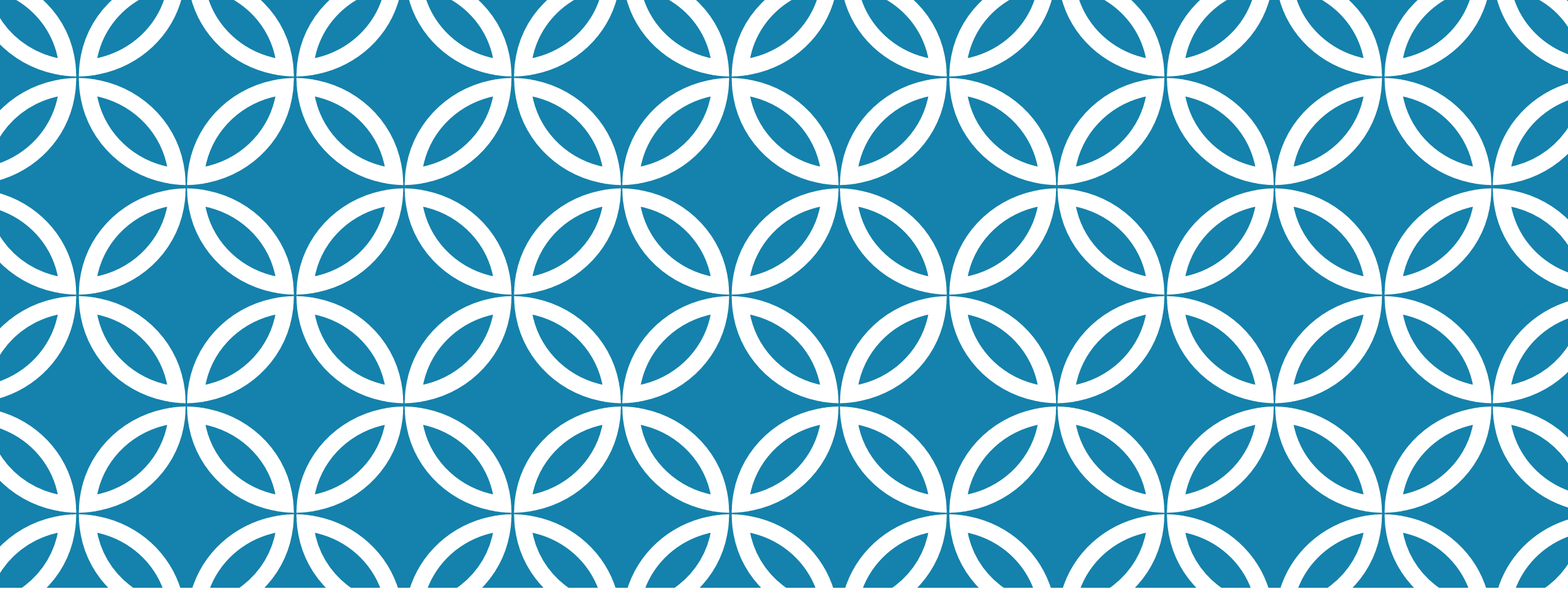




RESEARCH METHODS

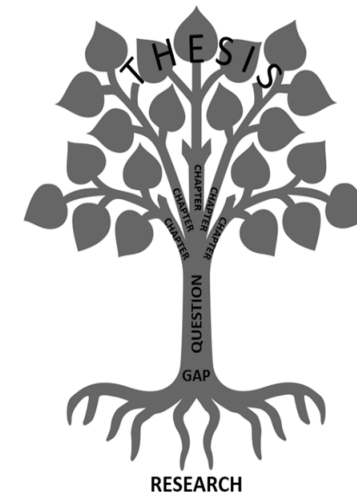
MODULE CODE 2101BM

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Definition, Purpose, and Types

Definition

- **Research** is a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific professional fields and academic disciplines.



Definition, Purpose, and Types

The Scientific Method

- The scientific method advances knowledge through observing phenomena, identifying questions, generating hypotheses, testing hypotheses, and then producing new observations, questions, and hypotheses.
- Descriptive analysis is a fundamental component of this process because of the role it plays in helping us to observe the world or a phenomenon and, subsequently, in identifying research questions and generating hypotheses based on what has been observed
- Inferential analysis for estimation and causal inference

Definition, Purpose, and Types

The scientific method

- Descriptive analyses are central to almost every research project. Whether the goal is to identify and describe trends and variation in populations, create new measures of key phenomena, or simply describe samples in studies aimed at identifying causal effects, descriptive analyses are part of almost every empirical paper and report.
- Some studies provide excellent descriptive analyses that are clearly focused on relevant aspects of a phenomenon.
- Unfortunately, other descriptive studies do little to provide relevant information, instead presenting a range of facts only tangentially related to the topic at hand.
- To be useful as an application of the scientific method both the goals and the findings of descriptive work should be clear.

Definition, Purpose, and Types

Purpose-general

- Research is conducted to gain a better understanding of the world, solve complex problems, and discover new information.
- It is essential for verifying truths, enhancing quality of life, fostering critical thinking, and driving innovation across academic, professional, and societal fields.

Definition, Purpose, and Types

Purpose-specific

- Knowledge Acquisition: Research helps answer questions, explore theories, and deepen understanding of challenging topics.
- Problem-Solving: It provides evidence-based solutions to practical challenges, rather than relying on "gut feel".
- Skill Development: Engaging in research strengthens critical thinking, analytical, writing, and research skills.
- Career & Academic Growth: It offers opportunities to work with mentors, build professional networks, earn credit, and create a stronger resume.
- Societal Impact & Innovation: Research advances science and technology, leading to advancements that can save lives and improve daily life.
- Validation: It allows for distinguishing truth from myths and verifying information.

Definition, Purpose, and Types

- Purpose

- Description /exploration

- Surface patterns and trends of phenomena
 - Create new measures of key phenomena
 - Describe samples in studies aimed at identifying causal effects

- Prediction

- Prediction research is intended to predict a phenomenon that will occur at time Y from information at an earlier time X. • In educational research, researchers have been engaged in acquiring knowledge about factors that predict student's success in school and in the world of work Identifying students who are likely to be unsuccessful so that prevention programs can be instituted.

- Control

- This type of research is mainly concerned with the effectiveness of intervention. The research approach include experimental design and evaluation research.

Basic and Applied research

- Basic research-Nursing students and give an example
- Applied research –PH and give an example
- Action research-Midwifery and give an example
- This exercise by students for 15 minutes

Types of research

Basic or pure research

- Is conducted solely for the purpose of gathering information and building on existing knowledge, as opposed to applied research, which is geared towards the resolution of a particular question.
- A neurologist who studies the brain to learn about its general workings is doing basic research, while a neurologist who is searching for the origins of Alzheimer's disease is involved in applied research.

Biomedical and fundamental research

- This approach seeks to discover new interventions (vaccines, drugs and diagnostic tools) or improve on existing ones to render them more effective and cost-effective.
- Development of vaccines constitutes the most important component of this type of research, since it prevents both morbidity and mortality.

Types of research

Epidemiological Research

- This is designed to classify the diseases of the environment, test new diagnostic and preventive approaches and evaluate prevalence, incidence and endemicity rates of different diseases, as well as evaluate the risk factors involved.

Operational and health systems research

- This seeks to apply existing knowledge to different socio cultural aspects of the environment to achieve improvement in the health system in a progressive procedure.
- It involves health services research and systems analysis.
- Some of its components are training, health education, planning supervision and community involvement.
- An example of this has been our study on the role of community women in improving high - risk care rural areas of Cameroon.

Types of research

Social research

- This seeks to investigate the economic, culture, anthropological, intersectional, agricultural, nutritional, educational and community participation and compliance.
- The Ministry of Health carries out some social research on the behavioural factors in disease control, effect of health education and drug compliance. In CUSS some social research is being carried out into the study of the socio-cultural determinants of acceptance or non-acceptance of contraception in the rural areas

Types of research

Implementation research

- General term for research that focuses on the question "What is happening?" in the design, implementation, administration, operation, services, and outcomes of social programs
- In the field of evaluation research, implementation studies are sometimes contrasted with impact studies, which measure the difference between "what is happening" and "what would have happened" in the program's absence

Health systems research

- Has been defined fairly broadly as: 'ultimately concerned with improving the health of a community, by enhancing the efficiency and effectiveness of the health system as an integrated part of the overall process of socio-economic development'

Health services research

- Is defined more narrowly in relation to the relationship between health service delivery and the health needs of the population: for example, as 'the identification of the health care needs of communities and the study of the provision, effectiveness and use of health services

Types of research

Action research

- Action research is a disciplined process of inquiry conducted *by* and *for* those taking the action.
- The primary reason for engaging in action research is to assist the “actor” in improving and/or refining his or her actions.
- Practitioners who engage in action research inevitably find it to be an empowering experience.
- Action research has this positive effect for many reasons.
- Obviously, the most important is that action research is always relevant to the participants. Relevance is guaranteed because the focus of each research project is determined by the researchers, who are also the primary consumers of the findings.

Qualitative research-Nursing students

- Define
- Explain
- Situate and Exemplify

Quantitative research-PH students

- Define
- Explain
- Situate and Exemplify

Mixed method research-Midwifery students

- Define
- Explain
- Situate and Exemplify

Application areas for research in health

Diverse field, aimed at:

- Improving patient outcomes
- Strengthening health systems
- Promoting wellness

Application areas for research in health

Digital Health and Artificial Intelligence (AI)

- AI in Diagnostics and Treatment: Researching AI-driven tools for image-based diagnosis (e.g., in dermatology or radiology) and personalized treatment plans.
- Mobile Health (mHealth): Using SMS and mobile applications for disease management (e.g., diabetes trackers, medication adherence) and health promotion.
- Telemedicine and Remote Monitoring: Evaluating virtual care, wearable sensors, and remote monitoring for chronic disease management.
- Electronic Health Records (EHR): Researching the optimization of electronic charting and data analytics to reduce errors and improve workflow.

Application areas for research in health

Clinical and Biomedical Research

- Cancer Research: Expanding understanding of cancer biology to improve treatment efficacy, including targeted therapies and immunotherapy.
- Cardiovascular Health: Investigating heart disease mechanisms, such as inflammatory and thrombotic processes in atherosclerosis.
- Genetics, Genomics, and Proteomics: Identifying genetic mutations underlying diseases and developing prognostic technologies.
- Infectious Diseases: Researching pathogen mechanisms, antimicrobial resistance, and vaccine effectiveness.
- Neuroscience: Studying neuroimmunology, neurogenetics, and mechanisms behind Alzheimer's and dementia.
- Regenerative Medicine: Developing artificial tissues and organ fabrication, as well as stem cell therapy.

Application areas for research in health

Public Health and Prevention

- Epidemiology: Tracking and analyzing the spread of diseases, such as COVID-19 and its long-term impacts.
- Environmental Health: Studying the impact of pollution, climate change, and occupational hazards on community health.
- Social Determinants of Health: Investigating how political, social, and economic systems (e.g., poverty, racism) impact health inequities.
- Substance Use and Harm Reduction: Developing treatments for addiction and behavioral health issues.
- Nutrition and Metabolic Health: Researching diet, obesity, and diabetes management.

Application areas for research in health

Health Systems, Policy, and Management

- Health Economics: Analyzing the cost-effectiveness of treatments, resource allocation, and healthcare financing.
- Health Policy and Planning: Evaluating health reforms, insurance regulations, and the impact of public health strategies.
- Healthcare Quality and Safety: Measuring patient safety, reducing medical errors, and improving care delivery in hospitals.
- Implementation Science: Studying methods to promote the adoption of evidence-based practices into routine clinical care.

Application areas for research in health

Special Populations and services

- Maternal and Child Health: Improving reproductive health and pediatric care.
- Aging and Regenerative Medicine: Promoting healthy aging, longevity, and prevention of disability.
- Mental Health: Researching mental illnesses, particularly in relation to physical health.

The research process

Key Stages in the Research Process

1. Identify the Problem: Defining the research topic, questions, objectives, and hypotheses.
 2. Literature Review: Examining existing studies to build on current knowledge and avoid duplication.
 3. Research Design: Developing a plan, choosing methodologies (quantitative or qualitative), and determining sampling methods.
 4. Data Collection: Gathering primary or secondary data through surveys, interviews, observations, or experiments.
 5. Data Analysis: Processing, analyzing, and interpreting the collected information to test hypotheses.
 6. Reporting Findings: Drawing conclusions, generalizing results, and writing the final report or presentation.
- NB: The research process generally follows a sequence of steps, though it may be iterative

Research proposal

What is the purpose of a research proposal?: The purpose of a research proposal can be summarized as follows:

- To propose a research project that will result in a significant contribution to knowledge.
- To formulate a detailed plan of the project including methodological approach and theoretical framework.
- To ensure that the proposed research is achievable within the required time and with the available resources.
- To demonstrate that you have adequate expertise and experience to undertake the project.
- To clarify objectives and key ideas.
- Develop a clear and detailed plan.
- Foresee problems during the process

Research proposal

- Structure

- Preliminary pages

- Title
 - Acknowledgement
 - Approvals
 - Declaration
 - Table of contents TOC

- Chapter 1

- Background to the topic
 - Problem statement
 - Research aims and questions
 - Significance

- Conceptual definitions
 - Conceptual framework

- Chapter 2

- Review of literature

- Chapter 3

- Methodology/Study/project design
 - Expected outcomes/impact
 - Operational definitions

- References

- Annexes

- Timeline
 - Budget

Research proposal

Key issues

- **First**, the proposal needs to identify a specific research area in the broader landscape of the discipline, and establish why it is significant and worth exploring.
- **Second**, the proposal needs to identify an existing or newly identified gap in knowledge that can be developed into a significant research problem.
- **Third**, the proposal needs to build a convincing case for your project as a viable way of approaching the research problem.
 - This aspect is often the most exciting and creative part of the proposal.
 - It allows you to showcase how your project design brings a new approach to an existing or newly identified problem.
- **Finally**, the proposal needs to demonstrate that your approach to the problem is achievable within the period of your candidature.

The research problem?

What it is

- A specific gap in knowledge
- A real-world challenge
- A contradiction in theory or findings

Importance

- Foundation for the research
- Dictates scope
- Guides methodology

Ways of identifying a research problem

- Literature review
 - Research gaps, contradictory findings, outdated studies
- Observing everyday inefficiencies and practices
 - Challenges, inefficiencies, puzzling trends
- Testing existing theories
 - In new context or geographical location
 - Discordance between theory and practice
- Consulting industry or sector experts
 - Most pressing unanswered questions
- Reflecting on you own professional or personal experiences
 - Personal experiences
- Past research calls to action
 - Recommendations for further research

Conceptualization of a research problem

Conceptualization of a research problem

- Is the crucial process of moving from a broad topic to a focused, researchable issue by defining key concepts, identifying knowledge gaps, and establishing the study's boundaries, purpose, questions, and framework, ensuring clarity and direction before data collection.
- It involves defining abstract ideas (like "student engagement") into measurable terms and linking them within a theoretical structure (conceptual framework) to guide the entire research project.

Conceptualization of research problem

Key Steps in Conceptualizing a Research Problem:

- Identify a Broad Topic: Start with an area of interest or a general problem, often sparked by observations or existing literature.
- Locate the Gap: Pinpoint what's unknown, under-explored, or controversial within that topic (e.g., gaps in methods, populations, or comparisons).
- Define Core Concepts: Clarify the meaning of key terms and variables, giving them theoretical definitions (e.g., defining "efficiency" in a technical context).
- Formulate a Problem Statement: Craft a concise statement that explains the specific issue, its significance, and why it needs research (e.g., "Current cells lose 30% efficiency in low light; this research will enhance performance").
- Develop Research Questions: Create specific questions that the research will answer, flowing from the problem statement.
- Build a Conceptual Framework: Map out the expected relationships between variables, often visually, to show how they connect to answer the questions.
- Consider Feasibility: Evaluate practical aspects like time, resources, and potential impact.

Conceptualization of research problem

Why It's Important:

- Focus & Clarity: Prevents random information gathering and ensures a clear path.
- Shared Understanding: Creates a common language for the research team.
- Foundation: Establishes the "why" and "what" of the study, guiding design and analysis

Characteristics of a good research problem

Novel:

- An ideal research problem introduces a fresh perspective, offering something new to the existing body of knowledge.
- It should contribute original insights and address unresolved matters or essential knowledge.

Significant:

- A problem should hold significance in terms of its potential impact on theory, practice, policy, or the understanding of a particular phenomenon.
- It should be relevant to the field of study, addressing a gap in knowledge, a practical concern, or a theoretical dilemma that holds significance.

