BUSINESS RESEARCH APPROACHES

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JAMES COOK UNIVERSITY

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Contents

Acknowledgement of Country

At James Cook University we acknowledge with respect the Aboriginal and Torres Strait Islander peoples as the first peoples, educators and innovators of this country. We acknowledge that Country was never ceded, and value the accumulation of knowledge and traditions that reflect the wisdom of ancestral lines going back some 60,000 years, and recognise the significance of this in the ways that Aboriginal and Torres Strait Islander peoples are custodians of Country. As a University, we will continue to learn ways to care for and be responsible for Country, and we will collectively seek to build a future that is based on truth-telling, mutual understanding, hope, empowerment, and self-determination.

Kassandra Savage (JCU Alumni), 'Coming Together and Respecting Difference', acrylic on canvas, 2014, 90cm x 90cm.

About the Authors

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Introduction

Welcome to *Business Research Approaches*.

This book guides you through critical thinking, ethics, research ideas, aims, objectives, and a variety of other information you need when conducting research.

Come with us on an interesting and intriguing journey into the realm of research.

CHAPTER 1. ETHICS IN RESEARCH

Ethics in Research

Learning Objectives

In this chapter you will discover and understand:

- the definition of ethics in relation to research
- the complexity of ethics in research
- ethics in human research.

1.1 What do we mean by Ethics?

You may initially think that ethics is just a tiresome nuisance that only interests old academics. Well, if you do, consider the following questions: how would you feel if you:

- agree to do an evaluation survey for a hotel and then find your contact details have been sold to an online hotel marketing service?
- complete an interview with a consultant evaluating your boss and your boss finds out what you said?
- accepted an offer of free hair care products for six months in return for evaluating the products and later find out the company was testing a new chemical which has caused allergies in other products?
- agree to participate in a short phone survey, and it takes over an hour?
- post a misspelt review of a restaurant on Facebook, and you find your quote used as a satirical title of a conference paper on restaurant service quality?

Watch the following video for a basic introduction to the principles and guidelines for ethical research [3.36].

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=217#oembed-1

1.2 Definition and Context of Research Ethics

"Research ethics govern the standards of conduct for scientific researchers" (World Health Organisation [WHO], n.d.).

There are many codes of ethical research conduct, rules and legislation about research. Two conflicting philosophical positions are **deontological** and **teleological**. Researchers who believe there should be rules to guide researchers' conduct, such as rights, duties, and equality, and that acting outside those rules is never justifiable, have a deontological view. Whereas researchers who have a teleological view believe being able to conduct research should be guided by the outcome of the research (desirable or undesirable), not by a set of rules (Wasieleski & Weber, 2019).

1.3 What is Human Research

At its simplest, “Human research is conducted with or about people, or their data, or tissue” (National Health and Medical Research Council [NHMRC] et al., 2023).

1.4 Principles of Research Ethics with Humans

There are four main principles of research ethics with humans: (1) research merit and integrity; (2) justice; (3) beneficence; and (4) respect (NHMRC et al., 2023). A brief description of each principle follows:

1. Research merit and integrity include, but is not limited to, contributions to knowledge and understanding, benefits to society, methods employed in research, literature search, respect of participants, researcher(s) qualifications, and dissemination of results.
2. Justice in research includes, but is not limited to, inclusion/exclusion criteria for participants, recruitment of participants, treatment of participants, and participant access to benefits of the research.
3. Beneficence includes, but is not limited to, the benefits from the research outweigh any potential harm or discomfort to participants; when benefits to participants are unlikely risks should be minimal; and if risks to participants can not be justified by potential benefits the research must cease immediately.
4. Respect in research includes, but is not limited to, ensuring the first three principles of research with humans are ensured, all privacy, confidentiality, and cultural sensitivities of participants (and communities) are recognised and respected. It is recognised that participants can make their own decisions, and where unable to do so, respect is shown to them and they are empowered where possible and protected.

The National Statement contributes to awareness of possible ethical dilemmas where agreement on what is right or wrong is difficult or impossible. While the National Statement does not cover every possible discussion on human research, there are specialised codes of practice for specific research areas. These codes of practice can be used as supplements to the National Statement if they are in line with it (NHMRC et al., 2023).

Risk and Consent

Risk

There are two main levels of risk: (1) lower risk and (2) higher risk. These are briefly described as follows:

1. Lower risk at a minimal level means the researcher(s) must ensure there is no risk of harm or discomfort to participants, and there is minimal risk for minor burdens or inconvenience. Lower risk at a low level means that there is no risk of harm or discomfort to participants in the study.
2. Higher risk relates to individual participants, groups, communities, societal, or global. When the higher risk is greater than low there is the risk of harm and foreseeable burden. When the higher risk is high, there is a significant risk of harm or foreseeable burden (NHMRC et al., 2023).

Consent

Information on the general requirements for consent in research can be found starting on page 16 of the National Statement on Ethical Conduct in Human Research (NHMRC et al., 2023).

NOTE: For full details on ethical conduct in human research, see The National Statement on Ethical Conduct in Human Research.

Useful Information and Links:

For all university-based research ethics information, you should contact your university's ethics department.

- The Australian Research Council (ARC) has codes and guidelines.
- The Research Society in Australia has information on regulations and codes for market research within Australia.
- The Australian Government, Department of Industry, Science, and Resources has Australia's Artificial Intelligence Ethics Principles.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=217#oembed-2

- Bellberry Limited is a not-for-profit (fee-charging) organisation providing scientific and ethical review of human research projects.
- AIATSIS Code of Ethics for Aboriginal and Torres Strait Islander Research.
- Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and Communities – NHMRC Building a Healthy Australia.
- Ethical Research Involving Children (ERIC)

Key Takeaways

- Ethical conduct in human research is very important.
- Ethical conduct in human research is very complex.
- It is extremely important to ensure all research follows ethical conduct very closely.

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CHAPTER 2. CRITICAL THINKING, RESEARCH BIASES/ERRORS

Critical Thinking, Research Biases/Errors

Learning Objectives

In this chapter you will learn how to understand:

- critical thinking, its application in academia, and also in life
- the various barriers and errors that occur in relation to critical thinking.

2.1 Critical Thinking

Critical thinking is highly important to your daily life, your work, your studies, and everything you do, and there are several standards that can help you keep on track.

- **Clarity:**
  - Is it clear what you are trying to say?
  - Have you been concise and to the point, or are you 'waffling'?
  - Do you have support (references) for what you are asserting is a fact?
  - Have you used industry and/or academic language correctly?
  - Is your punctuation correct?
  - Is your sentence structure correct?
- **Precision:**
  - You are writing a questionnaire, for example, are your questions precise, are they asking what you need to know, and would that provide precise answers?
  - Ask yourself, what do I really want to know?
  - Are my questions precise, or are they leading questions?
  - More on writing questionnaires in chapter 8.
- **Accuracy:**
  - How accurate is the information you have obtained from various sources?
  - Have you ensured that the sources are reliable?
  - Have you looked at a variety of sources for information that is both positive and negative, and compared their validity?
  - While accurate information from valid, reliable sources can assist with good decision making, information from unreliable sources can lead to catastrophic errors.
- **Relevance:**
  - How relevant is what you have written?
  - Does what you have written relate to your topic/point, or have you gone off on a tangent where you might end up down Alice's rabbit hole?
  - Is what you have written or what you are saying relevant to your audience?
- **Consistency:**
  - Are you consistent with what you are saying about your topic/point?
  - Is what you are writing about (saying) consistent with what you found in your literature searches?

    - Are you applying information and referencing sources correctly and consistently?
- **Logical Correctness:**
    - Is what you have written logical?
    - Does your argument come to a logical conclusion?
    - Read what you have written carefully. Does each sentence in each paragraph build your reasoning to a logical conclusion?
- **Fairness:**
    - When you have been researching your topic, have you fairly considered all points of view from reliable sources?
    - Are you satisfied you have not let personal feelings or preconceptions cloud your judgement?

Critical thinking may appear to be a field of obstacles, but taking a logical approach, and thinking carefully about what you have written, and keeping an open mind is going to deliver great results.

2.2 Barriers to Critical Thinking

While critical thinking can be logical and successful if you can answer the questions in the previous section, there are barriers that need to be addressed. These barriers are generally unconscious occurrences, but if you are aware of them, you can prevent them (or at least try to).

Anchoring bias

This occurs when a person places too much importance on the first piece of information they hear or see. For example, a person goes to a car dealer as they want to buy a new electric vehicle (EV). The first EV they see has a price tag of $73,000. The next EV has a price tag with $80,000 crossed out, and replaced with $73,000, the person sees this as an excellent deal. They have decided to place too much importance on the first price they saw.

Availability heuristic

This is when an individual overestimates the likelihood of something happening based on instances readily available in their memory. For example, an individual from Melbourne is on holiday in Alice Springs, they recall reports that crocodiles are found in waterways in the Northern Territory and kill people. The individual sees a waterway and immediately believes it is full of crocodiles (for those unaware, crocodiles do not live in Alice Springs waterways, it is too far south).

Bandwagon effect

This is a psychological phenomenon. You may find someone is more likely to adopt a belief or follow a trend based on the number of other people with that belief or following that trend. For example, State of Origin is on in Brisbane. Sam is from Darwin and is not interested in Rugby League and intends to binge-watch Stranger Things on Netflix. Sam is staying with Jo, who says, “Come and watch State of Origin tonight. Everyone is going to be there”. Sam goes to watch the State of Origin.

Blind-spot bias

Did you know that people are really quite good at spotting biases in other people? However, these same people often fail to recognise their own cognitive biases and consequently the resulting impacts on their decision-making. For example, someone may think they are being ethical by purchasing ‘fair-trade’ coffee. But they have not considered the carbon emissions created in transportation or ‘food-miles’ of the coffee.

Choice-supportive bias

Generally, this occurs sometime after a choice was made. The recollection of the choice is usually thought to be better than it might have been. That is, the focus is on the positives and the negatives are just ignored. For example, Ash wants a new phone and looks at an iPhone and an Android phone. Ash purchases the iPhone. When Ash recalls the purchase of the iPhone, the recollections are all positive – for example, all the great apps. Ash ignores the negatives, e.g. the iPhone won't link to the Dell laptop.

Cognitive bias

The term "cognitive bias" originated in the 1970s to explain humans' propensity to seek and find patterns in everything, even when they do not really exist. Although someone may be aware of cognitive bias they may still come up with an error, due to the error being compelling (Behimehr & Jamali, 2020). You can think of cognitive bias as our brains taking a shortcut to make information processing simpler. This can be caused by emotions, social influences, cultural conditioning, or availability of information (University of Texas, n.d.). There are many different types of cognitive biases. One of these is 'Clustering Illusion'. This occurs when people see patterns or clusters in random happenings (data), when there is no pattern or cluster. For example, your favourite basketball player is on court and scoring baskets. They shoot 3, 2, 3, 2, so you believe the next score is going to be 3. There is no pattern here, the scores come from the player's position on the court in relation to the 3-point line. If the player is outside the 3-point line they score 3 points, if they are inside the 3-point line they score 2 points.

Confirmation bias

This is when a person looks for and covets information that supports their strongly held beliefs. Any information that contradicts those beliefs is ignored (Nickerson, 1998). For example, in politics, many voters only seek information that supports their beliefs about their chosen candidate. Any negative information is ignored.

Group conformity

Group conformity is also referred to as social conformity, this is when a person follows a group's (or other people's) decisions even when it goes against their personal experiences, or better judgement (Li et al., 2019).

Conservatism bias

Here, people ignore new evidence or information that has emerged, and instead cling to prior evidence. For example, people were slow to accept the sun was the centre of the galaxy and all the planets, including the earth, orbited the sun. They maintained an earlier belief that everything in the galaxy orbited the earth.

Information bias

This happens when a person believes that the more information they have, the better the decision they can make, even when the information is irrelevant to the issue. For example, this can be applied effectively in marketing. A company provides a great deal of information on a smart TV, even if some is irrelevant to the consumer. The company hopes all the information is going to reassure consumers, so they are going to make a purchase.

Ostrich effect

This occurs when a person metaphorically puts their 'head in the sand'. They do not want to acknowledge any possible negative information. For example, you know you are due for your annual dental appointment, but you keep finding reasons not to go for fear of what the dentist may tell you. If you do not go you are not going to hear the negative information, e.g., you need a filling, therefore you don't need a filling.

Outcome bias

This is when a person evaluates the quality of their decision based on the outcome of the decision. For example, the score was one-one, the coach took the rookie 16-year-old off the bench and sent him on the

field with 3-minutes left in the game. The rookie scored the winning goal with 5-seconds left on the clock. The coach said after the match that it was a stroke of genius on his behalf, he knew the rookie would deliver. However, if the rookie had failed the coach would have looked a fool.

Overconfidence

There are numerous people who are overly confident in their abilities. This may cause them to be overconfident and take greater risks. For example, A.J. goes for a job interview. After the interview, he heads for a coffee. A.J.'s phone is put on the table. A.J. is overly confident about how well the job interview went. The phone is on the table in anticipation of a phone call for a job offer. A.J. has failed to consider the abilities of the other job applicants. This lack of consideration that other applicants may be just as capable or even better is overconfidence bias.

Placebo effect

The placebo effect is often seen in medical treatments, most often relating to mild ailments. For example, Sam cannot sleep and has been lying on the bed for about an hour. Sam decides to get up and take a sleeping tablet. Sam does not take a sleeping tablet, but instead takes a pain reliever by accident. Because Sam believed the tablet was a sleeping tablet, they went to sleep and woke in the morning and said they had the best sleep ever. As seen in this example, if a person is convinced that a treatment is going to provide the benefit needed that it does. Even though the treatment was 'fake', it just has to appear 'real' for it to take effect on some people.

Pro-innovation bias

This occurs when someone believes an innovation should be 'pushed out' straight away to everyone, regardless of any limitations or weaknesses. For example, A.I.s were 'pushed out' to the world without actually being ready. There are privacy and ethical issues that should have been resolved in the development stage. A.I.s have demonstrated bias, they lie, they make up information and/or references. A.I. may not meet expectations and so disappoint.

Recency

This is when someone overemphasises the importance of items, ideas, information, and events that have recently occurred and therefore remembered more clearly than older ones. This relates to short-term memory. For example, you write a shopping list, you go shopping and leave the list at home. You are more likely to remember the last two or three items on the list, but you struggle to recall any at the top or middle of the list.

Salience

When the human mind focuses on something that stands out (is easy to recognise) from everything else. For example, you are reading instructions for an assessment, your lecturer bolds some of the words to get your attention. You immediately focus on these words.

Selective perception

This is when a person tends not to notice, ignore, or quickly forget any stimuli that makes them feel uncomfortable or contradicts their prior beliefs. For example, a person must select a mixed (boys and girls) netball team for the final which everyone wants to win. The person selects more girls than boys in the team because the person believes girls are better at netball than boys.

Stereotyping

A predisposition to believing that a group or individual has certain qualities because of who they are, this could be race, gender, age, etc. For example, someone sees a person who they perceive is elderly and assume the most they would do is potter away in the garden, when in fact the person is an avid scuba diver.

Survivorship bias

This occurs when you focus on those who are success stories (survivors) and ignore those who have failed. For example, you may think making money on the stock market is easy as you have heard a lot of success stories, but what about all of those who have failed?

Zero-risk bias

When a person must make a choice, they prefer the option that eliminates small risks over the alternative that would decrease large risks and provide improved results, because this still has risk. For example, you are buying a new toaster, one is good value for money but has a 15-day money-back guarantee, the other is more expensive, but has a 45-day money-back guarantee. Most people select the more expensive toaster as they feel there is no purchase risk attached.

2.3 Research Errors

Coverage error

Coverage error is when your sample does not accurately reflect the population. This most commonly occurs when your sample is biased or is not large enough (Alvarez & Van Beselaere, 2005). Note: See Chapter 10 for more on sample size.

Measurement error

Measurement error occurs when the survey is designed and implemented, and can also occur when the results are interpreted. There is a lack of completeness and the ability to interpret results, meaning they are not generalisable (Davies, 2020).

Participant or response bias or error

Participant or response bias or participant error is all about what has affected the individual participant's responses. These biases or errors may be subconscious or deliberate and are most common in surveys where the focus is on individual opinions or behaviours. For example:

- The participant subconsciously feels the need to please the researcher and so answers the questions accordingly.
- The participant may deliberately randomly answer questions, not caring what they select as they are time poor, or not really interested in the survey, and even find it an annoyance. But they complete the survey anyway as they perceive this as helping the researcher(s), even though they are in reality skewing the data.
- The name of the survey, instructions provided to the respondent, or even question order can cause an issue.

Researcher error

Researcher error is also known as scope error. This occurs when there is an omission of required questions. That is, important questions needed to answer the research question have been left off or omitted from the survey.

Sampling error

A sampling error occurs when a specific characteristic of your sample differs from that of the whole population (McNabb, 2021). Your sub-group of interest is then over- or underrepresented therefore your study's results are not generalisable.

Selection or sampling bias

Selection bias is also known as sampling bias. This occurs when some members of a population have a greater chance of being included in a study than others or when potential participants are unintentionally excluded from the sample. Often this is due to how the sampling process has been conducted. When selection/sampling bias occurs results from the study may not be generalisable (Rose et al., 2024).

There are three main sources of sampling/selection bias:

1. Only a section of the target population has the opportunity to participate in the study, the rest have been excluded. This may be due to a sampling frame error, or the access to participants method. For example, you are using the internet to access a group of public bus users. However, not all public bus users are also internet users. This biases your sample to public bus users who also use the internet, instead of all public bus users, therefore your results are not generalisable.
2. People who do not meet the required criteria are accidentally included in your sample. For example, you have a filter question in your questionnaire, but it is not specific enough, therefore you may have participants included who do not meet your sample criteria.
3. People may decline or are unable to participate; this is non-response bias. This bias is created when those who decline or are unable to take part in the study are summarily different from those who do participate (Rose et al., 2024).

Prevention

A census is the most accurate way to collect data and avoid errors, here everyone in the population is included, but this is only practical for a government to conduct (Australian Bureau of Statistics [ABS], n.d.). Instead, you need to conduct a survey that has a proportionate representation of the population. Further discussions on sampling are in Chapter 10 of this text.

Key Takeaways

- Critical thinking and its importance in research and study in general.
- Research errors and biases are very similar with some terms almost interchangable.
- Why you must be vigilant in your research designs to avoid the multiple different biases/ errors.

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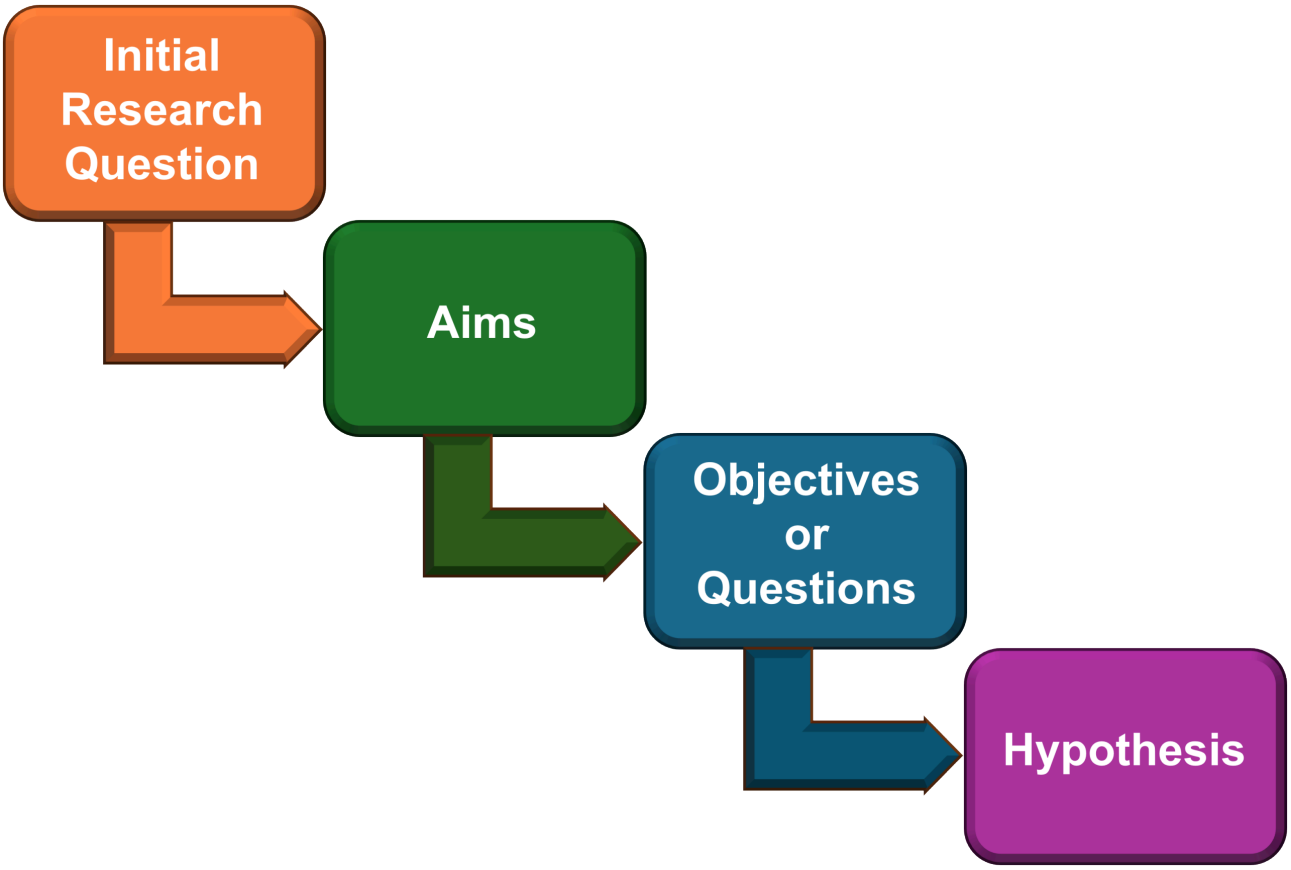
CHAPTER 3. FROM RESEARCH IDEA TO HYPOTHESIS



From Research Idea to Hypothesis

Learning Objectives

In this chapter you will learn how:

- to write a research aim
- to write research objectives or questions
- the research aim helps you to develop your initial research questions
- to write a hypothesis and the difference between a null hypothesis and the alternative.

3.1 Initial Research Question

You have decided to undertake some research for your business, which means the first thing to do is decide on your research idea or topic. To identify your research aim, or topic you should have gone to the literature that relates to your area of interest and identified any gaps that exist. A good quality topic (idea) should relate to theory, you need to be able to concisely define the idea, it should be achievable within your time limit, the data should be easy to collect, and it should be original, a new theory, or new approach (Samuels, 2023).

There are 3 categories of research where each uses different types of research questions and research design (Rose et al., 2024).

1. Descriptive/exploratory research uses 'what' questions. For example:

    a. What is the attitude of HR employees to the new payroll system?

    b. What are consumers saying about our new product on Facebook?

2. Explanatory research uses 'why' questions. For example:

    a. Why do people get involved in the State Emergency Services (SES)?

    b. Why do some company mergers fail?

3. Process research uses 'how' questions. For example:

    a. How do consumers select an insurance provider online?

3.2 Aims

A research aim is a brief statement of the main goal or purpose of the research project (Thomas & Hodges, 2010). For example, the aim of this study is to investigate motivations associated with volunteering with State Emergency Services (SES).

After you have developed your initial research question (3.1 above) you move to developing your research aim. For example:

- The aim of this study is to explore the impact of climate change on the Great Barrier Reef (GBR) in the waters off Cooktown, Queensland.
- The aim of this study is to explore the impact of procrastination on university students' assessment scores.

3.3 Objectives or Questions

Research objectives are framed as a statement and provide further detail on the research topic/problem the researcher(s) are investigating. This builds on the theme from the research aim(s). Often this results in two, or three research objectives (Thomas & Hodges, 2010).

Research objectives relating to the above research aims:

Example 1:

- This research examines the effect of rising temperatures on the GBR in the waters off Cooktown over the last 10 years.
- This research assesses changes in cyclone patterns across the Far Northern region of the GBR over the last 10 years.
- This research assesses the impact of changing weather patterns on the bleaching of coral across the Far Northern region of the GBR over the last 10 years.

Example 2:

- This research compares the assessment scores of university students who identify as procrastinators with those who do not.
- This research investigates the relationship between procrastination and assessment scores.
- This study surveys student perceptions of how their level of procrastination affects their assessment scores.

Research question(s):
The key issue(s)/problem(s) that are the focus of the study are stated in the form of a question or questions to assist in answering the research aim. For example:

- How have rising temperatures affected the big potato cod at the Cod Hole on the GBR off Cooktown?
- To what extent has coral bleaching occurred on the reefs off Cooktown over the last 10 years?

3.4 Hypothesis

As you have already undertaken a critical review of the existing literature, you have a grounded view of your topic/problem area. Therefore, your hypothesis is your educated guess as to what your research answer is going to be (Mewburn, 2017). There are a variety of ways to write hypotheses statements as shown in the following sections.

If-Then Statements

A hypothesis can be used to test if there are differences between or among two or more groups in relation

to one or more variables (Sekaran & Bougie, 2013). When testing whether or not a relationship exists, you can write the hypothesis as follows:

1. A proposition – Employees who are healthier are going to take less sick leave.
2. If-then statement – If employees are healthier, then they are going to take less sick leave.

