What is a research

**Research is the systematic, procedural, objective, logical process of gathering and analyzing, and interpretating information to increase understaning or solve a problem.**

System in research

* **Solve a problem objective, and significance**
* **Technology is the scientific ideas and tools put together t make life easire.**
* **Technologies is the product ouctcome of ideas and tool using technology to solve problem.**

IT research involves,

* **Software, hardware, usability, technologies, security**

XTICS OF IT RESEARCH

* **Technology - oriented**
* **Interdisclipnary**
* **Rapidly Evolving,**
* **Applied and theoritcal**

**TYPES OF IT RESEARCH**

**BASIC RESEARCH:** (only meant to show the interest of the scientist)

*Example*: developing new algorithms

**APPLIED RESEARCH:** Solve a specific practical problem

*Example*: Improves agricultural production.

**DEVELOPMENTAL RESEARCH**: Improves a system

*Example*: developing educational chatbots

**ACTION RESEARCH**: Involves analyzing, planning, cycling and reviewing.

*Example*: Improving IT supports processes.

STeps involve in action research

1. **Identify a problem**
2. **Gather data**
3. **Develops solution**
4. **Implement solution**
5. **Evalaute results**

**DESIGN SCIENTIST RESEARCH:** focuses on the creation of artificail artifacts.

*Example*: creating innovative artifacts.

**COMMON RESEARCH METHODOLOGIES IN IT**

**Quantitative Research** (focuses on numbers) scientific dealings with numbers, data, scientific analysis, measurable data.

Features:

**Uses statistical tools**

**Large sample size.You use a direct quote**

**You paraphrase or summarize someone’s idea**

**You use data, statistics, tables, or charts**

**You refer to theories, models, or methods created by others**

Examples:

**Surveys for user satisfactio**n

Tools:

**SPSS, python, Java**

**QUALITATIVE research** is the user behavior, experiences, system impact to give out generalization.

Features:

**Smaller focused samples**

**Open-ended and flexible**

Examples

**Observing user behavior in a system prototype**

Tools:

**Manual coding, ATLAS.ti, NVivo**

**MIXED METHOD:** combines both qualitative and quantitaive approaches in a comprehensive perspective.

**Examples:**

Surveying students(quantitative)

Analyzing system logs(qualitative)

**Experimental approach:**

Test cause and effect

*Example*: Comparing c++ vs python.

Componenst of an IT research study

* **Problem statement**
* **Literature review**
* **Research objecyives and questionaires   
  methodology**
* **Data gatheing and analysis**
* **Interpretation**
* **Dissemination**

Programming: python , java

* Programming: Python, Java, R
* Data Analysis: SPSS, Excel, MATLAB, ORIGIN
* Surveys: Google Forms, KoBoToolbox
* Simulation: NS2/NS3, AnyLogic
* Statistics: R, STATA
* Design: Figma, Adobe XD
* Reference Managers: Zotero, Mendeley

Ethical consideration

* Data protection
* Plagiarism avoidance

Limitaions

* Ensuring privacy, security, and ethical complinace
* Access dataets and participants.

Slides 2

Research process is the structured approach, used to identify, investaigate and solve a specifc problem through systematic data collection and analysis.

Information technology includes

Algorithm optimization

Cybersecurity enhancement.

Key early steps in research

* Problem identification
* Setting research objective.

Problem identification is the process of recognizing a specific issue,gap or challenge that needs investigation or solution.

Why its important

Define the scope and purpose of the study

Ensure research is relevant and focused.

Use appropraite tools and methods.

Characteristics of a good research problem.

* Clear and specific
* Relevant
* Researchable
* Feasible

Sources of research problems in IT.

* Literature review
* Industry challenges
* Observations and experience.

Steps to identify a research problem.

* Explore the the field( articles, books)
* Spot gaps and challenge
* Narrow the focus
* Validate the problem.

Researchquestions/objectives

**General objective**

**Specific objectives.**

What is research objective?

Is just a rephrase of the topic.

Specific objectives is the results you can measure in the work.

**S - Specific**

1. **Measurable**
2. **Attainable**

**R - Relevant**

**T - timebound.**

The specific objective should begine with a preamble.

Example: The specific objectives of this studay are to;

* **Devop**
* **Compare**
* **Measure**

How to change them into questions by adding how;

* How to develop
* How to compare
* How to measure

Slides 3

RESEARCH Philosophy is a belief about the way in which data about a phenomenon should be gathered analyzed, and used.

The main paradigms include:

**Positivism**: OBECTIVE, MEASURABLE REALITY( QUANTITATIVE)

In positivism you need to weigh both negative and positive before making generalization.

**Interpretivism**: SUBJECTIVE, SOCIALLY CONSTRUCTED REALITY( QUALITATIVE)

Subjective means the person considered only one side without considering the other side.

**Pragmatism**: Is the experimental side using both qualitative and quantitative approach(Mixed mthods)

**Critical theory**: Focus on power,inequality and change (social research)

QUANTITATIVE VRS QUALITATIVE

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SLIDES 4

*WHAT IS A LITERATURE SEARCH:*

* **Systematical method to locate scholarly sources**
* **Includes journal,articles, books, reports**

STEPS IN CONDUCTING LITERATURE SEARCH

* **Define your research topic or question( what Machine Learning are used for)**
* **Identify the keywords and search terms(synonyms, Boolean operators)**
* **Choose databases(like IEEE, SCOPUS, WEB OF SCIENCE)**
* **Apply search filters(Date range, document type).**
* **Evaluate and select sources (CRAAP TEST)**
* **Organize and document your findings (Referencing using mendeley)**

ACADEMIC DATABASES

* **SCOPUS**
* **Web of Science**
* **Plos One**
* **Doaj**
* **IEEE Explore**

INFORMATION GATHERING TECHNIQUES:

**Primary sources:** surveys, interviews, Experiments, system logs

These are the generation generated by the researc himself.