Characteristics of a good research problem

Feasible:

- A practical research problem allows for the formulation of hypotheses and the design of research methodologies.
- A feasible research problem is one that can realistically be investigated given the available resources, time, and expertise.
- It should not be too broad or too narrow to explore effectively, and should be measurable in terms of its variables and outcomes.
- It should be amenable to investigation through empirical research methods, such as data collection and analysis, to arrive at meaningful conclusions
- A practical research problem considers budgetary and time constraints, as well as limitations of the problem.
- These limitations may arise due to constraints in methodology, resources, or the complexity of the problem.

Characteristics of a good research problem

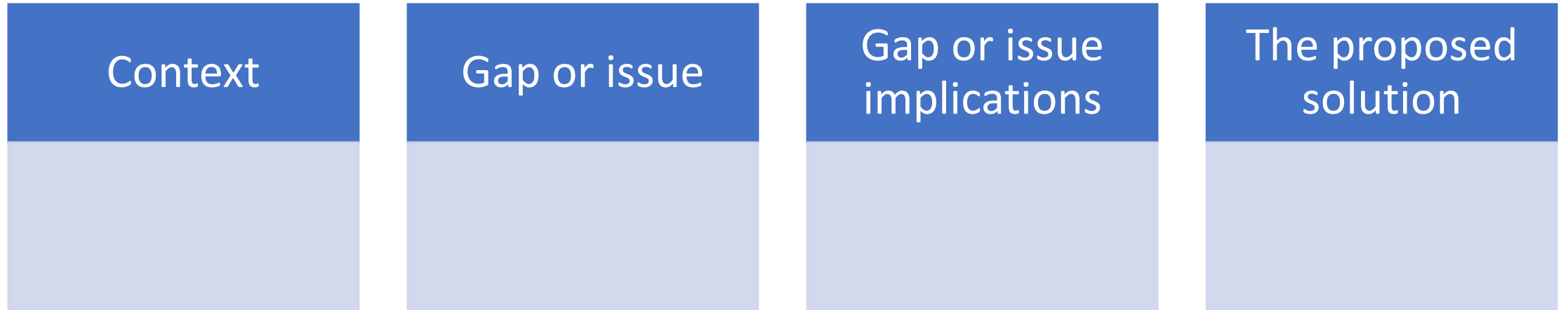
Clear and specific:

- A well-defined research problem is clear and specific, leaving no room for ambiguity; it should be easily understandable and precisely articulated.
- Ensuring specificity in the problem ensures that it is focused, addresses a distinct aspect of the broader topic and is not vague.

Rooted in evidence:

- A good research problem leans on trustworthy evidence and data, while dismissing unverifiable information.
- It must also consider ethical guidelines, ensuring the well-being and rights of any individuals or groups involved in the study.

Structure of a research problem



Types of research problems

What are research problems?

- Research problems are situations needing improvement, knowledge gaps, or theoretical challenges requiring investigation, generally categorized as theoretical, applied, or action-oriented.
- A research problem is a gap in existing knowledge, a contradiction in an established theory, or a real-world challenge that a researcher aims to address in their research.
- It is at the heart of any scientific inquiry, directing the trajectory of an investigation. Key types include descriptive (what is), relational (connections between variables), causal (cause-and-effect), and difference (comparing groups).
- Ideal problems are specific, original, and feasible.

Types of research problems

Type

- Theoretical Research Problems: Focus on expanding knowledge, understanding concepts, or developing theories within a field.
- Applied Research Problems: Aim to find immediate, practical solutions to specific problems, often applying theoretical knowledge.
- Action Research Problems: Time-sensitive, localized problems designed to improve specific practices or policies in a real-world setting.
- Descriptive Research Problems: Seek to describe the characteristics of a phenomenon, situation, or population (e.g., "What are the characteristics of...?").
- Relational Research Problems: Investigate connections, trends, or relationships between two or more variables.
- Causal Research Problems: Attempt to determine cause-and-effect relationships by manipulating variables to see if one causes the other.
- Difference Research Problems: Investigate whether there is a significant difference between two or more groups, or different treatments.
- Casuist Research Problems: Involve analyzing moral or ethical dilemmas to determine right from wrong, often using case studies.

Theoretical research problems

Modeling Health Systems:

- Developing a theoretical "production function" for health that models how inputs (costs, staff, infrastructure) affect outcomes like quality of life and patient satisfaction.

Behavioral Models in Health Education:

- Applying theories such as the Health Belief Model (HBM) to understand how perception of disease severity and self-efficacy influence preventive actions (e.g., in dengue prevention or smoking cessation).

Social Determinants of Health Frameworks:

- Analyzing how gender-related power dynamics, such as control over resources by partners, create vulnerabilities to HIV and mental health issues.

Theoretical research problems

Epidemiological Modeling:

- Developing theoretical models for the transmission of infectious diseases in dynamic, open-population contexts.

Bioethical Theory:

- Exploring the conceptual underpinnings of ethical dilemmas in emerging areas like AI in medicine or genetic engineering.

Healthcare Delivery Theory:

- Examining the theoretical basis for integrating primary healthcare systems to manage chronic diseases, such as tuberculosis or diabetes.

Practical research problems

- Practical research problems in health focus on solving immediate, real-world issues to improve patient outcomes, operational efficiency, and care accessibility.
- Examples include reducing 30-day hospital readmissions through improved discharge protocols, analyzing barriers to telehealth in rural areas, assessing mobile health (mHealth) effectiveness for chronic disease management, and tackling antibiotic resistance.

Practical research problems

Clinical and Patient Care

- Post-Operative Care: Evaluating if specific, nurse-led pain management protocols reduce reliance on opioids in post-operative patients.
- Chronic Condition Management: Investigating the impact of daily text message reminders on medication adherence for patients with hypertension.
- Infection Control: Studying the effectiveness of new sanitization protocols on decreasing hospital-acquired infections (MRSA).
- Diagnostic Efficiency: Analyzing the impact of Artificial Intelligence (AI) algorithms on the speed and accuracy of radiology image interpretation.

Practical research problems

Public Health and Health Systems

- Access to Care: Investigating the impact of transportation barriers on prenatal care attendance in underserved urban areas.
- Mental Health Access: Evaluating the effectiveness of school-based counseling programs in reducing anxiety among teenagers.
- Emergency Response: Assessing the impact of extreme weather events on the continuity of care for patients with chronic diseases.
- Vaccination Rates: Identifying factors that contribute to low vaccination rates in specific, targeted communities.

Practical research problems

Nursing and Health Administration

- Staffing Levels: Examining the relationship between nursing staff ratios and patient safety outcomes (e.g., fall rates, medication errors).
- Discharge Protocols: Comparing the effectiveness of in-person education versus video-based training on patient understanding of discharge instructions.
- Telehealth Adoption: Analyzing why elderly patients may not use telehealth services, despite having access, and how to increase adoption rates.

Problem statement structure

- Context-issue with statistical backing
 - Gap-challenge
 - Practical problem-effects
 - Purpose – intention
- Context: Community clinics lack standardized follow-up, causing high readmission.
 - Gap: Limited evidence exists on whether quick telephone check-ins reduce 30-day readmissions.
 - Practical Problem: High readmission increases costs and worsens patient outcomes.
 - Purpose: To evaluate if a standardized phone protocol reduces 30-day readmissions for patients over 65.

Problem statement

- Step 1: Contextualize the problem
 - The problem statement should frame your research problem, giving some background on what is already known.
 - The statement of a problem orients the reader to the importance of the topic, sets the problem into a particular context, and defines the relevant parameters, providing the framework for reporting the findings. Therein lies the importance of research problems.
 - Practical research problems
 - For practical research, focus on the concrete details of the situation:
 - Where and when does the problem arise?
 - Who does the problem affect?
 - What attempts have been made to solve the problem?

Problem statement-practice research problem

- Malaria prevalence the Eastern Uganda has been increasing steadily over the past ten years, in contrast to other areas of the country. According to surveys conducted by MoH, prevalence is highest among pregnant women and children under five. There have been some attempts at addressing the problem using interventions with well documented efficacy such as targeted distribution of mosquito nets and intensive presumptive treatment. However, these interventions have yet to have any significant effect on malaria prevalence.

Problem statement-theoretical research problem

Theoretical research problems

- For theoretical research, think about the scientific, social, geographical and/or historical background:
- What is already known about the problem?
- Is the problem limited to a certain time period or geographical area?
- How has the problem been defined and debated in the scholarly literature?

Problem statement

- Step 2: Show why it matters
 - The problem statement should also address the relevance of the research.
 - Why is it important that the problem is addressed?
 - This doesn't mean you have to do something groundbreaking or world-changing.
 - It's more important that the problem is researchable, feasible, and clearly addresses a relevant issue in your field.

Problem statement

- **Practical research problems**

- Practical research is directly relevant to a specific problem that affects an organization, institution, social group, or society more broadly.
- To make it clear why your research problem matters, you can ask yourself:
- What will happen if the problem is not solved?
- Who will feel the consequences?
- Does the problem have wider relevance? Are similar issues found in other contexts?

Problem statement

- **Practical research problems**

- Practical research is directly relevant to a specific problem that affects an organization, institution, social group, or society more broadly.
- To make it clear why your research problem matters, you can ask yourself:
- What will happen if the problem is not solved?
- Who will feel the consequences?
- Does the problem have wider relevance?
- Are similar issues found in other contexts?

Problem statement

- Malaria has been shown to increase maternal mortality, miscarriages, and poor child development. There is a 20% increase maternal mortality among mothers who suffer from malaria during pregnancy across all the trimesters. If not addressed maternal mortality will increase negatively affecting the pursuit of the SDG goals
- Addressing the problem will reduce overall mortality, save lives of mothers and children, and improve household productivity.

Problem statement

- Step 3: Set your aims and objectives
 - Finally, the problem statement should frame how you intend to address the problem.
 - The goal here should not be to find a conclusive solution, but rather to propose more effective approaches to tackling or understanding it.
 - The research aim is the overall purpose of your research.
 - It is generally written in the infinitive form:
 - The aim of this study is to determine...
 - This project aims to explore...
 - This research aims to investigate...

Problem statement

- The research objectives are the concrete steps you will take to achieve the aim:
 - Qualitative methods will be used to **identify**...
 - This work will use surveys to **collect**...
 - Using statistical analysis, the research will **measure**...

Research questions

What is a good research question?

- A research question is a statement made in a question form to provide focus, clarity, and structure to the research endeavor.
- This helps the researcher design methodologies, collect data, and analyze results in a systematic and coherent manner.
- A study may have one or more research questions depending on the nature of the study.
- Constructing a clear and focused research question (or questions) is crucial to producing a good research proposal and, more importantly, shaping the direction of your research.
- The question indicates exactly what you want to explore and allows the reader to assess whether or not your project is viable.
- It also gives the reader a sense of the arguments or findings that you might produce in response.

Research questions

What is a good research question?

- The criteria for a good research question vary from one field of study to another.
- It is therefore advisable that you consult with your supervisor and closely examine examples from other theses and published studies to get a sense of the requirements in your field.
- In general terms, however, a good research question should be:
- **Relevant:** It must clearly relate to the problems or issues that the project seeks to address.
- **Important:** It should address a key problem in the field (see *From identifying a gap to constructing a problem* above).
- **Clear:** It should be expressed using concise language and contain no ambiguity.
- **Precise:** What is being investigated should be clearly specified.
- **Researchable:** The information and sources required to answer the question must exist and you must be able to access them (with the exception of data that you will generate yourself through surveys, experiments, etc.).

Research questions

Constructing a research question

- The wording of the research question (or questions) is important because it will direct the approach and writing and help to shape the feedback that you receive from readers of your proposal.
- It is important to understand that you can change your research question at a later date if you think that the wording needs to be changed or if you make discoveries that encourage a different approach to the topic.
- It is highly likely, in fact, that the question that you pose in your proposal will be different from the question or questions that your thesis actually answers.

Research questions

Constructing a research question

- Wording of research questions can vary significantly from one field of study to another, so it is advisable that you consult with your supervisor and seek out examples from other research proposals, theses, or published papers.
- However, the following general points can be made:
- *How* and *why* questions are usually preferred as they generate analytical rather than descriptive findings.
- The question should be worded in such a way that a number of different responses would be possible.
- The wording should be neutral in tone. Avoid value judgements or untested assumptions.
- The wording should include the key concepts and relationships that you have identified.

Research questions

Interrogate your research question

- After the initial drafting of your research question you should interrogate it to highlight strengths and weaknesses in your thinking or wording.
- Write responses to the following questions:
- Does this research question interest me? Will it sustain my interest?
- Does this question help to address a significant research problem?
- Has this question already been answered by others? If so, how will my response differ?
- Is the question too easy to answer? Is the answer too obvious?
- Can the question be approached from different angles?

Research questions

Interrogate your research question

- Will this question allow me to generate a strong and interesting position or findings? At this point in time what hypothesis would I make in response to the question?
- Does the question have an appropriate scope? Is the specified content too broad or too narrow?
- Is the question researchable?
- What kind of information and sources will I need to answer the question? Am I able to access this information? Will I need to generate my own data?
- What about the ethics of the question? Does it entail risks for the researcher or (if relevant) the participants?

Characteristics of a good research question

Specific and Clear: It clearly identifies the variables, target population, and the boundaries of the study so readers know exactly what is being investigated.

Focused: It is narrow enough to be thoroughly explored within the scope of your time, budget, and assignment length.

Researchable: It can be answered using empirical data, literature, or tangible evidence. Purely opinion-based or philosophical questions are generally avoided.

Complex: It requires critical thinking, analysis, and discussion rather than a simple, closed-ended "yes" or "no" answer (e.g., *To what extent does X affect Y?*).

Feasible: You must actually have access to the resources, data, methods, and subjects required to answer the question.

Relevant and Original: It adds meaningful value to your academic field or solves a practical problem, ensuring it passes the "so what?" test

Criteria for research question

- PICO/PICOT
- FINER
- FINERMAPS



1. Existence

This is designed to uphold the existence of a particular phenomenon or to rule out rival explanation.

for example, can neonates perceive pain?

2. Description and classification

This type of question encompasses statement of uniqueness

for example,

what are characteristics and types of anxiety disorder?





3. Composition

It calls for breakdown of whole into components

for example

what are stages of Grief cycle?

4. Relationship

Evaluate relation between variables for example, association between anxiety and PTSD

5. Descriptive— comparative

Expected that researcher will ensure that all is same between groups except issue in question

for example, Are GAD and PTSD share common symptoms?

6. Causality

Does relaxation therapy has an impact on anxiety disorder?

7. Causality—comparative:

Such questions frequently aim to see effect of two rival treatments

for example, does integrating therapy improves survival rate outcome in children with stress and anxiety disorders?

8. Causality–Comparative interactions

Does psychotherapy leads to better outcome in PTSD?

(Does X cause more changes in Y than those caused by Z under certain condition and not under other conditions).

Finer criteria

The FINER criteria is a framework used to evaluate and refine research questions, ensuring they are Feasible, Interesting, Novel, Ethical, and Relevant.

It helps researchers—particularly beginners—develop actionable questions that are, respectively, manageable in scope, engaging to the scientific community, innovative, ethically sound, and impactful to their field.

Finer criteria

Feasible:

- The study can be completed within the limits of time, resources, funding, and expertise. It requires manageable sample sizes and available, appropriate technical, and, in clinical settings, accessible participants.

Interesting:

- The research question should pique the curiosity of the investigator, colleagues, and the broader scientific community.

Novel:

- The research should provide new insights, confirm, disprove, or extend previous findings. It aims to fill gaps in existing knowledge.

Ethical:

- The study must conform to ethical guidelines, protecting the rights, safety, and confidentiality of participants (human or animal).

Relevant:

- The findings should be significant to clinical practice, policy formulation, or future research directions.

FINER criteria

F – Feasible

- Adequate number of subjects
- Adequate technical expertise
- Affordable in time and money
- Manageable in scope

I – Interesting

- Getting the answer intrigues investigator, peers and community

N – Novel

- Confirms, refutes or extends previous findings

E – Ethical

- Amenable to a study that institutional review board will approve

R – Relevant

- To scientific knowledge
- To clinical and health policy
- To future research

PICOTS criteria

The PICOTS criteria (Population, Intervention, Comparator, Outcomes, Timing, Setting) is an evidence-based framework used to structure clinical research questions, guide literature searches, and define study inclusion criteria.

It helps researchers precisely define the patient group, intervention, control, expected results, timeframe, and environment.

PICOT criteria

PICOT criteria tend to be used to frame questions used in evidence-based studies, such as medical studies.

Such research may focus on assessment or evaluation of patients or problems, as well as what may be the causal factor(s) with control and experimental group.