Directional and Non-Directional Statements

Directional statements provide the direction of the relationship or difference between two variables.

Non-directional statements (AKA two-tailed) predict there is a relationship or difference between two variables, however, the direction of the relationship is not specified (McLeod, 2023). For example: There is a difference in procrastination levels between project management students and economic students.

The Null and Alternative Hypothesis

- Null hypothesis testing is used to determine if there is any statistical relationship between two variables in a sample (Hitchcock & Onwuegbuzie, 2022).
- The null hypothesis is written as: H_0
- The alternate hypothesis is written as: H_1
    - For example:
        - H_0: There is no relationship between drinking iced coffee and eating Caramello Koalas.
        - H_1: There is a relationship between drinking iced coffee and eating Caramello Koalas.

When your analysis shows the alternative is correct (reject the null) you say, for example:

- We accept there is a relationship between drinking iced coffee and eating Caramello Koalas, therefore we reject the null.

When your analysis shows the null is true (you retain the null) you say, for example:

- Analysis indicates there is no relationship between drinking iced coffee and eating Caramello Koalas, therefore we retain the null.

P-value (for another explanation go to: What are p-values??

- The p-value is the probability of the test results being the result of your hypothesis, and not just random luck.
- The p-value assumes that the null is true for the population, and that any difference in the sample is caused by random chance.
- A low p-value indicates your data results are unlikely assuming a true null hypothesis; therefore we reject the null hypothesis.
- A high p-value indicates your data results are likely assuming a true null hypothesis; therefore, we fail to reject the null hypothesis.

How low?

- Criteria for testing the null hypothesis is alpha (α) and is generally set at 0.05 (5%).
- When $p < 0.05$, you would expect to only find a test statistic as extreme as that calculated by your test only 5% of the time assuming a true null hypothesis, therefore we reject the null hypothesis.
- When $p > 0.05$, you would expect to find a test statistic as extreme as that calculated by your test more than 5% of the time assuming a true null hypothesis, therefore we retain the null hypothesis.
- However, retaining the null hypothesis does not mean you accept that the null hypothesis is true, it

means that the sample data results are insufficient to conclude the effect exists in the population.
- In general, when writing up results the correct terminology is to say we "fail to reject the null hypothesis" (Price et al., 2015).

Key Takeaways

- Identifying gaps in the literature is a first step to finalising your topic.
- Specifying your research aim helps to develop the initial research questions.
- There are important steps to follow to get from topic to hypothesis successfully.
- There is a specific way to write a null hypothesis and the alternative.

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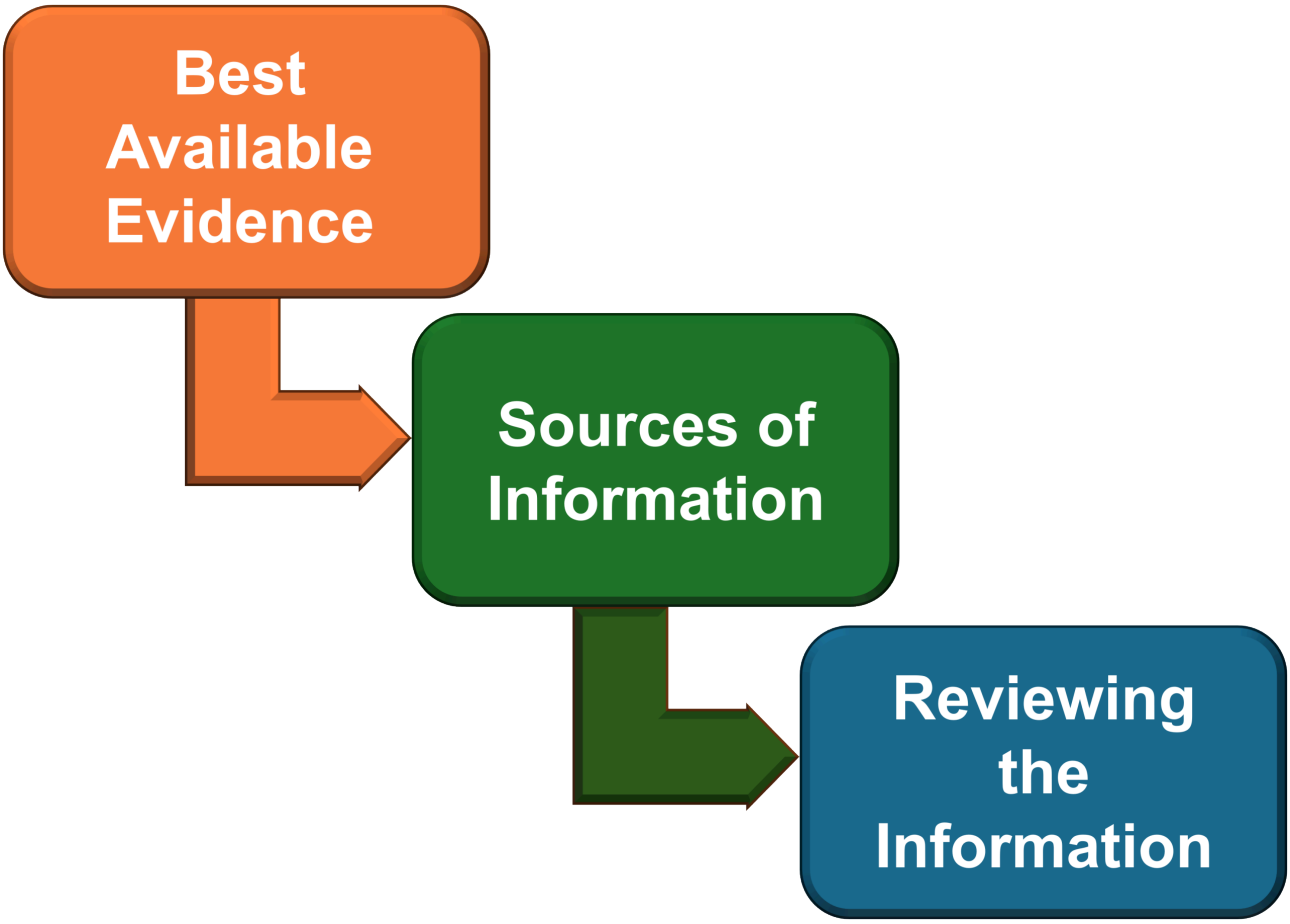
CHAPTER 4. INFORMATION SOURCES AND REVIEWING



Information - Sources and Reviewing

Learning Objectives

In this chapter you will learn:

- how to source and review the best available evidence for research purposes
- multiple ways to review information obtained
- learn about writing a literature review.

4.1 Best Available Evidence

The evidence in evidence-based business decision making is information you have obtained in the form of facts or data that support or contradict a claim, an assumption, or a hypothesis. Organisations can obtain information and data from numerous places, for example, internally (from inside the organisation), and externally (from outside the organisation). The four main sources of information are:

1. Empirical studies published in reputable scientific journals (scientific literature).
2. Professional expertise from practitioners in the targeted area.
3. Values and concerns from stakeholders involved in the business (project).
4. Internal data from within the organisation from various departments.

Evidence-based management translates to management decisions (routine, complex, novel) being made based on the best available evidence and critical thinking to judge the trustworthiness and relevance of the evidence (Rousseau, 2020). The six steps to follow in relation to the above four sources of information and data are:

1. **Ask** – take your practical problem/issue and write it as an answerable question.
2. **Acquire** – systematically search for relevant, reliable literature from the four sources to obtain what is required.
3. **Appraise** – carefully consider and critically evaluate the information obtained (from the literature), is it relevant, is it trustworthy?
4. **Aggregate** – judge the importance of the evidence you have sourced, then combine it in a concise manner.
5. **Apply** – include evidence obtained into the organisation's decision-making.
6. **Assess** – carefully evaluate the outcome of applying the decision made (Criado-Perez et al., 2020).

4.2 Sources of Information

Scientific literature

Scientific literature undergoes a rigorous publication process. Scientific literature are articles published in

reputable scholarly journals that have a 'double-blind, peer review' of each submitted article. This means each article is reviewed by other authors in the article's field of study. The reviewers are not aware of the authors' names, and the authors are not aware of the reviewers' names (hence, double-blind). The reviewers critique the article and can suggest to the journal editor that the article be accepted without any changes, accepted subject to addressing the suggestions put forward, or rejecting the submission as being below the journal's standards. This is a process that aims to ensure each journal only accepts papers of high quality, that are accurate, and academic integrity is maintained. You may find some who ascertain articles published in conference proceedings are not held to the same high standard as those published in scholarly journals. However, most reputable conferences require full articles and abstracts to be double-blind peer review prior to acceptance to the conference, and hence, publication in the conference proceedings.

Each journal publisher has specific criteria for publishing in their journals. For example, the following are four of the major publishers of business-related scientific articles (click on the hyperlinks to go to their websites):

- Emerald Insight
- Emerald Publishing
- Elsevier
- SAGE Journals

To access scientific literature at JCU, go to the JCU Library site. If you are not familiar with the JCU Library One Search, you can find instructions in the One Search guide. There is also a pop-up that gives you the opportunity to chat with a librarian on each page. These are real people who are happy to assist.

Another option for finding relevant scientific literature is Google Scholar. To use Google Scholar's advanced search features, see these instructions.

Industry literature

Industry literature is publications available in print and/or electronic formats, by governments, academics, businesses, and other areas of industry. These publications are not controlled by commercial publishers and include industry reports, trade journals, newsletters, and non-academic conference proceedings.

Industry and organisation websites are another source of useful information; here you can locate annual reports, media releases, case studies, and more. Other useful sites are news sites, such as:

- ABC News Australia
- News.com.au
- The Australian
- Crikey
- 9News
- McKinsey & Company

However, before you reference any article from these news sites, you must do due diligence. Check where else the information has been reported; you want to ensure you are referring to fact and not fiction.

Internal information

Organisations hold enormous amounts of data regardless of their size. For example, you go to the local coffee shop, it is only small, but they have a loyalty card. To register your loyalty card, you go to their website or social media site and complete your details to activate the card. You may only have needed to put in an email address; however, some require a postal address and phone number. The small local coffee shop scans your loyalty card when you purchase a coffee from them. They now have a database of all their customers with loyalty cards. They know what your favourite coffee is, how often you buy a coffee, and the

size of the coffee you purchase. This enables them to calculate how much you are 'worth' to the shop. If you have not been to the shop for a while, they have your email address and can send you email greetings and/or offers to encourage a return visit.

Large organisations have large amounts of data. However, it is not always in a central database that is easy to access. Often, the databases are 'siloed'; each department stores its own information, for example, the human resources department stores data relating to staff (annual pay, annual leave, superannuation, the date they started, training undertaken, etc.). The finance department may store data on financial assets and liabilities, but may not be aware of the value of physical assets, and the future cost of staff in relation to long-service leave, for example. Even though the finance department may hold 'the purse strings' they may not be connected to the other databases. Most organisations have data regarding staff, physical assets (buildings, equipment, inventory), clients and customers, suppliers, financial assets and liabilities, operations, marketing and sales, and quality. Although large organisations have a plethora of data if you are external to the organisation, you may have considerable difficulty and cost associated with any access unless you have been contracted by the organisation to conduct research on their behalf.

Stakeholder information

The term stakeholder is used to describe individuals, groups, and organisations whose interests are affected by, or can affect an organisation's project. Internal stakeholders would be the project manager, the customer, the project team, and the sponsor of the project. However, there are other stakeholders who can influence the organisation's project outcomes, for example, local residents, local groups (e.g., sporting), suppliers, local businesses, the local council, and other members of society.

An example of the power of external stakeholders was evidenced in NSW in 2019. A proposal for a 23-turbine wind farm project on the Southern Tablelands in NSW was rejected. This was due to the unacceptable visual impact on nearby properties (external stakeholders). These external stakeholders had informed the Planning Commission that the proposed wind turbines would affect their land value, aesthetics, and health. While a cattle producer was quoted as saying wind turbines were "scenic vandalism" (Fookes, 2019). Interestingly, in other parts, such as Ravenshoe in Far North Queensland, the wind turbines are a tourist attraction with off-road parking to enable safe viewing. The cows sharing the paddock use them as scratching posts, and birds nest near the top of the inspection platforms.

4.3 Reviewing the Information

A critical literature review

You have collected literature relevant to your topic/problem. You then conduct a critical literature review, here you conduct an in-depth analysis and critical evaluation of your collected literature. This assists you in developing a clear argument around what has been published and what has not been published on your topic/problem, you identify the gaps in the literature (Raimi et al., 2021). You analyse each piece of literature, critically looking at the theories, methodology, arguments, and results, look for biases, and whether the analysis has been conducted and interpreted correctly and is therefore valid.

A thematic literature review

When you conduct a thematic literature review you are organising the literature around a topic/problem, not a progression of time, although the progression of time may be part of your thematic literature review. For example, you are focusing on one topic, the topic can be organised chronologically as it reflects developments or changes over time. However, most thematic reviews are not conducted chronologically, with the emphasis placed on the theme (University of North Carolina, n.d.).

A systematic literature review

The systematic literature review is a scientific approach that summarises and aims to identify all relevant studies on a specific topic. The systematic literature review is highly structured, and protocol driven so every part of the research process can be repeated. When conducting a systematic literature review, you must remain neutral and objective to ensure any instances of bias or error are minimised. Systematic literature reviews are generally quantitative, using statistical data, however on occasion they may include a limited number of qualitative studies (Efron & Ravid, 2018). A properly executed systematic review may take a considerable amount of time.

You should find a good guide to assist you with writing a systematic or a systematic-style review, such as some of the reviews mentioned below.

A rapid literature review

A rapid literature review is just that; it is conducted quickly due to time constraints. There are decisions made at the outset on what theories or methods to focus on and which to ignore. High-quality resources are obtained, and published literature reviews can be of advantage here as they summarise several studies on a specific topic/area (Efron & Ravid, 2018).

The integrative literature review

This type of review critically analyses existing literature, carefully considering the main ideas relating to the topic of interest. Here, the focus is on identifying directions for future research or offering a new topic, or a new perspective on the existing topic. The integrative literature review is generally the approach taken in fields where the research is mature, that is there are numerous empirical, and theoretical studies (Toronto & Remington, 2020).

The meta-analysis literature review

The meta-analysis literature review is a type of systematic literature review, generally using quantitative studies. Here, numerous quantitative studies are collected, and their findings are statistically combined to detect patterns of causal relationships among variables of interest and arrive at a conclusion (Petticrew et al., 2013).

The narrative literature review

The narrative literature review is comprehensive, obtaining literature from a variety of academic disciplines relating to the topic/problem. This type of review includes literature with diverse research methods, and qualitative, quantitative, and theoretical studies. The narrative literature review seeks to critically and objectively analyse current knowledge on the topic/problem and may be useful in building theories (Baumeister & Leary, 1997).

A conceptual literature review

A conceptual literature review offers a conceptual framework for the topic under study. Here the literature on the topic is investigated to identify and analyse different concepts. For example, you might critically discuss how the topic was conceptualised in the literature, how this was reflected in empirical studies, and the implications of the conceptualisations (Efron & Ravid, 2018).

Writing a literature review

The following hyperlink takes you to a resource on how to write a literature review.

Key Takeaways

- The main sources of reputable evidence are scientific literature (journal articles), practitioners, stakeholders, and organisations.
- There are several search protocols for obtaining scientific literature.
- Industry literature may be referred to as 'grey' literature.
- Due diligence is highly important.
- Even though there is a plethora of internal information available to organisations there can be issues with accessing it
- The term stakeholder describes individuals , groups, and organisations whose interests are affected by or can affect an organisations project, for example.
- There are several different types of literature reviews.
- Writing a literature review is not scary as long as you follow the process prescribed.

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CHAPTER 5. DATA COLLECTION AND ANALYSIS, RELIABILITY AND VALIDITY, COMMUNICATING RESULTS

Data Collection and Analysis

Learning Objectives

In this chapter you will learn:

- how to define different types of quantitative data
- the variety of analysis techniques for quantitative data
- descriptive statistics
- the difference between parametric and non-parametric tests
- how to define different types of qualitative data
- the variety of analysis techniques for qualitative data.

5.1 Quantitative Data

Quantitative research is all about the numbers, it is deductive, imposing structure on the data and controlling context (etic) to get one interpretation. These are studies where data are collected and coded as numbers. Quantitative research comes from the scientific realm, various statistical methods are used to analyse the gathered data and answer the research question(s).

Methods of quantitative research are:

- experiments – carefully controlled in a lab.
- surveys – local/regional, or nationally, as a census.
- official statistics.
- naturally occurring data.

Big data are measurements and records created through our contact with the rest of the world, for example:

- social media
- auction sites
- online searches
- online map use
- Internet of Things (IoT)
- use of any digital device.
- customer loyalty cards... and so on.

Much of this type of data is captured passively; it is a by-product of what you are doing, and you are generally not even aware that what you are doing is being recorded or captured, and you do not have to do anything specifically for it to be recorded. These data sets are huge and comprehensive; they are created instantly and constantly updated. They are becoming increasingly cheap and easy to access in real-time.

5.2 Qualitative Data

Qualitative research is conducted using non-numeric statistical techniques. These data are words, pictures, symbols, artifacts, materials, etc., of relevance to a targeted social group. A major strength of qualitative research is the inductive analysis employed. Qualitative research aims to understand and interpret data using thick, detailed descriptions. Structure emerges from the data, patterns are connected to context (emic), and multiple interpretations are sought in developing theory.

Qualitative research has three core concepts:

Self-reflexivity

- This is your understanding of how your life experiences, views, and even your roles in life (student, employee, significant other, etc.) can impact your interactions and interpretations of other interactions or context.
- Your background encompasses your values and beliefs and determines and shapes your approach to conducting research.
- You are the research instrument, you are absorbing and interpreting the world you are in using observation, participation, and interviews.
- Your studies revolve around theory at every stage.

Context

- You immerse yourself in what is happening and try to make sense of it.
- The scene could be a business meeting, a community festival, an interview, or a community group, for example.

Thick description

- This relates back to context, it is how you, as a researcher, engage yourself in a culture, or a particular circumstance, only after you have absorbed all there is, can you move towards new impressive statements and theories.
- Meaning and thick contextual description co-exist; they are combined.
- Without a thick contextual description, what has occurred can be misinterpreted (Tracy, 2019).

Mixed Methods

Mixed methods research strategically integrates (or combines) quantitative and qualitative research to use the strengths of each and achieve greater insight into the topic at hand (McNabb, 2021). There are several advantages and disadvantages to mixed methods research design as detailed below.

Advantages of Mixed Methods Research Designs

- Combining numbers, graphics (images, symbols, pictures), and narrative (written and recorded) can improve the interpretation and comprehension of the topic which is being studied
- Combining qualitative and quantitative research methods allows the researcher(s) to consider a greater number of research problems in more detail
- Where there may be weaknesses in one method these can be overcome by using multiple methods
- Mixed methods research design can strengthen the validity of research findings via triangulation

- The additional thematic focus mixed methods research design can bring to a study can be very beneficial.

Disadvantages of Mixed Methods Research Designs

- A mixed methods research design has the potential to be highly complex, requiring multiple researchers.
- Mixed methodology requires extensive methodological skills.
- Mixed methods designs can be time-consuming and costly.
- Those funding research may be unwilling to support a mixed methods approach, which they may be unfamiliar with.
- Researchers who are unfamiliar with mixed methods research may struggle with having, or obtaining, the necessary skills to provide accurate results for their study (McNabb, 2021).

Why use Mixed Methods Research Design?

Mixed methods research designs are used for the following reasons:

1. **Triangulation** – confirms or reinforces the validity of the findings from different points.
2. **Complementarity** – complements, expands, illustrates, clarifies, or enhances the understanding emerging from research data analysis.
3. **Reinforcement** – application of the findings of one method to help inform or expand the findings of another design.
4. **Conversion** – reshaping or reforming the research problem(s) by resolving any paradoxes or contradictions that emerged when using a single method.
5. **Expansion** – building on the scope of the research by approaching elements of the study from different points of view.

The following are different types of mixed methods research designs.

Exploratory Mixed Methods is a Two-Phase or Sequential Approach

- First, a qualitative approach generates insights from a small sample size.
- Next, a quantitative approach is used to obtain a large sample size.

Exploratory mixed methods is usually undertaken by qualitative researchers with a qualitative topic/problem, when they struggle to identify the most pressing issues associated with the topic/problem and:

- there are no time constraints or funding constraints
- the research design is sequential
- qualitative analysis throws up questions that can only be answered with quantitative data.

Explanatory or Causal Mixed Methods

- uses theory in the form of hypotheses
- used to gain an understanding of the topic/problem
- may use quantitative experiments – control group and experimental group
- randomly selects/appoints participants to control and experimental groups

- controls all variables other than those being tested.

First, measure/describe all participants. Next, apply the treatment to the experimental group. Withhold the treatment or provide a placebo to the control group.

Where the design of the research, for example, implements in the first instance, a quantitative experiment, the results can be used to identify key variables/themes for the second part of the study. The identified variables/themes are then used in a qualitative study which can provide richer, thicker descriptions to 'flesh out' the quantitative results (McNabb, 2021).

Sequence Variations

Quantitative and qualitative data are collected, analysed, and results interpreted in 'parallel', but results may focus on either type.

- Quantitative and qualitative data are collected and analysed separately. Results are combined in the discussion of what has been found.
- One type of data is collected and analysed before the other, the process is sequential.

Parallel Designs

- Data are analysed separately.
- All information is kept separate until after the data are analysed.
- Both quantitative and qualitative data sets must be complete and analysed separately prior to comparing or integrating results.

Coincidental or Concurrent Designs

- Qualitative and quantitative data are collected.
- When data are analysed, relevant qualitative data is recorded and analysed quantitatively.
- Effect size of identified themes can be utilised.

Sequential Mixed Analysis Designs

- Begin by collecting qualitative data about the target population who have been identified with several similar characteristics.
- Define a distinct group using the qualitative data.
- Use a quantitative process and analysis to compare the groups.

Analysis Emphases

- Mixed methods data analysis has 3 approaches with distinct emphasis on data methods according to the research focus.
- Qualitative – quantitative (QUAL-Quant) design:
    - Here, the emphasis is placed on the qualitative collection and analysis of data to begin with.
    - More weight is given to the qualitative results.
- Quantitative – qualitative (QUANT-Qual) design:

- It is generally undertaken after an initial exploratory research where the sample size is small.
- Data are collected and analysed quantitatively.
- Quantitative analysis is conducted on qualitative data with the aim to provide deeper understanding of quantitative results.

- QUAL-QUANT or QUANT-QUALT design:
  - Qualitative and quantitative data are obtained at the same time.
  - When analysed, both sets of data are given equal weighting.
  - Discussion does not focus on one set of results over the other (McNabb, 2021).

5.3 Quantitative Data Analysis

Defining types of quantitative data

Quantitative data are made up of variables that represent amounts, the number of things, for example, the number of fish in Lake Tinaroo (Far North Queensland).

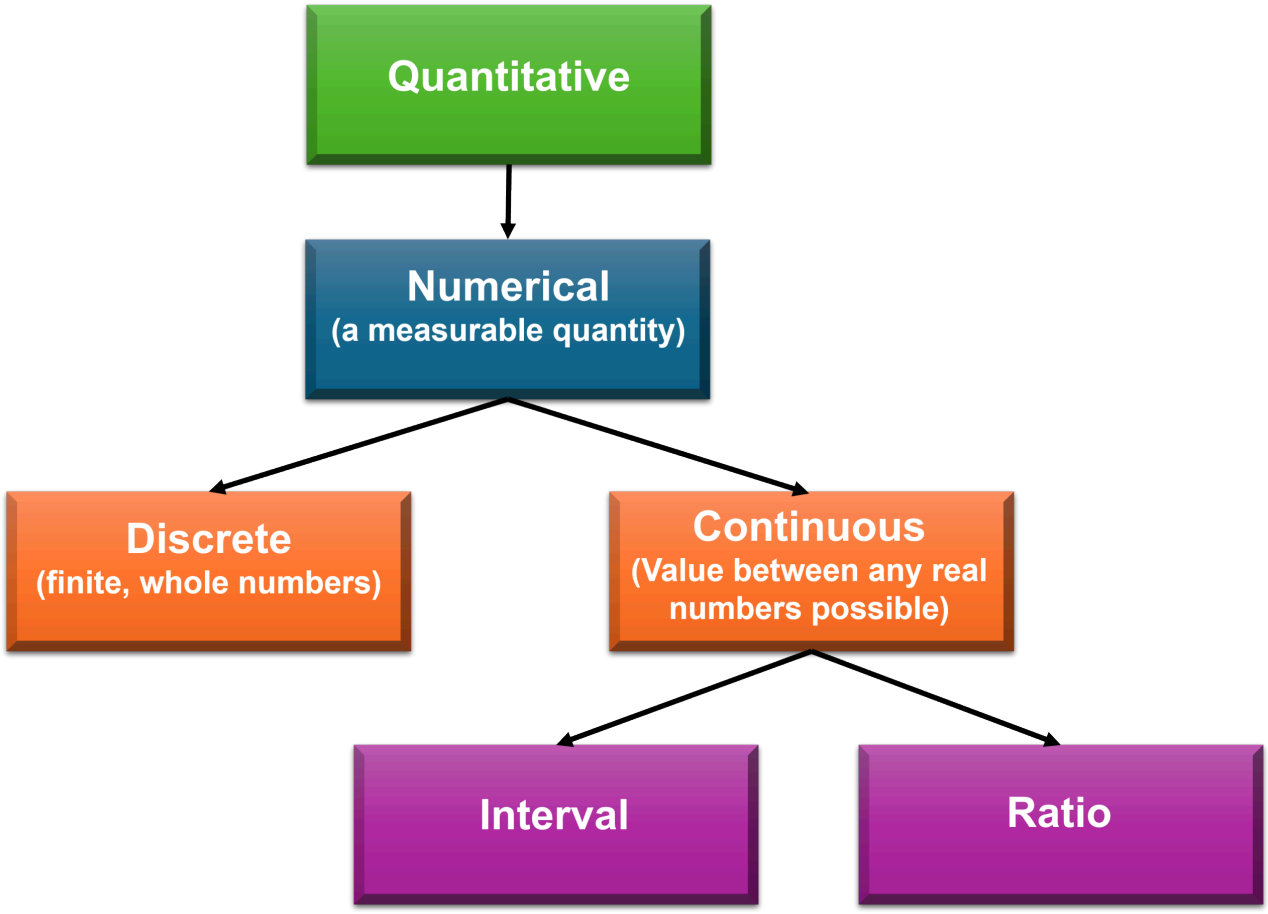

Figure 5.1. Determining your quantitative variable data type

Discrete Data (can be counted)

- Discrete data (Figure 5.1) contains only whole numbers, they can only take specific numeric values as they are finite. As the number of possibilities is finite, it is countable.
- For example, the number of pets a person owns, you cannot have 1.25 pets; you would have 1 or 2 pets.

