

African Virtual University

MAT 2101: RESEARCH METHODS

Learning Object 1

Main Learning Objective	Explain the major research concepts and the relationship between theory and research
Nature of learning object	Text
Key concept (s)	Research Methods
Source Module information	Module Title: Research Methods Code; MAT 2101 Author: Dr. Joseph K. Adjei
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Key Terms

There are many different kinds of research. For example:

- ***Scientific research*** may involve a whole range of sophisticated and specialist *research instruments*, such as mathematical or chemical formulas and very specialized methodologies.
- ***Market research*** is learning about business markets so that investment or business decisions can be made. The kinds of questions that get asked here include: Who are the potential customers? What do the customers need? Who are the competitors? And what is the market environment?
- ***Economic research*** has its own way of going about things. For instance, it may involve specially constructed formulas and equations that facilitate an understanding of the economic environment. It may ask questions such as: Are the economic fundamentals in

place? What are the economic trends in the manufacturing or mining sectors?

- **Media research** will involve looking at issues such as media content and audience using specific research instruments like Radio Audience Measurement Survey (RAMS) and the Television Audience Measurement Survey (TAMS).
- **Social research** is a broad term which may involve different kinds of research including gathering information on the population (*demographics*) to the attitudes and behaviour of people in a community or country.

Learning Object 2

Main Learning Objective	Identify information technology related challenges and opportunities, and apply scientific rigor to address those problems
Nature of learning object	Text
Key concept (s)	Types of Information Systems Research Designs
Source Module information	Module Title: Research Methods Code; MAT 2101 Author: Dr. Joseph K. Adjei
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Basic and Applied Research

Introduction

In this section, you will discover the two main types of research, basic and applied research. Various examples will be given for students to test their understanding of the two concepts.

Basic Research

Also referred as fundamental research, basic research is an investigation on basic principles and reasons for occurrence of a particular event or process or phenomenon. It is also called theoretical research. Basic researches may not necessarily lead to immediate use, immediate application or discovery of new things. It is not concerned with solving any practical problems of immediate interest. But it is original or basic in character since it

provides a systematic and deep insight into a problem and facilitates extraction of scientific and logical explanation and conclusion on it. This type of research is very useful in pushing or building new frontiers of knowledge.

For example, suppose a theory is applicable to a system provided the system satisfies certain specific conditions. Modifying the theory to apply it to a general situation is a basic research. Attempts to find answers to the following questions actually form basic research.

- Why are materials like that?
- What are they?
- How does a crystal melt?
- Why is sound produced when water is heated?
- Why do we find it difficult to walk on seashore?
- Why are birds arrange them in '>' shape when flying in a group?

Fundamental research leads to a new theory or a new property of matter or even the existence of a new matter, the knowledge of which has not been known or reported earlier. For example, fundamental research on

- (1) astronomy may leads to identification of new planets or stars in our galaxy,
- (2) elementary particles results in identification of new particles,
- (3) complex functions may leads to new patterns or new properties associated with them,
- (4) differential equations results in new types of solutions or new properties of solutions not known so far.

Applied Research

In an applied research one solves certain problems employing well known and accepted theories and principles. Most of the experimental research, case studies and interdisciplinary research are essentially applied research. Applied research is helpful for basic research. A research, the outcome of which has immediate application is also termed as applied research. Such a research is of practical use to current activity. For example, research on social problems have immediate use. Applied research is concerned with actual life research such as research on increasing efficiency of a machine, increasing gain factor of production of a material, pollution control, preparing vaccination for a disease, etc. Obviously, they have immediate potential applications. Thus, the central aim of applied research is to find a solution for a practical problem which warrants solution for immediate use, whereas basic research is directed towards finding information that has broad base of applications and thus add new information to the already existing scientific knowledge. Researchers working on applied research have to make use of the outcomes of basic

research and explore the utility of them. The outcomes of basic research form the basis for many applied research. Some of the differences between basic and applied research are summarized in table the table below.

Basic Research	Applied Research
Seeks generalization	Studies individual or specific cases without the objective to generalize
Aims at basic processes	Aims at any variable which makes the desired difference
Attempts to explain why things happen	Tries to say how things can be changed
Tries to get all the facts	Tries to correct the facts which are problematic
Reports in technical language of the topic	Reports in common language

Learning Object 3

Main Learning Objective	Formulate research problems and hypothesis; Choose appropriate research methodology
Nature of learning object	Text
Key concept (s)	Literature Review
Source Module information	Module Title: Research Methods Code; MAT 2101 Author: Dr. Joseph K. Adjei
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A literature review is a survey of everything that has been written about a particular topic, theory, or research question. The word “literature” means “sources of information”. The literature will inform you about the research that has already been conducted on your chosen subject. Literature reviews usually provide a background for larger work, or it may stand on its own. Much more than a simple list of sources, an effective literature review analyses and synthesizes information about key themes or issues.

Purpose of Literature Review

Literature survey is a collection of research publications, books and other documents related to the defined problem. It is very essential to know whether the defined problem has already been solved, status of the problem, techniques that are useful to investigate the problem and other related details.

A literature review goes beyond the search for information and includes the identification and articulation of relationships between existing literature and your field of research. Literature review enables the researcher to discover what has been already been written about a topic and to understand the relationship between the various contributions. This will enable the researcher to determine the contributions of each sources (books, article, etc) to the topic. Literature review will also enable the researcher to identify and (if possible) resolve contradictions, and also determine research gaps or unanswered questions.