PICOT criteria

P – Patient (or Problem)

I – Intervention (or Indicator)

C – Comparison group

O – Outcomes

T – Time

A good research is represented by acronym FINERMAPS

- Feasible
- Interesting
- Novel
- Ethical
- Relevant
- Manageable
- Appropriate
- Potential value and publishability
- Systematic.

Research Question

The process of developing the research question follows several steps:

- Selection of a broad topic
- Do some preliminary reading to find out about topical debates and issues
- Narrow down a specific one that the researcher want to focus on
- Identify a practical or theoretical research problem that will be addressed

Steps to developing a research question

1. *Choose an interesting general topic.*
2. *Do some preliminary research on the topic.*
3. *Consider the audience.*
4. *Start asking questions.*
5. *Evaluate the question.*
 - i. *Is the research question clear?*
 - ii. *Is the research question focused?*
 - iii. *Is the research question complex?*
6. *Begin the research.*

Steps 1

Choose an interesting general topic.

- Most professional researchers focus on topics they are genuinely interested in studying.
- Writers should choose a broad topic about which they genuinely would like to know more.
- An example of a general topic might be “Mental Health of People”

Steps 2

Do some preliminary research on the general topic.

- Do a few quick searches in current periodicals and journals on the topic to see what's already been done and to help you narrow your focus.
- What issues are scholars and researchers discussing, when it comes to your topic?
- What questions occur to you as you read these articles?

Steps 3

Consider the audience.

- For most college papers, the audience will be academic, but always keep the audience in mind when narrowing the topic and developing the question.
- Would that particular audience be interested in the questions are developed?

Steps 4

Start asking questions.

- Taking into consideration all of the above, start asking oneself open-ended “how” and “why” questions about the general topic.
- For example, “Why were mental health of people not given much importance when compared to general health?”

Steps 5

Evaluate the question.

After putting a question or even a couple of questions down on paper, evaluate these questions to determine whether they would be effective research questions or whether they need more revising and refining.

Evaluate the question.

- *Is the research question clear?* With so much research available on any given topic, research questions must be as clear as possible in order to be effective in helping the writer direct his or her research.
- *Is the research question focused?* Research questions must be specific enough to be well covered in the space available.
- *Is the research question complex?* Research questions should not be answerable with a simple “yes” or “no” or by easily-found facts. They should, instead, require both research and analysis on the part of the writer. They often begin with “How” or “Why.”

Begin the research

- After come up with a question, think about the possible paths about the research could take.
- What sources should you consult as a source to seek answers for the question?
- What research process will ensure that to find a variety of perspectives and responses to the research question?

Good and Bad Research Questions

- What effect does social media have on people's minds?
- What effect does daily use of Twitter have on the attention span of under-16s?

Good and Bad Research Questions

- Why is there a housing crisis in the Netherlands?
- What impact have university internationalisation policies had on the availability and affordability of housing in the Netherlands?

Explanation

- Starting with “why” often means that the question is not focused enough:
- there are too many possible answers and no clear starting point for research.
- By targeting just one aspect of the problem and using more specific terms,
- the second question offers a clear path to finding an answer.

Good and Bad Research Questions

- Does the US or the UK have a better healthcare system? (Poor)
- How do the US and the UK compare in health outcomes and patient satisfaction among low-income people with chronic illnesses? (Good)

Explanation

- The first question is too broad and overly subjective:
- there's no clear criteria for what counts as “better”.
- The second question is much more researchable.
- It uses clearly defined terms and narrows its focus to a specific population.

Good and Bad Research Questions

- What should political parties do about low voter turnout in region X?
- What are the most effective communication strategies for increasing voter turnout among under-30s in region X?

Explanation

It is generally not feasible for academic research to answer broad questions about “what should be done”.

The second question is more specific, and aims to gain an understanding of possible solutions in order to make informed recommendations.

Good and Bad Research Questions

- Has there been an increase in homelessness in San Francisco in the past ten years?
- How have economic, political and social factors affected patterns of homelessness in San Francisco over the past ten years?

Explanation

The first question is too simple: it can be answered with a simple yes or no. The second question is more complex, requiring in-depth investigation and the development of an original argument.

Good and Bad Research Questions

- What factors led to women gaining the right to vote in the UK in 1918?
- How did Irish women perceive and relate to the British women's suffrage movement?

The first question is too broad and not very original. It has been extensively researched by historians, and it would be very difficult to contribute new knowledge. The second question identifies an underexplored aspect of the topic that requires investigation and discussion of various primary and secondary sources to answer.

Explanation

Good and Bad Research Questions

- How can sexual health services and LGBT support services in district X be improved?
- How can sexual health clinics in district X develop their services and communications to be more LGBT-inclusive?

Explanation

The first question is not focused enough: it tries to address two different practical problems (the quality of sexual health services and LGBT support services). Even though the two issues are related, it's not clear how the research will bring them together. The second integrates the two problems into one focused, specific question.

- Where do the majority of immigrants to Germany come from?
- What are the similarities and differences in the experiences of recent Turkish, Polish and Syrian immigrants in Berlin?

Good and Bad Research Questions

Explanation

The first question is too simple, asking for a straightforward fact that can be easily found online. The second is a more complex comparative question that requires data collection and detailed discussion to answer.

Good and Bad Research Questions

- How is race represented in Shakespeare's *Othello*?
- How have modern adaptations of Shakespeare's *Othello* dealt with the theme of racism through casting, staging and allusion to contemporary events?

Explanation

The first question is not original or relevant — it has been answered so many times that it would be very difficult to contribute anything new. The second question takes a specific angle with scope to make an original argument, and has more relevance to current social concerns and debates.

- How can drunk driving be prevented?
- What effect do different legal approaches have on the number of people who drive after drinking in European countries?

Good and Bad
Research
Questions

Explanation

The first question asks for a ready-made solution, and is not focused or researchable. The second question is a clearer comparative question, but note that it may not be practically feasible. For a smaller research project or thesis, it could be narrowed down further to focus on the effectiveness of drunk driving laws in just one or two countries.

Research Question

Unclear: *How should social networking sites address the harm they cause?*

Clear: *What action should social networking sites like MySpace and Facebook take to protect users' personal information and privacy?*

The unclear version of this question doesn't specify which social networking sites or suggest what kind of harm the sites might be causing. It also assumes that this "harm" is proven and/or accepted. The clearer version specifies sites (MySpace and Facebook), the type of potential harm (privacy issues), and who may be experiencing that harm (users). A strong research question should never leave room for ambiguity or interpretation.

Research Question

Unfocused: *What is the effect on the environment from global warming?*

Focused: *What is the most significant effect of glacial melting on the lives of penguins in Antarctica?*

The unfocused research question is so broad that it couldn't be adequately answered in a book-length piece, let alone a standard college-level paper. The focused version narrows down to a specific effect of global warming (glacial melting), a specific place (Antarctica), and a specific animal that is affected (penguins). It also requires the writer to take a stance on which effect has the greatest impact on the affected animal. When in doubt, make a research question as narrow and focused as possible.

Research Question

Too simple: *How are doctors addressing diabetes in the U.S.?*

Appropriately Complex: *What main environmental, behavioral, and genetic factors predict whether Americans will develop diabetes, and how can these commonalities be used to aid the medical community in prevention of the disease?*

The simple version of this question can be looked up online and answered in a few factual sentences; it leaves no room for analysis. The more complex version is written in two parts; it is thought provoking and requires both significant investigation and evaluation from the writer. As a general rule of thumb, if a quick Google search can answer a research question, it's likely not very effective.

A simple question gets a simple answer. And a simple answer will not be enough information for a thesis. How you ask the question is important. Avoid questions that can be answered with "yes" or "no" or a single word or phrase.

- **Bad:** Does owning a pet improve quality of life for older people?
- **Good:** In what ways does owning a pet improve quality of life for older people?

With this "bad" question, the answer is a simple "yes" or "no." However, when you ask about the specific ways a pet can improve the quality of life for its owner, you get a much more detailed and interesting answer. This type of answer allows you create a thesis statement.

A good research question should be focused on a single topic or on several closely related ideas.

If it isn't, you won't end up with a good thesis. If a question is too general or doesn't stay on one topic, you can fix it by deciding which part of the topic you want to research.

- Bad: Does medication help alleviate attention deficit hyperactivity disorder (ADHD) symptoms? And do kids need more exercise?
- Good: How effective are the various types of medication in treating elementary students with ADHD?

Instead of covering both ADHD medication and exercise as topics, the good question focuses on medication only. It's also more specific about the age of the students. The answer to this question will provide a good thesis.

It's possible to ask a really interesting question and not be able to find the answer. Don't forget that your reason for asking this question is to come up with a really great answer - one on which you'll be able to build a paper or project. If you can't answer it, you can't write a paper or do the project.

- Bad: Is there a higher power in the universe?
- Good: What factors affect people's belief in a higher power?

You can keep the same topic but change the question to be something you have the ability to answer within the time period and using the resources available to you.

As researcher write the question, think about the answer they want to receive. An opinion or value judgement isn't a good start for a strong research paper or project. Instead, researcher want to create a thesis based on data and objective evidence.

- Bad: Which national park is the best?
- Good: What features do the most popular national parks have in common?

Asking which national park is the best does not provide a thesis that can serve as the basis for a project or essay. It only asks for an opinion. However, you can use visitor data and lists of park features to answer the better version of this question.

As you write your question, make it as specific as possible. This will give you a more detailed answer - one that is strong enough to be the topic of your project or paper.

- Bad: How do artificial sweeteners affect people?
- Good: How does aspartame affect post-menopausal women who suffer from migraines?

By specifying which artificial sweetener and which people, the question is easier to answer with facts. These facts help form a strong, focused thesis and they also lend support to your work.

If you ask a question that's already been answered a thousand times before, you're only doing research that someone else has already done. This doesn't provide you with a good thesis. Instead, ask a question with an original slant to it.

- Bad: What are the advantages and disadvantages of cell phone use in schools?
- Good: How does restricting cell phone use in school affect student social interaction?

Many people have studied the topic of cell phone use in schools, and it's easy to find information about the advantages and disadvantages. A more interesting perspective on the same topic is to examine how the restriction of cell phones affects students' interactions with one another.

If you're writing interview questions or planning to talk with a source for a feature article, "why" questions are great because of how open-ended they are. However, when you're writing a research question, that open-endedness is the opposite of what you need. You need a question that has a clear and specific answer.

- Bad: Why do some corporations pollute the water if they aren't regulated?
- Good: How do government regulations prevent corporations from polluting the water?

By changing the "why" question to a "how" question, you're asking for specifics instead of a vague opinion. This will help you create a much stronger thesis statement for your research paper.

If you can answer a research question without doing much research, it's a bad question. It's better to formulate your question so that you need to dig a little to answer it. If you can answer with a simple web search, you need a more complex question.

- Bad: Has the population of the world increased in the past century?
- Good: What factors have influenced population growth in the fastest growing countries?

A quick search can answer the initial question here. The revised question, by contrast, requires more digging around to find an adequate answer.

It's easy to write a research paper or do a project about something that isn't controversial, but you likely won't be creating anything new. Instead, ask a research question about something that has multiple sides. That way, the research you do and details you include will have more impact.

- Bad: Are illicit drugs bad for kids?
- Good: Which effective education strategies prevent drug abuse in teens?

Everyone knows illicit drugs are bad for kids, but people will disagree about which education strategies actually help. You'll need to dig for data to back up your answer to this question, since some people will not agree with you.

A good research question can be answered with primary sources or secondary sources. It doesn't ask for an opinion or require a guess. If you look for support for the answer, the research is out there.

- Bad: Are white mice better than gray mice?
- Good: When tested for intelligence and longevity, how do white mice and gray mice compare?

Testing mice for intelligence will give you a primary source for answering this question, and looking at records summarizing longevity will provide a secondary source. Because the question is specific, you can answer it with good research sources.

How to develop a research question?

Checklist

- Is RQ clear? With so much research available on any given topic, RQs must be as clear as possible in order to be effective in helping the writer direct his or her research
- Is the RQ focused? RQs must be specific enough to be well covered in the space available
- Is the RQ complex? RQs should not be answerable with a simple “yes” or “no” or by easily found facts. They should, instead, require both research and analysis on the part of the writer
- Is the RQ one that is of interest to the researcher and potentially useful to others? Is it a new issue or problem that needs to be solved or is it attempting to shed light on previously researched topic
- Is the RQ researchable? Consider the available time frame and the required resources. Is the methodology to conduct the research feasible?
- Is the RQ measurable and will the process produce data that can be supported or contradicted?
- Is the RQ too broad or too narrow?

Brainstorm/Concept map for formulating research question

- First, identify what types of studies have been done in the past?
- Is there a unique area that is yet to be investigated or is there a particular question that may be worth replicating?
- Begin to narrow the topic by asking open-ended “how” and “why” questions
- Evaluate the question
- Develop a Hypothesis (Hs)
- Write down the RQ.

- State the question in your own words
- Write down the RQ as completely as possible.

For example, Evaluation of reproductive hormonal profile in children presenting with isolated hypospadias)

- Divide your question into concepts. Narrow to two or three concepts (reproductive hormonal profile, isolated hypospadias, compare with normal/not isolated hypospadias—implied)
- Specify the population to be studied (children with isolated hypospadias)
- Refer to the exposure or intervention to be investigated, if any
- Reflect the outcome of interest (hormonal profile).

1. Make reference to a population when a relationship is expected among a certain type of subjects
2. RQs and Hs should be made as specific as possible
3. Avoid words or terms that do not add to the meaning of RQs and Hs
4. Stick to what will be studied, not implications
5. Name the variables in the order in which they occur/will be measured
6. Avoid the words significant/"prove"
7. Avoid using two different terms to refer to the same variable.

Research question type	Formulation
Descriptive research	<i>What are the characteristics of X?</i>
Comparative research	<i>What are the differences and similarities between X and Y?</i>
Correlational research	<i>What is the relationship between variable X and variable Y?</i>
Exploratory research	<i>What are the main factors in X? What is the role of Y in Z?</i>
Explanatory research	<i>Does X have an effect on Y? What is the impact of Y on Z? What are the causes of X?</i>
Evaluation research	<i>What are the advantages and disadvantages of X? How well does Y work? How effective or desirable is Z?</i>
Action research	<i>How can X be achieved? What are the most effective strategies to improve Y?</i>

Significance

- What are the study outcomes?
- What are the benefits from the outcomes?
- Who benefits?
- How do they benefit?
 - I will document the factors contributing the low utilization of PH guidelines
 - Benefits
 - Beneficiaries
 - I will publish the report
- If all the research questions were answered appropriately who would benefit and how .

Operational definitions

- Conceptual definitions: these are theoretical definitions.
- A teenager is a young person aged 13 through 19, also known as a teen or adolescent, representing the transitional stage between childhood and adulthood.