Continuous Data (can be measured)

- Values are not countable; there are an infinite number of possibilities.
- **Interval data**
  - Has a relative distance between numbers on a scale but does not have an absolute zero.
  - Zero is an arbitrary point, for example, the temperature scale. Celsius has zero as the temperature at which water freezes at normal atmospheric pressure. With Fahrenheit zero is the temperature at which a mixture of ice, water, and ammonium chloride freezes.
  - As zero is arbitrary, any attempt at using ratios of the scale values do not offer any meaning.
- **Ratio data**
  - Ratio scales have a true zero.
  - For example, the Kelvin temperature scale starts at absolute zero, there is no motion and no heat.
  - Therefore, 0 on a scale measuring Kelvin temperature is the absence of the variable being measured. This also means that the differences in points on the scale are meaningful; 300 Kelvin is twice as hot as 150 Kelvin.

Analysing the Data

Quantitative data analysis is analysing numbers-based data or data that can easily be converted to numbers without losing any meaning. There are several software programs that enable quantitative data analysis, such as SPSS (including AMOS), R, SAS, Stata, and Excel. Excel requires the Data Analysis ToolPak to be installed. For instructions on how to do this, click here.

Selecting Quantitative Data Analysis Tools

Descriptive Statistics

Descriptive statistics are used to explore, summarise, and describe data collected. Descriptive statistics are useful in making some general observations about the data, for example, age range, mean age, and gender numbers. For video instructions on how to use descriptive statistics in Excel click here.

Histogram

To check if the data are normally distributed, a histogram is used. When the variable is continuous, such as age or salary, the category width (range) is determined manually. This is generally simple for age by going up in 10-year steps. The minimum and maximum age, with the number of respondents, provides an indication of starting and finishing ranges. For video instructions on creating histograms in Excel click here.

Histogram Types

There are three main types of histograms:

- Normally distributed data display as a bell-shaped curve in a histogram. This means the data passes the normality test for parametric data analysis (Figure 5.2).

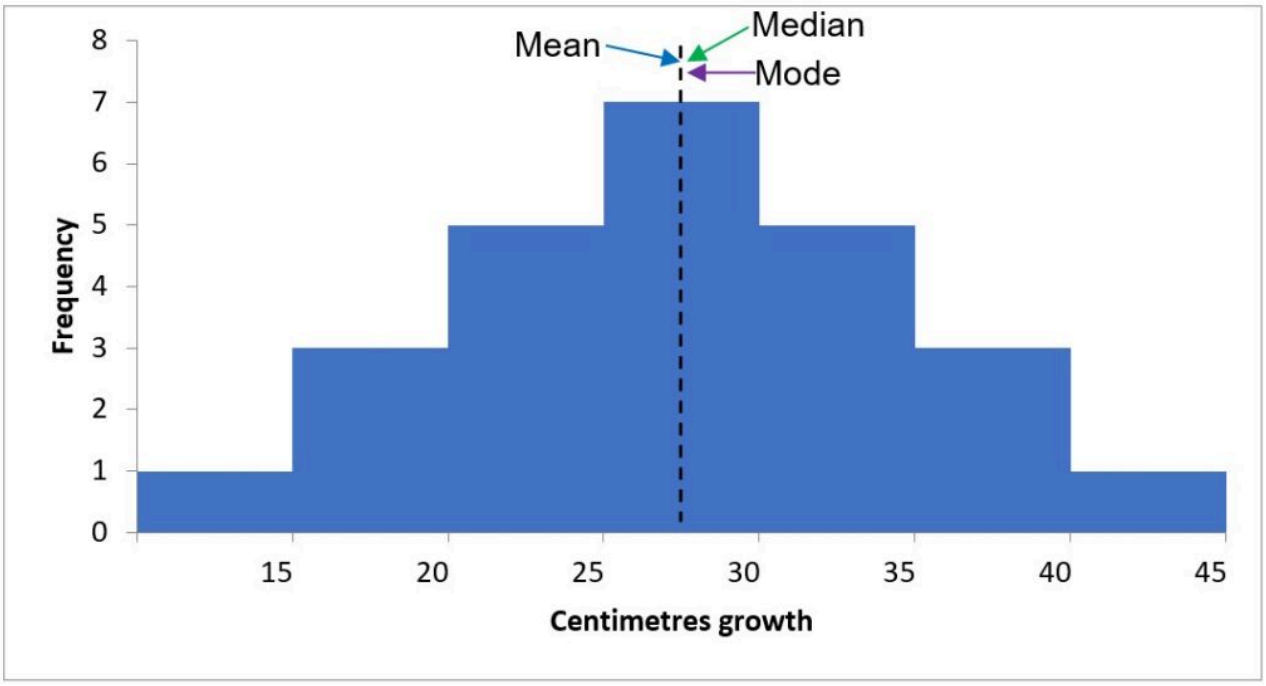

Figure 5.2. Histogram showing normal distribution of data

- Positively skewed data have a 'long tail' to the right in a histogram. This means that the data do not pass the test of normality and are not suitable for parametric analysis (Figure 5.3)

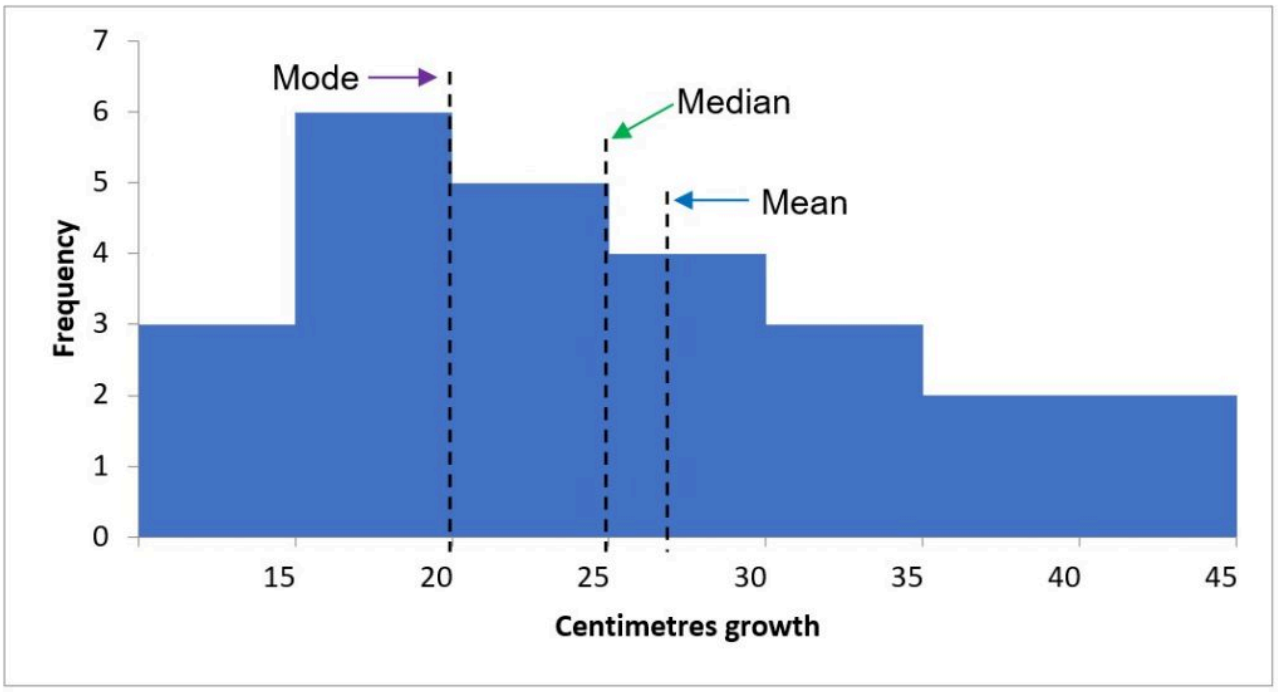

Figure 5.3. Histogram with data that has a positive skew

- Negatively skewed data have a 'long tail' to the left in a histogram. This means that the data do not pass the test of normality and are not suitable for parametric analysis (Figure 5.4).

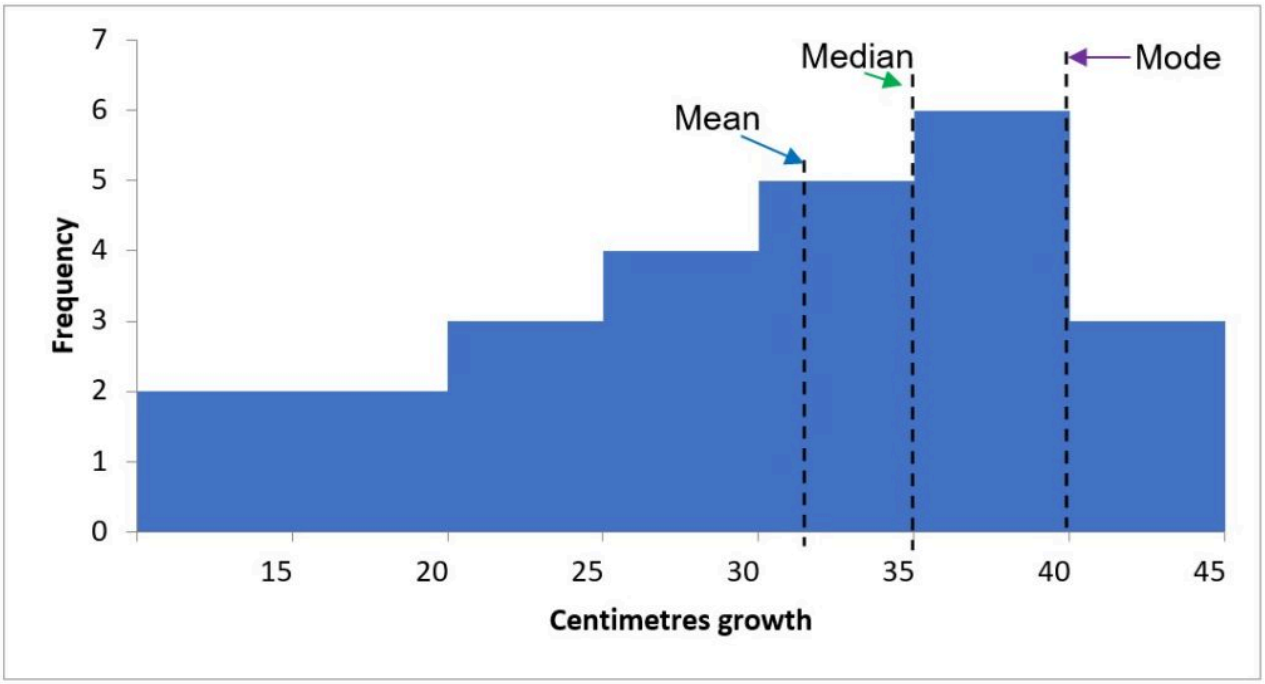

Figure 5.4. Histogram with data that has a negative skew

- Another way of checking for normality is to look at your descriptive statistics output table (Table 5.1). Look for the kurtosis and the skewness figures. If Kurtosis is between -.73 and +.73 the data is acceptable, if the skewness is between -.36 and +.36 the data is acceptable. Always use it in combination with the histogram to check the normality of data.

Table 5.1 Descriptive statistics output

Mean	27.40
Standard error	1.81
Median	25.00
Mode	20.00
Standard deviation	9.03
Sample variance	81.50
Kurtosis	-0.66
Skewness	0.50
Range	30.00
Miniumum	15.00
Maximum	45.00
Sum	685.00
Count	25.00

Pivot Table

A Pivot Table is used to compare multiple categorical variables. For video instructions on creating a pivot table in Excel, click here.

For video instructions on creating a pivot table chart in Excel, click here.

Scatter Plot

A Scatter Plot can be used to look at the relationship between two variables. For video instructions on creating a scatterplot in Excel, click here.

Chi-Square for Nominal or Ordinal Data

A Chi-Square test is conducted to determine if the distribution of the number of items in each category is the same as the expected values. If values are below 5 (<5), or the total of the values is below 50, Chi-Square is not generally used. For video instructions on how to use Chi-Square in Excel, click here.

Parametric and Non-Parametric Tests

When deciding on what type of data analysis to conduct, you need to know whether to use a Parametric or Non-Parametric test. Each parametric test has several assumptions that must be met, the main one being that data are normally distributed. If data are not normally distributed, the equivalent non-parametric test should be used (Table 5.2).

Table 5.2. Common parametric and non-parametric tests, use, and examples

Source: Manning & Munro, 2007

Parametric Test	Non-Parametric Test	Test	Example
Independent groups t-test	Mann-Whitney U test	Used to determine if 2 groups are significantly different from each other on the variable of interest (continuous).	Is income determined by where you live (city or rural)?
Paired t-test	Wilcoxon signed-rank test	The same participants perform under each level of the independent variable (pre-test and post-test).	Examine student test results before (pretest) and after (post-test) a unit of study.
One-way between-groups analysis of variance ANOVA	Kruskal-Wallis test	Examines possible differences between 2 or more groups.	Is there a difference in crop yield if a farmer uses fertiliser A, B, or C?
Pearson's r (Pearson's correlation coefficient)	Spearman's rank-order correlation (Spearman's rho)	Estimate the degree of association between 2 variables.	Does the number of hours a person spends on social media affect the number of hours they sleep at night?

Parametric Tests

Parametric tests compare the distributions in the data for groups rather than using individual values for each sample. Remember that a parametric test can only be used if the data is normally distributed.

- T-test: A t-test is used to compare the means of two groups. For video instructions on undertaking a t-test two samples assuming unequal variance, click here.
- Click here for a Paired t-test video

- Single Factor ANOVA: used to compare two or more groups.
- Two-Way ANOVA: looking at one variable and comparing it to two others, for example, looking at Salaries by Department and Year. For video instructions on ANOVA in Excel, click here.
- For video instructions on how to calculate Pearson's Correlation Coefficient (Pearson's r) in Excel, click here.

Non-Parametric Tests

- A Mann-Whitney U Test is used to compare ordinal data or as a non-parametric test for interval data that is not normally distributed. A non-parametric test compares the individual ranked sample values for each group. This is different to a non-parametric test (for normally distributed data) where we disregard the individual values and compare the mean and standard deviations (i.e., comparing bell curves for degree of overlap). The Mann-Whitney U test creates a ranked list of values which it uses to compare the mediums of the 2 groups. For video instructions on calculating Mann-Whitney U in Excel there are three videos, click on the following links: Part 1, Part 2, Part 3.

- For video instructions on using Wilcoxon Signed-Rank Test in Excel, click here.

- For video instructions on Repeated Measures or Within-Subjects ANOVA in Excel click here.

5.4 Qualitative Data Analysis

Defining Types of Qualitative Data

Qualitative data are variables whose values fit in categories; they are not numerical. Qualitative data are either nominal or ordinal (Figure 5.5).

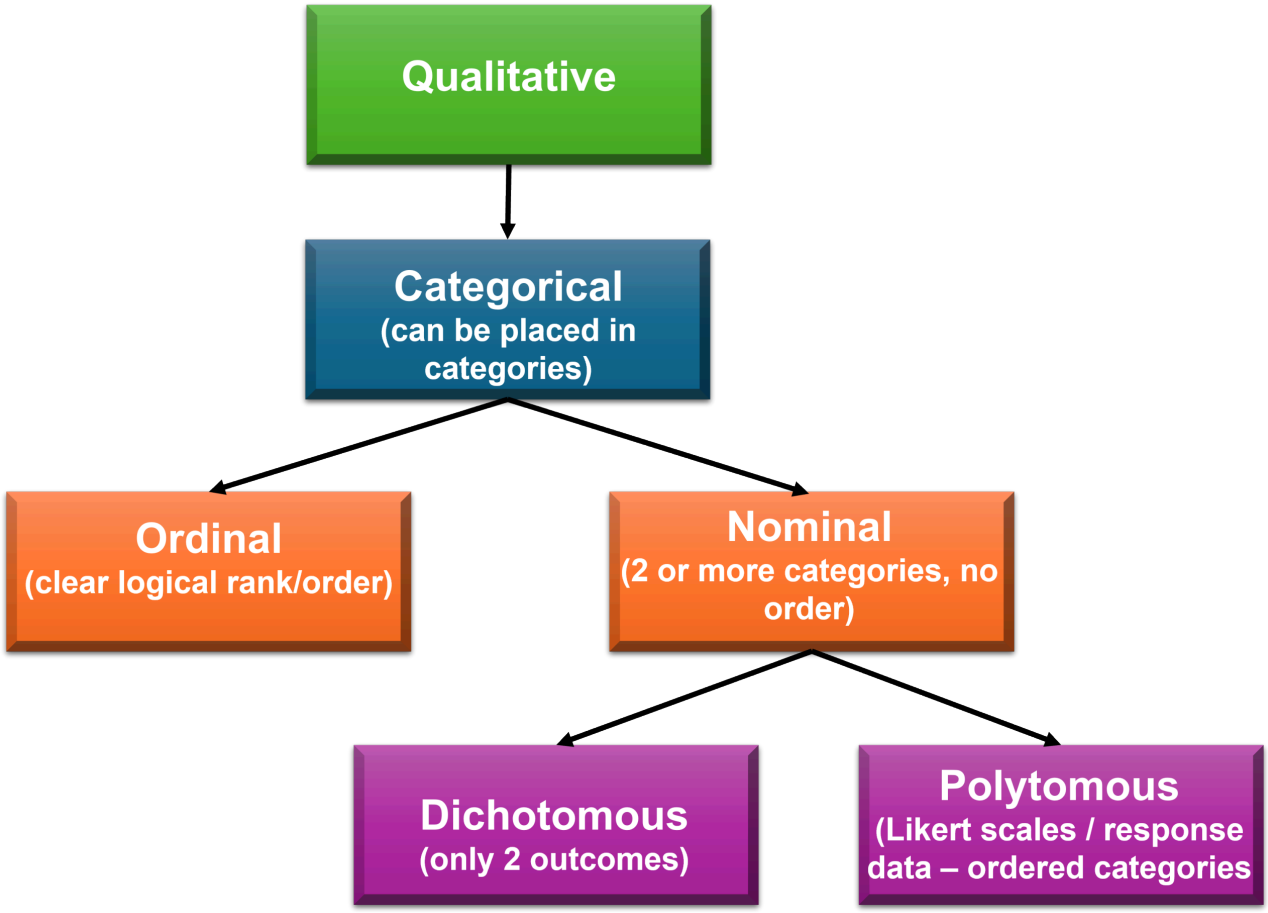

Figure 5.5. Determining your qualitative variable data type by category.

Ordinal Data

Ordinal data categories can be placed in a clear logical rank or order. For example, a person's health can be categorised as poor, reasonable, good, or excellent, which provides a clear logical order. Although there is no even distribution between categories. Likert scales (Figure 5.6) are an example of ordinal data. However, be cautious with your analysis of data obtained from Likert-type scale questions, as they are often treated as quantitative interval data. The type of analysis all depends on your research question(s).

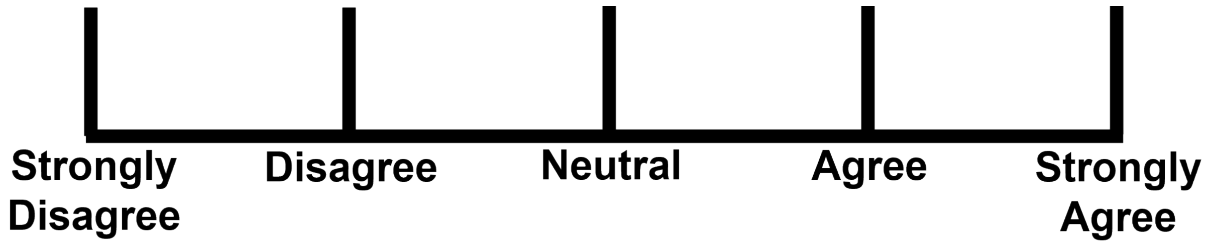

Figure 5.6. Example of a 5-point Likert-type scale

Nominal Data

- Nominal data categories have no ordering. For example, eye colour. Eyes can be blue, green, brown,

hazel, multi-coloured; you cannot place them in an order.

- Nominal data with only 2 categories are dichotomous (also known as binary). For example: Do you own a dog? No/Yes.
- Dichotomous data can be assigned numbers in their data analysis software, for example, 0 = No, and 1 = Yes. This does not make the data quantitative; it is still qualitative and assists in preventing coding errors.
- Polytomous data (obtained from Likert-type scales [Figure 5.6]) have more than two values, for example, 0, 1, 2, 3...

Analysing Qualitative Data

Qualitative research presents many choices for research design, including ethnography, grounded theory, and phenomenology. When it comes to the analysis of qualitative data, most approaches are based on an iterative process of coding and recoding until some meaningful interpretation of the data can be arrived at. This approach means that there is a continual going back and forth of data and theory or theory and data, depending on whether the process is inductive (data to theory) or deductive (theory to data). In all approaches, the researchers immerse themselves in the data and build a story from the data.

With qualitative data analysis, the researcher is seeking to determine how the data fits together (Silverman, 2021). Coding helps to collate and label the data and by constantly comparing the data and the emerging codes, it is possible to identify where there are differences and to recognise patterns of similarity. Another tool that is used in qualitative data analysis is memos. Memos are important for keeping track of the researcher's thinking about the data, why particular codes/variables/themes/categories are developed, and potential comparative investigations. Hence, the memos are really records for the researchers to remember what they have done and what they intend to do. They log the 'journey of discovery' as the story from the data is unravelled.

As the researcher works on collating the data, memos are written about the data, codes are developed to label the data, segments of the text are coded, and variables/themes/categories are created so that comparisons can be made, especially where differences in the patterns emerge (Ritchie et al., 2013). Codes assist in indexing the data and so comparable to the index in a book, which helps the researcher to find a particular topic.

Associate Professor Karen Andes (2021) refers to the four Rs of qualitative data analysis: Retrieve, Review, Reflect and Reduce. Codes (or themes/categories/variables) are used to **retrieve** data. Researchers then read & re-read data (i.e., **review**) that is retrieved, generally in conjunction with the memos that have been written so as to find patterns. The researcher then **reflects** upon the potential meaning of the codes (or themes/categories/variables) to see what comparisons and interpretations can be made. As part of the reflection process, the researcher may ask whether the patterns in the data are similar to or different from current understanding and knowledge or are the patterns indicate 'new' concepts or theories. This process of retrieving, reviewing and reflecting is iterative and in time, will **reduce** the data into concise and meaningful elements that can be described by the patterns that were observed.

In the last decade, there has been an increasing use of software to assist researchers in qualitative data analysis (e.g., NVivo, MAXQDA, QDAS, Leximancer). Regardless of these software tools, qualitative data analysis still relies on the researcher to immerse themselves in the data, develop the codes and know the story that is emerging from the data. The researcher still needs to interact with the data, be guided by the research questions and refine the definitions of the codes so that the codes are well-defined, meaningful, and manageable. A well-defined code is specific and clear about what segments of the data should be included in that code and what should not be included in that code.

Whether the research design adopts a deductive or inductive approach, and regardless of whether the

software is used, the researcher needs to develop the code definitions inductively so that the data is represented with integrity. The importance of undertaking qualitative analysis in this way is that there may be unanticipated elements that emerge from the data. Hence, regardless of how the initial research design is derived (i.e., inductively or deductively), qualitative data analysis requires the researcher to lead the process.

There are many variants of qualitative data analysis, e.g., narrative analysis, discourse analysis, thematic analysis, interpretive analysis, sequential analysis, grounded theory, and meta-ethnography (Lester et al., 2020). Scholars such as Lester et al. (2020) argue that "thematic analysis is a useful starting point for learning how to conduct qualitative analysis, as it provides a foundation for learning other approaches" (p. 103). Essentially, thematic analysis forms the basis of a range of other approaches to qualitative data analysis. Often, it is the disciplinary emphasis that will determine the nuanced application of thematic analysis. For example, ethnographies are the research approach of choice for many anthropologists and their use of thematic analysis may be less structured than, say, a management scholar who uses ethnographies to study organisations. In both cases the rigour, reliability and validity of the work are commensurate, but in the former, the analysis may lead to a more narrative style of presentation of the work, whereas with the latter, the analysis and presentation of the results will be more consistent with conventional content analysis.

