*Design is NOT research, which may be defined as “a careful investigation or study, especially of a scholarly or scientific nature. A design task may require research to accomplish a task, but it typically involves the integration of knowledge, not the creation of knowledge.” Design is different than research. Design considers alternative solutions by selecting the optimal solution with a fixed goal or specifications in mind. Design often results in a commercial product being developed. Research has an open-ended goal and is exploratory, with no set specifications in mind, and does not necessarily result in a product or a service.*

*Illustration:*

Research and design can be easily explained in the following situation. Suppose you are the Light Rail Transit (LRT) administrator and you are tasked to operate the LRT in such a manner that you will incur lower expenses but will give the highest revenue.

If your organization does not have any data as to what day and time of the week will there be less passengers as well as the day and time of the week, where there will be numerous passengers, then you have to conduct a research. In this phase of research, the researcher will use the traditional data gathering procedures. After conducting this procedure, the researchers will come to understand why there are so many passengers during 7:30 to 8:30am and why there are less passengers during 2:00PM. Recall that we conduct research to UNDERSTAND THE WORLD. In this phase, we already understand the problem.

However, if you already have such data, all you have to do is to make an appropriate scheduling system so that you employ a significant number of trains during the time of the day, where there are numerous passengers.

In the first situation, wherein the organization does not have any historical data, the LRT administrator needs to do both research and design, while in the second situation where historical data is already available, he only needs to do a design.

Hence, a research work is different from design. In the foregoing paragraphs, a research work is needed to make a good design. In practical application, a person may directly do a design without conducting a research because his design may be predicated by a previous research done by the others.

A final design may need initial research and a final conclusion in research may need an initial design. Research and design may be recursive with each other. There are many research outputs which will lead to design and some designs which will lead to research.

Design under the phraseology of social science research is equivalent to applied research. However, in computing and engineering parlance, an applied research is just a design. The authors subscribe to the phraseology of the computing and engineering profession because strictly speaking, only pure research can be considered as research in the real sense of the world.



## *Summary*

This chapter discussed the fundamental concepts of research. The learners were introduced on the meaning of research, why researches are conducted, characteristics of both research and researcher, the structure of research, the criteria for evaluating good research topic, types of research and the components of ethics of research. It is expected that they will be motivated to do research and come up with concept paper that signify a research topic to study in IS field. The knowledge gained from this chapter would enable the students to justify why their research topic is viable for conducting research.

### *Supplementary Learning Resources:*

- **DISCUSSION ON UNDERGRADUATE RESEARCH AND CAPSTONE PROJECT MANUAL**

Marcial, Dave E. (2013), Lecture (Speech) during the 9<sup>th</sup> PSITE Regional Convention on April 18-19, 2013, Bayview Hotel, Dumaguete City

- **CHED CMO 53 S. 2006 (UNDERGRADUATE RESEARCH AND CAPSTONE PROJECT)**

## *Self-Assessed Questions* 1



1. Define research
2. Explain the Objectives of Research
3. Enumerate and discuss the Characteristics of Research
4. Explain the Structure of Research
5. What are the Criteria of Good Research Topic?
6. What are the Qualities of Good Research?
7. What are the different Types of Research?
8. How could you differentiate a research from problem solving?



- Search the United Nations Sustainable Development Goals (SDG) and from the 17 goals, select what goal your study should be anchored with.
- Search on the different emerging technologies and choose the kind of technology are you going to utilize for your research subject
- Come up with 3 to 5 research titles and your concept/justification why you want to embark on them
- The following should be part of your justification:
  1. The problem that is being addressed of your research
  2. The (particular) UN SDG your study should be anchored with.
  3. The technology to integrate in your research and how it will be applied to your study
  4. The expected functionality/outcome of your system
- Fill up the table for the contribution/activity done of each of the group members:

	Name	Role (Leader/Member)	Contribution/Activity Done
1.			
2.			
3.			
4.			

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