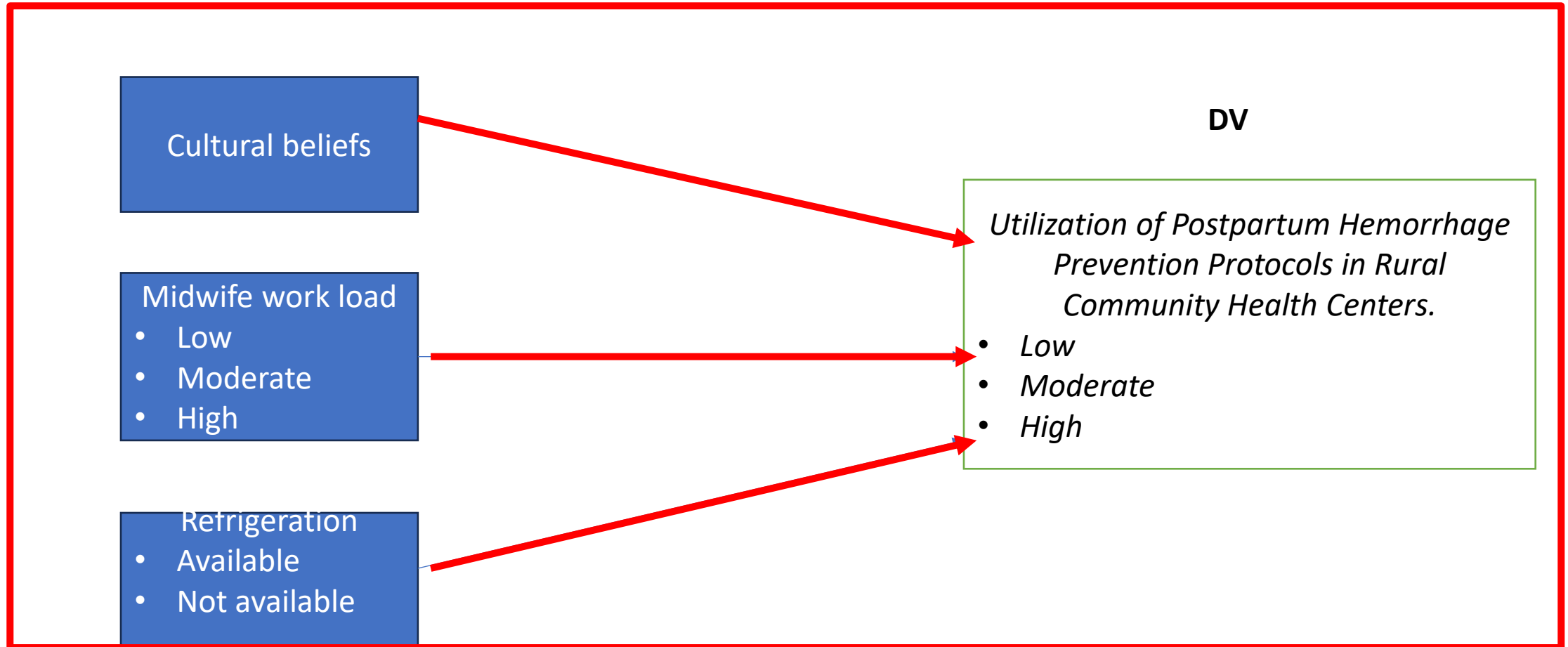
Conceptual framework

- How the variables relate-illustrated diagrammatically
- Dependent variable and its levels
- Independent variable and its levels
- Construct the relationship between the variables
- Relations and broad hypothesis

Example

- *Title*
 - *Barriers to the Utilization of Postpartum Hemorrhage Prevention Protocols in Rural Community Health Centers.*
- Dependent variable (The one that is affected or changed by our actions, effort, beliefs)
 - *Utilization of Postpartum Hemorrhage Prevention Protocols in Rural Community Health Centers.*
 - Low, Moderate, High
- Independent variables: The actions or attitude or behaviour that affects the dependent variable
 - Cultural beliefs
 - Midwife work load
 - Low, Moderate, High
 - Refrigeration
 - Available, not available

CF



CF narrative

- General overall
- Low utilization refers to:
 - **Visual estimation only:** Staff rely on guesswork instead of using calibrated collection drapes to measure blood loss.
 - **Delayed response:** Interventions start only after a high-volume loss (>500 mL) rather than acting early at 300 mL with vital sign changes
 - **Omitted bundle steps:** Failure to apply the complete first-line treatment steps (uterine massage, oxytocin, tranexamic acid, IV fluids, and exam) within 15 minutes.
- Moderate utilization refers
- High utilization

Midwife workload

- Low
 - **WISN Ratio > 1.0:** The number of available midwives exceeds the calculated staffing requirement for the recorded annual service volume
 - **Low Caseload per FTE:** Managing significantly fewer than 30 to 40 women per full-time equivalent midwife annually in continuous care models.
 - **Low Patient Acuity Ratios:** Falling well below standard 1:4 or 1:6 staffing-to-patient ratios for combined mothers and babies on postnatal wards

Literature

- Any documented information
 - Reports
 - Newspapers
 - Journal articles
 - Circulars/memos
 - Letters
- Types
 - Source : website, online, office, social media
 - Ownership/authority: Government, private-personal, private institutional,
 - Currency: current or outdated

Literature : define and give an example

- Primary
- Secondary
- Tertiary
- Grey

Purpose of literature review

Purposes

- Identify or validate the research problem
- Select the research methods
- Guide the discussion of findings

Approach

- Guided by research question
- Follows a clear procedures'
- Involves comparison of observations and findings

Chapter 2: Literature review

- A literature review is a scholarly survey of existing books and articles on a topic, summarizing, synthesizing, and critically evaluating them to establish context, identify gaps, and position new research within the field
- It's more than just a summary; it's a critical discussion that connects sources, revealing trends, debates, and unanswered questions to show how new work contributes to existing knowledge.

Literature review

- A review of literature presents much more than a summary of relevant sources.
- The act of reviewing involves evaluating individual sources as well as synthesizing these sources in order to gain a broad view of the field.
- At this ‘field level’, a literature review discusses common and emerging approaches, notable patterns and trends, areas of conflict and controversies, and gaps within the relevant literature.
- When you can clearly observe these things, you will be able to situate your own research and contribute to ongoing debates within the field.
- When reviewing the literature, “not only do you need to engage with a body of literature, you also need to be able to compare, contrast, synthesize, and make arguments with that literature in ways that indicate a readiness to contribute to the literature itself”

Literature review

- **The purpose of a literature review for a research proposal**
 - The literature review surveys key academic works in your field of research, such as books, refereed journal articles, and postgraduate theses.
 - The review should summarize, analyze, categorize and compare the most significant works - it does not need to cover everything that has been written on the topic.
 - Most importantly, it should clearly demonstrate the gap or problem that your research project will address by outlining both the strengths and the limitations of previous research.

Literature review

- **The purpose of a literature review for a research proposal**
 - In essence, a literature review identifies, evaluates and synthesises the relevant literature within a particular field of research.
 - It illuminates how knowledge has evolved within the field, highlighting what has already been done, what is generally accepted, what is emerging and what is the current state of thinking on the topic.
 - In addition, within research-based texts such as a Doctoral thesis, a literature review identifies a research gap (i.e. unexplored or under-researched areas) and articulates how a particular research project addresses this gap.

Literature review

- **The purpose of a literature review for a research proposal**
 - Provide a background to your work by summarizing the previously published work
 - Classify the research into different categories and demonstrate how the research in a particular area has changed over time by indicating historical background (early research findings in an area) as well as explaining recent developments in an area
 - Clarify areas of controversy and agreement between experts in the area as well as identify dominant views
 - Evaluate the previous research and identify gaps (i.e. Unexplored areas)
 - Help justify your research by indicating how it is different from other works in the same area

Literature review

- **The purpose of a literature review for a research proposal**
 - Contextualize Research: Shows familiarity with the topic and places your work within the broader academic conversation.
 - Identify Gaps: Highlights areas where research is lacking or under-explored, justifying your own study.
 - Synthesize Knowledge: Combines different sources to form new interpretations or trace the development of ideas.
 - Evaluate Sources: Assesses the quality and relevance of existing research and methodologies.

Literature review

- **The purpose of a literature review for a research proposal**
 - Avoid Duplication: Prevents you from repeating research already done.
 - Develop Theory: Helps you understand the theoretical frameworks driving your field.
 - Inform Your Study: Provides a foundation, methodology, and justification for your own research questions.

Literature review

- **What is meant by the term *literature*?**

- Literature refers to a collection of published information/materials on a particular area of research or topic, such as books and journal articles of academic value.
- However, your literature review does not need to be inclusive of every article and book that has been written on your topic because that will be too broad.
- Rather, it should include the key sources related to the main debates, trends and gaps in your research area.

Literature review

- **What is meant by the term *review*:** To review the literature means to be able to identify:
 - What has been established, discredited and accepted in your field
 - Areas of controversy or conflict among different schools of thought
 - Problems or issues that remain unsolved
 - Emerging trends and new approaches
 - How your research extends, builds upon, and departs from previous research.

Broad stages

- Summary: table only
- Synthesis : is narrative

RQ for literature review

- How do demographic factors influence access to health care among first-time pregnant mothers?
 - Identify the significant factors
 - Illustrate the direct of effect
- Sea literature from 2016 to-date
- Tabulate the findings
 - Author/researcher
 - Year
 - Findings
 - Methods
 - Remarks
- A minimum of 10 articles or publications an max of 20 articles or publications

Summary table

Author	Year	Findings	Methods	Remarks
Kennedy et al	2022	Age , marital status, housing status have a negative influence on access	Quantitative, cross-sectional, chi square, bivariate analysis, multivariate analysis Sample size 60, s ampling method systematic sampling	The study was properly structure to answer the research question
Indico et al				

Literature review

Planning and writing a literature review

- **Focus:** A literature review for a research project should give an accurate picture of the general field, but rather than discuss every text in detail it should focus on works that are directly related to your specific topic.
- It is usually best to focus on the most prominent and recent contributions to the topic.

Literature review

Planning and writing a literature review

- **Structure:** Rather than discuss each selected text separately, a literature review should be organized around key similarities, differences, and other points that you want to make about the development of academic writing on the topic.
- Search for a review article on the topic (a kind of literature review found in refereed journals) and study the literature reviews contained in recently published books and journal articles on the topic.
- Consider how these authors categorize and evaluate the literature.
- **Faculty/School specifics:** The above points apply for most research proposals, but some faculties and schools will have their own requirements regarding the content and word count of the literature review component.
- This will have an influence on how you select and critique the literature. It is therefore important that you check the specific requirements of your Faculty or School.

Literature review: Process

1. Locating literature

- Identify key texts

2. Reviewing literature

- Read key texts
- Analyse & evaluate critically

3. Writing the literature review

- Synthesise
- Organise

Literature review

- How it Works

- Define Scope: Start with a clear research question and define the boundaries (time, geography, criteria).
- Search Strategically: Use keywords in databases to find relevant scholarly articles and books.
- Analyze & Synthesize: Don't just list summaries; group sources by themes, methodologies, or arguments, identifying agreements and disagreements.
- Structure: Organize the review logically (e.g., thematically, chronologically) to build a coherent narrative.
- Evaluate: Critically assess the strengths and weaknesses of prior studies, highlighting what's established and what's missing.

Literature review

- **Selection**

- The review must be shaped by a focus on key areas of interest, and include research which provides a background to the topic.
- It should also be **selective**. A common mistake is to comment on everything you have read regardless of its relevance.
- How to decide what's in and what's out is always a hard question. You need to work on developing your own criteria for the bodies of literature - and the scholars - you end up including in the literature review and those you exclude.
- Your criteria should always include:
 - relevance to your study
 - importance to the field.
- A useful way of thinking about the literature review is to picture it as a dinner party (Kamler & Thomson, 2006).
- You are the host, and you decide who comes and who sits where, depending on how much they can contribute to the conversation about your topic.
- Don't forget that you are in charge: if someone's talk becomes irrelevant, throw them out!

Literature review

- **Brainstorming for your literature review**
- A useful way to generate ideas for your literature review is to brainstorm the key scholars, texts, arguments, sources and methods that are related to your research topic.
- Write down responses to the following questions.
- The answers might take the form of brief dot points or you might prefer to write more extensive responses.
- Extensive responses are often a useful way of thinking through a question or issue that you find challenging:

Literature review

- **Brainstorming for your literature review**

- Have scholars attempted to address the research gap or problem that I intend to explore?
 - If so, how have they attempted to address it? Can I place them into different categories?
 - If not, why not?
- How and why are the approaches of key scholars similar? How and why are their approaches different? Consider similarities and differences in:
 - Theoretical frameworks
 - The sources and data used
 - Research methods (e.g. quantitative, qualitative, experimental, mixed-method)
- What are the strengths of research on this topic?
- What are the limitations, gaps and weaknesses in the field?
- Highlight your most significant points and think about how and where you should present these in your review.

Literature review viz other types of reviews

- A core characteristic of literature reviews - and a point of difference from these other genres - is the synthesis of multiple sources.
- Whereas a critical review evaluates a single source, and an annotated bibliography evaluates a number of sources (presented separately within a series of isolated paragraphs), a literature review connects and brings together a number of sources, often within single paragraphs - and indeed sentences.
- While an annotated bibliography functions as a list, with little opportunity to connect sources, a literature review necessitates the juxtaposing, comparing and contrasting of sources.
- Creating an annotated bibliography is a useful step towards completing a literature review, and it is a useful note taking method.
- However, the literature review is one step beyond this evaluation of resources, as it is primarily concerned with examining the field.

Literature review viz other types of reviews

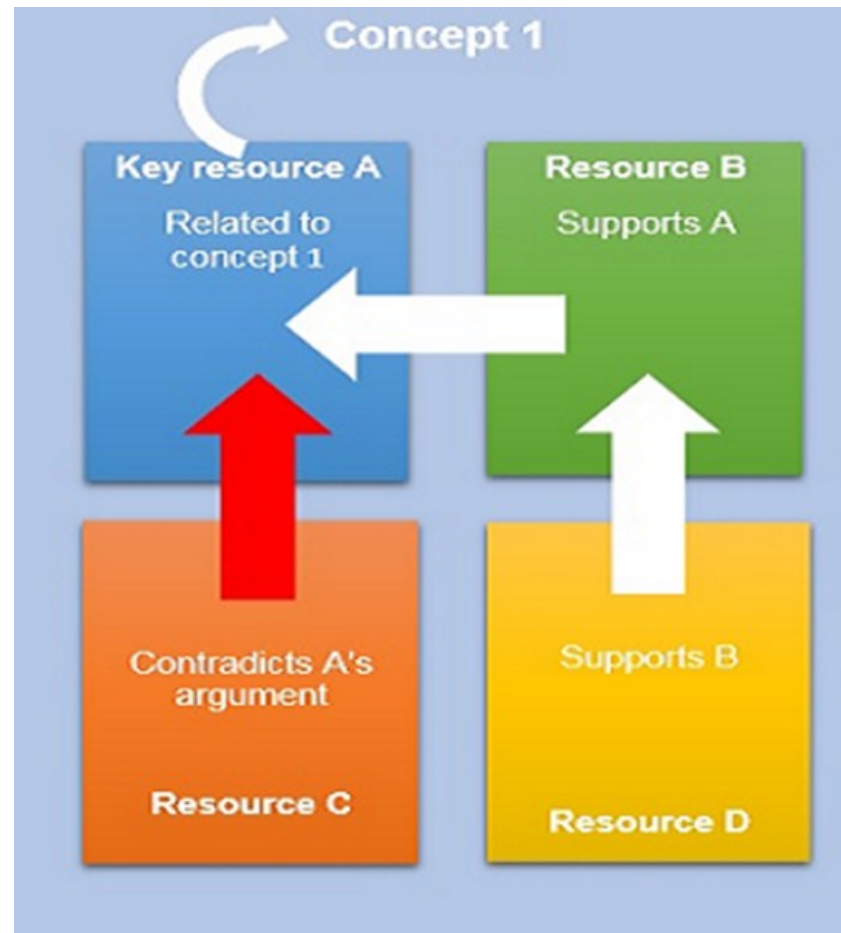
- **Analysis and synthesis**

- Writing a literature review involves analyzing and synthesizing previous research.
- Analysis and synthesis may appear to be two opposing methods: 'Whereas analysis involves systematically breaking down the relevant literature into its constituent parts, synthesis is the act of making connections between those parts identified in the analysis' (Bloomberg & Volpe, 2012, p.84).
- In a literature review, however, you will notice the synergy between analysis and synthesis as you zoom-in to closely analyse an individual source, then zoom-out to consider it in relation to the broader field.
- After analysing a range of sources, you should synthesise the relevant sources, connecting, linking and positioning them against each other, in order to identify the recurring themes, trends and areas of agreement or disagreement within your research field

Literature review viz other types of reviews

- **Example of analysis and synthesis**
- After reading and analysing individual sources, you have identified a key concept relating to your research topic as well as a key resource (A) relating to that concept.
- The argument in resource A is supported by another article (B), which is in turn supported by article (D).
- However, you have also found article C, which contradicts the argument presented in resource A.
- One way to synthesise these texts, is to group together the texts supporting your key resource (articles B and D), and explain that article C presents contradictory results.
- Then, you would need to examine the methodological differences or any other possible reasons for the contradictory results.

Literature review viz other types of reviews



Synthesis matrix

- Another way of managing sources and arguments presented in them is to use a literature review matrix (also called synthesis matrix).
- Literature review matrix is a table in which you can represent the views, ideas, or data according to thematic categories that correspond to your research project.