Content Analysis

Content analysis is a very good example of how qualitative data may be analysed. Content analysis is generally reserved for examining large volumes of textual material to identify patterns/trends in the words being used. It also seeks to determine the frequency of the words, their connections and the structures and discourses of the way in which the words are brought together (Bengtsson, 2016). Essentially, content analysis allows the researcher to transform the qualitative data into quantitative information because it enables the quantifying of words, messages or concepts and quantifies the relationships between concepts. Leximancer is a software program that utilises content analysis in its management of qualitative data. Hsieh and Shannon (2005) make a distinction between three different forms of content analysis. The first form is **Conventional Content Analysis**. For conventional content analysis, the researcher starts out by reading texts and then coding texts. A theoretical framework or a theory is not required. As the researcher develops codes, the researcher looks for how the codes can be grouped into themes. This process of coding is inductive and generally utilises a coding frame or scheme that has been developed by the researcher. For this process, the researcher generally develops sets of mechanisms so that the data is coded in the same way by all researchers involved in the project, with the same definitions. The mechanisms include descriptions/definitions of the codes, coding/interpretation rules, and instructions for coders. This approach allows for two (or more) researchers to undertake the coding and so add reliability to the analysis. Software programs such as NVivo present intercoder reliability measures such as Krippendorff's alpha, which provide a measure of the consistency in coding between two (or more) researchers.

A second form of content analysis that is recognised by Hsieh and Shannon (2005) is **Directed Content Analysis.** In directed content analysis, the researcher brings in a coding scheme or a coding system that is drawn from theory established by other researchers, or it can be the researcher's own theory, e.g., derived previously from a conventional content analysis. A third form of content analysis noted by Hsieh and Shannon (2005) is **Summative Content Analysis**. This type of content analysis is more quantitative in nature. Regardless of the type of content analysis, the goal of this technique is to break the text down into manageable codes for analysis. The analysis follows the following protocol: de-contextualisation, re-contextualisation, categorisation and compilation (Bengtsson, 2016). In the **de-contextualisation** stage, the researcher must immerse themselves in the data, i.e., read through the transcribed text to familiarise themselves with the data and to understand the data before breaking it into smaller meaningful units that are assigned as codes. For **re-contextualisation**, the researcher checks that all aspects of the content have been addressed in relation to the aim of the study. The original text is reread with the final list of codes, and

any missed relevant text is included. In the **categorisation** stage, the codes are condensed, and themes are identified. These themes are then condensed even further into categories. In the final stage of **compilation**, once the themes and categories have been established, the interpretation of the results and the writing-up process begins.

Thematic Analysis

As the name suggests, thematic analysis is a technique for determining the themes that are emerging from the data. It is the most common form of qualitative analysis and is a process of finding, examining, classifying and reporting those themes (Braun & Clarke, 2006). Like the other approaches to qualitative analysis, it begins by identifying codes (or units of analysis) that emerge from the data.

The protocol for thematic analysis involves six phases: familiarising yourself with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report (Braun & Clarke, 2006). The process is iterative and reflective; it requires the researcher to move back and forth between the phases as the themes evolve and are consolidated.

Thematic analysis offers an analytical approach that is rigorous and allows for a detailed representation and description of the data. The researcher examines the data and codes for themes. The data can be interview transcripts, photos, drawings, videos, field notes, TripAdvisor comments, and memos. With content analysis, the research tries to organise the data and generally does so by using codes.

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=257#oembed-1

USEFUL VIDEO: Thematic analysis – an introduction by Professor Virginia Braun and Dr Victoria Clarke [1:02:20].

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=257#oembed-2

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Key Takeaways

- Data that cannot be measured numerically in quantities are categorical data.
- Categorical data can be descriptive and dichotomous or descriptive and nominal or ranked and ordinal.
- Data that can be measured numerically as quantities are numerical data.
- Numerical data can be interval or ratio or continuous or discrete.
- Excel can be used to analyse data in various ways.
- Quantitative data is numerical.
- Qualitative data is non-numerical.
- Research can combine quantitative and qualitative approaches, this is called mixed methods.
- Thematic analysis is a technique that is used for analysing qualitative data. It involves the researcher immersing themself in the data by reading through the data and looking for patterns in the meaning of the data, with a view to creating codes and from the codes to find the themes that emerge from the data. It is an active and iterative process that involves reflexivity and the researcher's ability to make sense of the data.

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Reliability and Validity

Learning Objectives

In this chapter you will learn:

- what reliability in relation to research is and why it is used
- what validity in relation to research is and why it is used.

5.5 Reliability and Validity Checks for Quantitative Research

Assessing the goodness of data is determining that how we are conducting our research is actually measuring the variables supposed to be measured and measuring them accurately. To achieve this, we look at reliability, this is accuracy in measurement. Our measurement instrument consistently measures what it is supposed to be measuring. We also look at validity to determine we are measuring the right thing, and how well our instrument measures what it is supposed to be measuring. Research can be reliable but not valid, but when valid, it is reliable, hence, both are extremely important in research (Sekaran & Bougie, 2013).

Reliability

Reliability is the extent to which:

- the measure is error-free (without bias)
- measurements are consistent across time and items within the instrument
- you can replicate the research design and achieve the same results. (Sallis et al., 2021; Sekaran & Bougie, 2013)

There are several tests of reliability:

- Test-retest
  - The measure remains stable over time.
  - Regardless of changes in uncontrolled testing conditions, and any changes in the state of the respondents, the measure has low vulnerability to change over time.
  - Determining using correlation of responses obtained from the same respondents using the same measures across time, for example, application one, and then at least 2 weeks later, application two.
- Alternative form
  - Different forms measuring the same construct are equivalent.
  - Determined using correlation of responses obtained from the same respondents using the same measures across time, for example, application one, and then at least 2 weeks later, application two.
- Split-halves

- items of measures in the instrument are divided into 2 sets
- considers the correlation of the 2 halves of the instrument as measuring the same construct.

- Internal consistency
  - the homogeneity of items used in the measure
  - items should 'hang together' as a set and be capable of independently measuring the same construct
  - a variety of algorithms can be used to estimate how reliable a measure is at one point-in-time. (Forza & Sandrin, 2024; Sekaran & Bougie, 2013)

Validity

Validity relates to the appropriateness of measures used, the accuracy of the analysis of results, and the generalisability of the findings. That is, measures must accurately measure what the researcher(s) intend them to measure for them to be valid (Newcomer et al., 2015).
There are several types of validity:

- Content validity
  - Each measure's items should come within the concept's theory, or in qualitative studies, the theoretical domain.
  - Each measure's items should not be too similar; they need to capture different elements of the concept in a balanced way. (Forza & Sandrin, 2024)
- Face validity
  - measures used should be easy to understand; it should be clear what is being measured, and on the 'face of it', they are measuring the concept. (McLaughlin & Jordan, 2015)
- Construct validity
  - measured through convergent validity and discriminant validity
  - convergent validity is when 2 different instruments measuring the same concept produce highly correlated results
  - Discriminant validity can be established when, on a theoretical basis, where 2 items (variables) are predicted to be distinct, that is, they are not correlated. Here, scores produced when measuring the two items (variables) show they are not correlated. (Forza & Sandrin, 2024)
- Criterion-related validity
  - To establish criterion-related validity, the measure must differentiate participants on a criterion it is expected to predict. To achieve this concurrent or predictive validity must be achieved.
  - Concurrent validity is when the scale discriminates between participants who are known to be different.
  - Predictive validity is the ability of the measuring instrument to differentiate among participants with reference to future criterion. (Forza & Sandrin, 2024; Sekaran & Bougie, 2013)

5.6 Reliability and Validity Checks for Qualitative Research

Testing the reliability and validity of data in qualitative research is not as simple and straightforward as with quantitative research, and there is also debate over the use of the terms reliability and validity in relation to qualitative research. Whereas in quantitative research we seek reliability, in qualitative research this is seen as consistency. This is how much methods used by qualitative researchers can be trusted and followed, decisions made can be clearly followed and an independent researcher's findings would differ very little

(Noble & Smith, 2025). Validity in qualitative research is all about the truth and its value. This relates closely to how the researcher situates themselves in reality, that is, their paradigm. The researchers are upfront in relation to any pre-conceived views or biases they may have in relation to the research conducted (Noble & Smith, 2025).

Key Takeaways

- Quantitative reliability is accuracy in measurement, while validity is checking to see if the right things are being measured by the research.
- Quantitative reliability includes the stability of measures, test-retest reliability, parallel-form reliability, internal consistency, interitem consistency, and split-half reliability.
- Quantitative validity includes content validity, face validity, construct validity, and criterion-related validity.
- Qualitative reliability and validity are not straightforward, but careful planning and consideration of internal biases are the basis of successful reporting of results.

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Communicating Results

Learning Objectives

In this chapter you will learn:

- how to communicate results for quantitative studies
- how to communicate results for qualitative studies.

5.6 Quantitative Studies: Communicating Results

In the results section of a report (or article), the findings of the study are reported with connection(s) to the study's research question(s). Here, the author(s) present findings in the form of tables and/or figures presented in a logical sequence. The written sections accompanying each table/figure need to link back to the research question(s), but only state the facts of what the table/figure presents. The results section should inform the reader what the author(s) found (do not interpret, be careful of introducing bias), and the discussion section is where the author(s) explain/discuss what the findings mean.

The opening paragraph(s) of the results section should start with an introduction. The results need to be connected to the research question(s). This reorients the reader back to the study's purpose. Next, present your results in a logical manner. This is where you present your tables and/or figures with a written description that highlights the most important/interesting piece of information in the table/figure. To end the results section, provide a paragraph that highlights and summarises the key information you have presented, with a concluding sentence linking the results section to the discussion section of the report (article).

Tables and figures must be numbered in the order they appear in the report, along with an appropriate name that represents what is shown in the table/figure. Do not mix the table and figure numbering; they are numbered separately, for example, Table 1, Table 2, Table 3, Figure 1, Figure 2, Figure 3. When writing about what a table/figure shows, only refer to them as, for example, Table 1 or Figure 1, do not include the name of the table/figure.

Remember:

- Pay attention to your sentence construction, paragraph construction, punctuation, spelling (Australian English), and grammar.
- Be careful not to introduce bias into your writing. You can only state what you have found; you cannot make assumptions.
- Ensure you provide (written) linkages back to the research question(s).
- Ensure you label and name your tables/figures correctly.
- Save the interpretation for the discussion section.

Selecting the Graph (Figure) or Table

There are a variety of figures and tables that can be used to present the results of a study. The following section provides examples for presenting results from nominal, ordinal, continuous, and discrete data.

Frequency Table

- Used for one variable
- Suitable for nominal, ordinal, continuous or discrete data.

See tables 5.3 and 5.4 for different ways to display information in a frequency table.

Table 5.3. Number of pets owned (n=40)

Pet	Frequency	Percentage
Dog	21	52.5%
Cat	15	37.5%
Fish	3	7.5%
Bird	1	2.5%
None	0	0.0%

Table 5.4. Pets by percentage

Pet	Percentage
Dog	52.5%
Cat	37.5%
fish	7.5%
Bird	2.5%
None	0.0%

Trend Line

- used for one variable
- suitable for nominal, ordinal, continuous, or discrete data.

You want to know the trend in average summer rainfall over 10 years for Cairns in Far North Queensland. The best way to display this is a trend line (Figure 5.7).

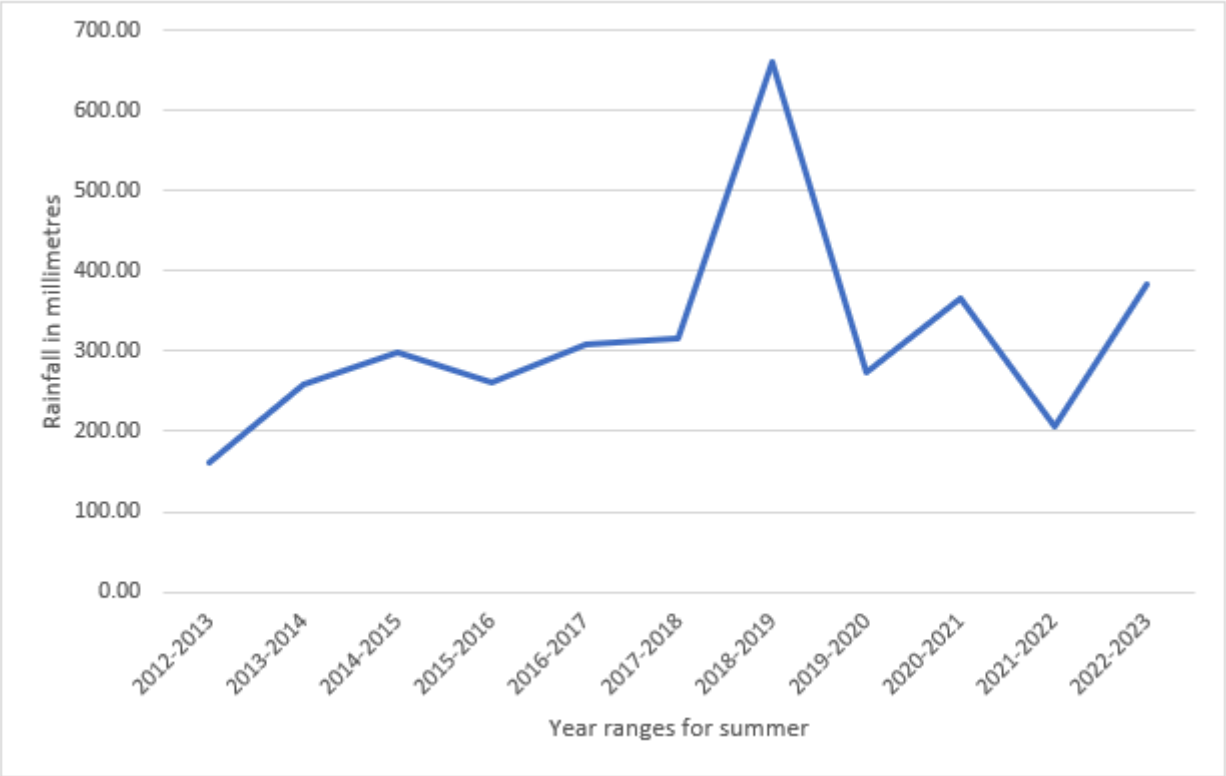

Figure 5.7. Trend for average summer rainfall for 10 years in Cairns

Multiple Line Figure

- suitable for two or more variables
- suitable for ordinal, continuous, or discrete data.
- does not indicate a trend, it compares multiple data sets over time or across categories.

This time, we look at total rainfall for Cairns during January, February, March, and April in the years 2021, 2022, and 2023 (Figure 5.8).

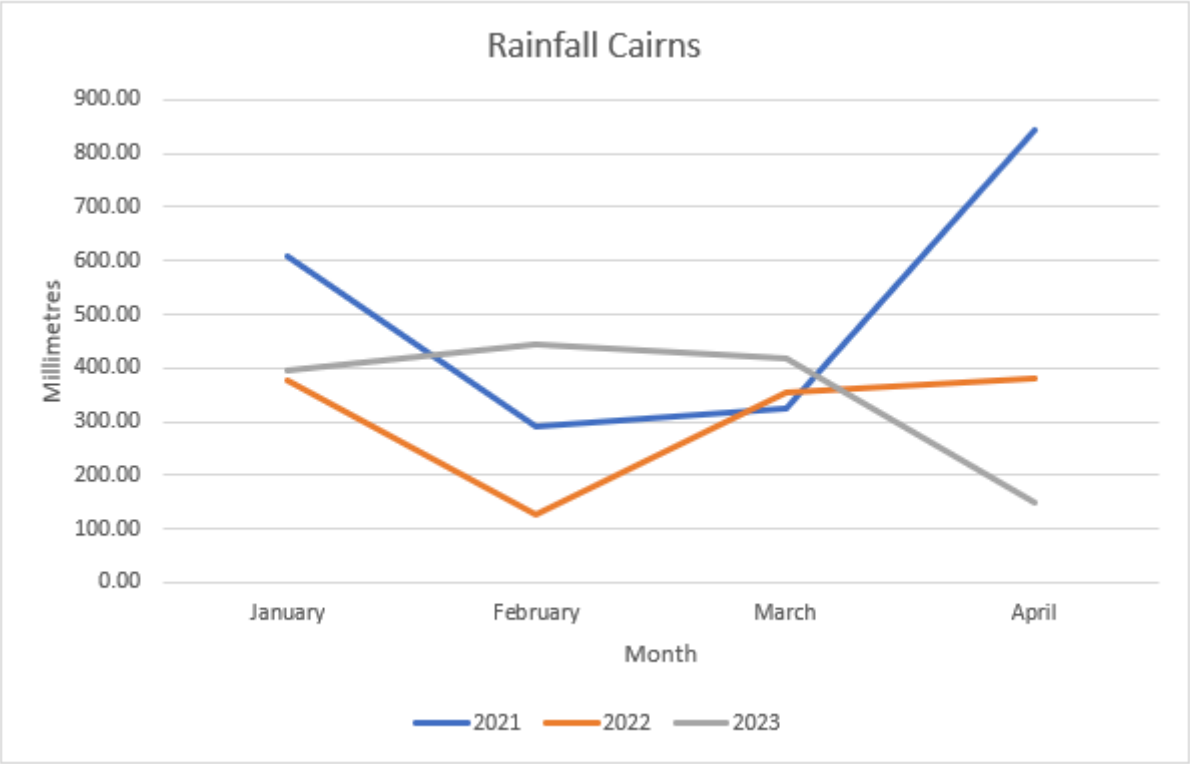

Figure 5.8. Rainfall for Cairns for years 2021, 2022, and 2023

Bar Figure

- use for one variable
- suitable for nominal, ordinal, or discrete data (Figure 5.9).

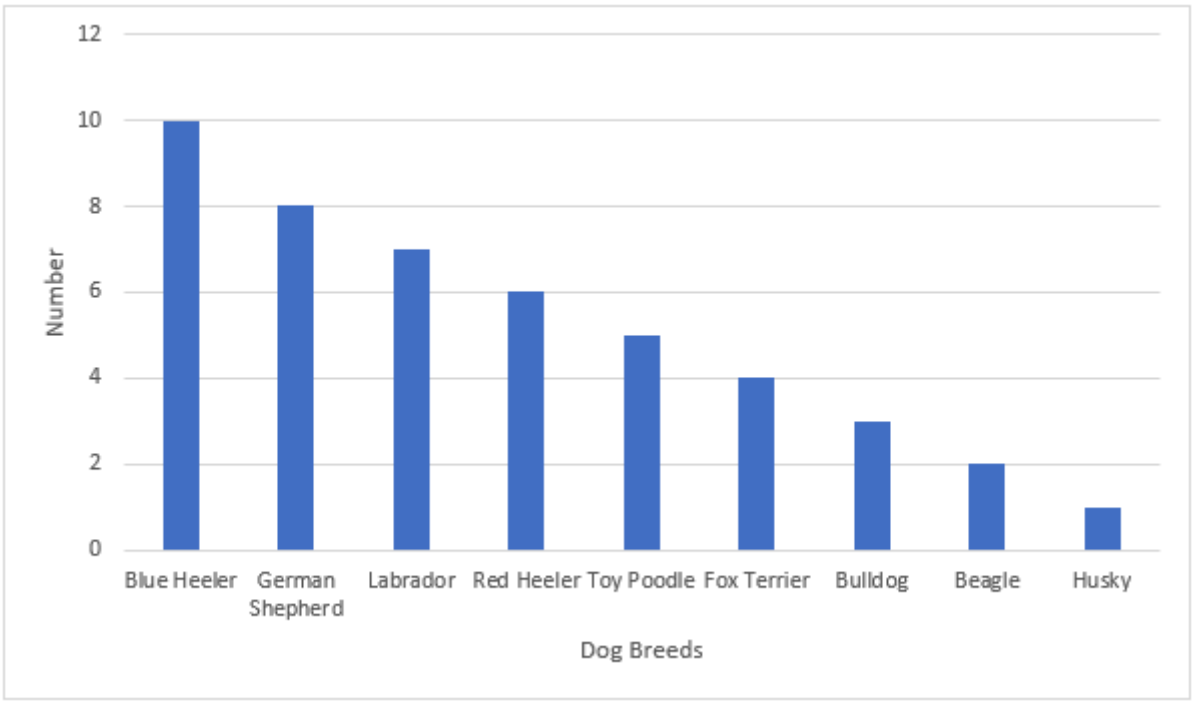

Figure 5.9. The number of different dog breeds in 1km of the house (n=46)

Multi-Bar Figure

- Use for two or more variables.
- Suitable for nominal, ordinal, continuous, or discrete data.

Rainfall data are displayed for January, February, March, and April in Cairns from 2013 to 2023 (Figure 5.10).

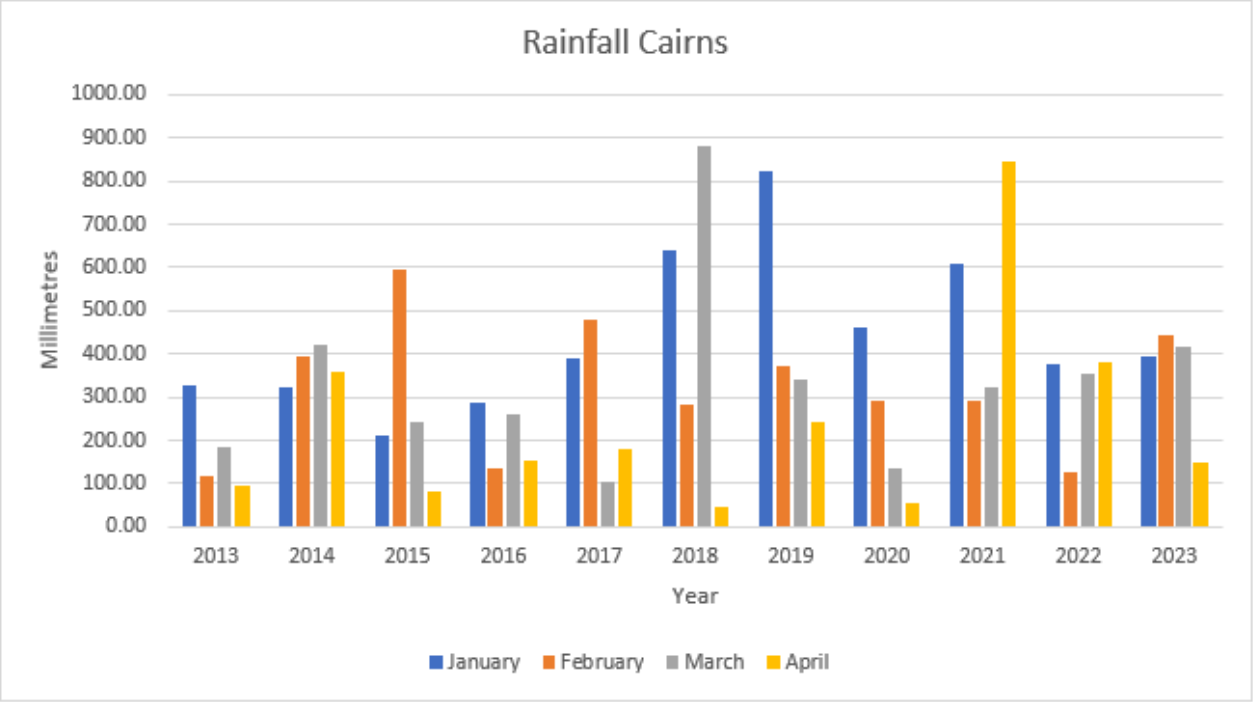

Figure 5.10. Rainfall for January, February, March, and April in Cairns from 2013 to 2023

Stacked Bar Figure

- use for two or more variables
- suitable for nominal, ordinal, continuous, or discrete data.

We are using the same data as used for Figure 5.10, however, this time the data are displayed as a stacked bar figure (Figure 5.11).