Even though the nature of the literature review may vary with different types of studies, the basic purposes remain constant and could be summarized as follows:

- Provide a context for the research
- Justify the research
- Ensure that the current research has not been carried out by another person
- Show where the research fits into the existing body of knowledge
- Enable the researcher to learn from previous theory on the subject
- Illustrate how the subject has been studied previously
- Highlight flaws in previous research
- Outline gaps in previous research
- Show that the work is adding to the understanding and knowledge of the field
- Help refine, refocus or even change the topic

What is involved in writing a literature review?

- Research – to discover what has been written about the topic
- Critical Appraisal – to evaluate the literature, determine the relationship between the sources and ascertain what has been done already and what still needs to be done

- Writing – to explain what you have found

Learning Object 4

Main Learning Objective	Describe and compare quantitative, qualitative and mixed research methods in computer science
Nature of learning object	Text
Key concept (s)	Formulating Research Questions and Hypothesis
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Research Questions and Hypothesis

Once you have identified your research question, it is time to formulate your hypothesis.

While the research question is broad and includes all the variables you want your study to consider, the hypothesis is a statement that specific relationship you expect to find from your examination of these variables. When formulating the hypothesis(es) for your study, there are a few things you need to keep in mind.

Good hypotheses meet the following criteria:

- 1) Identify the independent and dependent variables to be studied.
- 2) Specify the nature of the relationship that exists between these variables.

- 3) Simple (often referred to as parsimonious). It is better to be concise than to be long-winded. It is also better to have several simple hypotheses than one complicated hypothesis.
- 4) Does not include reference to specific measures.
- 5) Does not refer to specific statistical procedures that will be used in analysis.
- 6) Implies the population that you are going to study.
- 7) Is falsifiable and testable.

As indicated above, it is better to have several simple hypotheses than one complex one. However, it is also a good idea to limit the number of hypotheses you use in a study to six or fewer. Studies that address more hypotheses than six will often be too time consuming to keep participants interested, and uninterested participants do not take the importance of their responses as seriously. Another advantage to limiting the number of formal hypotheses you formulate is that too many can make the discussion section of your paper very hard to write.

It is important to remember that you do not have to have a formal hypothesis to justify all comparisons and statistical procedures you might use. For instance, it is only when you start doing exploratory analysis of your data that you realize that gender is an influencing factor. You do not have to back up and write a hypothesis that addresses this finding. In fact, it is better in most cases to not do this. You can report any statistical findings you feel are relevant, whether or not you have a hypothesis that addressed them.

The final criterion listed above warrants additional mention. A good hypothesis is not only testable, that is, something you can actually test for in your study, but it must also be

falsifiable. It is tempting to ignore this requirement, especially as a new researcher. We want so badly to find great things, and for our study to turn out exactly as we expect it to, that we tend to ignore the possibility that we don't know everything and that no prediction is failsafe when it comes to humans. Try to keep in mind that all research is relevant. Whether or not your findings are what you expect, you will find something. Believe it or not, failing to find group differences can be just as important as finding expected group differences. In fact, studies that return results in opposition to what we were hoping for, or believed would logically occur, often lead to many more great studies than we could have hoped for. After all, it could be great for the findings of your current research to act as a guiding principal to your future research... it is likely that this would require less work in terms of literature review, as you would always be familiar with at least a portion of the literature that is relevant to your latest study

Learning Object 5

Main Learning Objective	Be able to assess published journal article that uses one of the primary research methods in the field
Nature of learning object	Text
Key concept (s)	Research Methodology
Source Module information	Module Title: Research Methods Code; MAT 2101 Author: Dr. Joseph K. Adjei
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Importance of Good Research Methodology

Introduction

1. Why is research methodology important in academic research?

The list below describes some of the reasons why it is important to describe the research methodology in academic research.

Research Methodology is important and also necessary because, it will help the researcher to provide explanation for the following:

- Why a particular research study undertaken?
- How the research problem was formulated?
- What types of data were collected?
- What particular method has been used?
- Why was a particular technique of analysis of data used?

Importance of Research of Research Methodology

Researchers must explain how they obtained and analyzed the results for the following reasons:

- Readers need to know how the data was obtained because the method you chose affects the findings and, by extension, how you likely interpreted them.
- Methodology is crucial for any branch of scholarship because an unreliable method produces unreliable results and, as a consequence, undermines the value of your interpretations of the findings.
- In most cases, there are a variety of different methods you can choose to investigate a research problem. The methodology section of your paper should clearly articulate the reasons why you chose a particular procedure or technique.
- The reader wants to know that the data was collected or generated in a way that

is consistent with accepted practice in the field of study. For example, if you are using a multiple choice questionnaire, readers need to know that it offered your respondents a reasonable range of answers to choose from.

- The method must be appropriate to fulfilling the overall aims of the study. For example, you need to ensure that you have a large enough sample size to be able to generalize and make recommendations based upon the findings.
- The methodology should discuss the problems that were anticipated and the steps you took to prevent them from occurring. For any problems that do arise, you must describe the ways in which they were minimized or why these problems do not impact in any meaningful way your interpretation of the findings.
- In the social and behavioral sciences, it is important to always provide sufficient information to allow other researchers to adopt or replicate your methodology. This information is particularly important when a new method has been developed or an innovative use of an existing method is utilized.