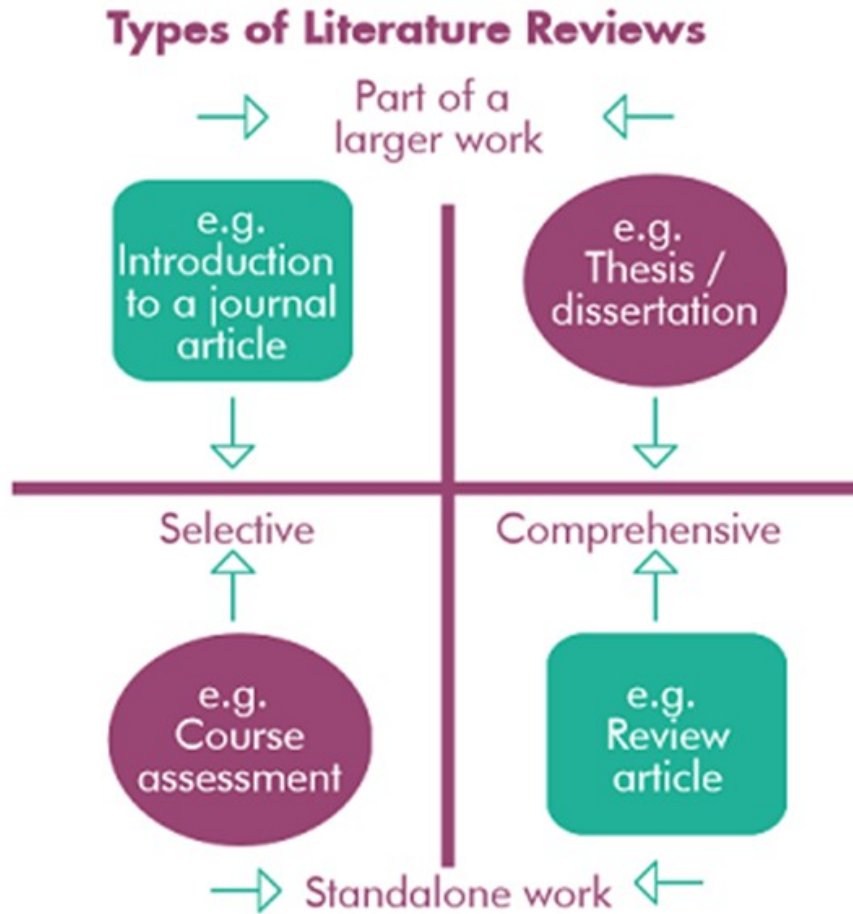
Synthesis matrix

Author	Year	Title	Aims	Method	Sample	Conclusion	Comments
Willis	2009	Memory efficiency and critical thinking among entry-level students	Test whether memory correlates positively with critical thinking	Quiz	50	Good memory positively influences critical thinking	Interesting quiz structure. Framing of critical thinking and memory is too similar, leading to exaggerated correlation.
Qinhua	2011	De Bono Mnemonic places technique and note taking	Examine how the De Bono mnemonic places technique influences note taking	Quiz and note analysis	12	Significant improvement (20%) in 6-strong sample.	One of the better papers on memory impact of note taking. Method useful for constructing experiment for testing critical thinking skills
Summers	2007						
D'Brant	2012						

Literature review

- Different types of literature review
 - Literature reviews exist within different types of scholarly works with varying foci and emphases.
 - Short or miniature literature reviews can be presented in journal articles, book chapters, or coursework assignments to set the background for the research work and provide a general understanding of the research topic.
 - However, the focus of a literature review in a graduate research thesis is to identify gaps and argue for the need for further research.
 - Depending on the purpose of the writer and the context in which the literature review will be presented, a selective or comprehensive approach may be taken.
 - In the selective approach, a single or limited number of sources are reviewed (e.g. as in an annotated bibliography assignment, or the introduction of a journal article

Literature review



Writing the review

- **Argument**

- When you review the literature in your field you are conducting research about the research others have done, so the written review is a report of your findings.
- In the same way that you construct an argument to present the findings from your data, you need to make an argument in your literature review.
- That argument will establish what has already been done, what still needs to be done, and how your study contributes to meeting that need.

Writing the review

- **Argument**

- **Summary of an argument**

- The outline for a summary of a literature review argument might look like this:

- The study builds on and contributes to work in.....

- Although studies in have examinedthere has not been an.....

- As such, this study provides an additional insight into

- The analytic focus on.....enables another contribution.

- This study analyses

- Although numerous studies () have identified , little analytic attention has been paid to

- I address this issue by demonstrating

Literature review structure

- **Structure**

- Much advice about literature review writing warns against the 'laundry list' (e.g. "Brown (2008) studied A and found Y. Roberts (2012) investigated B and found X and Y. Peterson (2007, 2013) conducted a long-term investigation into C and found X, Y and Z.").
- For argument about the literature to come through clearly, the review must have a structure. It must make connections between the works you have read, and between them and your own study.
- There is no single "correct" structure, since every review is shaped by the nature of the field being reviewed and the particular needs of the study the review is supporting.
- Some common organising patterns are:
 - Themes or concepts
 - Approaches to a question
 - Debates
 - Historical development.

Literature review structure

- **Structure**

- They may be used in combination. Usually there is a move from general overview to specific studies within the sections of a literature review, however they are determined.
- The more important works are to your own research, the more detailed your analysis will be.
- This move in focus, from the wide-angle view to the close-up, can also work at paragraph level.
- The following example moves from distant to close (in terms of relevance and applicability) as well as chronologically.
- It moves from 1) the broader historical context to 2) the implementation which demonstrates superior performance, and then to 3) the implementation which provides the model to be tested for the study.

Literature review structure

- **Introductions and conclusions**

- The main aim in structuring your review of the literature is to lead your reader to the point where they can see no other option than the need to conduct precisely the form of research you are proposing.
- The introduction and conclusion to a literature review chapter will indicate how your research is going to bring a satisfactory resolution to unresolved questions in others' work. Not all introductions and conclusions will include all of the points listed below.

- The **introduction** may:

- Contextualise the review, perhaps by relating it to the research question(s)
- Identify the key terms and concepts
- Summarise overall trends
- Justify the selection of literature
- Outline the structure of the review itself.

Literature review structure

- **Introductions and conclusions**

- The technical literature of trickling filters is very extensive.
 - This is evidenced by the literature search and critical analysis published by Dow (1971), which cited over 5,600 references in the literature published up to 1968. An exhaustive review of the literature is thus beyond the scope of this work.
- The aim of this chapter is to provide, through selective reference to some of the literature, a clearer understanding of the different microbiological, chemical and physical processes that occur within trickling filters.
- Experimental observations of various trickling filter phenomena are reviewed, and there is discussion of the sometimes conflicting conclusions about the mechanisms of trickling filtration that have been drawn from the empirical evidence.

Literature review structure

- **Introductions and conclusions**

- The chapter is divided into two parts.
- The subject of the first is the biological film which is the site of the biological oxidation of organic matter from the wastewater, and is thus the heart of the process of trickling filtration.
- The formation and structure of the biofilm (or slime layer) is outlined, and the different processes which occur within it are discussed.
- The remainder of the chapter is devoted to a consideration of the operating variables which determine trickling filter performance

Literature review structure

- The **conclusion** may:
- Recapitulate significance of key studies
- Evaluate the current state of the area
- Establish the relation of your study to gap(s) in research literature (or show how your study builds on existing research)
- Foreshadow the direction of the next section/chapter.

Study design

What it is

Creating a strategic framework (research design) to answer research questions by determining how to collect and analyze data, with key steps including defining aims, choosing a design type (observational, experimental, quantitative, qualitative), selecting samples, and planning data collection/analysis.

The overall process guides research from initial concept to conclusion, ensuring validity and reliability.

Ultimately

- Identifying the appropriate data sources

- Selecting appropriate study design, study site and population)

Study design

A research design is a strategy for answering your research question using empirical data. Creating a research design means making decisions about:

Your overall research objectives and approach

Whether you'll rely on primary research or secondary research

Your sampling methods or criteria for selecting subjects

Your data collection methods

The procedures you'll follow to collect data

Your data analysis methods.

Study design

Key Components of Study Design

Define Aims & Questions

Clearly state what you want to find out.

Choose a Design Type:

Descriptive: Describes phenomena (e.g., case studies, surveys).

Evaluative: Assesses interventions.

Observational: Observes subjects without intervention (e.g., cohort, case-control).

Experimental: Applies interventions (e.g., randomized controlled trials).

Quantitative: Uses numbers, statistics (e.g., surveys, experiments).

Qualitative: Explores themes, words (e.g., interviews, focus groups).

Identify Population & Sample: Who or what are you studying, and how will you select them?.

Select Data Collection Methods: Surveys, interviews, observations, experiments, etc..

Plan Data Collection: How, when, and where data will be gathered.

Plan Data Analysis: Statistical tests for quantitative; thematic analysis for qualitative.

Study design

Types of quantitative research designs

Quantitative designs can be split into four main types.

Experimental and quasi-experimental designs allow you to test cause-and-effect relationships

Descriptive and correlational designs allow you to measure variables and describe relationships between them..

Study design

Type of design

Experimental

Purpose and characteristics

- Used to test [causal](#) relationships
- Involves manipulating an independent variable and measuring [its](#) effect on a [dependent variable](#)
- Subjects are randomly assigned to groups
- Usually conducted in a controlled environment (e.g., a lab)

Quasi-experimental

- Used to test causal relationships
- Similar to experimental design, but without [random assignment](#)
- Often involves comparing the outcomes of pre-existing groups
- Often conducted in a natural environment (higher [ecological validity](#))

Correlational

- Used to test whether (and how strongly) variables are related
- Variables are measured without influencing them

Descriptive

- Used to describe characteristics, averages, trends, etc
- Variables are measured without influencing them

Study design

Type of design

[Case study](#)

Purpose and characteristics

- Detailed study of a specific subject (e.g., a place, event, organization, etc).
- Data can be collected using a variety of sources and methods.
- Focuses on gaining a holistic understanding of the case.

[Ethnography](#)

- Detailed study of the culture of a specific community or group.
- Data is collected by extended immersion and close observation.
- Focuses on describing and interpreting beliefs, conventions, social dynamics, etc.

Grounded theory

- Aims to develop a theory inductively by systematically analyzing qualitative data.

Phenomenology

- Aims to understand a phenomenon or event by describing participants' lived experiences.

Study design

- **Practical and ethical considerations when designing research**
- As well as scientific considerations, you need to think practically when designing your research. If your research involves people or animals, you also need to consider research ethics.
- How much time do you have to collect data and write up the research?
- Will you be able to gain access to the data you need (e.g., by travelling to a specific location or contacting specific people)?
- Do you have the necessary research skills (e.g., statistical analysis or interview techniques)?
- Will you need ethical approval?

Study design

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Study design

Qualitative approach

- Understand subjective experiences, beliefs, and concepts
- Gain in-depth knowledge of a specific context or culture
- Explore under-researched problems and generate new ideas

Quantitative approach

- Measure different [types of variables](#) and describe frequencies, averages, and correlations
- [Test hypotheses](#) about relationships between variables
- Test the effectiveness of a new treatment, program or product

Population

- General population
- Target population
- Study population
- Sample

population

- Key Types of Populations in Research
 - Target Population (Theoretical Population): The total group of individuals or objects that the researcher is interested in generalizing their findings to.
 - Accessible Population (Study Population): The subset of the target population that is actually available, reachable, and willing to participate in the study, from which the sample is drawn.
 - Finite Population (Countable): A group with a specific, countable number of members (e.g., all students in a specific school).
 - Infinite Population (Uncountable): A group with an uncountably large or indefinite number of members (e.g., all stars in the sky, or bacteria in a body).
 - Existent Population: A population consisting of concrete, tangible, and physically present individuals or objects.
 - Hypothetical Population: A population consisting of potential, future, or theoretical sets of observations rather than physically present entities.

Population

- Related Concepts
 - Sampling: The process of selecting a subset (a sample) from the accessible population to represent the whole.
 - Generalization: The ability to apply findings from the sample to the target population.

Sampling

- Sampling strategies
 - Identifying the appropriate sampling strategy
 - Recruitment of study participants
 - Specifying the inclusion and exclusion criteria

Sampling methods

Probability sampling

- Sample is selected using random methods
- Mainly used in quantitative research
- Allows you to make strong statistical inferences about the population

Non-probability sampling

- Sample selected in a non-random way
- Used in both qualitative and quantitative research
- Easier to achieve, but more risk of [research bias](#)

Sampling

- Probabilistic sampling methods
 - Simple Random Sampling: Every individual has an equal chance of selection, often using a random number generator.
 - Stratified Sampling: The population is divided into subgroups (strata) based on shared characteristics, and then random samples are drawn from each stratum, ensuring proportional representation.
 - Systematic Sampling: Selecting individuals at regular intervals (e.g., every 5th person) from a list after a random start, offering a simple way to get a representative sample.
 - Cluster Sampling: The population is divided into clusters (often geographic), and a few clusters are randomly selected, with all members within those selected clusters surveyed.
 - Multi-Stage Sampling: Combines multiple methods, such as cluster sampling followed by stratified or simple random sampling within the chosen clusters, for greater efficiency.

Sampling

- Key Benefits

- Reduces Bias: Random selection minimizes researcher bias.
- Generalizability: Allows researchers to make statistically valid inferences about the entire population.
- Quantifiable Error: Enables estimation of sampling error.

- When to Use

- When a complete list (sampling frame) of the population is available.
- For quantitative research, hypothesis testing, and studies needing generalizable results.

Sampling

Simple random sampling key elements

- Simple random sampling gives all members of the population an equal chance of being selected.
- Selection is done randomly. For example, researchers may use tools like a random number generator to select participants from a population.
- Simple random sampling is prone to bias. The smaller the sample size compared to the population, the less likely it is that a simple random sample will include all key subgroups.

Advantages, limitations, and how to improve

- Advantage: This method is remarkably easy to execute and the results are straightforward to interpret.
- Limitation: While theoretically sound, using small sample sizes may, purely by chance, fail to include important subgroups, leading to an incomplete or biased view of the total population.
- How to improve accuracy: To mitigate the risk of missed subgroups, you should either increase your overall sample size or strategically use stratified sampling when subgroup representation is critical for your analysis

Sampling

Stratified random sampling

- Stratified random sampling divides the population into distinct subgroups and randomly samples within each one to ensure balanced representation across key characteristics.
- Stratified random sampling key elements
- Stratified sampling draws a sample from each group (or stratum) separately to ensure every subgroup is represented.
- It's common to stratify by characteristics like sex, age, income bracket, or ethnicity.
- Strata must be specific and exclusive, meaning every individual in the population should only be assigned to one group.
- After splitting a population into strata, randomly select individuals from each group in proportion to the total population. Then, combine those individuals into a sample.

Advantages, limitations, and how to improve

- Advantage: This method dramatically improves the accuracy of your results by guaranteeing that every key subgroup is proportionally represented, preventing chance from distorting your findings.
- Limitation: It requires both clear, predefined subgroup definitions and reliable, up-to-date population counts for each group, making setup more intensive.
- How to improve accuracy: To ensure validity, you must rigorously validate your sampling frame and be prepared to reweight the results during analysis if final response rates among subgroups vary unexpectedly.

Sampling

Cluster sampling

- Cluster sampling randomly selects entire groups or clusters of individuals, making it a cost-efficient way to study large or geographically dispersed populations.
- Cluster sampling key elements
- Each cluster should have similar characteristics to the population. Instead of selecting individuals from each cluster, randomly select entire clusters.
- Include every individual from each selected cluster in the final sample. If the clusters are too large, randomly select individuals from each cluster.
- Researchers often use pre-established and easily available groups as clusters. Groups are based on geographic boundaries, like cities or counties, but they can also be schools or office locations.
- Researchers use cluster sampling to save costs surveying large or geographically spread-out populations. However, cluster sampling has a higher risk of sampling error. Each cluster is supposed to represent the total population, but this can be difficult to guarantee.

Advantages, limitations, and how to improve

- Advantage: This method is highly efficient and cost-effective for surveying extremely large or geographically dispersed populations by sampling existing natural groups (clusters).
- Limitation: A significant risk is that individuals within a single cluster may be too internally similar, meaning a sample might over-represent specific local characteristics and potentially increase the overall sampling error.
- How to improve accuracy: To minimize this risk, select more clusters while keeping the number of individuals sampled from each cluster smaller, or add a stratified step (Multi-Stage Sampling) to ensure a better balance across the final sample.

Sampling

Systematic sampling

- Systematic sampling, also known as interval sampling, selects individuals at regular intervals from an ordered or de facto list, starting at a random point, offering an efficient alternative to simple random sampling.
- Systematic sampling key elements
- Each member of the population is assigned a number and then selected at regular intervals to form a sample. To put it another way, every “kth” individual in the population joins the sample. Systematic sampling is chosen after a random start.
- It’s important to ensure that there’s no hidden pattern in the sample frame that may affect random selection. If there’s a risk of data manipulation, the sample may over- or underrepresent characteristics.
- Systematic sampling is simpler than other methods because it has a clear selection process without a random number generator. On the flip side, the resulting selection may not be as random as if a generator was used.
- Say you plan to survey employees within an organization, and the employees are listed alphabetically. You use systematic sampling to select every 4th employee for your sample. However, suppose the list is also organized by team and seniority. You might select too many or too few senior people, leading to bias in your sample.