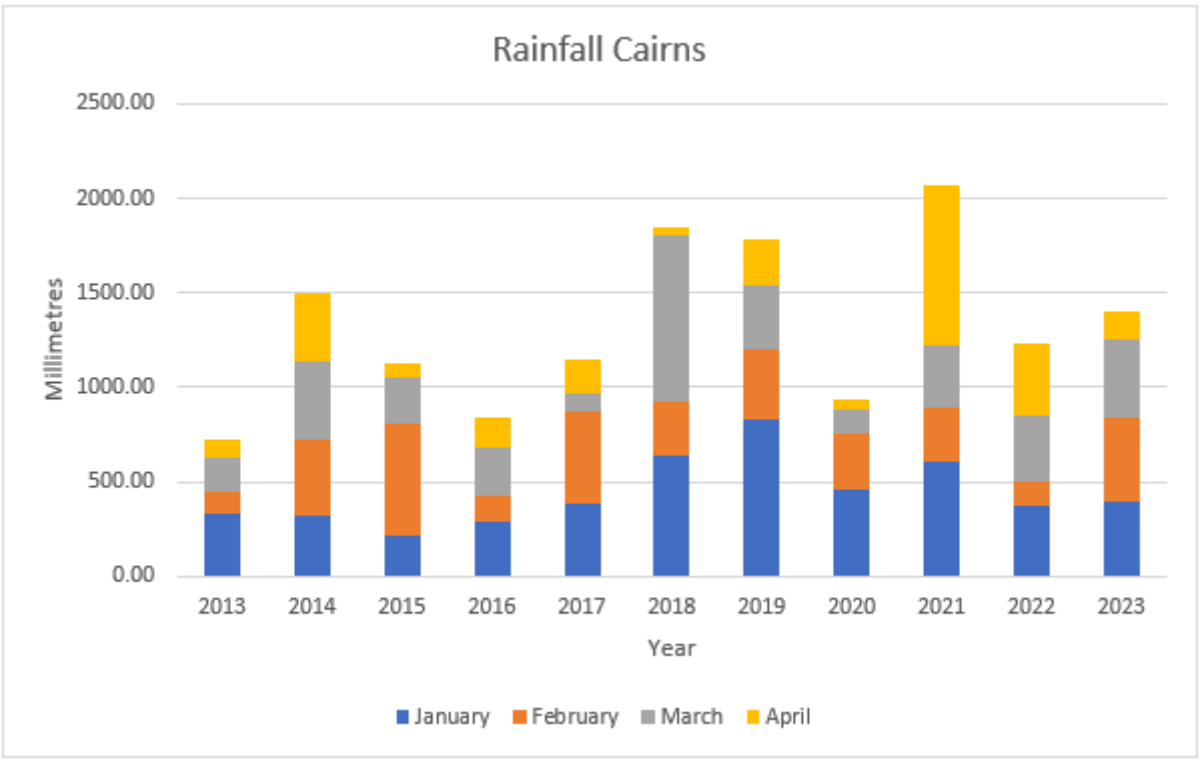

Figure 5.11. Rainfall for January, February, March, and April 2013 to 2023

Pie Figure (= Pie Chart)

- use for one variable
- suitable for nominal, ordinal, continuous, or discrete data.

You are interested in knowing who your cohort of students believes would win a battle between superheroes. The superheroes are Batman, Ironman, Wolverine, Superman, and the Flash. Results are in Figure 5.12. Remember, when you use a pie figure, the total percentages must add to 100%.

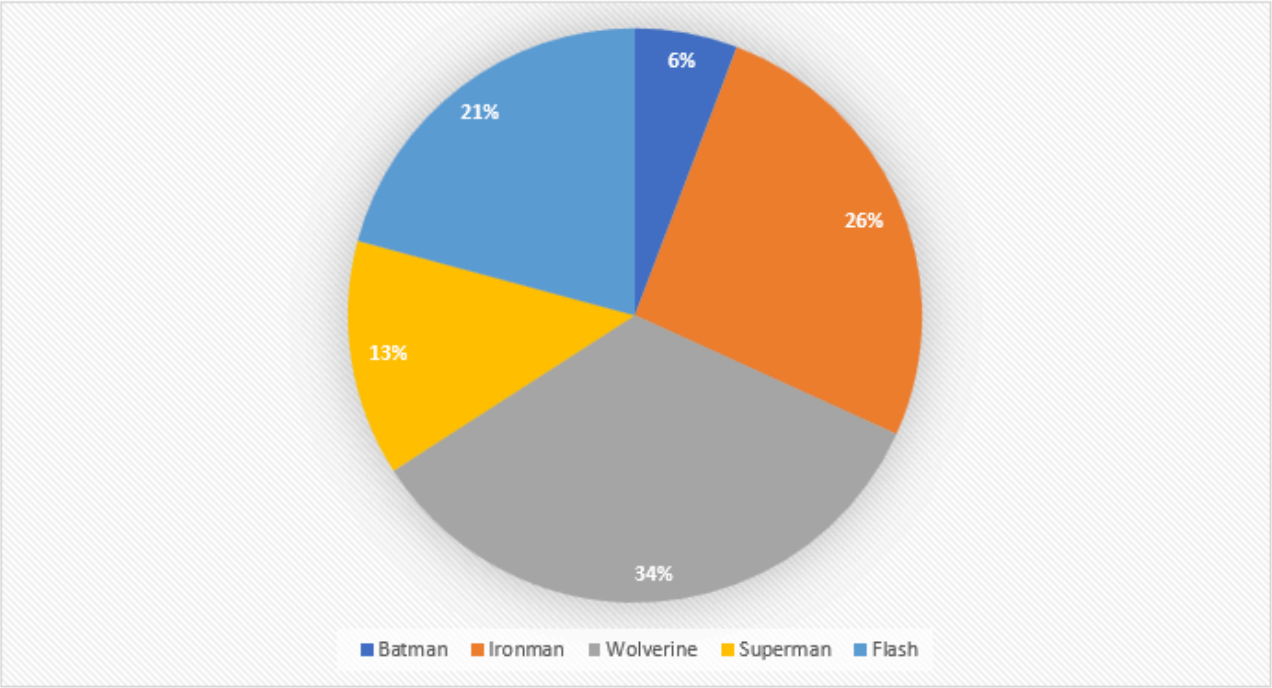

Figure 5.12. Student belief of superhero battle outcome (n=173)

Comparative Pie Figures

- Use for two or more variables.
- Suitable for nominal, ordinal, continuous, or discrete data.

Comparative pie figures (AKA, pie charts) are used to compare the same things at different points in time. Figure 5.13 shows the difference in renewable energy production for 2011-2012 and 2021-2022.

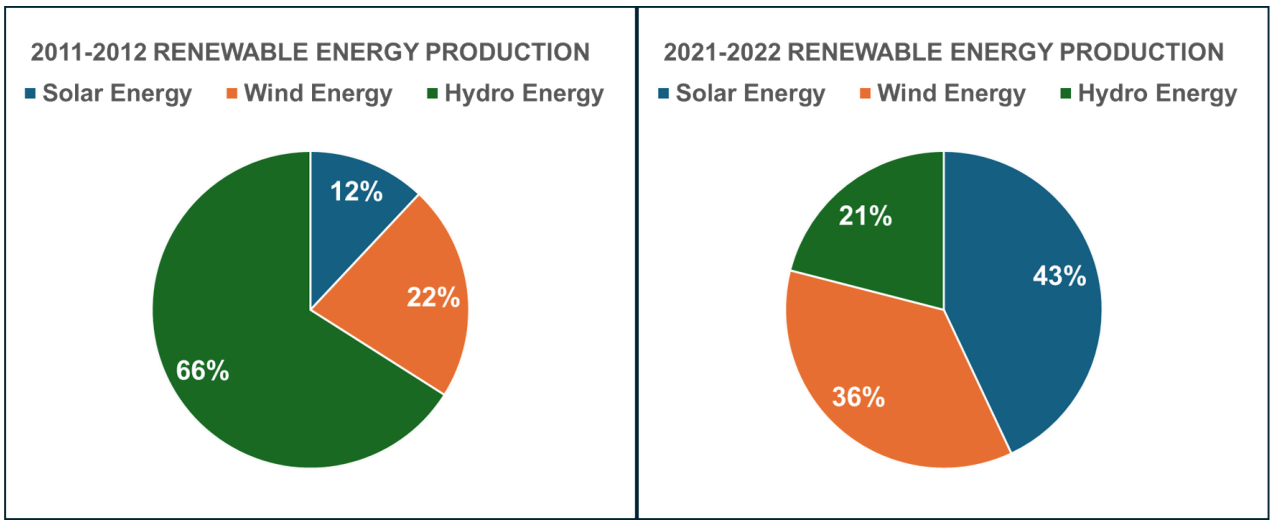

Figure 5.13. Comparison of renewable energy production in 2011-2012 to 2021-2022.

Cross-Tablulation

- use for two or more variables

- suitable for nominal, ordinal, continuous, or discrete data.

What you see below is the output of a cross-tabulation; this is not how you would display the results, for that, you could write the information. For example, the majority of respondents live in Bendigo (38.56%), with 42.37% saying Essendon is their favourite AFL team. Over half (52.27%) of respondents whose favourite team is Collingwood live in Collingwood, and 44% of respondents whose favourite team is the Brisbane Lions live in Fitzroy (Table 5.5).

Table 5.5. Cross-tabulation output

Cross tabulation frequency percent		What is your favourite AFL team?			
		Collingwood	Brisbane Lions	Essendon	Row totals
In what city/ town do you live?	Collingwood	23	14	7	44
	Row percent	52.27%	31.82%	15.91%	28.76%
	Fitzroy	13	22	15	50
	Row percent	26.00%	44.00%	30.00%	32.68%
	Bendigo	15	19	25	59
	Row percent	24.42%	32.20%	42.37%	38.56%
	Column totals	51	55	47	153
	Column percent	33.33%	35.95%	30.72%	100.00%

Contingency Table

- use for two or more variables
- suitable for nominal, ordinal, continuous, or discrete data.

The following (Table 5.6) is an example of the output for a contingency table. To report results, you would write them up. For example: You want to know if there is a relationship between milkshake preference and gender. You run the data, and the contingency results answer the question. Due to the way the question is written you must look at the row results. You find males prefer chocolate (31.25%), females also prefer chocolate (36.14%), and those who do not identify as male, or female prefer the blue heaven milkshake (34.67%).

Table 5.6. Contingency table output

Gender	Chocolate	Caramel	Blue Heaven	Vanilla	Total
Male	25	22	18	15	**80**
Row percentage	31.25%	27.50%	22.50%	18.75%	**100%**
Column percentage	34.72%	35.48%	26.47%	41.67%	**100%**
Female	30	19	24	10	**83**
Row percentage	36.14%	22.89%	28.92%	12.05%	**100%**
Column percentage	41.67%	30.65%	35.29%	27.78%	
Other	17	21	26	11	**75**
Row percentage	22.67%	28.00%	34.67%	14.67%	**100%**
Column percentages	23.61%	33.87%	38.24%	30.56%	
Total	**72**	**62**	**68**	**36**	**238**
	100%	**100%**	**100%**	**100%**	

Scatter Figure (AKA scatter graph)

- used for two variables
- suitable for ordinal, continuous, or discrete data.

Figure 5.14 shows the annual monthly rainfall and temperature for Cairns on a scatter plot (AKA scatter graph).

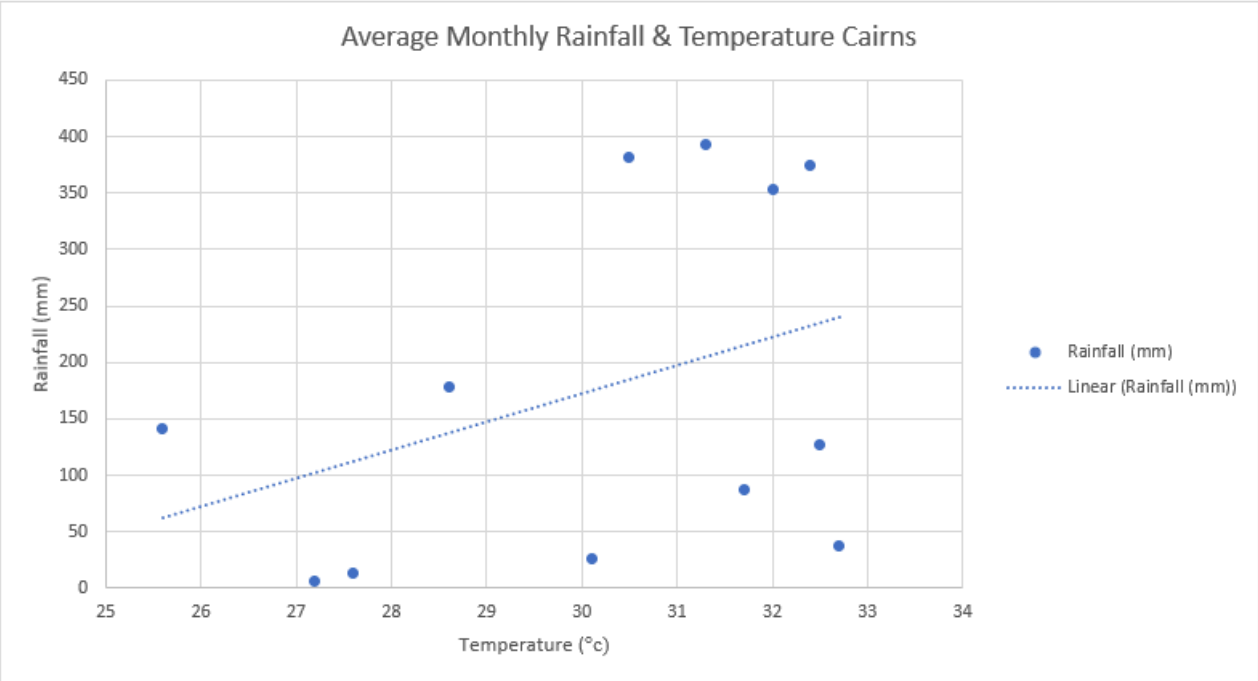

Figure 5.14. Average monthly rainfall and temperature for Cairns

Histogram

- use for one variable
- suitable for continuous or discrete data.

This time, we are looking at the growth rate of plants over one month to see if the data are normally distributed (Figure 5.15).

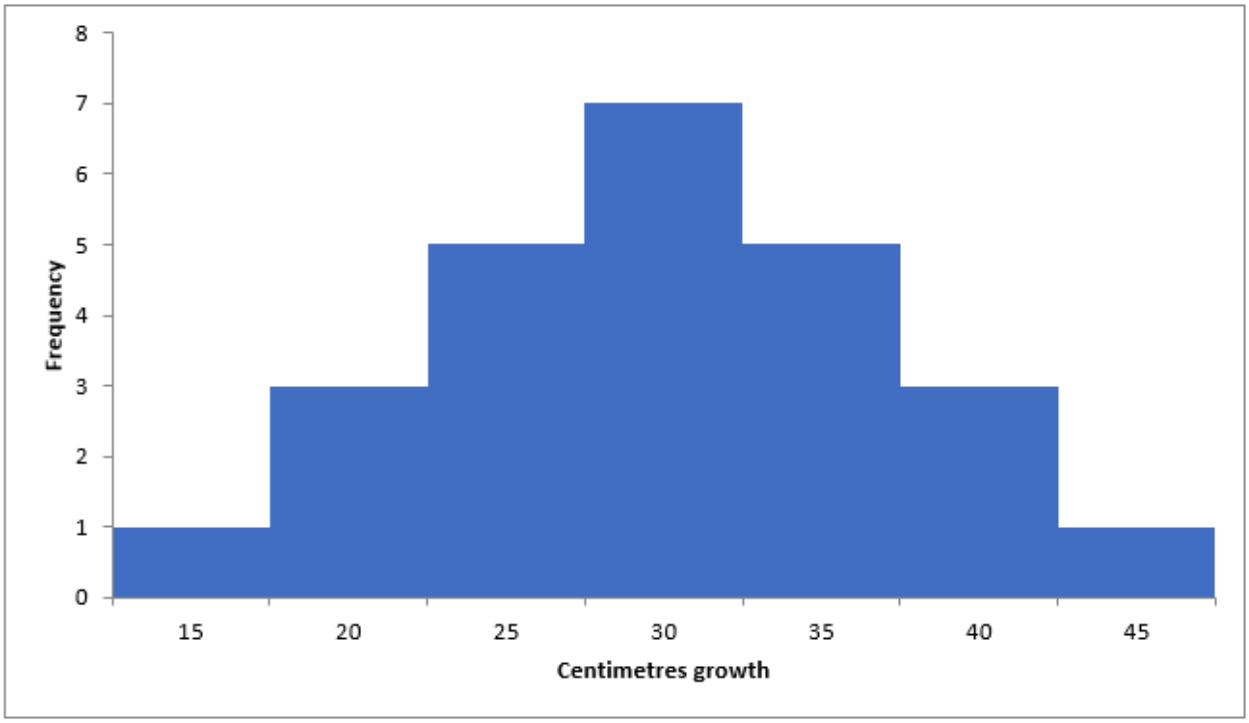

Figure 5.15. Growth rate of plants over one month (n=25)

Frequency Polygon (Figure)

- use for one variable
- suitable for continuous or discrete data.

The data are fictitious and relate to assessment scores (Figure 5.16).

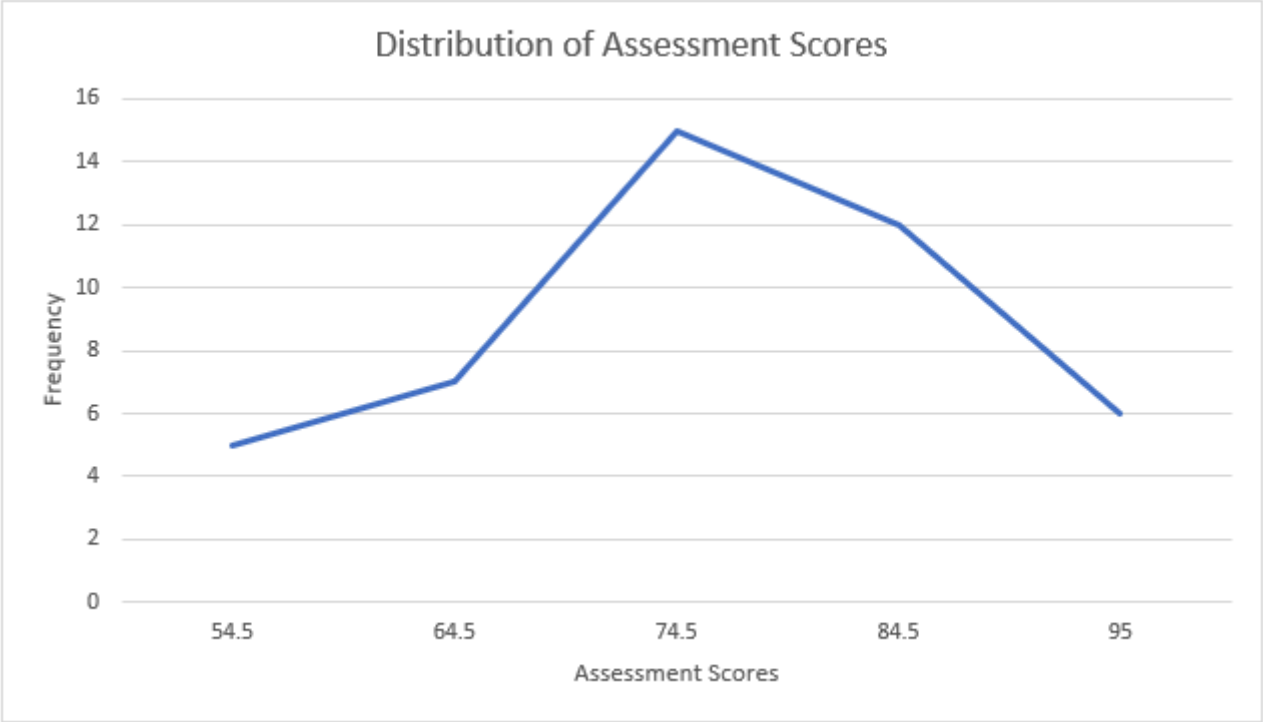

Figure 5.16. Distribution of assessment scores (n=45)

Multiple Box Plot (Figure)

- use for two or more variables
- suitable for continuous or discrete data.

The growth of three groups of plants over one month is shown in Figure 5.17.

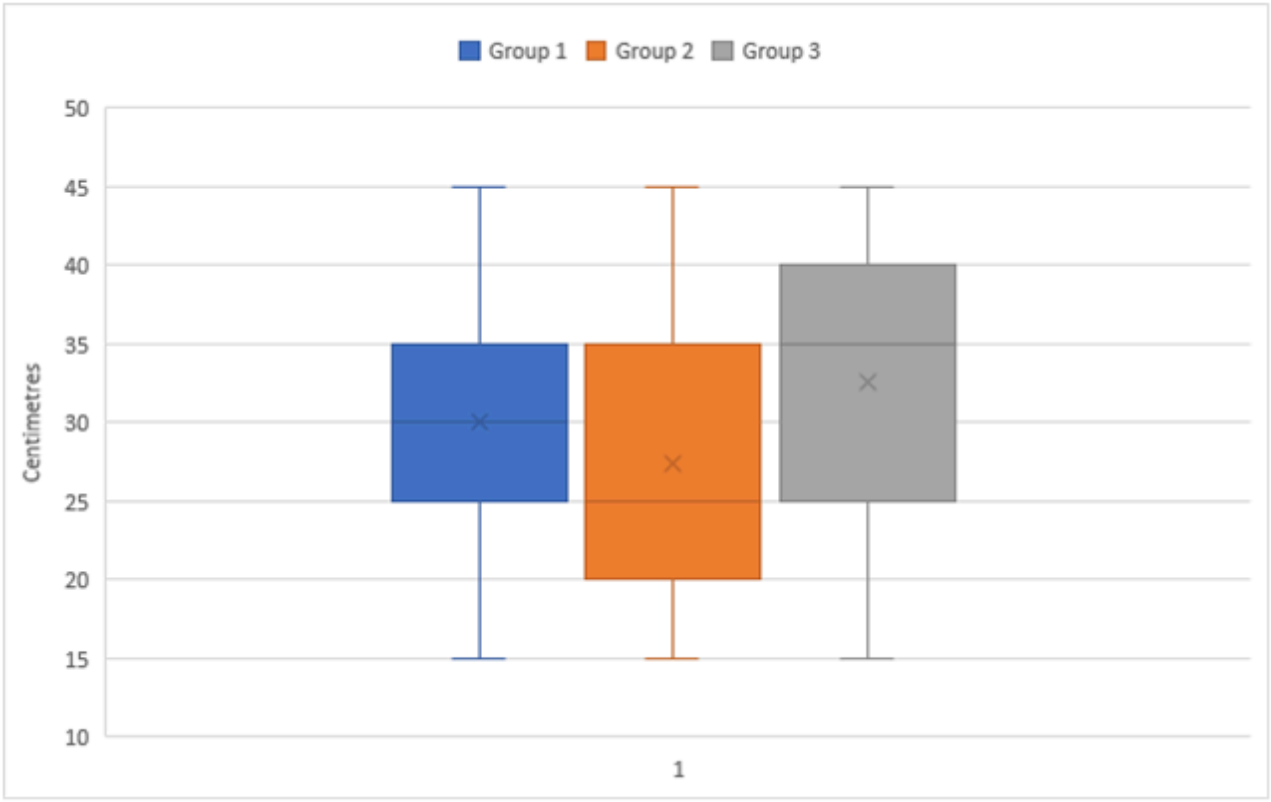

Figure 5.17. Growth in centimetres of three separate groups of plants over one month

Examples of Tables and Graphs

(Figures 5.18, 5.19, and 5.20 use the same data, but results are displayed differently.)

An example of how to write a brief explanation that goes with the Figure/Table in the results section is included. This would be further elaborated on in the discussion section.

The majority of respondents in this study are female (Figure 5.18).

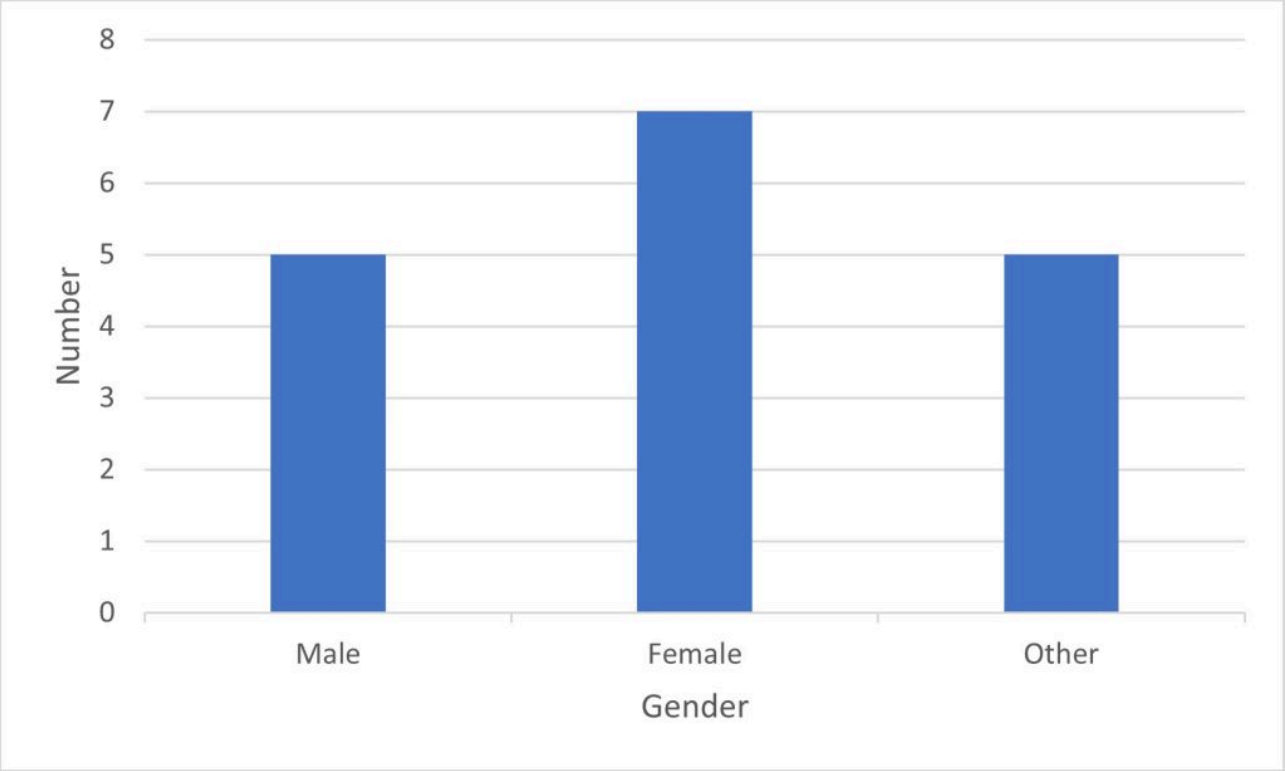

Figure 5.18. Gender distribution (n=17)

As seen in Figure 5.19, the majority of respondents in this study identify as female (41.18%).