**Secondary source**s: Journal, articles,Books, Reviews, Meta-analyses

After your primary data is well known we called it secondary sources

**Grey Literature:** Government Reports, NGO

It includes materials that are not formally published in books or journals but are still valuable sources of information.

SEARCH STRATEGIES:

* **Truncation**
* **Boolean opertaors**
* **Field searching.**

**TIPS FOR EFFICIENT SEARCHING**

* **Start broad and narrow your scope.**
* **Use advance search features in database**
* **Skim abstract before downaloding the document**
* **Keep search journal.**

Managing References & Citations

**Use reference managers to:**

* **Automatically cite in APA, IEEE, MLA, or Chicago styles**
* **Organize sources by topic or chapter**
* **Insert references directly into Word or LaTeX documents**
* **Recommended Tools:**
* **Zotero, Mendeley, EndNote**

SLIDES 5s

What is Critical Reading?

**Critical reading is the process of actively engaging with a text to assess:**

* Its purpose
* The validity of its methods and findings
* The strength of the arguments
* Its limitations and biases
* Its relevance to your own research
* Unlike passive reading, critical reading encourages questioning, annotation, comparison, and synthesis.

***Types of Research Papers***

* **Empirical Study:** Reports original research or experiments
* **Review Paper** : Summarizes findings from multiple studies
* **Theoritcal Paper:**  Develops new model or framework
* **Methodological paper :** Introduces new research methods
* **Case Study:** Detailed study of a specific event

Structure of a Research Paper

**Abstract** : Summary of purpose, methods, results, and conclusion

**Introduction :** Research problem, objectives, significance

**Literature Review :** Key theories, gaps in knowledge

**Methodology:** How data was collected and analyzed

**Results:** Key findings (tables, figures, stats)

**Discussion:** Interpretation of findings, limitations

**Conclusion :** Summary, contributions, suggestions

**References:** Prior work that supports the research

How to Read a Research Paper Critically

**Skim the Abstract:**

* **U**nderstand the main idea: What was the study about?
* Decide if it's relevant to your topic**.**

**Read the Introduction and Conclusion**

* Identify the problem, research questions, and justification.
* Note the key findings and claims in the conclusion.

**Scan the Methods and Results**

* What was the sample size? Was it valid?
* What tools and techniques were used?
* Are the results statistically significant?

**Read the Discussion Critically**

* How do the authors interpret the results?
* Do they acknowledge limitations?
* Are their claims supported by data?

**Review References**

* Check if the paper is grounded in strong, up-to-date research.
* You may find useful sources for your own work.

How to Take Notes While Reading

* **Title/Authors**
* **Problem**
* **Methodology**
* **Findings**
* **Limitations**
* **How it relates to my work**

Mistakes to Avoid

* **Reading without a purpose:** Wastes time and reduces comprehension
* **Accepting all claims as truth**
* **Ignoring limitations**
* **Not verifying sources**

**SLIDES 6**

What Is Technical Writing?

**Technical writing** is the process of creating documents that explain technical information in a clear, concise, and accessible way to a specific audience.

Importance of Technical Writing in IT

1. **Improves communication**
2. **Supports software development**
3. **Aids user adoption**
4. **Essential for product support**
5. **Enhances professional credibility**

Key Features of Good Technical Writing

* **Clarity**
* **Accuracy**
* **Conciseness**
* **Structure**
* **Audience-aware**
* **Objective tone**

**Common Types of Technical Documents in IT**

* **User Manuals**
* **Installation Guides**
* **API Documentation**
* **Technical Reports**
* **System Design Documents**
* **White Papers**

**The Technical Writing Process**

* **Understand the Purpose**
* **Gather Information**
* **Plan the Structure(Typical format: Title Page, Table of Contents, introduction)**
* **Write with Precision**
* **Edit and Revise**
* **Format and Publish**

Tools Used in IT Technical Writing

* **Microsoft Word**
* **Google DocS**
* **LaTeX**

Challenges

* **Keeping up with changes**
* **Explaining complex code**
* **Adapting to multiple audiences**
* **Maintaining consistency**

**SLIDES 7**

Referencing Styles, Plagiarism & Citation Tools (Zotero, Mendeley)

**Referencing allows readers to trace ideas, verify facts, and explore further readings**

**Referencing is the practice of giving credit to the original authors of the work, ideas, or data you use in your writing.**

**It typically includes:**

* **In-text citation:** Short references within the body of your work.
* **Reference list or bibliography**: Full citations at the end of the work

Why Referencing is Important

* **Avoids plagiarism**
* **Strengthens your argument**
* **Allows readers to verify sources**
* **Shows the depth of your research**

What is Plagiarism?

**Plagiarism** is the act of using someone else's words, ideas, or work without giving proper credit.

This includes:

* **Copying and pasting text from sources without citation**
* **Paraphrasing without referencing**
* **Submitting someone else’s work as your own**
* **Using AI tools or websites without attribution**

**A. APA (American Psychological Association)**

* **Format: Author-Date**
* **In-text: (Appiahene, 2023)**

**When to Cite**

* **You use a direct quote**
* **You paraphrase or summarize someone’s idea**
* **You use data, statistics, tables, or charts**
* **You refer to theories, models, or methods created by others**