Advantages, limitations, and how to improve

- Advantage: Systematic sampling is incredibly simple, efficient, and quick to implement, requiring minimal administrative effort to select respondents.
- Limitation: The major risk is that hidden periodic patterns within the ordered sampling list can align with your sampling interval, inadvertently introducing significant bias into your results.
- How to improve accuracy: To neutralize this risk, randomize the original list before you begin sampling, and test different interval choices to ensure the method does not align with any underlying structure.

Sampling

- Case selection in qualitative research
- In some types of qualitative designs, sampling may not be relevant.
- For example, in an ethnography or a case study, your aim is to deeply understand a specific context, not to generalize to a population. Instead of sampling, you may simply aim to collect as much data as possible about the context you are studying.
- In these types of design, you still have to carefully consider your choice of case or community. You should have a clear rationale for why this particular case is suitable for answering your research question.
- For example, you might choose a case study that reveals an unusual or neglected aspect of your research problem, or you might choose several very similar or very different cases in order to compare them.

Sampling

Sampling type	How it works	Best for	Limitations / risks
Simple random	Select individuals entirely by chance	Small or well-defined populations	Can miss subgroups if the population isn't diverse
Stratified	Divide population into subgroups and sample within each	Ensuring subgroup representation (e.g., age, region)	Requires accurate population data for each subgroup
Cluster	Randomly select entire clusters (e.g., schools, stores)	Large or geographically spread populations	Higher sampling error due to internal similarities within clusters
Systematic	Choose every kth person after a random start	Ordered datasets, such as customer lists or IDs	Risk of bias if hidden patterns align with the interval

Non probabilistic sampling methods

- Non-probability sampling is a research method where respondents are selected using criteria that are not random, such as convenience, specific characteristics, or self-selection.
- Researchers use non-probability sampling for exploratory and qualitative research or when a probability sample is too expensive or infeasible.
- The target population is often people with specific expertise, experiences, or insights. Some non-probability methods are often used in exploratory research to reach specific groups or insights.

Non probabilistic sampling methods

Quota sampling:

- Quota sampling divides the population into subgroups based on known characteristics, traits, or interests.
- A cleaning company researching its popularity might split its population by age and gender.
- Then, it may take a sample from each group to meet a predetermined quota.

Snowball sampling:

- This type of sampling relies on people in your population to identify others to sample.
- Say you're researching local use of mobility ramps.
- Your population of interest is people in your city who use wheelchairs.
- You don't have a complete list of these people, so probability sampling isn't an option.
- However, the few identified survey respondents can connect you with other local people who use wheelchairs.

Non probabilistic sampling methods

- Intercept sampling:
 - This method involves stopping individuals in a public space—such as a shopping mall or a trade show—to collect data on the spot.
 - It is an effective way to capture immediate feedback and "in-the-moment" consumer behavior while the experience is fresh.
 - While this approach allows for high response rates and quick turnaround, it is prone to selection bias, as your sample is limited to those physically present at a specific location and time.

Non probabilistic sampling methods

Judgmental sampling:

- Judgmental sampling is frequently used in qualitative research.
- It entails researchers choosing the sample they believe will be most relevant.
- The mobility ramp researchers, for example, would do a purposive sample by choosing employees with disabilities to explore their needs.

Opt-in sampling:

- This method relies on volunteers who proactively join research panels or sign up for surveys, often incentivized by rewards.
- It is a highly efficient way to quickly reach large groups or specific niches. However, because participants self-select, the results may be biased toward certain demographics or "professional respondents."

Sample size determination

What it is

- Sample size determination is the process of calculating the optimal number of observations (people, items) for a study to ensure statistically valid, reliable, and cost-effective results, balancing precision needs (margin of error, power) against feasibility (time, cost).
- Key factors include desired confidence level, precision, population variability, and effect size, using formulas like those involving Z-scores, proportions, and margins of error, or specialized software for complex designs.

Sample size determination

- Key Components of Sample Size Calculation
 - Confidence Level (Z-score): How sure you want to be (e.g., 95% confidence uses a Z-score of 1.96).
 - Margin of Error (E): Acceptable range of error in your results (e.g., $\pm 3\%$).
 - Population Proportion (p): Expected percentage of the population with the characteristic (use 0.5 if unknown for maximum sample size).
 - Population Variability (Standard Deviation): How spread out the data is; higher variability needs larger samples.
 - Statistical Power: Ability to detect a real effect; usually 80% ($1 - \beta$).
 - Effect Size: The minimum difference you consider practically important.

Sample size determination

- Factors Influencing Sample Size
 - Study Type: Political polls need large samples; customer feedback can use smaller ones.
 - Population Size: Very large populations need less adjustment than small ones.
 - Resource Constraints: Time, budget, and accessibility impact feasibility.
 - Study Design: Different designs (e.g., clinical trials vs. surveys) require different methods.

Sample size

Key consideration for sample size for FGDs

- Optimal Range: While 6-10 is standard, groups can range from 4-12 people.
- Composition: Participants should share similar characteristics (homogeneity) relevant to the topic to encourage open discussion, such as grouping by gender or specific roles.
- Number of Groups: It is common practice to hold at least two focus groups for each specific target audience or segment.
- Saturation: Research suggests that 4-8 focus groups are often sufficient to reach saturation (where no new information is being discovered).
- Logistics: The size should allow all participants enough time to contribute in-depth while being manageable for the moderator.

Sampling

- **Sampling procedures**
- As well as choosing an appropriate sampling method, you need a concrete plan for how you'll actually contact and recruit your selected sample.
- That means making decisions about things like:
- How many participants do you need for an adequate sample size?
- What inclusion and exclusion criteria will you use to identify eligible participants?
- How will you contact your sample—by mail, online, by phone, or in person?
- When using a probability sampling method, it's important that everyone who is randomly selected actually participates in the study. How will you ensure a high response rate?
- When using a non-probability method, how will you avoid research bias and ensure a representative sample?

Sample size

Focus group discussion

- The ideal focus group discussion (FGD) size is 6 to 10 participants.
- Groups smaller than 6 may lack diverse perspectives and energy, while those larger than 10-12 become difficult to manage and limit individual contribution. For most studies, conducting 3-4 separate focus groups is recommended to reach thematic saturation.
- Studies using empirical data reached saturation within a narrow range of interviews (9–17) or focus group discussions (4–8), particularly those with relatively homogenous study populations and narrowly defined objectives.
- Most studies had a relatively homogenous study population and assessed code saturation; the few outliers (e.g., multi-country research, meta-themes, “code meaning” saturation) needed larger samples for saturation.

Types of variables & measurement scales

Refer to Biostat 2 notes

Variables

- Other names for independent variable
- Other names for dependent variable

Measurement scales

- Nominal
- Ordinal
- Interval
- Ratio/scale

Operationalization of variables

- **Operationalization of variables**

- Some variables, like height or age, are easily measured.
- But often you'll be dealing with more abstract concepts, like satisfaction, anxiety, or competence.
- Operationalization means turning these fuzzy ideas into measurable indicators.
- When using **observations**, which events or actions will you count?

Operationalization of variables

Example

- To measure student participation in an online course, you could record the number of times students ask and answer questions.
- If you're using **surveys**, which questions will you ask and what range of responses will be offered?
- Example To measure teachers' satisfaction with online learning tools, you could create a questionnaire with a 5-point rating scale.

Identifying confounders

- Steps to Identify Confounders
 - Domain Knowledge & Literature: Prior research often reveals known confounders (e.g., age, socioeconomic status, or smoking in health studies).
 - Create a Conceptual Model/DAG: Draw causal diagrams to identify variables influencing both the independent and dependent variables.
 - Check for Group Differences: Ensure potential confounders are not unequally distributed across treatment and control groups.
- Statistical Techniques:
 - Regression Analysis: Include suspected variables in models; if the main effect size changes, they are likely confounders.
 - Stratification: Analyze relationships within subgroups (e.g., age groups) to check for consistent effects.
 - Change in Estimate (CIE): A common criterion is to test if adjusting for a variable alters the effect estimate by a specific threshold (e.g., 10%).
 - A/A Testing: If comparing identical groups yields different results, confounding variables may be present.

Identifying confounders

Characteristics of a Confounder

- Associated with Exposure: Must be linked to the risk factor or intervention.
- Causes Outcome: Must independently affect the outcome.
- Not an Intermediary: Cannot be on the direct causal pathway between exposure and outcome.

Examples of Confounders

- Study: Coffee (exposure) and heart disease (outcome). Confounder: Smoking (smokers drink more coffee and are at higher risk for heart disease).
- Study: Ice cream sales (exposure) and sunburns (outcome). Confounder: Temperature (high heat increases both).
- Study: Exercise (exposure) and weight loss (outcome). Confounder: Diet.

Exclusion and inclusion criteria

What is it?

- Inclusion and exclusion criteria define the specific characteristics—such as age, diagnosis, or study design—that determine who can participate in a research study or which studies are included in a review.
- Inclusion criteria set the necessary requirements for eligibility, while exclusion criteria identify characteristics that disqualify potential participants or studies, ensuring study safety, accuracy, and scientific validity.

Exclusion and inclusion criteria

- Inclusion Criteria (Requirements for Eligibility)
 - Definition: Key features of the target population that make them eligible for a study.
 - Purpose: To create a homogeneous group to answer the research question.
 - Examples: Specific age range (e.g., 18–65 years), particular diagnosis (e.g., Type 2 Diabetes), gender, or geographic location.
- Exclusion Criteria (Reasons for Disqualification)
 - Definition: Characteristics that make individuals who meet inclusion criteria ineligible for the study.
 - Purpose: To protect participant safety (e.g., in clinical trials), prevent invalid data, or avoid confounding variables.
 - Examples: Comorbidities (other diseases), inability to comply with study requirements, pregnancy, or use of conflicting medications.

Data management plan

A Data Management Plan (DMP)

- 1-2 page living document outlining how data is collected, organized, secured, stored, and shared throughout a project's lifecycle.
- Key components include identifying data types, using metadata standards, ensuring ethical/legal compliance, planning secure backups, and detailing long-term preservation.

Data management plan

- Key Components of a Data Management Plan
 - Data Collection & Documentation: Describe the types of data (e.g., surveys, images, code) being generated or acquired, and the metadata, documentation, or codebooks used to make the data understandable.
 - Storage & Security: Detail how data will be stored securely during the project, including backup procedures, version control, and access control for sensitive information (e.g., PII).
 - Ethical & Legal Compliance: Outline how to handle informed consent, data ownership, copyright, and compliance with privacy regulations.
 - Data Sharing & Preservation: Specify how data will be shared (e.g., repositories) for reuse and how it will be preserved for the long term.
 - Responsibilities & Resources: Assign specific roles to team members for managing data and identify required resources, such as, storage costs or specialized tools.

Data management plan

- Data collection methods
 - Surveys & Questionnaires: Structured questions (online, phone, paper) to gather opinions, demographics, etc..
 - Interviews: One-on-one or group (focus groups) conversations, structured or open-ended, for in-depth insights.
 - Observations: Directly watching and recording behaviors or events in natural or controlled settings.
 - Experiments: Manipulating variables in controlled environments to test hypotheses.
 - Document Analysis: Reviewing existing records, reports, or content.
 - Secondary Data Collection Methods (Existing data)
 - Secondary Data Analysis: Using data collected by others, such as government records, company data, or academic research.
 - Archival Research: Systematically reviewing historical records.

Types of data sources

Primary data

- Is the information you collect directly from first-hand engagements. It's gathered specifically for your research and tailored to your research question.
- Primary data collection methods can range from surveys and interviews to focus groups and observations. Because you design the data collection process, primary data can offer precise, context-specific information directly related to your research objectives. For example, suppose you are investigating the impact of a new education policy.
- In that case, primary data might be collected through surveys distributed to teachers or interviews with school administrators dealing directly with the policy's implementation.

Types of data sources

Secondary data

- Is derived from resources that already exist. This can include information gathered for other research projects, administrative records, historical documents, statistical databases, and more.
- While not originally collected for your specific study, secondary data can offer valuable insights and background information that complement your primary data.
- For instance, continuing with the education policy example, secondary data might involve academic articles about similar policies, government reports on education or previous survey data about teachers' opinions on educational reforms.

Types of data sources

- **Secondary data**

- If you don't have the time or resources to collect data from the population you're interested in, you can also choose to use secondary data that other researchers already collected—for example, datasets from government surveys or previous studies on your topic.
- With this raw data, you can do your own analysis to answer new research questions that weren't addressed by the original study.
- Using secondary data can expand the [scope](#) of your research, as you may be able to access much larger and more varied samples [than](#) you could collect yourself.
- However, it also means you don't have any control over which variables to measure or how to measure them, so the conclusions you can draw may be limited.

Methods of data collection

Surveys

- Surveys and questionnaires are methods for gathering information about a group of individuals, typically by asking them predefined questions.
- They can be used to collect quantitative and qualitative data and be administered in various ways, including online, over the phone, in person (offline), or by mail.

Advantages:

- Surveys allows researchers to reach many participants quickly and cost-effectively, making them ideal for large-scale studies.
- The structured format of survey questions can also make analysis easier than other methods.

Disadvantages:

- Survey data collection may not capture complex or nuanced information well, as participants are limited to predefined response choices.
- Also, there can be issues with response bias, where participants might provide socially desirable answers rather than honest ones.

Methods of data collection

Interviews

- Interviews involve a one-on-one conversation between the researcher and the participant. The interviewer asks open-ended questions to gain detailed information about the participant's thoughts, feelings, experiences, and behaviors.

Advantages:

- They allow for an in-depth understanding of the topic at hand.
- The researcher can adapt the questioning in real time based on the participant's responses, allowing for more flexibility.

Disadvantages:

- They can be time-consuming and resource-intensive, as they require trained interviewers and a significant amount of time for both conducting and analyzing responses.
- They may also introduce interviewer bias if not conducted carefully, due to how an interviewer presents questions and perceives the respondent, and how the respondent perceives the interviewer.

Methods of data collection

Surveys and Interviews

- Surveys allow you to collect data about opinions, behaviors, experiences, and characteristics by asking people directly.
- There are two main survey methods to choose from: questionnaires and interviews.
- Survey methods involve collecting data from a large group using structured, self-reported questionnaires (online, mail) to identify trends, while interview methods involve direct,, interactive communication (in-person, phone) to gain deep, qualitative insights into personal experiences, motivations, and detailed feedback.
- Both are used to gather data on attitudes and behaviors.

Survey method and interview method

Data Type & Depth:

- Interviews excel at collecting deep, qualitative, or nuanced data (exploratory). Surveys excel at gathering broad, quantitative data to identify patterns or trends (descriptive).

Presence of Researcher:

- Interviews involve direct interaction (in-person, video, or phone), allowing for immediate follow-up questions and clarification of misunderstandings. Surveys are generally self-administered, without a researcher present.

Flexibility:

- Interviews are flexible, allowing researchers to adapt questions based on responses. Surveys are rigid with standardized, often closed-ended, questions.

Sample Size & Cost:

- Surveys are highly effective for reaching large, dispersed populations cost-effectively. Interviews are resource-intensive, requiring more time and effort per participant.

Analysis:

- Interviews produce rich, unstructured data that is complex to analyze. Surveys produce structured data that is easy to analyze numerically.

Methods of data collection

Surveys and interviews

- Use interviews for exploratory research, understanding motivations, or when complex, open-ended answers are required.
- Use surveys for testing hypotheses, measuring trends, or getting a quick "snapshot" of a large population.

Methods of data collection

Observations

- Observations involve directly observing and recording behavior or other phenomena as they occur in their natural settings.

Advantages:

- Observations can provide valuable contextual information, as researchers can study behavior in the environment where it naturally occurs, reducing the risk of artificiality associated with laboratory settings or self-reported measures.

Disadvantages:

- Observational studies may suffer from observer bias, where the observer's expectations or biases could influence their interpretation of the data.
- Also, some behaviors might be altered if subjects are aware they are being observed.

Data collection methods

Observation methods

- Observational studies allow you to collect data unobtrusively, observing characteristics, behaviors or social interactions without relying on self-reporting.
- Observations may be conducted in real time, taking notes as you observe, or you might make audiovisual recordings for later analysis. They can be qualitative or quantitative.

Methods of data collection

Focus Groups

- Focus groups are guided discussions among selected individuals to gain information about their views and experiences.

Advantages:

- Focus groups allow for interaction among participants, which can generate a diverse range of opinions and ideas.
- They are good for exploring new topics where there is little pre-existing knowledge.

Disadvantages:

- Dominant voices in the group can sway the discussion, potentially silencing less assertive participants.
- They also require skilled facilitators to moderate the discussion effectively.