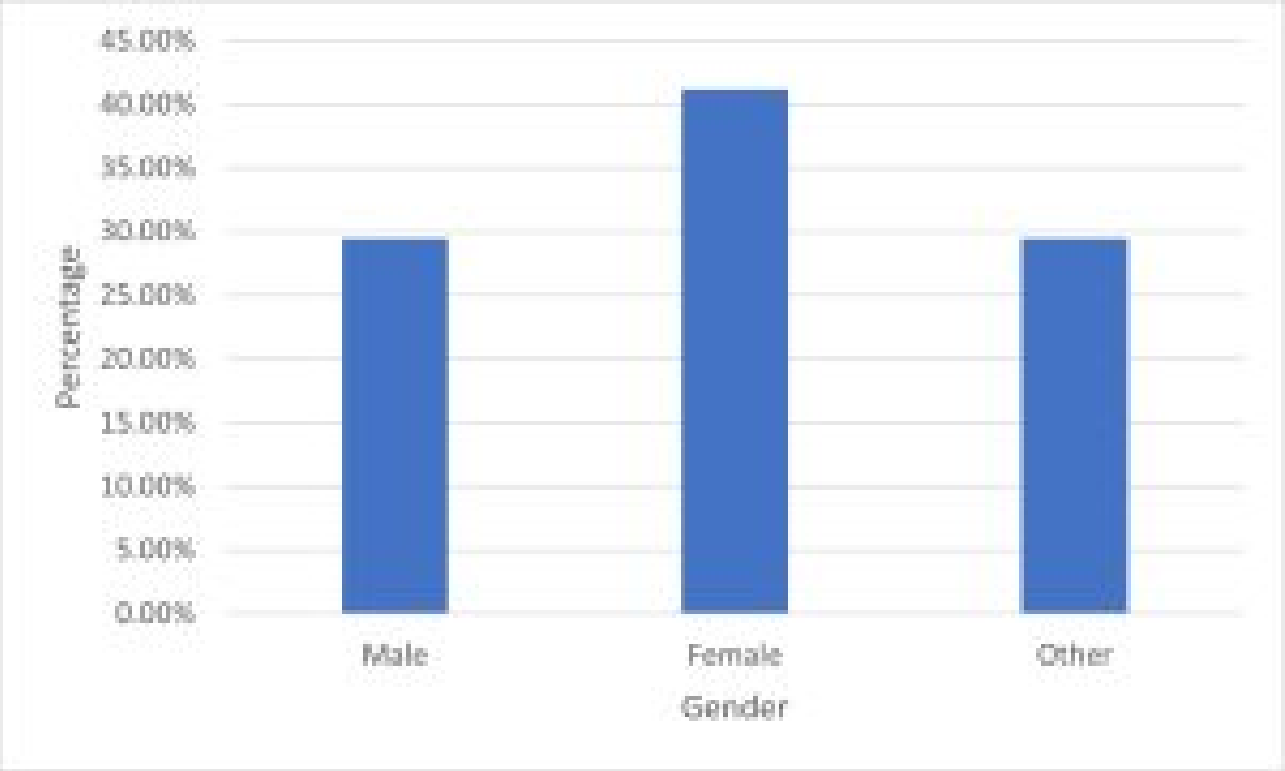

Figure 5.19. Gender distribution (n=17)

As seen in Figure 5.20, the majority of respondents in this study identify as female (41.18%).

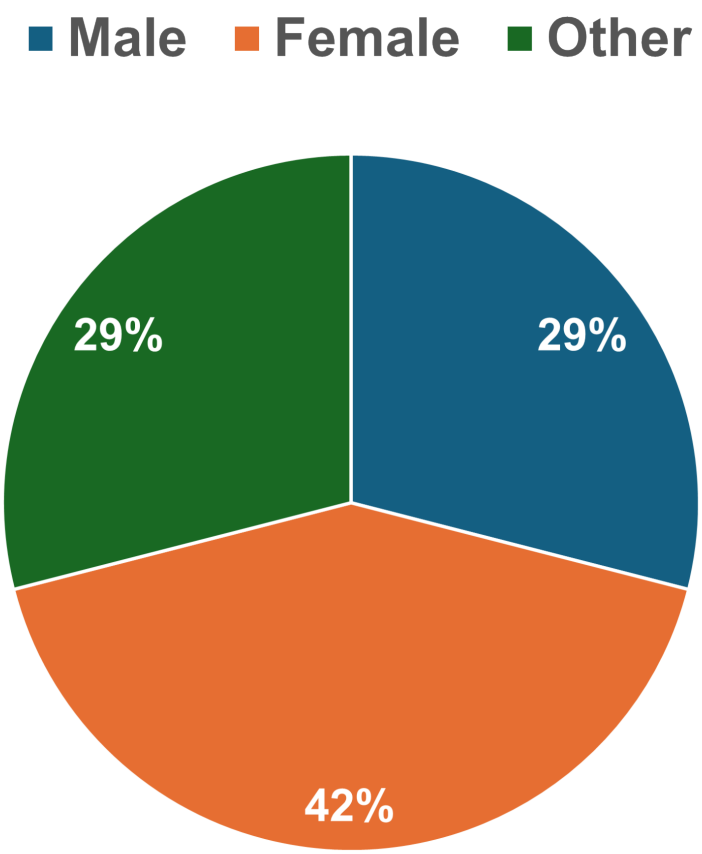

Figure 5.20. Gender distribution (n=17)

Gender results can also be reported as part of a table that relates to respondent demographics. The majority of male respondents (80%), in this study are in the 18 to 30 age group (Table 5.7). Female respondents were split evenly between the 18 to 30, 41 to 50, and 51 to 60 years age groups (28.57% each); with 40% of those who did not identify as male or female falling into the 18 to 30 age group, with another 40% falling within the 51 to 60 age group (Table 5.7).

Table 5.7. Demographics of respondents (n=17)

Variable		% Male (n=5)	%Female (n=7)	% Other (n=5)
Gender		29.41	41.18	29.41
Age group	18-30	80.00	28.57	40.00
	31-40	0.00	14.28	0.00
	41-50	20.00	28.57	20.00
	51-60	0.00	28.57	40.00

5.7 Qualitative Studies – Communicating Results

Communicating results for qualitative studies is the writing up and publishing of research based on qualitative data is as per that of quantitative or mixed methods data in that it requires that consideration be

given to the intent of the research and the audience for which it is intended, e.g., for an academic journal or for funders reports, book chapters, thesis or for the wider public or policy and decision makers.

These days, there is a big focus on presenting the research for outreach and impact, i.e., making sure that the research is read and has applications that are beyond academia. Also, there is an expectation that the results will be shared with the participants. Hence, there are some points to consider when sharing and communicating qualitative research. Tracy (2020, p. 304) identifies these points as follows:

- What is the story about?
- What is the rationale behind the research?
- Who is the intended audience?
- What are the themes/topics?
- How am I connecting to a scholarly conversation?
- What are the conclusions, implications, limitations, and future research?
- Is the writing flowing in a logical manner and is it persuasive?
- Use prose and visual representations of the data and/or results.

Successfully presenting the results from qualitative studies can depend on such factors as the researcher's discipline, the researcher's goals, or the journal/tome to be published in. How the presentation of the results looks should take advantage of the deep, rich data obtained from qualitative studies (Tracy, 2020). For example, ethnographers may present narrative portraits of the communities that they have been studying (Rodriǵuez-Dorans, 2023). Other researchers may prefer to utilise tables and diagrams in the presentation of their qualitative findings (Kriukow, 2020). The following webinar provides some 'Creative Ways to Visualise Qualitative Data' [1:02:15].

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=292#oembed-1

See also How to Present Qualitative Findings from qualitative researcher, Dr Kriukow [21:30].

One or more interactive elements has been excluded from this version of the text. You can view them online here: https://jcu.pressbooks.pub/business-research-approaches/?p=292#oembed-2

Key Takeaways

- Quantitative, qualitative and mixed methods approaches to research allow for the sharing and communicating of the research findings in an array of ways.
- Not surprisingly, quantitative researchers tend to use more numerical tools for presenting their data, e.g., tables and graphs.
- Qualitative researchers, on the other hand, can extend the use of quantitative tools to adopt techniques that utilise prose and narrative more extensively.

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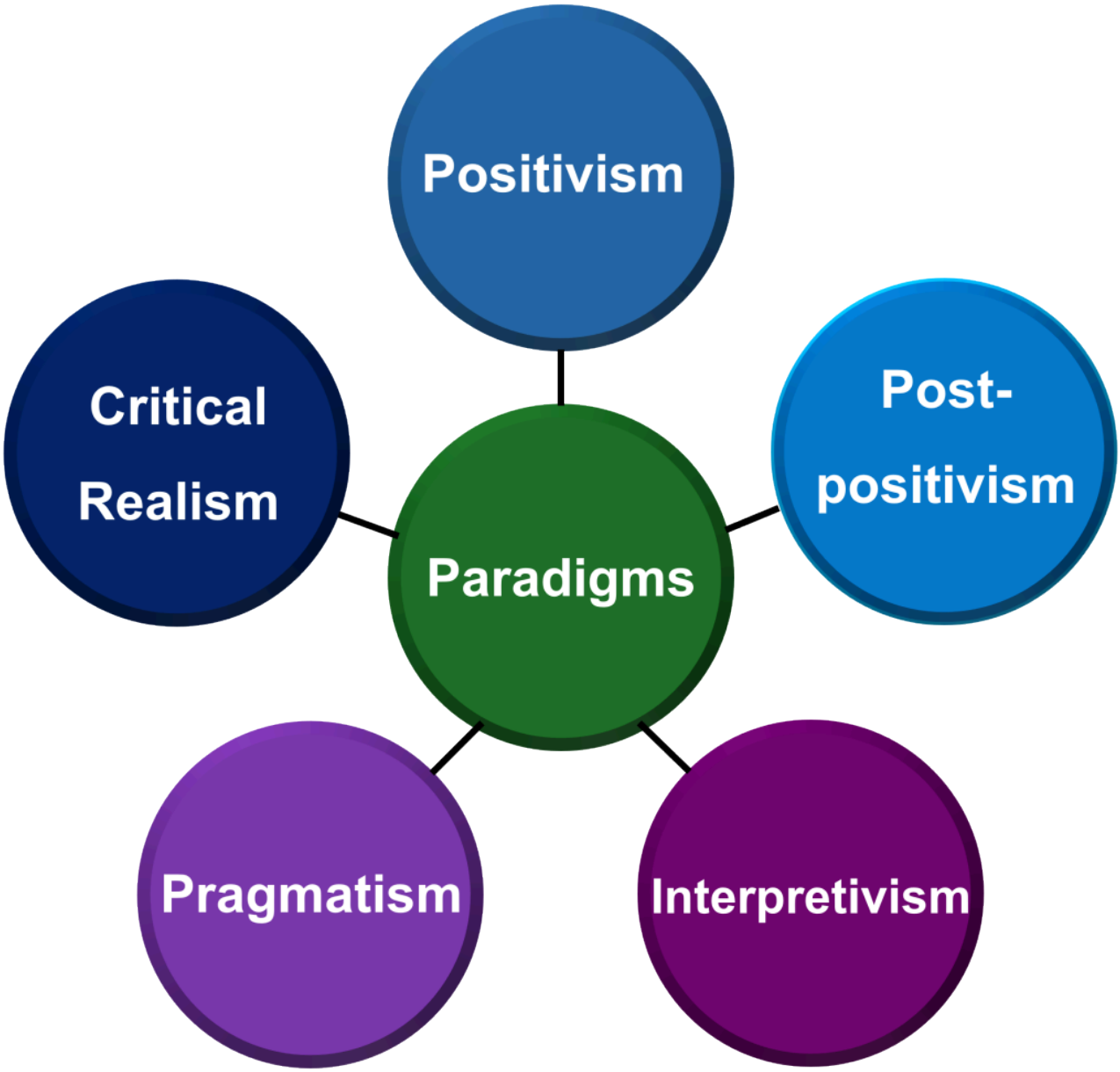
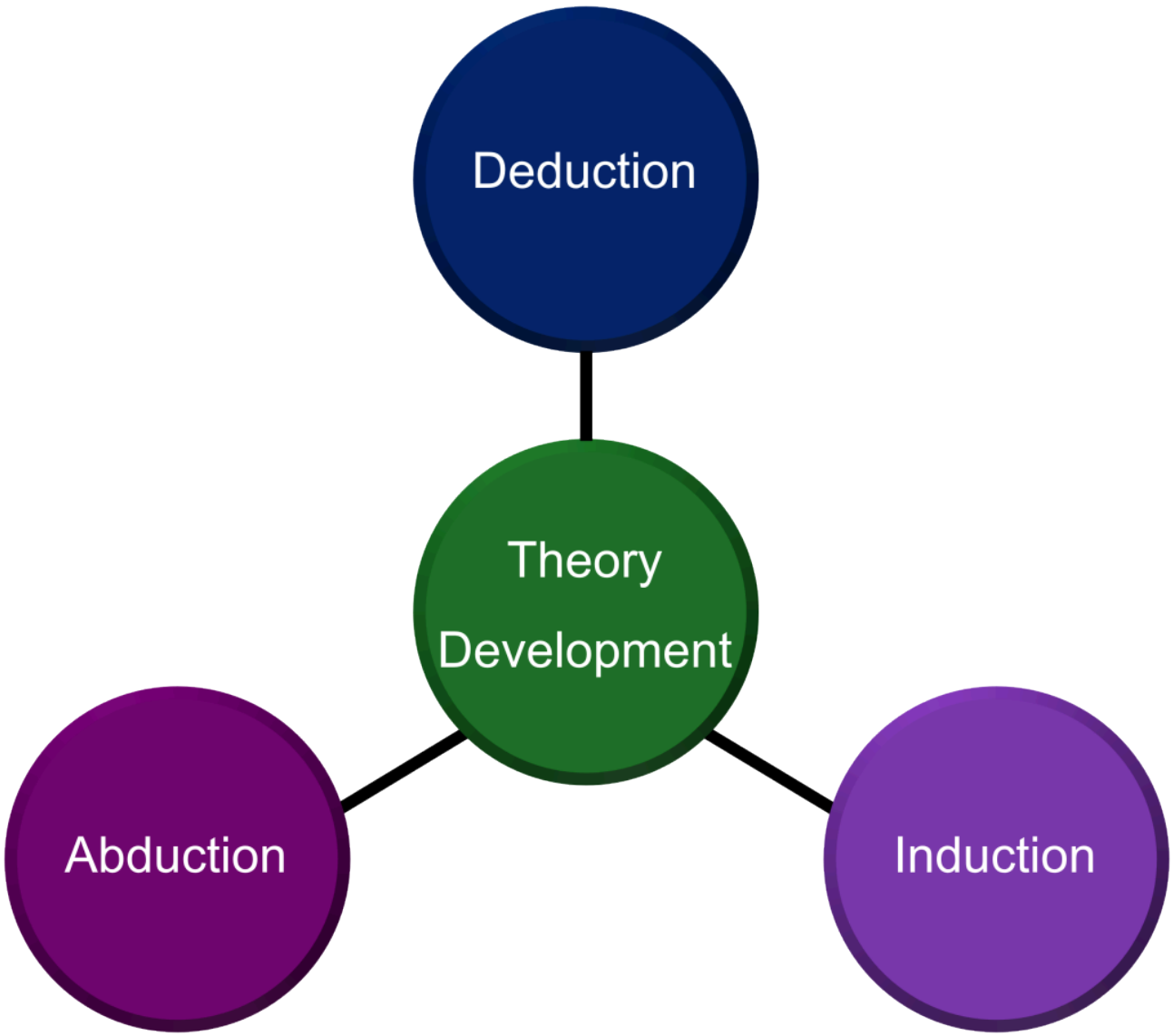
CHAPTER 6. RESEARCH PHILOSOPHY AND THEORY DEVELOPMENT




Deduction
Theory Development
Abduction
Induction

Research Philosophy and Theory Development

Learning Objectives

In this chapter you will understand:

- what is meant by research philosophy and paradigms
- what is meant by ontology, empistomology, and axiology
- the differences between deduction, induction, and abduction in relation to theory development.

6.1 Introduction to Research Philosophy and Paradigms

The way in which we conduct research is influenced by what scholars call 'our worldview'. That is our approach to the conduct of research is informed by the collection of factors about our being, such as our values, attitudes, perceptions, expectations, and backgrounds. Our view of the world is at the heart of our being and influences our minds and behaviours. Hence, our worldview is how we acquire and advance knowledge and it informs our approach to the conduct of research.

Table 6.1. Research paradigms, ontologies, epistemology, and axiology

Paradigm	Ontology	Epistemology	Axiology
Positivism	Realist: • An objective reality exists independently of human perception.	Objective: • Knowledge is discovered by empirical observation and measurement.	Value-free: • Research should strive for objectivity. • Research should eliminate researcher bias.
Post-positivism	Critical-realist: • An objective reality exists. • The objective reality can only be imperfectly understood.	Critical and fallible: • Knowledge is theory laden. • Knowledge is subject to revision by empirical testing.	Value-aware: • Complete objectivity is not attainable. • Researchers must be reflexive about biases.
Interpretivism	Individual-realist: • Reality is subjective. • Reality can only be partially known through individual interpretations.	Interpretive: • Knowledge is obtained by understanding meaning individuals attach to their experiences.	Value-laden: • Values are central to interpretation. • Reflexivity is encouraged. • The aim is to privilege participants' perspectives and context.
Pragmatism	Dynamic: • Reality is ever changing. • Reality is shaped by experiences and practical outcomes.	Practical: • Knowledge is judged by how useful it is and the outcomes it produces.	Value-driven: • Values are important in developing your research goals, focusing on the practical solutions that have real-world impact.
Critical realism	Stratified-realist: • An objective reality exists and is layered. • The layers are composed of observable events and hidden structures.	Explanatory: • Knowledge is obtained by understanding observable events and their underlying mechanisms.	Value-laden: • Researchers acknowledge the role of values. • They must be reflexive in regard to biases.

Paradigms

Scholars talk of worldviews in terms of paradigms or philosophical assumptions that help us to understand the nature of the world and how (i.e. the methods by which) we can understand it (Crotty, 1998; Lincoln & Guba, 2007). These paradigms are the lenses through which researchers view the world and hence, the ways by which researchers design research projects, engage with methodologies and make decisions about the methods to be used and how the data will be collected, analysed, interpreted and presented.

In his 1962 book (*Structure of Scientific Revolutions*), Thomas Kuhn introduced the term paradigms to describe the "dominant theories or models by which science proceeded, until they were overtaken and superseded by newer and more encompassing theories or models" (Lincoln & Guba, 2007, p. 1). Equally, it is recognised that Rohmann (1999, p. 295) later defined paradigms as "An ideal or archetypal pattern or

example that provides a model to be emulated". Then there are some scholars who use the term paradigms to describe a set of methodologies or methods (e.g., Tashakkori & Teddlie, 2003). Paradigms relevant to research are positivism, post-positivism, interpretivism, pragmatism, and critical realism (Table 6.1).

As the notion of 'paradigms' continues to be a much-contested domain in qualitative research, the preferred definition here is aligned with that of Lincoln and Guba (1985, p. 15) who built on the work of Reese (1980) and noted as "a set of basic or metaphysical beliefs … sometimes constituted into a system of ideas that 'either give us some judgment about the nature of reality, or a reason why we must be content with knowing something less than the nature of reality, along with a method for taking hold of whatever can be known' (Reese, 1980, p. 352)". This definition captures the notion that paradigms "an entire set of ideas based on sets of fundamental or metaphysical beliefs" (Lincoln & Guba, 2007, p. 1), which is an important consideration because it behooves researchers to think about how they view the nature of reality (**ontology**) and the ways by which they come to know about the nature of reality (**epistemology**). The latter encompasses the theories, models and methods of how researchers come to know about reality or the world they live in (Table 6.1).

Ontology

As stated above, ontology is about how we perceive reality, how we view the nature of reality (Table 6.1), and how we consider the way in which humans engage with reality (Creswell, 2013; Creswell et al., 2007). Ordinarily, our individual research focuses on a phenomenon. Our ontologies allow us to perceive that phenomenon through our own worldviews (i.e., our values, our beliefs, our cultural and sociological backgrounds, our personalities, our attitudes, and so on). Through our ontological lens, we perceive and come to understand the characteristics and nature of that phenomenon and how humans engage with or interact with that phenomenon (e.g., urban greenspaces) or how the phenomenon influences or impacts humans (e.g., climate change). Hence, our ontologies encompass the assumptions that we as researchers make as we explore the phenomenon and endeavour to make sense of it.

Being aware of our ontologies is important in realising that the underlying assumptions of our worldview can assist us in thinking about our research and the phenomenon that we are exploring. That awareness can even lead us to realise some of the limitations in the approach we take with our research. Either way, an awareness of our ontologies lends insight into what we understand as being real in the world and how we conceptualise the phenomenon we are exploring. The main ontological taxonomies are positivism, post-positivism, interpretivism, pragmatism and critical theory (Crotty, 1998; Lincoln & Guba, 2007).

As an example of an ontological stance, a scholar of Management with **a social constructivist ontological stance** may assume that the various aspects of running a business (e.g., the business model, the recruitment and training of staff, the leadership of the organisation, or customer service) are phenomena that are socially constructed and shaped by the cultural and social factors within which the business is run (e.g., the region or country, the political regime) or even by the individual business owner's cultural and social identity and background.

Epistemologies

Aligned with one's ontology is one's epistemology. I.e., the way we view the world and reality will inform the way we go about acquiring information/data about that world and reality, and how we understand or interpret and use or disseminate that information/data (Babbie, 2020; Creswell, 2013). Hence, it is no surprise that knowing about one's epistemology enables us to make sense of the way we approach research, how we seek to find answers to our research questions, what we value as being knowledge that can be trusted and phenomena that is worthy of further investigation (Babbie, 2020). Some scholars say that epistemologies

capture our 'ways of doing' and that such ways can range from being 'objective' to being 'subjective' (Saunders et al., 2019).

As an example of an epistemological stance, a scholar of Management with **an interpretivism stance** believes and thinks that knowledge is constructed by humans through their own experiences, social interactions and interpretations (Table 6.1). Hence, such a stance emphasises the nature of human experiences and the meanings that humans attach to those experiences; and so, underlines the subjective nature of the associated research of interpretivist researchers. For example, a researcher studying the organisational culture of hotels may use qualitative methods such as ethnography to explore the lived experiences of frontline hotel workers to gain a deeper and richer understanding of the nature and characteristics of the organisational culture of hotels (Pryce, 2005).

Axiology

Another term closely related to ontology and epistemology is 'axiology'. It refers to the researcher's considerations of their values and how issues of right or wrong are dealt with (Creswell, 2013; Guba & Lincoln, 1994). Axiology takes into account perceptual biases and influences the researcher in the values that they assign to their research (Table 6.1). Essentially, the axiological stance of a researcher relates to their values, beliefs and ethical positions and how this informs the research. It focuses the researcher to think about aspects such as the cultural and intercultural issues of the research, the conduct of the research in a respectful way, and the minimising of risk to participants and researchers (Babbie, 2020; Guba & Lincoln, 1994). Axiology is concerned with what "we believe is true in terms of moral choices, ethics and normative judgements" (Pabel et al., 2021, p. 6).

As an example of an axiological stance, a scholar of Management may take a customer-centeredness approach when looking at how institutions/organisations are taking steps to address climate change. In such a case, the researcher may utilise qualitative research methods (perhaps semi-structured interviews) to examine to what extent customers consider an institutions/organisations initiatives in responding to climate change before they purchase from the institution/organisation.

Time Horizon

In developing the research design, another aspect to consider is the 'time horizon'. Thought should be given to whether the research is a 'snapshot' in time (i.e., cross-sectional) or whether it extends over a period (i.e., longitudinal studies) (Saunders et al., 2019). Both cross-sectional and longitudinal studies can involve quantitative, qualitative or mixed methods approaches. The life of the project would determine if the research is cross-section or longitudinal.

6.2 Approach to Theory Development

Deduction

With deductive reasoning, you begin with:

1. An existing theory and problem statement,
2. You develop one or more falsifiable hypotheses,
3. You then observe or experiment to collect data to test the hypothesis,

4. Analyse and test the data,
5. Results – accept or reject your hypothesis (Mauldin, n.d.).

Figure 6.1 provides an example of deductive reasoning in relation to platypuses' diets, remembering that deductive reasoning provides a specific (certain) conclusion.

