

BIT 2207 Research Methodology

Introduction to Scientific Research

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Research Methodology

- **Course description:** This course unit enables students to learn and apply principles of conducting scientific research, or undertaking a systematic research study.
- **Aims:** To enable the student to relate data gathering techniques and principles taught in Systems Analysis and Design (and software engineering or other course units in his/her Programme) to his/her final year research project.

Learning outcomes:

A student who has undertaken this course unit will be able to successfully undertake a research project. He/she will be able to:

- Identity a **significant** research problem,
- identity the **aims of a research project** that can solve the identified problem,
- Select **appropriate research methods** to be used in his/her project,
- Select **appropriate data collection techniques** that are to be used when gathering required data for the project.
- Select **appropriate data analysis techniques** that are to be used when processing collected data.
- Produce a research proposal in **LaTeX**

Course format

- Lectures
- Assignments to be done individually and in groups
- Class discussions to be conducted with the aim of guiding students to properly apply research concepts such that they can develop into a proposal

Assessment:

- **Tests: 20%**
- **Online assignments: 40%**
- **Final written exam: 40%**

References:

1. Graham Birley and Neil Moreland, 1998. A Practical Guide to Academic Research. Publisher: Biddles Ltd.
2. Priscilla Salant and Dona A. Dillman, 1994. How to conduct your own Survey. Publisher: John Wiley & Sons, Inc. New York.
3. Neil J. Salkind. 2009. *Exploring Research (7th Edition)*. Publisher: Pearson International.
4. P. Sam Daniel and Aroma G. Sam. 2011. *Research Methodology*. Publisher: Gyan Publishing House.
5. Briony J Oates. 2005. *Researching Information Systems and Computing*. Illustrated Edition. Publisher: SAGE.

Research Methodology

Part I

LECTURE 1 – INTRODUCTION TO RESEARCH

Learning Objectives

After completing this module, the student should be able to:

1. Define research in general and Scientific research in particular.
2. Enumerate the characteristics of research
3. Identify the reasons for undertaking research.
4. Identify the different types of research.

Definitions of research

- Research is a process of *systematic* enquiry or investigation into a *specific problem or issue* that leads to *new or improved knowledge*

Why Conduct Research?

1. For academic purposes.
2. To acquire new knowledge.
3. To find answers to questions.
4. To solve a problem in the practical world.
5. Enhance critical skills in communication, independent thinking, creativity and problem-solving.
6. To answer “What-if” questions e.g. what happens if tuition fees are increased?

Why Conduct Research?

- To improve people's well-being e.g. social networking, earn a living.
- To test or disprove a hypothesis E.g. Girls hate mathematics; researchers can prove or disprove this hypothesis.
- To test or disprove a theory E.g. $A^2 + B^2 = C^2$; researchers can prove or disprove this theory.

Characteristics of good research

1. *The research process is systematic.* It follows pre-established rules & regulations.
2. *It builds on, but also offers something new to previous research.*
3. *It has the potential to suggest direction for future research.*
4. *It addresses directly or indirectly some real world problem.*
5. *It takes ethical/moral issues into consideration.*

Characteristics of good research cont'd

- It clearly states the variables or constructs to be examined. E.g. examining **students' performance (variable)** with respect to day and evening students
- It is not biased in position.
- It has multiple possible answers.

What research is not

If the above attributes make good research, what is bad research? It takes the opposite approach of all the things stated above. In summary, bad research is;

1. **Plagiarizing** other peoples work
2. **Falsifying data** to prove a point
3. Misrepresenting information and misleading participants
4. Providing in-adequate references for your work

Problems encountered during research

1. Lack of sufficient/appropriate literature.
2. Inadequate data.
3. Inadequate funding.
4. Lack of trust by data providers.
5. Research demands a lot of time and effort.

Types of Research

Basic vs Applied research

Variations in undertaking basic and applied research

- Descriptive vs Analytical
- Quantitative vs Qualitative
- Conceptual vs Empirical

Basic vs Applied Research

Basic Research (also known as fundamental or pure research)

- Basic research is driven by the scientists curiosity or interest in a scientific question. The main motivation is to expand *one's knowledge*.
- Basic research aims at *increasing the scientific knowledge base* through developing (scientific laws), theories, methods, systems that advance knowledge on given aspects or matters.

Basic vs Applied Research cont'd

Applied Research

- Is designed to solve *practical problems* of the modern world, rather than to simply acquire knowledge.
- It investigates how effective your activities are, what can be done to improve them, and as a result you improve the quality of what you do.
- *Examples* include projects that improve agricultural yield, developing software for the blind, etc

Descriptive Research vs Analytical Research

Descriptive Research

- Includes *surveys and fact finding enquiries* of different kinds.
- The purpose is *description of the state of affairs* as it exists at present.
- The main characteristic of this method is that the researcher has no control over the variables; *he can only report* what has happened or what is happening

Example: Student attendance, frequency of power cut offs

Descriptive Research vs Analytical Research

Analytical Research

- The researcher *uses facts or information* that is *already available*, and analyzes these to make a *critical evaluation of the material*.

Example: You can evaluate students' performance from students' results

Quantitative research vs. Qualitative research

Quantitative research

- This is concerned with *variables/factors whose values can be expressed in numbers or numerical form*. It is applicable to occurrences that can be expressed in terms of quantity or numerical form.
- For example, *measurements of variables* (such as weight, age, duration) have values that can be expressed in terms of quantity, i.e. kilograms, years, hours respectively

Example: How many customers purchase flash disks in a given period?

Quantitative vs. Qualitative research

Qualitative research

- This is concerned with variables/factors *whose values cannot* be expressed in numbers or numerical form, but *can be expressed in text form and/or graphical form*.
- *Example:* When investigating the reasons for human behavior (i.e. why do people think or do certain things)
- The aim of qualitative research is to *discover the underlying motives* and desires using techniques such as *interviews, observation*.
- The study is classified as qualitative if the purpose of the study is *primarily to describe a situation, phenomenon or event*.
- Qualitative research attempts to increase our understanding of why things are the way they are in our social world and why people act the way they do.
- Qualitative research is concerned with finding the answers to questions which begin with: *why? How? In what way?*

Conceptual Research vs Empirical Research

Conceptual research

- Also commonly referred to as *analytical* research
- It involves *formulating an idea or theory from existing ideas* or theories so as to explain events or incidences as they occur.
- *E.g.* involves developing a theory to *explain phenomena* or factors as they occur

Conceptual Research vs Empirical Research

Empirical research

- This involves *testing hypothesis or research outputs* by making use of methods such as *experiments and observation*.
- Clearly, output from conceptual or analytical research can be evaluated or justified by conducting an empirical study.
- Empirical evidence can be gathered in *quantitative form or qualitative form*, and can therefore be analyzed using quantitative methods or qualitative methods.

Example: Investigating students performance (evening vs day)

Summary and caution of types of research

Various authors categorize research in various types:

- Some categorize it in terms of its output (i.e. Basic vs. Applied)
- Some categorize it in terms of the methods used to create or generate the research output (i.e. the variations on Basic vs. Applied).

In this module we have seen these classifications

Caution: Note that classifying research according to its output is a more generic way compared to classifying research according to methods used to achieve the output.

Class Task 1

As a follow up on the “general research” assignment that is due Thursday, classify it as at least one type of the research classifications we have looked at. You could categorize it as more than one ofcourse.