Data collection methods

Questionnaires	Interviews
• More common in quantitative research • May be distributed online, by phone, by mail or in person • Usually offer closed questions with limited options • Consistent data can be collected from many people	• More common in qualitative research • Conducted by researcher in person, by phone or online • Usually allow participants to answer in their own words • Ideas can be explored in-depth with a smaller group (e.g., focus group)

Data collection methods

Quantitative observation

- Systematically counting or measuring
- Categories and criteria determined in advance

Qualitative observation

- Taking detailed notes and writing rich descriptions
- All relevant observations can be recorded

Data collection methods

Field	Examples of data collection methods
Media & communication	Collecting a sample of texts (e.g., speeches, articles, or social media posts) for data on cultural norms and narratives
Psychology	Using technologies like neuroimaging, eye-tracking, or computer-based tasks to collect data on things like attention, emotional response, or reaction time
Education	Using tests or assignments to collect data on knowledge and skills
Physical sciences	Using scientific instruments to collect data on things like weight, blood pressure, or chemical composition

Data collection procedure

Plan your data collection procedures

- As well as deciding on your methods, you need to plan exactly how you'll use these methods to collect data that's consistent, accurate, and unbiased.
- Planning systematic procedures is especially important in quantitative research, where you need to precisely define your variables and ensure your measurements are high in reliability and validity.

Data collection instruments

Types

- Questionnaire
- Interview guide
- Observation checklist
- Focus group discussion guide
- Technical/measurement instruments

Data collection instruments

- You may also choose to use or adapt existing materials designed to measure the concept you're interested in—for example, questionnaires or inventories whose reliability and validity has already been established.
- **Reliability and validity**
 - Reliability means your results can be consistently reproduced,
 - Validity means that you're actually measuring the concept you're interested in.

Data collection instruments

Reliability

- Does your measure capture the same concept consistently over time?
- Does it produce the same results in different contexts?
- Do all questions measure the exact same concept?

Validity

- Do your measurement materials test all aspects of the concept?
(content validity)
- Does it correlate with different measures of the same concept?
(criterion validity)

Data collection instruments

- For valid and reliable results, measurement materials should be thoroughly researched and carefully designed.
- Plan your procedures to make sure you carry out the same steps in the same way for each participant.
- When developing a new questionnaire or other instrument to measure a specific concept, running a pilot study allows you to check its validity and reliability in advance.

Data collection instruments

Questionnaire

- A research tool or instrument consisting of a list of questions or prompts designed to gather information, opinions, or data from respondents for surveys, studies, or feedback, collecting both quantitative (numerical) and qualitative (descriptive) data, often using a mix of closed (multiple choice) and open-ended questions.
- Used across business, health, and social sciences, questionnaires aim to provide structured insights into behaviors, attitudes, and experiences.

Data collection instruments

Questionnaire

- **Key Characteristics**
- **Purpose:** To collect structured data for analysis, research, or feedback.
- **Format:** Can be written, online, phone-based, or face-to-face.
- **Question Types:** Includes multiple-choice, true/false, rating scales (closed-ended), and text boxes (open-ended)
- **Data Types:** Gathers quantitative (numbers) and qualitative (narrative) information.
- **Consistency:** Ensures all participants receive the same questions, making results comparable

Data collection instruments

Interview guide

- An interview guide is a structured framework used in qualitative research to direct the conversation during interviews.
- It is an essential tool for maintaining focus while allowing for flexibility during the interview.
- The guide typically consists of a list of open-ended questions or key topics for exploring participants' experiences, opinions, and feelings related to the research topic.
- The purpose of an interview guide is twofold.
 - First, it ensures that all relevant topics are covered across different interviews, enhancing consistency.
 - Second, it allows interviewers to probe further into participants' responses, encouraging deeper insights that align with the research objectives.
- Although it provides structure, the guide is not rigid, allowing for deviations based on the natural flow of the conversation, ensuring richer data collection.

Data collection instruments

Interview guide

- Pilot testing
- Before conducting the actual interview, a pilot interview is an important step. It allows the interviewer to practice conducting the interview and test the flow of the interview guide.
- Through a review of the pilot interview, interviewers can identify unclear or irrelevant questions and make adjustments accordingly.
- This process also helps interviewers estimate the time required for each interview and ensures that the guide covers all relevant topics without overwhelming the participant.
- Pilot testing also gives the researcher a chance to practice asking questions naturally, adjusting to the conversational flow that qualitative interviews often require.
- Pilot tests can be very helpful, significantly developing a researcher's knowledge and understanding of what to expect for the actual interview.

Data collection instruments

Interview guide

- Building rapport with participants
- The interviewer's ability to build rapport with participants is a vital skill that greatly influences each interview.
- Establishing trust at the beginning of the interview helps participants feel at ease and encourages them to talk openly. By focusing on the person rather than just the data, interviewers can facilitate more natural conversations.
- Strong communication skills are necessary to maintain the flow of conversation and keep the focus on the topic. During the interviewing process, the interviewer must practice active listening, demonstrate empathy, and avoid rushing participants through their responses.
- Before the interview, researchers should familiarize themselves with the participants' backgrounds, where relevant, to understand their context. During the interview, the researcher should encourage open dialogue while maintaining a non-judgmental stance.
- This rapport enables participants to provide richer, more detailed responses, ultimately enhancing the quality of the data collected.

Data collection instruments

Interview guide

- Anticipating logistical challenges
- Careful attention to logistics is also part of effective interview preparation.
- Whether the interview is in-person or remote, the interviewer must ensure the setting is conducive to open and comfortable communication.
- For example, interviewers should choose a quiet location and test any necessary equipment beforehand.
- Being well-prepared and anticipating potential issues, such as technical difficulties or external distractions, helps to foster an enjoyable interview and allows the interviewer to focus on obtaining valuable data.
- Scheduling flexibility is also important, as participants' availability may vary.
- Researchers should be prepared to accommodate different time zones or personal schedules to facilitate participation. This attention to logistics helps create a smooth and uninterrupted interview experience

Data collection instruments

Interview guide

- Create a framework that outlines the main concepts to study: structuring interview guides by organizing questions into overarching themes rather than prescribing fixed questions.
- The guide should accommodate a series of themes that broadly frame the participant's narrative.
- In Seidman's three-interview series model, these themes progress from a life history focus to current lived experience, and finally to reflection on meaning.
- Each theme allows the researcher to understand the participant's experiences deeply and within the context of their personal narrative.

Data collection instruments

Interview guide

- Design open-ended questions about each concept: The questions have to be in everyday language, not include jargon, and reflect on operational definitions of concepts to think about how questions could be crafted about that concept.
- The effectiveness of an interview guide lies in its capacity to elicit detailed and authentic responses.
- Seidman (2006) underscores the importance of open-ended questions, which invite participants to reconstruct their experiences rather than simply answer direct prompts.
- Questions should encourage narrative depth, for example: "Can you describe how you first became interested in your field?"

Data collection instruments

Interview guide

- **Verify the order of questions:** Questions need to go from broad to more specific, or more sensitive, challenging and direct.
- Make sure you have opening and closing questions.
- **Add prompts and probes to questions:** While open-ended questions drive the interview, it is recommended to use specific prompts to deepen understanding when necessary.
- Prompts such as “Can you give an example?” or “What were your thoughts at that moment?” allow the interviewer to explore topics that emerge naturally from participants' responses, while still maintaining a non-intrusive approach.

Data collection instruments

Interview guide

- **Allow for flexibility and adapt to participant responses:** It is important to maintain flexibility in qualitative interviewing, allowing the guide to adapt according to the participant's narrative.
- If a participant organically addresses certain themes, the researcher should adjust questions to avoid redundancy and follow the natural trajectory of the conversation.
- This flexibility is particularly beneficial in phenomenological approaches, where understanding participants' lived experiences takes precedence over rigid adherence to a predefined question list

Data collection instruments

Interview guide

- **Embrace silence as a tool for reflection:** The guide should remind researchers to utilize silence and pauses strategically. According to Seidman (2006), allowing participants moments of reflection can often lead to deeper, more thoughtful insights.
- A well-designed guide includes prompts or notes encouraging the interviewer to embrace brief silences, providing space for participants to contemplate and expand upon their answers.
- **Pilot and revise the interview guide:** It is important to check the wording of questions and revise for leading questions that may elicit social desirability bias and other errors.

Steps in data management

- **Data management**

- It's also important to create a data management plan for organizing and storing your data.
- Will you need to transcribe interviews or perform data entry for observations? You should anonymize and safeguard any sensitive data, and make sure it's backed up regularly.
- Keeping your data well-organized will save time when it comes to analyzing it. It can also help other researchers validate and add to your findings (high replicability).

Steps in data management

- **Data management**

- Editing
- Cleaning
- Checking Structure and assumptions
- Transformation
- Storage
- Back up

Data management

- **Data analysis strategies**
- On its own, raw data can't answer your research question.
- last step of designing your research is planning how you'll analyze the data.

Data analysis

- Data analysis is the systematic process of inspecting, cleaning, transforming, and modeling raw data to discover useful information, identify patterns, draw conclusions, and support informed decision-making for business, science, or research.
- It uses statistical and logical techniques to turn complex data into actionable insights, helping organizations solve problems, predict future trends, and operate more effectively by understanding performance and behavior.

Data analysis

Key Objectives

- Describe Data: Summarize key characteristics like means and frequencies.
- Identify Patterns: Detect trends, correlations, and anomalies in data.
- Test Hypotheses: Validate or reject assumptions using statistical methods.
- Make Predictions: Forecast future outcomes using models.
- Support Decisions: Provide empirical evidence for strategic choices. .

Data analysis

Types of Analysis

- Quantitative Analysis: Focuses on numerical data with statistical methods (e.g., regression, t-tests).
- Qualitative Analysis: Interprets non-numerical data (text, audio) for rich insights.
- Descriptive Analysis: Summarizes past data (e.g., "What happened?").
- Diagnostic Analysis: Explores why something happened.
- Predictive Analysis: Forecasts future trends (e.g., "What might happen?").
- Prescriptive Analysis: Recommends actions (e.g., "What should we do?").

Statistical analysis plan

- A Statistical Analysis Plan (SAP) is a detailed, pre-specified document, often created alongside a research protocol, that outlines the precise methods for analyzing study data to ensure transparency, reproducibility, and minimal bias.
- It defines study endpoints, populations, statistical methods, and techniques for handling missing data, ensuring analyses are locked before data unblinding.

Statistical analysis plan

Content of plan

- Preprocessing
- Unit of analysis/observation
- Levels of analysis
- Type of analysis

Data preprocessing

- Data preprocessing is a crucial, initial step in data analysis and machine learning that transforms raw, messy data into a clean, structured, and usable format.
- It improves data quality by handling missing values, removing noise/duplicates, and scaling features, ensuring models produce accurate and reliable insights.
- Key techniques include cleaning, integration, reduction, and transformation.

Data preprocessing

Key Steps and Techniques in Data Preprocessing

- **Data Cleaning:** Involves handling missing data (imputation), removing noisy data, identifying or removing outliers, and fixing inconsistencies to improve data quality.
- **Data Integration:** Merges data from different sources (databases, files) into a unified dataset.
- **Data Transformation:** Converts data into formats suitable for modeling, including normalization (scaling numerical data to a small range, like 0-1) and encoding categorical variables.
- **Data Reduction:** Reduces the volume of data while maintaining its integrity, such as dimensionality reduction (PCA) or sampling.

Statistical analysis plan

- Unit of analysis/observation
 - Person
 - Group
 - Occupation
 - Households
 - Health facilities

Statistical analysis plan

- Levels of analysis
 - Descriptive analysis
 - Inferential analysis
 - Bivariate
 - Multivariable
 - Statistical modeling

Statistical analysis plan

Descriptive Statistics (Summarizing Data)

- Descriptive statistics are the first step in data analysis, focusing on organizing, summarizing, and presenting the main features of a specific dataset (sample or population).
- They describe what has already occurred and do not make generalizations beyond the data at hand.
- Purpose: To simplify and understand large chunks of data.
- Key Measures:
 - Central Tendency: Mean, Median, Mode.
 - Variability/Dispersion: Range, Standard Deviation, Variance.
 - Distribution/Frequency: Histograms, Bar Charts, Box Plots.
- Example: Calculating the average test score and the range of scores for a single classroom.

Statistical analysis plan

Inferential Statistics (Drawing Conclusions)

- Inferential statistics go beyond the immediate data to draw conclusions, test hypotheses, and make predictions about a larger population based on a smaller sample.
- Purpose: To infer or generalize findings from a sample to a broader population.
- Key Techniques:
 - Hypothesis Testing: t-tests, ANOVA, Chi-square tests.
 - Estimation: Confidence Intervals, Point Estimates.
 - Relationship Testing: Correlation Analysis.
- Example: Using the test scores of 100 students (sample) to estimate the average test score of all 8th graders in a state (population).

Statistical analysis plan

Inferential Statistics (Drawing Conclusions)

- Bivariate analysis is a quantitative statistical method used to determine the empirical relationship, correlation, or association between two variables (X) and (Y).
- It examines how one variable (independent/predictor) affects or relates to another (dependent/outcome).
- Common techniques include scatter plots, correlation coefficients, and regression analysis.
- T test
- ANOVA single factor
- Chi-square test

Statistical analysis plan

- Statistical Modelling (Predicting and Understanding Relationships)
 - Statistical modelling is a more advanced level of analysis that builds mathematical representations of relationships between variables, often involving predictive analysis and causal inference.
 - Purpose: To explain, predict, or model complex relationships, such as how one or more independent variables predict a dependent variable.
 - Key Techniques:
 - Regression Analysis: Linear regression, logistic regression, multiple regression.
 - Predictive Modelling: Forecasting future trends based on historical data.
 - Causal Analysis: Determining cause-and-effect relationships.
 - Example: Developing a model to predict a patient's risk of developing diabetes (outcome) based on their BMI, age, and blood pressure (predictors).

Statistical analysis plan

Content of plan

- Unit of analysis/observation
- Levels of analysis
- Type of analysis
- Missing data

Statistical analysis plan

Quantitative data analysis

- In quantitative research, you'll most likely use some form of statistical analysis.
- With statistics, you can summarize your sample data, make estimates, and test hypotheses.
- Using descriptive statistics, you can summarize your sample data in terms of:
 - The **distribution** of the data (e.g., the frequency of each score on a test)
 - The **central tendency** of the data (e.g., the mean to describe the average score)
 - The **variability** of the data (e.g., the standard deviation to describe how spread out the scores are)

Statistical analysis

Qualitative data analysis

- In qualitative research, your data will usually be very dense with information and ideas.
- Instead of summing it up in numbers, you'll need to comb through the data in detail, interpret its meanings, identify patterns, and extract the parts that are most relevant to your research question.
- Two of the most common approaches to doing this are thematic analysis and discourse analysis.

Statistical analysis

Approach

Thematic analysis

Characteristics

- Focuses on the content of the data
- Involves coding and organizing the data to identify key themes

Discourse analysis

- Focuses on putting the data in context
- Involves analyzing different levels of communication (language, structure, tone, etc)

Research ethics

- Research ethics involves applying fundamental moral principles—such as honesty, integrity, and respect—to the design, implementation, and reporting of research to protect participants, researchers, and society.
- Key requirements include obtaining voluntary informed consent, minimizing harm, ensuring confidentiality, and maintaining scientific integrity.

Research ethics

Key Principles and Core Concepts

- **Informed Consent:** Participants must fully understand the study's purpose, risks, and benefits before agreeing to participate, and they must be free to withdraw at any time.
- **Beneficence and Non-maleficence:** Researchers must maximize potential benefits while minimizing physical, psychological, social, or financial harm.
- **Respect for Autonomy:** Protecting the dignity, rights, and privacy of individuals.
- **Justice:** Fair selection of subjects and equitable distribution of research burdens and benefits.
- **Integrity and Honesty:** Reporting data, results, and methods truthfully without fabrication, falsification, or plagiarism.

Research ethics

Ethical Issues and Monitoring

- Institutional Review Boards (IRBs): Committees that review, approve, or halt studies to ensure ethical standards are met.
- Potential Misconduct: Includes, but is not limited to, fraud, failure to inform participants, and lack of transparency.
- Confidentiality: Ensuring participant data and identity remain private.

Research ethics

- Preparing for ethical considerations
 - Researchers must ensure that participants provide written informed consent and are aware of their rights throughout the study.
 - Ethical considerations are of paramount importance to protect participants' privacy and emotional well-being.
 - Participants must feel secure that their responses will be kept confidential, and the interviewer must anticipate any potential sensitive topics that might arise.
 - Additionally, researchers should examine the emotional or psychological risks associated with certain topics and be prepared to offer support or referrals if needed.
 - This ensures that the interview process remains respectful and professional while collecting useful research data.