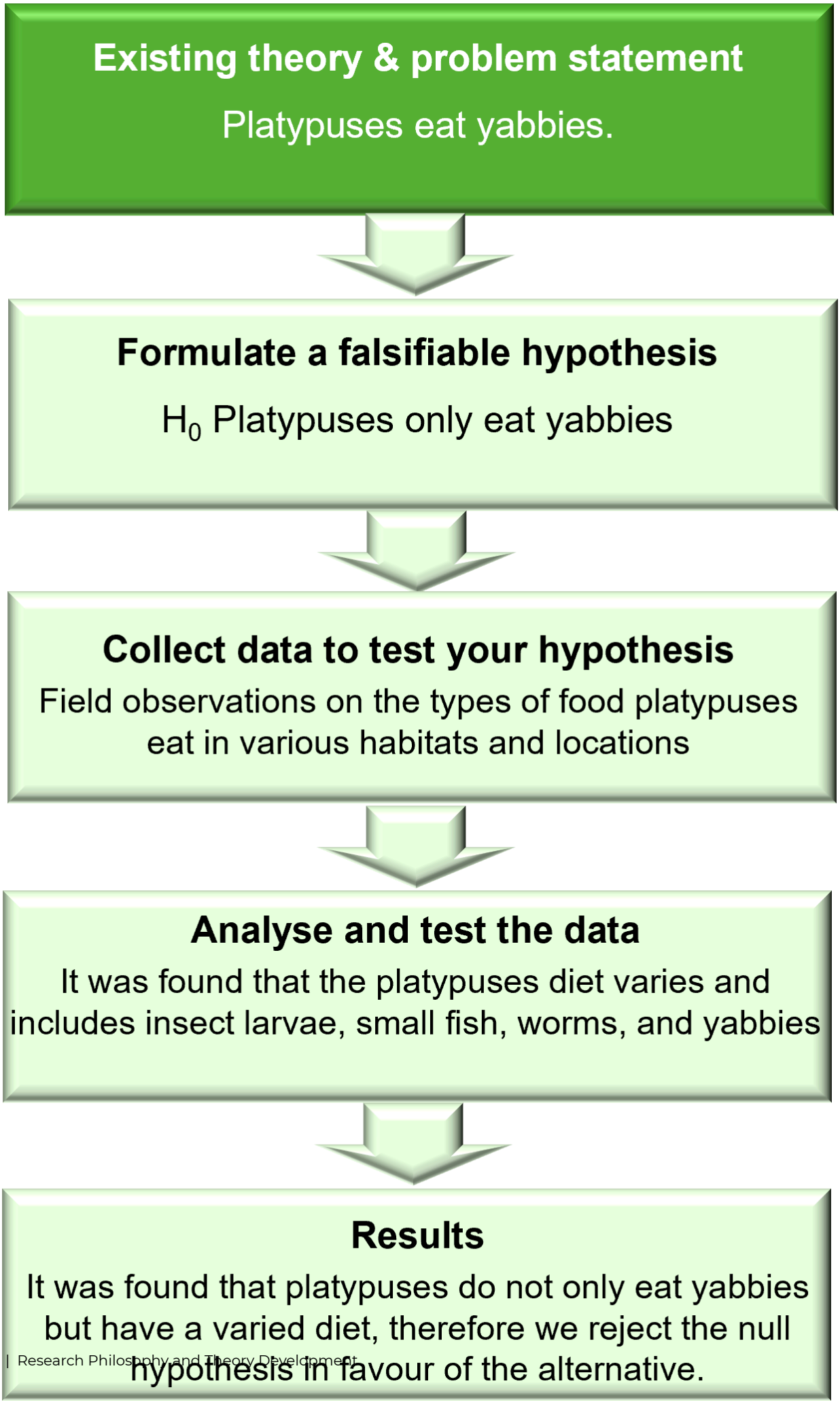

Existing theory & problem statement
Platypuses eat yabbies.
Formulate a falsifiable hypothesis
H_0 Platypuses only eat yabbies
Collect data to test your hypothesis
Field observations on the types of food platypuses eat in various habitats and locations
Analyse and test the data
It was found that the platypuses diet varies and includes insect larvae, small fish, worms, and yabbies
Results
It was found that platypuses do not only eat yabbies but have a varied diet, therefore we reject the null hypothesis in favour of the alternative.

Figure 6.1. Deductive reasoning, platypus example.

Induction

With inductive reasoning, you begin with your observations, look to identify patterns, develop a tentative hypothesis and then test your theory (Mauldin, n.d.). Figure 6.2 shows an example of inductive reasoning in relation to platypus diets, remembering that inductive reasoning provides a specific observation and general (probabilistic) conclusion.

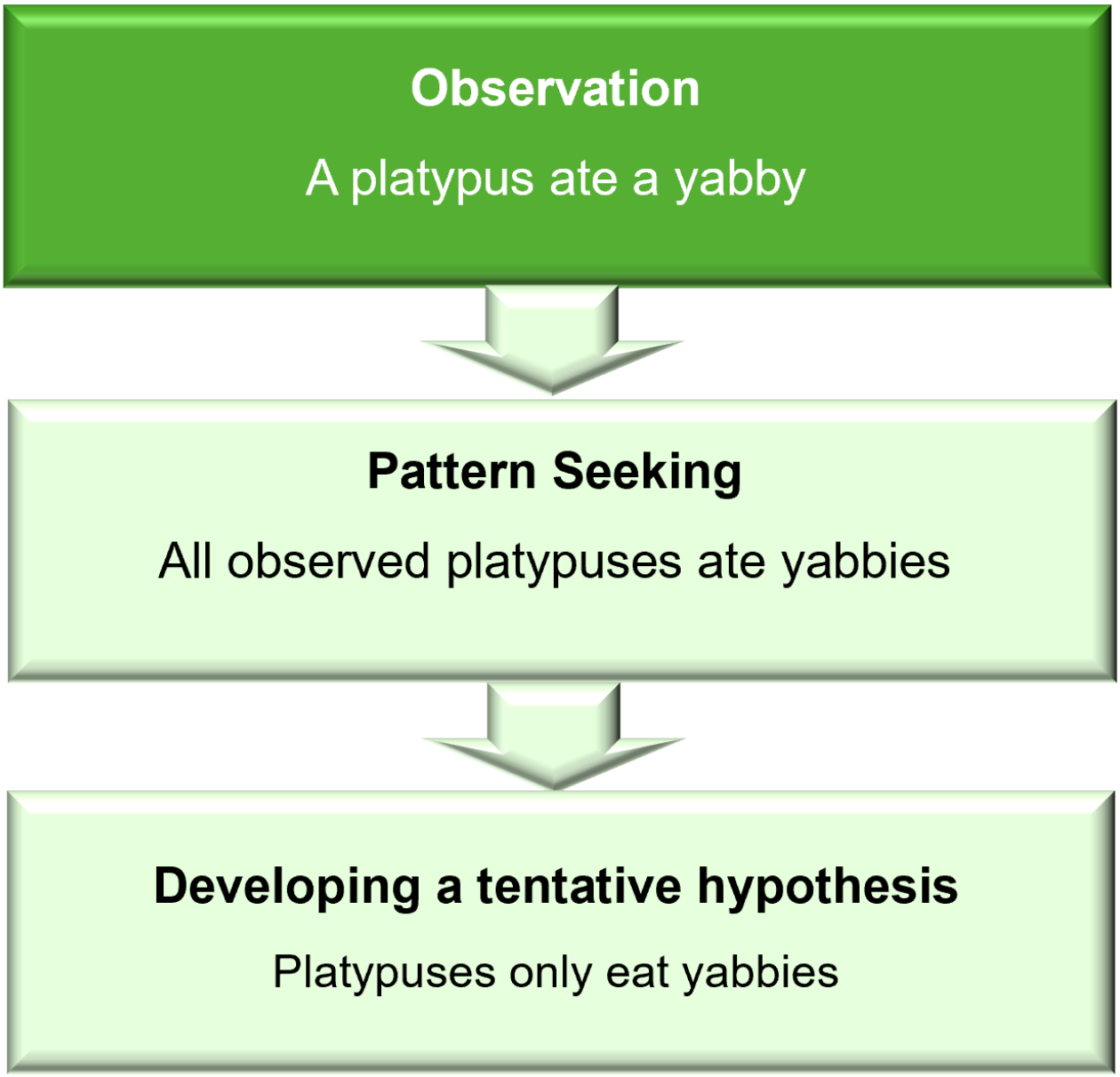


Figure 6.2. Inductive reasoning platypus example.

Abduction

Abductive reasoning is a combination of deductive and inductive reasoning. It generally begins with an incomplete set of observations and then proceeds to the likeliest possible explanation. Abductive reasoning

is used in daily decision making where information is often incomplete, but a decision needs to be made. For example, in the medical field, when a person comes in and describes their symptoms, the medical practitioner looks for the diagnosis that best explains most of the symptoms (Butte College, n.d.). Figure 6.3 provides an example of abductive reasoning when you do not have all the available information. Abductive reasoning has incomplete observations; therefore, the result is the best prediction (probabilistic).

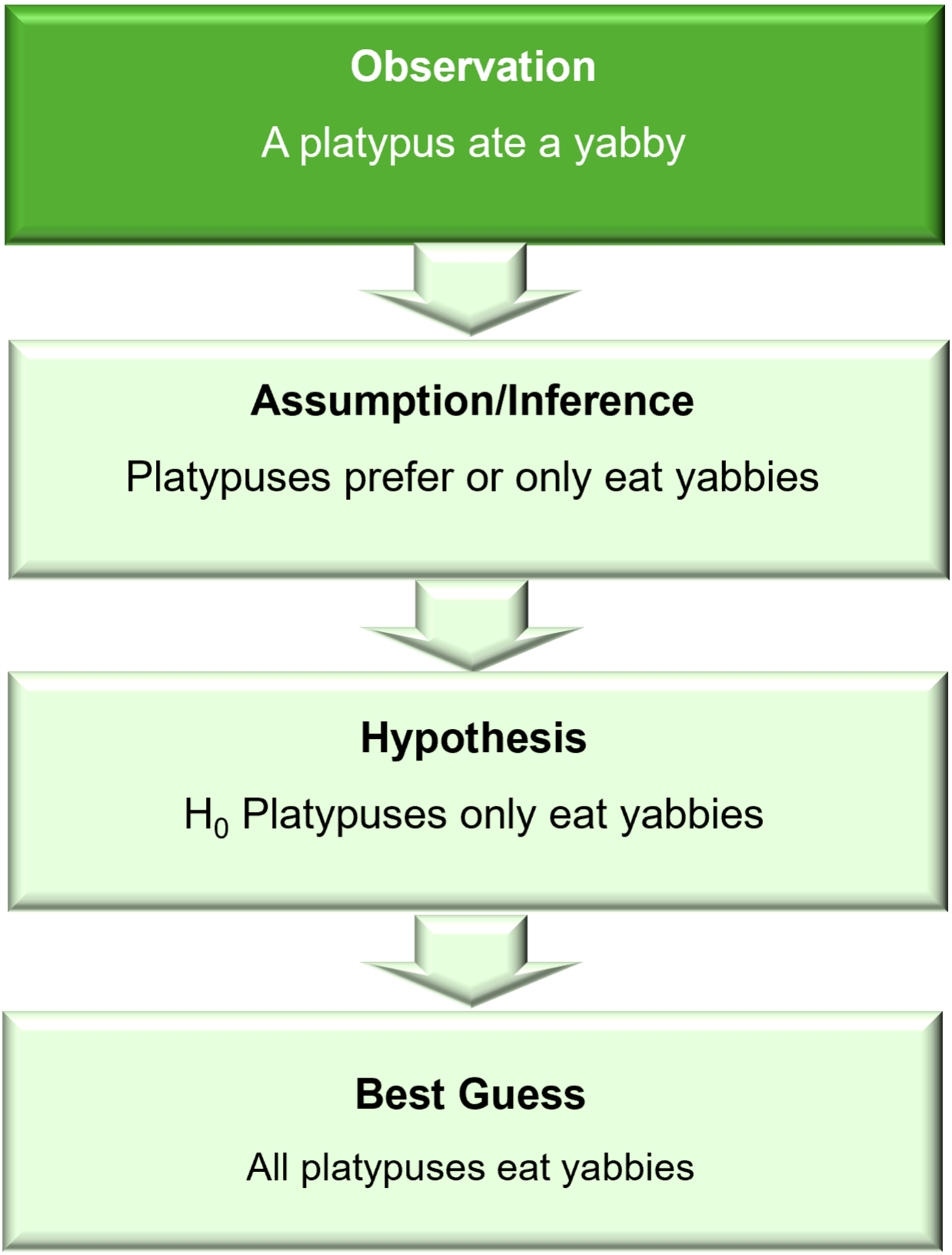


Figure 6.3. Abductive reasoning platypus example

Key Takeaways

- The conduct of research is based on how researchers see the world and reality.
- Research paradigms refer to the philosophical beliefs and assumptions that underlie the researchers' approach to research and so, the development of knowledge.
- There is no single best research philosophy or paradigm. Rather, it is based on the researcher's stance in terms of ontology, epistemology and axiology.
- Deductive reasoning begins with an existing theory and problem statement and comes to a specific conclusion.
- Inductive reasoning begins with an observation and has a general conclusion.
- Abductive reasoning is a combination of deductive and inductive reasoning, starting with observation and ending with a best prediction (best guess).

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CHAPTER 7. RESEARCH STRATEGIES

Research Strategy

Learning Objectives

In this chapter you will:

- recognise and understand that there are numerous research strategies to consider when designing your research.
- understand that there is a basic application for each strategy.

Research Strategies

Action Research

Action research is associated with social systems where members of the community, organisations (groups) are participating in the research (McNabb, 2021; Rapoport, 1970). When businesses are undergoing radical changes, such as redundancies, action research may assist everyone to more fully understand what is happening and why.

There are several versions of action research, for example:

- Canonical Action Research is based on five principles:
  - The researcher-client agreement – the client must understand how this type of research works, including positives and negatives.
  - The cyclical process model – this includes starting the process, planning, intervention, evaluation, and reflection, prior to either continuing for another cycle or being satisfied with results from the first cycle.
  - Theory – can begin with no theory but move to theorising as the research progresses.
  - Change through action – when a problem has been identified through action then change can occur.
  - Learning through reflection – continuous learning occurs and is shared throughout the research (Davison et al., 2004).

- Educational Action Research is based on the following for classroom consideration:
  - The process aims to improve educational practice. Methods involve action, evaluation, and reflection. This process gathers evidence allowing change in practices to be implemented.
  - The process is undertaken collaboratively by individuals with a common purpose.
  - Situation and context based.
  - Interpretations made by participants aid in the development of reflective practices.
  - Action and application lead to the creation of knowledge.
  - Can be problem solving – the solution provides improvement in practice.
  - It is iterative, you can come back to any point in the process, if something has not worked as

expected change the approach and try again. This creates an ongoing process of reflection and revision.
    - As actions develop and are implemented findings begin to emerge, they are not conclusive, they are ongoing (Spencer-Clark et al., n.d.).

Archival Research

Archival research uses data that are already in existence prior to the researcher(s) beginning their study. The researcher's first decision is deciding which information is required, and the most appropriate way to analyse it (Timothy, 2012).

- Archival data can be in a variety of formats, for example:
    - numerical data sets collected by someone else for a different purpose
    - artefacts
    - texts, for example, a library collection
    - government records
    - personal notes, memos, and other written and digital information
    - photographs
    - illustrations
    - art works
    - film
    - video.

Research fellowships and residencies with the State Library of Queensland are examples of archival research taking place.

Case Study Research

Case studies can be descriptive, explanatory, or exploratory. A case study is the investigation at a deeper level of one individual subject (Martelli & Greener, 2018), for example: Harley Davidson Motorcycles; Mozart; Greenland, etc.

However, there are other views on case studies, with some believing there are three distinct types:

1. Instrumental case studies which are exploratory, seeking to provide understanding of a topic/problem rather than focusing on the case itself.
2. Intrinsic case studies are undertaken when a researcher finds the case of particular interest, and where deeper knowledge of the topic/problem may occur.
3. Collective case studies are also known as cross-case studies due to the research focusing on one particular topic/problem but across multiple places. For example, populist world leaders are the focus, in an effort to understand their approaches to democracy (McNabb, 2021).

Correlational Research

Correlational research seeks relationships between variables, these could be statistical relationships. In this instance if one variable changes, another variable also changes, although it might not be in the same direction. Just because these variables are associated, it does not then lead to a causal relationship.

For example, university students often miss Monday's 8.00am class. You cannot then conclude that the early class time has a causal impact on attendance. Further research is required to provide any definite conclusions. The statistical method used for correlational research is correlational coefficients (Martelli & Greener, 2018).

Cross-sectional Research

There are several varying views on cross-sectional research, all depending on the field of study, for example:

- Cross-sectional research, in relation to business, could be looking from the standpoint of several employees at a point-in-time on how they use Artificial Intelligence (AI) in the workplace (Martelli & Greener, 2018).
- Cross-sectional research is a common approach used in health and medicine (Horrigan et al., 2013).
- Cross-sectional research is observational, no manipulation of variables occurs, this is a snapshot of what is happening at that exact time (Wang & Chen, 2020).

Descriptive Research

Descriptive research, as it sounds, describes something. Often this type of research is collecting data that describes the characteristics of people, events, or situations. Descriptive research can be quantitative or qualitative (Sekaran & Bougie, 2013).

To develop an accurate profile of events, persons, or a situation the descriptive research often asks questions that begin with or contain one of the following:

- Who?
- What?
- When?
- Where?
- How?

In general, descriptive research is analysed using descriptive statistics, such as mean, median, mode, skewness, kurtosis, standard deviation, etc., (Martelli & Greener, 2018).

There are two types of strategies that can be used for descriptive research, field studies or field surveys. Field studies contain fewer issues or items but investigate to a greater depth than field surveys. Field surveys are a popular way to gather data as they are reasonably easy to design and distribute. Both types of studies provide data that are used as numeric descriptors (McNabb, 2021).

Design Science Research

In a seminal paper published in 2010, Hevner and Chatterjee provide the following definition of Design Science:

> Design science research allows a designer to answer questions relevant to human problems via the creation of innovative artefacts – thereby contributing new knowledge to the body of scientific evidence. The designed aretefacts are both useful and fundamental in understanding that problem. (p. 5)

Design science research has a methodology (DSRM) that is iterative; it consists of six steps or activities, they are:

1. Problem identification and motivation – you need to define the problem you have identified and a motivation for solving the problem.
2. Define objectives for a solution – you need to define and discuss what a better artefact* would achieve than what already exists.
3. Artefact design and development – here you design and develop the new artefact.
4. Demonstration – here you use and test the new artefact.
5. Evaluation – you observe how effective and efficient the new artefact is, here you can refine your artefact by returning to steps 2 or 3.
6. Communication – you now publish your results in scholarly and professional publications (Peffers et al., 2007).

*The artefact is useful and fundamental in understanding the problem.

This DSRM approach has been used in information systems research for many years. However, it is only in recent years that it has made its way fully into other areas of research. For example, in business, in the development of a website benchmarking artefact (Cassidy, 2015; Cassidy, 2021).

Figure 7.1. DSRM for the WAM artefact by Leonie Cassidy, used under a CC BY-NC ND 4.0 licence. Click here for a machine-readable version.

In the case of website benchmarking, the artefact produced was a website analysis method (WAM). WAM contains a universal set of website components that can be used to assess a website (Cassidy & Hamilton, 2016). Figure 7.1 outlines the steps taken in the development of WAM.

Ethnography Research

Ethnography is a methodological tool used to study cultural phenomena of a group or sub-group (Hayre & Hackett, 2021). Ethnography can be a written account of a particular group or sub-group, or it can be field work, where the researcher(s) spend an extended amount of time with the group or sub-group in the hope of generating new cultural insights (Adams, 2012).

Ethnography or ethnographic research may use several additional research techniques, such as questionnaires, structured interviews, unstructured interviews, focus groups, video recording, or photographs. When conducting ethnographic research, the researcher(s) must leave any preconceptions (biases) behind (Adams, 2012).

Louis Theroux's documentary series where he is embedded with the people/groups he is exploring is a type of ethnography research, videos are available on ABC iView.

Experimental Research

This is a type of quantitative research. Experimental research uses independent variables, and dependent variables to test if, and how, manipulation of the independent variable(s) affect the dependent variable (Bhattacherjee, 2019). For further information, see the Data Collection and Analysis chapter.

Explanatory Research

Explanatory research is used when the researcher is attempting to identify the cause-and-effect two or more variables they are studying, attention must be paid to any possible confounding and modifying variables (Bentouhami et al., 2021; DeCarlo et al., n.d.).

The three main steps to explanatory research are:

1. Define the problem – what is it that you want to know more about?
2. Gather data – can be via experiments, surveys, interviews, observations, or focus groups.
3. Analyse the data – this could be done with regression analysis, Chi-Square, T-test or ANOVA

For explanatory research using case studies there are six steps:

1. Organise data
2. Look for and develop categories, themes, and patterns
3. Code the data by refining the categories, themes and patterns that emerged in step two
4. Apply the codes to the data
5. Investigate and seek alternative explanations
6. Communicate results. (McNabb, 2021)

Explanatory research allows for a more in-depth understanding of the problem (issue), identifying possible causes and solutions to the problem; however, it can be time-consuming, especially when used with grounded theory (McNabb, 2021).

Exploratory Research

Exploratory research is generally used in the first instance when there has been very little prior research conducted, therefore, not much is known about the topic of interest or there is very little information on how

similar problems (issues) have been solved previously. This approach tests the feasibility and justification of undertaking a larger study (DeCarlo et al., n.d.).

The main qualitative data collection techniques are:

- focus groups
- literature searches
- case studies
- interviews with a key group of experts (the Delphi Method). (McNabb, 2021)

Grounded Theory

Grounded theory research is a qualitative approach to research. Here, the researcher(s) focus on the social experiences of people and their inherent realities. The study does not begin with a theory as there are no preconceptions, theory emerges from the research process of information gathering, which may be in the form of experiential stories from respondents, and from the interpretation of those stories (Junek & Killion, 2012).

Grounded theory research has the following steps:

1. The researcher(s) focusing on an area of interest, in behavioural, social, or administrative sciences areas, for example, a phenomenon, circumstance, trend, behaviour, etc.
2. Purposive sampling is used for data collection by observation, and/or interviewing.
3. Analysis requires data to be grouped into categories, and codes are assigned.
4. Data are continually compared to data in other categories to hopefully generate a theory (Tie et al., 2019).

The researcher(s) are organising and applying structure to the data which is achieved by employing a set of researcher-determined groups and categories. Linkages between categories are identified.

Internet-Mediated Research

Internet-mediated research does not treat the internet as a subject for research, but rather as a medium, where research can be conducted.

For example:

- online surveys
- online interviews
- archives
- data scraping
- social media conversations and observations
- content analysis of websites or webpages
- blogs
- discussion boards
- reviews
- virtual worlds (e.g., Second Life)
- gaming
- chatrooms
- software, coding, and technologies
- interfaces

- Internet of Things (IoT) connections, etc. (Anabo et al., 2018; UK Research Integrity Office, 2016)

Narrative Research

Narrative research is research that may use narrative materials such as video games, novels, films, and speeches that already exist. The researcher(s) may ask participants to produce stories, these may be oral, photographic, self-portraits, or journals of events, and these are also forms of narrative material (Squire et al., 2014). However, there are no definite starting or finishing points in narrative research, as there has been continuous debate on what definition of 'narrative' should be used. Narrative research basically, as yet, has no defined set of rules covering how to conduct this type of research (Andrews, 2021).

The following are some important things to consider with narrative research:

- the story must mean something
- these stories are a rich source of information in our attempts to understand people, and indeed, the world around us
- it is 'messy', and it is not always clear what is, and what is not data
- the story, and when it happened, are bound together; one does not have meaning without the other. (Andrews, 2021)

Assessing the quality of narrative research:

- You hope for truthfulness. You may not be able to verify the story given to you, but you hope it is true, or at least the person who provides it believes it to be true. With public figures, you would generally expect some embellishments or omissions in their narratives.
- The reader believes that the researcher(s) are trustworthy. This can be strengthened when the researcher(s) theoretical claims are supported by respondents' accounts, including any negative cases, and alternative interpretations are presented.
- Critical reflexivity – researcher(s) need to indicate the positioning of their personal situated knowledge in relation to the investigation. This is where a researcher's biography is valuable.
- Scholarship and accessibility – although it can be difficult to achieve both, research output should be scholarly and accessible. Always ensure you are writing for the audience you are targeting. If a journal it would require more theoretical discussion than a report to an organisation.
- Ethical sensitivity (see Chapter 1) in this text for ethics requirements in research).
- Meaning in the narrative is co-constructed – the meaning of the narrative can be remade by the participant (at any point), the researcher (at any point), the story transcriber, and even the person reading the final output.
- The researcher(s) must consider what is not said in addition to what is said. Look closely at the research design. Is everyone included that should be? What kind of stories are being encouraged by the researcher(s)? Are there untold stories? You may find clues to these from participants' body language. Untold stories can affect the interpretation of the stories that are told.
- The researcher(s) need to understand temporal fluidity – narrative research tends to shift around, and researchers must understand this: 'life does not stand still. ' Expecting the social world to hold still for a 'snapshot' may seem like reducing the flow to frozen moments of a realist's description. Narrative research needs to confront these 'frozen moments' in the analysis, paying close attention to the contents of the gathered data.
- Attention must be given to the fact that stories are multilayered; they do not exist in isolation; they are always connected to other stories in some way. The researcher(s) need to investigate the coexistence of stories and how they are interconnected at the macro and micro levels.
- The researcher(s) must provide contextualisation of the research. Consideration and understanding must be given to the fact that stories are produced in specific contexts, at a particular point in time, for

a particular audience in analysing the data collected (Andrews, 2021).