Methodology

- **The purpose of the study/project design component**
- In this section of your proposal you will need to answer three questions:
- What kind of data or sources will you use?
- How will you collect and manage this material?
- Which theoretical and methodological techniques will you use to interpret and analyse these data/sources?
- It is important that you explain the design of your project in a clear and logical way.
- Your reader should be able to clearly see what you will do and how will you do it, and how this combination of data/sources and methods will allow you to address your research problem.

Methodology

- **Tips for completing the study/project design component**
- The most important thing to keep in mind about the study/project design component is that it should not simply consist of a list of tasks that will be undertaken.
- Above all, it needs to establish that these tasks constitute the most effective way of exploring the research problem.
- Specify the particular activities that you will undertake and show how they will contribute to the investigation of your research problem (e.g. “I will engage in a close content analysis of political satire in order to show how it subverts the visual and rhetorical tropes of ‘serious’ political discourse”).
- Anticipate any potential barriers that you will face in carrying out your research design. No method is perfect, so you need to describe what the shortcomings will be and explain how you will address them.

Methodology

- **Tips for completing the study/project design component**

- The key to composing a clear and focused study/project design is to show how you are building upon and/or departing from the theoretical and methodological approaches of key scholars in the field.
- It is therefore necessary to:
 - Consider the theories and methods that other researchers have used, and
 - Consider the theories and methods that have not been used (or that have been underutilised) but perhaps could be.
- When writing up your study/project design, be specific about:
 - The methods that you will use to gather your information
 - The theories and techniques you will use to analyse the information
 - The relevance of these approaches to your research problem

Methodology

- **Brainstorm your study/project design**

- The following questions will help you to formulate your study/project design. You might find it useful to organise your responses into a table, mind-map, or flow-chart (see example below)..
- What is your research problem?
- What are the specific research goals or questions that you will need to address in order to investigate this problem?
- What kind of data or sources will best allow you to reach these goals?
- How will you gather your data/sources/information? How will you gain access to them? Will you need to generate your own data by conducting surveys or experiments?
- What method or methods of interpretation and analysis is most suitable for your project? Will your study be qualitative, quantitative, or mixed-method?
- What theories underlie your research? How will these theories allow you to meet your research goals?
- Are there any ethical implications of your data collection or method of analysis?

Expected outcomes

- Conclude your research proposal by stating your expected outcomes.
- At this stage in the research process, what arguments and conclusions do you expect to reach?
- Your reader will understand that these are projected outcomes based on the extent of research at the time of writing, and that they will almost certainly change in the light of further research.
- It is essential, however, that you give your reader a sense of what conclusions may be drawn.
- This will allow your reader to further assess the significance and validity of your project. It will also indicate to your reader that you have thought ahead and considered the potential outcomes and implications of your research.
- To avoid repetition with the description of your research aims and significance earlier in the proposal, focus on how you envisage your research will contribute to debates and trends in your field.
- What impact might your findings have on how the problem is perceived?
- What impact might your methods have on how research is conducted in the future?

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Timeline

Dates	Tasks
October 2014-October 2015	• Reading Period • Refine thesis topic, read and record existing literature, identify relevant primary sources
November 2015 – February 2016	• Leave – due to work commitments • Rethink thesis topic and access to primary sources
February 2016 – February 2017	• Return to doctoral program • Continue research, identify additional primary sources • Work on confirmation document and chapter structure
February 2017	• Confirmation of Candidature
March-May 2017	• Finalise chapter structure • Draft Chapter One
June – September 2017	• Draft Chapter Two • Attend ANZAMEMS conference
October – December 2017	• Draft Chapter Three
February-May 2018	• Draft Chapter Four
June – September 2018	• Draft Chapter Five
October – December 2018	• Draft Chapter Six and Conclusion
February-December 2019	• Revise and Submit

Report

- Writing about methods
- Reporting and discussing your findings
- Structuring a long text

Report

Methods

- Every thesis, regardless of the discipline and field of inquiry it relates to, needs to answer these questions:
- "How did you do your research?"
- "Why did you do it that way?"
- This covers not only the methods used to collect and analyse data, but also the theoretical framework that informs both the choice of methods and the approach to interpreting the data.
- In some disciplines, the approach to knowledge underpinning both the type of research questions asked and the methods chosen to answer them is called “methodology”, and needs to be articulated. B
- Both methods and theoretical approach relates all of these explicitly to the research question(s) addressed in the thesis.
- You may need to summarize available methods and theoretical approaches for your research topic; you will certainly need to justify your choice of method(s).
- Where a combination of methods is used, that needs to be justified too.
- Your explanation should also indicate any reliability or validity of the data, and discuss any ethical considerations that arise from your choices.

Report

- **Three kinds of story: macrostructures for a thesis**
- The way you present the analysis and interpretation of your data sits within a wider thesis framework, which can itself be thought of as a story (adapted from Silverman, 2005, p. 242-43):
- **the hypothesis story** (this is the standard framework for theses in the empirical sciences)
 - state your hypotheses
 - test them
 - discuss the implications
- **the analytic story** (a common framework for theses in the social sciences)
 - What are the key concepts you have used in this study?
 - How do your 'findings' shed light on these concepts and, through them, on the substantive topics you studied?
 - What, therefore, has become of your original research problem and the literature regarding it?
- **the mystery story**
 - starts from empirical examples
 - develops the questions by discussing them
 - gradually leads the reader to interpretations of the material and to more general implications of the results.

Report

The big picture

- The challenge for every thesis writer is to hold the detail of the data in focus without losing sight of the big picture of the research. This is why reporting data analysis is not enough; you need to:
- establish the connections between the patterns that emerge from your analysis and your research questions
- relate those connections to the existing research and theory
- in order to make clear your contribution to knowledge in the field

Report

- **Reporting conventions**

- Reporting conventions differ according to whether the data involved is quantitative or qualitative.
- **Quantitative data**
- The purpose of the results section of the thesis is to report the findings of your research. You usually present the data you obtained in appropriate figures (diagrams, graphs, tables and photographs) and you then comment on this data.

Comments on figures and tables (data commentary) usually have the following elements:

- a **location element**
- a **summary** of the information presented in the figure
- a **highlighting statement** to point out what is significant in all the data presented (eg trends, patterns, results that stand out).

Report

- **Reporting conventions**

- Table 5 shows the most common modes of computer infection in Australian businesses.
- The influents to filter A and B were analysed fully on a number of occasions, and the averaged results are presented in Table 6.1. It can be seen from the table that the wastewaters from plants A and B and of similar composition.
- Sometimes a reduced location element is used which gives only the table or figure number in brackets after the highlighting statement.

- **Examples:**

- The ranges of metal atom concentrations for the two precipitate types were found to overlap (Table 6)
- Quantitative analysis revealed some variation in the composition of the rods in the various exservice samples (Figure 7 and Table 5).
- **Commentary** on results may include:
 - explanations
 - comparisons between results
 - comments on whether the results are expected or unexpected
 - comments about unsatisfactory data

Report

- The difference between expected and obtained results **may be due to** the incorrect instruments.
 - This discrepancy **can be attributed to** the small sar
 - The anomaly in the observations **can probably be accounted for** by a defect in
 - The lack of statistical significance **is probably a consequence of** weaknesses
 - The difficulty in dating this archeological site **would seem to stem from** the limited data available.
-

Past or present tense

Location element	present tense	<i>...the averaged results are presented in Table 6. Table 5 shows...</i>
Summary of procedure	past tense	<i>The influents to filter A and B were analysed fully occasions,...</i>
Results of analysis	past tense	<i>The ranges of metal atom concentrations ... were</i>
Comments	present tense	<i>This discrepancy can be attributed to the small s</i>

Report

- **Qualitative data**
- The reporting of qualitative data is much less bound by convention than that of quantitative data.
- The data itself usually consists of words, from written documents or interview transcripts (but may include images), which have been analysed in some way, often into themes. In reporting the data, it is generally important to convey both the themes and some of the flavour of the actual words.
- The data needs to be connected back through the layers of detail to the overarching research question it relates to.
- This can be done through the introductions to carefully-structured sections and subsections. Individual data extracts can be connected back into this structure through a process of 'tell-show-tell'.

Discussion of findings

- **Discuss your findings**
- In the discussion of your findings you have an opportunity to develop the story you found in the data, making connections between the results of your analysis and existing theory and research. While the amount of discussion required in a thesis may vary according to discipline, all disciplines expect some interpretation of the findings that makes these connections.

Discussion of findings

Research question

- In your discussion you must draw together your research question and your own research results. If the discussion is in a self-contained chapter or section you will need to briefly summarise the major findings that come from the research and relate them to what you originally proposed to find out.

If your research is testing a hypothesis, you need to answer these questions:

- Do your research findings support your initial hypothesis? Why and how?
- Do your findings only support the hypothesis in part? Why and how?
- Do your findings disprove your hypothesis? Why and how?
- What else do your findings tell you, over and above what you initially set out to investigate?

Discussion of findings

Relation to other research

- Since one of the requirements of a doctorate is to make a contribution to knowledge, it is essential to show how your results fit in with other work that has been done in your field.
- Point out the agreements and disagreements between your data and that of others.
- In presenting your own interpretation of the results, consider the strengths and weaknesses of alternative interpretations from the literature.

Discussion of findings

Implications

- Another aspect of making clear the contribution of your research is to draw out the implications of your findings. Depending on the nature of your research, these will probably be related to:
 - current theory
 - technical applications
 - professional practice

Discussion of findings

Writing your discussion

- The skill in writing a successful discussion is in moving backwards and forwards between others' research and your own research, making it clear:
 - which has been done by other people
 - which has been done by you
 - **and** how they complement each other.

Discussion of findings

- Remember that you are dealing with three different issues and the three must be clearly differentiated for the reader.
- Some techniques to differentiate your own research from previous research in your writing (these are suggestions, not rules, and your best guide is to see how other writers in your discipline do this):

Discussion of findings

Use the first person to describe your findings.

My data shows...

Consistently use 'this' to refer to your own research and refer to previous research by name, place or time.

*This study...
The findings of this research
Smith and Geva found that.
A previous study in Belgrade*

Make reference to similarities or differences in approach or findings.

Similar research carried out

Use the **present perfect** tense to highlight the recent relevance of your research in comparison with earlier research, referring to it in the **simple past**.

*This study **has shown** a prevalence
greater than that **found** by
Belgrade study...*

Discussion of findings

Using cautious language

- Discussing results and drawing conclusions involves making claims about interpretation, significance and applicability. This is done within a research tradition where existing knowledge is always being modified in the light of new results. As a researcher, you are expected to distinguish carefully between:
 - knowledge you are sure of because you have reliable evidence for it
 - other knowledge you are less sure of
 - other knowledge you think is only within the realms of possibility
- Therefore, very strong claims, like the one below, are rare in academic writing
- Reducing fat intake lowers the risk of heart disease.
- A claim like this, which implies that the statement is true in every case, cannot be supported with evidence. Claims should therefore be specific and precise, and the level of certainty must match the level of evidence.

Discussion of findings

Using cautious language

- There are many methods used in academic writing to qualify a claim:
- Indicate the degree of probability (note how the claim progressively weakens):
- It is **certain** that
- It is **very probable/ highly likely** that
- It is **likely** that
- It is **possible** that
- It is **unlikely** that

Discussion of findings

Using cautious language

- reducing fat intake lowers the risk of heart disease.
- Reducing fat intake **lowers** the risk of heart disease.
- Reducing fat intake **could/might lower** the risk of heart disease.
- Reducing fat intake **may lower** the risk of heart disease.

Distance yourself

- a) from the claim:
 - Reducing fat intake **appears** to lower the risk of heart disease.
 - **It seems that** reducing fat intake lowers the risk of heart disease.
 - **Some researchers suggest that** reducing fat intake lowers the risk of heart disease.
- or b) from the data, by showing its limitations:
 - **Some studies indicate that** reducing fat intake lowers the risk of heart disease.
 - **For this age group** , reducing fat intake lowers the risk of heart disease.
 - **In most of the cases studied** , reducing fat intake lowered the risk of heart disease

Discussion of findings

Use a qualifying verb:

- Reducing fat intake **tends** to lower the risk of heart disease.
- Reducing fat intake **contributes** to lowering the risk of heart disease.
- In practice, a combination of these methods is often used:
- The majority of studies indicate that for this age group, reducing fat intake contributes to lowering the risk of heart disease.

Thesis structure

- Just as there are different types of research, there are different ways of reporting it.
- Whatever format is used, however, a thesis needs to answer these questions:
 - What was done?
 - Why was it done?
 - How was it done?
 - What were the results?
 - What do they mean?
 - Why are they important?

Thesis structure

- 1. Table of Contents
- 2. Abstract (Synopsis/Summary)
- 3. Introduction
- 4. Literature Review
- 5. The 'body' of the thesis
 - Methods
 - Findings
- 6. Conclusion/Discussion
- 7. References/Appendices
- 8. Other Language Matters

Thesis

- Abstract/Synopsis/Summary
- How long is the abstract? Do you get a clear sense of what the research is about from the abstract? Does the abstract motivate you to read (some of) the rest of thesis?
- The following is a sequence of 'moves' used in many abstracts:
 - introduction to the area covered in the study
 - statement of the aim of the study and its rationale
 - brief description of approach used
 - brief description of main findings
 - implications of findings and conclusions.
- Can you readily identify these in your sample abstract? Are any other 'moves' included? Do they strengthen the abstract?

Thesis

Introduction to the research problem

- (brief) review of the current state of knowledge in the area
- indication of gaps, shortcomings, problems in research to date
- statement of the aim of your research, especially how it will fill the gap, solve the problem etc.
- overview or chapter outline of the thesis.
- They may also contain something about research methods and/or theoretical approaches, if these matters are not dealt with in other chapters.
- Since establishing the need for the research within the current knowledge of the discipline is an important function of the thesis introduction, there generally needs to be a brief consideration of research on the topic, even if this is dealt with in more detail elsewhere in the thesis.

Thesis

Body of thesis

- In the middle sections (or body) of a thesis, the focus is very much on the study itself. In very general terms, these sections will give an account of:
 - What was done in the study (methods, procedures, approaches etc.)
 - What was found (results, findings etc.)
- In some theses, especially those based on experimental models of research, these two elements may be incorporated in separate Method and Results sections.
- In theses which have a more thematic organisation of chapters, these elements might be signalled less explicitly.
 - How do these two elements (A and B) appear to be organised in the sample?
 - What level of detail is given for A? (e.g. subjects, equipment, procedures for data collection, methods of analysis etc.)
 - How are the findings (B) organised? In a series of separate sections? In what form(s) are the findings presented? (e.g. as tables, calculations, examples, extended description etc)

- **Conclusion**

- Depending on the type of research presented in the thesis, conclusion chapters or sections tend to include at least some of the following:
- summary of the main findings or argument
- relation of findings/argument to other research
- explanations for findings
- implications of the findings
- limitations of the research
- suggestions for future research

- Conclusion/Discussion
- Note that these 'moves' do not necessarily appear in the order shown above. Some 'moves' may also be repeated, especially those that deal with the discussion of findings (moves A-D).
- Which of the 'moves' A-F can you identify in your sample thesis? In which order do they appear? Are any 'moves' repeated?
- Move A is concerned with making claims about your subject. These often need to be expressed in a qualified way, using expressions like the following:
 - On the basis of this study, it would appear that X is...
 - The findings of this study suggest that X is...

Scientific manuscript

- A scientific manuscript is a structured document reporting original research, designed for peer-reviewed journal submission to disseminate findings, establish expertise, and allow replication.
- It typically follows the IMRaD format (Introduction, Methods, Results, and Discussion).
- Key components include a clear title, abstract, figures/tables, and references, focusing on logical flow rather than elaborate style.

Scientific manuscript

- Key Aspects of a Scientific Manuscript
- Structure (IMRaD):
 - Introduction: Sets the context, identifies the knowledge gap, and states the hypothesis.
 - Methods: Details study design, participants, and, when necessary, ethical approval.
 - Results: Presents key findings with figures and tables, avoiding interpretation.
 - Discussion: Interprets results, addresses limitations, and explains implications.

Scientific manuscript

Preparation Process:

- Start with Figures/Tables: Create visual data representations first to guide the narrative.
- Methods & Results Next: Document what was done and found before interpreting.
- Introduction & Discussion Last: Craft these to fit the story revealed by the data.
- Write Abstract Last: Summarize the entire work concisely only after the paper is finished..

Scientific manuscript

Submission

- Adhere to Guidelines: Rigorously follow the target journal's "Instructions for Authors" to avoid rejection.
- Focus on Clarity: Present a clear, logical, and concise narrative.
- Review & Edit: Utilize co-author feedback and track changes for revisions.
- Reference Management: Ensure accurate, properly formatted citations.

References

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