Phenomenology Research

The "phenomenon" in phenomenology is a social construction of a group of people. Everyone has their own worldview. This worldview is constructed from our specific beliefs, our specific values, and our experiences which we attach meaning to. Researcher(s) endeavour to understand these different worldviews and what has contributed to them at a deeper level, producing richer information (Alele & Malau-Aduli, 2023).

Phenomenology research sees the researcher(s) setting aside any understanding or belief of the phenomenon under study (Martelli & Greener, 2018). To this end, they focus on theme analysis (Alele & Malau-Aduli, 2023). When used in interviewing, it is a combination of life history and in-depth interviewing (McGehee, 2012). Phenomenology is a common form of qualitative research producing richer, deeper, more complex understanding of the phenomena under study (Alele & Malau-Aduli, n.d.).

Survey Research with Questionnaires

Survey research with questionnaires is where the questionnaire contains a standardised set of questions: every participant in the study has exactly the same set of questions in exactly the same order (standardised). The only change to this occurs when 'filter' questions are included. This when the participant (respondent) ceases their completion of the questionnaire and is either directed to move to a question out of sequence, or to resume and continue as before. The survey can be conducted face-to-face where the researcher reads the questions out to the respondent and marks the answer, or the researcher hands the respondent the questionnaire for them to complete and return. Online, where the respondent clicks on a link to take them to the electronic survey, or in the case of a Census, online or hand-delivered for later collection (Sallis et al., 2021).

Survey research allows the researcher(s) to collect data that can be analysed quantitatively (with Excel, SPSS, or R) using descriptive and inferential statistics. The data can be used to suggest a possible relationship between variables and produce models of these relationships (Manning & Munro, 2007). When conducting survey research, time needs to be spent determining the sample size for the study (discussed further in Chapter 10). Further detail on surveys is provided in the next chapter.

Key Takeaways

- There are numerous research strategies that you can consider for any research undertaken.
- Each type of research strategy has a basic application.

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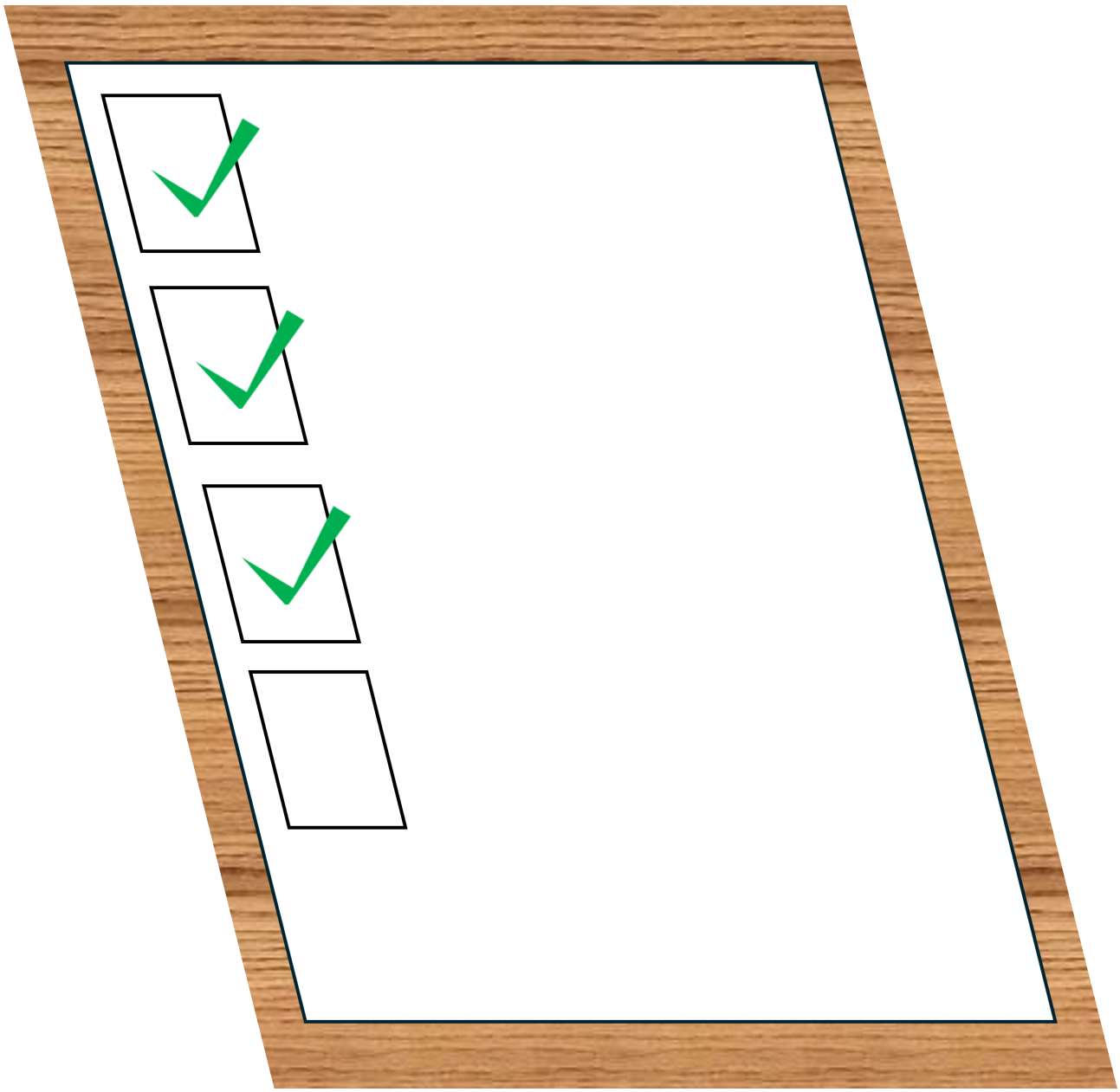
CHAPTER 8. SURVEYS AND INTERVIEWS



Surveys and Interviews

Learning Objectives

In this chapter you will:

- understand and recognise that writing a questionnaire requires considerable planning
- understand the importance of writing good questions
- discover problems that can occur when writing questions
- recognise the difference between open-ended and closed questions and their uses
- understand and recognise the differences and uses for categorical questions, semantic differential scales, interval scales, ratio scales, and Likert scales
- learn the differences between a structured interview, a semi-structured interview, and an unstructured interview.

Surveys or Questionnaires?

You are often going to find the terms survey and questionnaire used interchangeably. In this chapter we use questionnaire in relation to design and survey in relation to the distribution or 'surveying' of people.

8.1 Questionnaire Design

Before designing your questionnaire, think about your research focus, what do you want to measure, and who the target population is. For example, is the target population based on a specific demographic, (e.g., Gen Y, Gen Z, Baby Boomers, etc.), or is it based on location or some other factor? Then determine how you are going to collect the data, self-completion, online, face-to-face interviews, email, telephone etc.

Questions for your study can come from an existing questionnaire or questionnaires within the published literature, from your organisation, or your industry. These questionnaires can be adapted to suit your study, or you can develop your own. The opening question should not be difficult, nor overly personal, you do not want to put the potential participant off. On the other hand, do ensure you have your most important questions reasonably early in the questionnaire to ensure that even when the respondent does not complete every question their answers may still be useful. Be very careful of using multiple choice in your questionnaire as this can encourage respondents to do a 'tick and flick' set of answers which in the end can skew your results.

Questionnaires do not just contain the questions relating to your study focus. As per your ethics requirements, you must provide potential respondents with a 'participant information sheet' this includes the name of your project, what is required of the participant, the protocols, how respondents are recruited, and details of the principal researcher. An informed consent form must also be completed by the respondent and retained by the researcher(s), it must be explained to the potential participant that their personal details do not form part of the study, is not retained with their completed questionnaire, and the information is only retained as part of ethics requirements. The informed consent form has the principal

investigator (researcher), the project title, the university college, what is being agreed to, Yes/No boxes for consent, and a section for the participan's name, signature, and date.

Your questions must include instructions on how to answer each question, e.g., place a check in only one box; circle only one answer; circle all that apply; number in order of importance etc. Some questions may require further explanation depending on the exact type of question.

There are several question types, for example:

- A factual question about attributes – e.g., How many cars do you own?
- An attitude question – e.g., Do you think politicians should have their parliamentary pension frozen until they are no longer working?
- A beliefs question – e.g., Do you believe the Loch Ness monster really exists?
- A behaviour question – e.g., Which Australian state and territory capital have you visited in the last 2 years?

In general, questionnaires have questions that request demographic information. Depending on the importance of the information the questions may be situated at the beginning of the questionnaire, towards the end of the questionnaire, or divided between both positions.

Demographic information includes:

- Age – while some are happy to provide their age others are not. However, they are happy to provide the year they were born or the age range they fall into.
- Gender – this should not be only male/female, provide an alternative where respondents can specify how they view themselves.
- Town/country they live in, you may include 'for how long' depending on the importance of the information. This can be useful for tourism studies.
- Ethnicity can be a tricky question to ask, for example, in the USA you may have people identify as Irish-American, however the Irish may be from the 1700s. Another option might be to ask their cultural identity, which could link back to a question on how long they had lived in a town/country.
- When asking about employment you may need to be specific about type of employment if this is important to your study.
- As with age, people do not generally provide an answer to 'how much do you earn in a year' or 'what is your yearly income', these types of questions often go unanswered, or the answer provided is not true. Try using an income range if this is important to your study.

Any demographic questions asked need to be closely related to your target population and the overall aim of the research. Do not ask the question if you do not need the answer.

Categorical Questions

Categorical questions have answers that contain categories. Depending on the question(s), the respondent may select:

- only one answer (category), or
- multiple answers (multiple categories).
- When the categories are No/Yes, the question is referred to as a dichotomous (or binary) question.

A dichotomous, categorical question is referred to as a nominal scale in relation to data analysis. These answers are coded as either '0' or '1' for data analysis. When a categorical question has one category that

can be seen as 'larger' than the previous, but not how much larger, such as 'highest form of educational qualification' the scale is ordinal for data analysis (Manning & Munro, 2007).

Semantic Differential Scales

A semantic differential scale has two opposite key word anchors with spaces between for respondents to indicate their opinion. The scale may be 5-point, 7-point, or 10-point. For example (Figure 8.1):

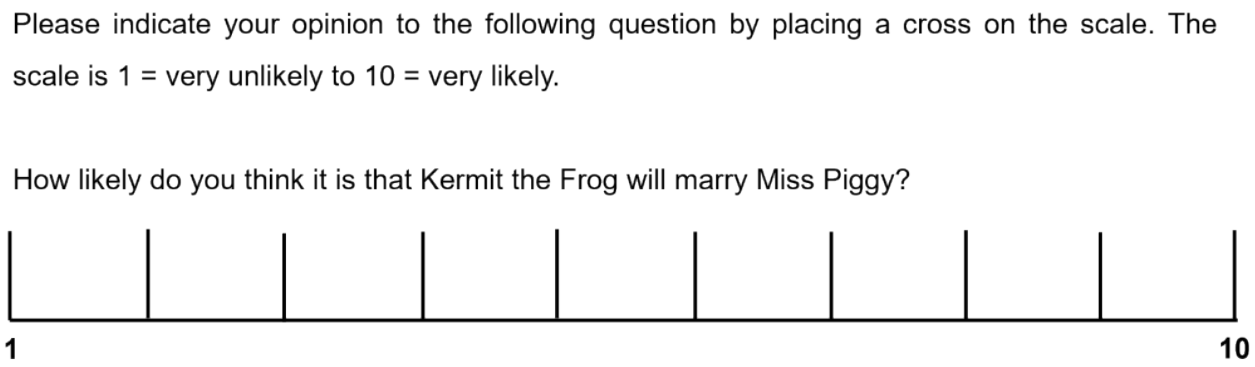


Figure 8.1. Semantic differential scale example

As seen in Figure 8.1, respondents are requested to indicate their opinion on a scale with anchored opposites. The scale indicators can be indicated in a variety of ways, another option is Figure 8.2.

Figure 8.2. Semantic differential scale alternative.

There is some debate amongst researchers on semantic differential scales. One group believes the scale to be equidistant and therefore can be seen as interval data. While another group is of the opposite view, they see the scale to be arbitrary, and therefore the data are ordinal. As there is a lack of agreement on the semantic differential scale it has dropped out of favour and is now, not often used (McNabb, 2021).

Interval Scale

Interval scale data is continuous data and can be measured (Chapter 5). With the interval scale, points on the scale can be arranged in a definite order and the scale increments are the same throughout the scale. For example, using calendar years as an interval scale. However, zero on an interval scale is not a true zero, as discussed in Chapter 5.

Ratio Scale

Ratio scale data is continuous data and can be measured (Chapter 5). The difference between points on a ratio scale are meaningful, as zero is a true zero, as discussed in Chapter 5.

Likert Scales

Likert Scales measure a respondent's attitude, generally the extent they agree or disagree with a statement or set of statements. Although not interval data, researchers often treat Likert scale data as such, they do this to obtain the mean.

Likert scales should have an odd number of points to allow a neutral position in the middle. Researchers have used Likert scales with 3, 5, 7, and even 15 points but too few or too many points are not appropriate. Less than 5 points does not give you suitably granular feedback, and more than 7 points can discourage respondents from answering the question as they are required to spend an excessive amount of time considering their position on the scale.

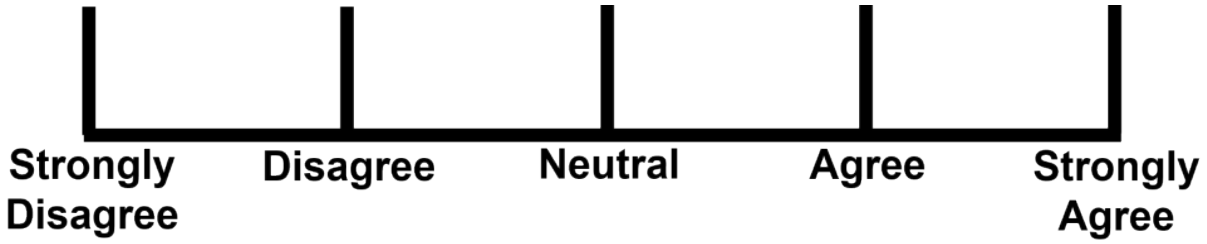


Figure 8.3. 5-point Likert scale example

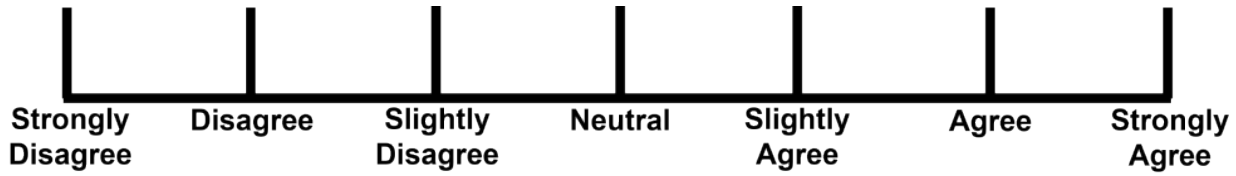


Figure 8.4. Example of 7-point Likert scale.

A Likert scale may use a satisfaction rating, for example, 5-point or 7-point (Figures 8.3 and 8.4). If you look more closely at Figure 8.3 you may begin to understand that a 3-point scale would provide little information, and you might as well ask a dichotomous question. Looking at Figure 8.4, imagine if you had a nine-point scale, what other attitudes would you include, 'moderately disagree' and 'moderately agree'? What about a fifteen-point Likert scale? Researchers must put a lot of thought into using Likert scales and the number of attitude options they use.

Researchers must also be very careful when writing the Likert scale questions, they need to be very specific about what they want to know, for example, it is pointless just asking how satisfied someone is with the restaurant customer service as it is not specific. Does customer service relate to waitstaff, bar staff, speed of service, how long it took to be seated etc. But what about satisfaction with the food, the quality of drinks,

and so on? To ensure results are meaningful the researcher(s) may be required to break the initial question down into more specific and targeted questions.

Open-Ended Questions

Open-ended questions do not have a selection of pre-determined answers, they have a space to allow respondents to answer in their own words. The researcher is seeking extra, more textual information. However, this type of data can be difficult to analyse as no two respondents are going to provide exactly the same answer. Therefore, open-ended questions are should be used sparingly in questionnaires.

Problems to Avoid When Writing a Question

Double-Barrelled Questions

The question asks for feedback or opinions on two different issues or topics within one single question.

When the respondent can only select one answer (closed questions), your data is going to be skewed.

For example: Do you like bacon and eggs for breakfast? This could be split into two simple Yes/No questions. Do you like bacon for breakfast? Yes/No; Do you like eggs for breakfast? Yes/No.

Unclear Terms

You need to think about what the average person would think when they read your question.

For example: a questions asks – Do you drink often? What is this question asking? What is meant by often? What is meant by 'drink'? Does drink mean fluid in relation to staying hydrated?

To counter any issues researchers should conduct a limited test of their questionnaire prior to distribution to their wider target audience.

In limited testing the respondents can ask for clarification, or comment on problems they perceive with the questions, this strengthens the questions and in turn the study.

Leading or Loaded Questions

Leading or loaded questions contain in-built bias, an opinion, or non-neutral language. This can potentially influence the way the respondent answers.

For example, when someone cuts you off in traffic, which of the following do you do?

- speed up and tailgate them
- speed up and overtake them
- wave your fist at them
- yell abuse at them
- flip them the 'bird'.

The selection of answer choices for the question makes the assumption that all drivers/riders are aggressive in traffic when someone cuts them off, and only the level of aggression is in question.

- This question does not provide any neutral options.
- This type of leading or loaded question invalidates any results of your research and puts your ethical stance in the spotlight.

Absolute Questions

These are questions that force a respondent to answer Yes or No when there should be at least 3 options.

For example: Do you always drive your car to work? No/Yes.

The word 'always', and only having responses of No/Yes to select from creates a far from ideal experience for the respondents, and they may cease to participate.

Recall-Dependent Questions

These types of questions ask respondents to recall (remember) experiences/information from their past that are probably no more than a hazy memory. This can introduce bias into the study.

For example, an employee has been with the company for over 28 years, your question asks them when they became qualified for the machine they operate. You may find they struggle to give you a correct answer, and over or underestimate the date. For this type of question, it would be much easier to obtain the correct answer from employee records.

Another example could be: How much do you spend on wine in a year? Respondents won't know this. If they purchase their wine from the same outlet each time, they may be able to find out from their bank account statement how much they spent overall at each visit. But if they purchased anything else at the same time, such as a gift, or her alcohol, or non-alcoholic beverages the amount is not going to be accurate.

Answering recall-dependent questions always comes down to the amount of time covering the question, or how long ago it occurred.

Socially Desirable Questions

These questions are worded to elicit socially desirable responses, they make the respondent feel the way they answer needs to be viewed favourably by others.

For example: Do you think older people should be sacked from their jobs? This question would generally receive a majority of 'No' answers. Respondents may feel society would not look favourably on them if they thought older people should be sacked even if they are still capable of doing their job.

This question is also written using unclear terms. What is 'older'?

A better question could be: Do you believe there should be mandatory retirement for workers at age 65? Here an age is specified, it is no longer unclear, and there may be a greater mix of Yes/No answers received.

Double-Negative Questions

Basically, double-negative questions cancel each other out and you end up with a positive.

For example: Do you disagree that vaping should not be permitted in playgrounds? This question implies that vaping should be permitted in playgrounds. Read it very carefully and you can see why, but when it comes down to it, the question is just very badly worded.

Limited Response Options

This happens when questions do not provide an answer choice the respondent requires.

For example: Who buys the groceries in your household?

- you
- Mum
- Dad.

There are only 3 options, what if your husband, boyfriend, girlfriend, significant other, grandparent, Aunt, Uncle, cousin, flatmate, etc buys the groceries, or what if it is a shared activity?

When the researcher has no way to know all the variations of answers possible to a question the question should be open-ended, allowing the respondent to input their own answer.

Overlapping Response Options:

This is an error in question design, or proofreading.

For example: What is your current age group – <20, 21-30, 30-40, 40-50, >50. Which selection do those who are 30 or 40 make, there are two options for each age. What about a person aged 20? The choices are less than 20 or 21 to 30, there is no 20 age group.

To ensure no overlaps or exclusions a better selection of age groups could be:

- 20 or less; 21-30; 31-40; 41-50; over 50.

8.2 Distribution

For online distribution of surveys there are several approaches you can select from. There are companies such as Survey Monkey and Qualtrics, or you can develop your own website, or blog. If you are considering using someone else's website or using social media you may run into issues as many do not permit survey distribution on their platform, you need to read their requirements carefully prior to attempting to use their platform.

You are going to find some textbooks may recommend emailing surveys to potential respondents, but first you need to obtain their email address. After you obtain the email address you have to find out if the person is willing to undertake the survey. Your approach by email may just end up in the Junk or SPAM folders. Emailed surveys can get lost in the incoming tide to an inbox and may be overlooked.

Traditional 'old fashioned' ways of surveying such as posting a physical survey to someone, e.g., the household, may result in the survey being dumped in the bin as junk mail or rubbish. This is quite an expensive way of distributing a survey and generally only works when the person has already agreed to undertake the survey. Telephone surveys are quite restricted now in Australia as to the hours they can be conducted and who can conduct them. There is also a 'do not call' register of those who definitely do not want to participate, and the reduction in landline phones is also prohibitive.

The remaining traditional form of survey distribution that is still effective is in person. The researcher(s) or assistant(s) physically attend an area where their target population frequents and can hand the survey to those who agree to participate, or if the survey is interview style ask the questions.

8.3 Interviews

Structured or Standardised Interviews

A structured or standardised interview is on occasion described as a quantitative interview. With this type of interview, the researcher reads each question and the answer options to the respondent, with the researcher marking down the answers. The questions are generally closed. In this instance if the respondent does not understand a question they can ask for clarification.

In a quantitative structured interview, an interview schedule is used. This provides a guide to the researcher as they ask the questions, and selection of answers to the respondent. The researcher must ask each question and provide each answer in the same way for the whole interview, the tone of voice, inflections etc must stay the same to prevent any researcher influence on the answers. This form of data collection can be very labour intensive due to the amount of time it takes for the researcher to ask each question and record each answer; unless there is a team, it is conducted one interview at a time (Sheppard, 2020).

Semi-Structured Interviews

The semi-structured interview is qualitative, it is a more relaxed approach than the quantitative structured interview. There is a mix of both open-ended and closed questions asked, but the interviewer does not have to stop when the respondent first answers, they can seek further information from the respondent. Although more time consuming (up to 1-hour generally) than the structured interview the semi-structured interview is seen as providing more valuable insights into the respondents and their answers. In a semi-structured interview demographic questions are generally left until last as the answers can be viewed by respondents as sensitive, or private, and they may be reluctant to part with the information. A researcher should only ask the absolute necessary demographic questions to ensure the respondent stays relaxed and no harm is caused (Adams, 2015). Themes and key questions rely on the researcher's philosophical stance.

Unstructured Interviews

An unstructured interview is qualitative, very relaxed and informal, they do not apply to a list of pre-determined questions. The researcher (or interviewer) conducting the unstructured interview needs to be highly skilled and experienced to successfully obtain the information they are seeking from the respondents, and in the respondents' own voice. This type of interview is generally an extension of research conducted as participant observation, and the researcher/interviewer has, at times, already developed a relationship with the respondent, when this occurs the relationship often continues after the research has ceased (Sanchez, 2014).

Recording Interviews

As with other forms of recording respondent information, there are ethical considerations that need to be applied. See Chapter 1 about ethics.

Key Takeaways

- There are multiple factors to consider when writing a questionnaire and it requires careful planning.
- Writing a good question is extremely important. You now understand how to write a question so that it is not double-barrelled, unclear, leading or loaded, absolute, recall dependent, socially desirable, double negative, limited response, or containing overlapping responses.
- There is a difference between open-ended and closed questions, and what demographic questions are and why they are useful.
- You understand what a categorical question is, and the differences between semantic differential scales, interval scales, ratio scales, and Likert scales.
- A structured interview is sometimes referred to as a quantitative interview due to its structured nature.
- Themes and key questions for a semi-structured interview depend on the researchers' philosophical stance.
- An unstructured interview has no predetermined themes or questions.

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CHAPTER 9. FOCUS GROUPS, EXPERIMENTS, AND OBSERVATIONAL RESEARCH

(Image generated by Firefly AI, 2025)

Focus Groups, Experiments, and Observational Research

Learning Objectives

In this chapter you will:

- understand what a focus group is and what focus groups can be used for
- understand the selection and recruitment of focus group participants
- discover the important role ethics plays
- understand the difference between experimental research design, pre-experimental research design, true experimental research design, and quasi-experimental research design
- learn the process and steps for focus groups, experiments, and observational research.

9.1 Focus Groups

The Focus Group

A focus group is an interview and discussion with a small group of people, generally consisting of 8 to 12 participants, plus the moderator, and note-taker/observer. Focus groups can test generalisations and theory, and aid in the development of questions to be used in a further, larger study on the topic in question

Researchers using focus groups are seeking evaluations, impressions, and opinions about an event, concept, or product from the target audience. A focus group can run from 1 to 2 hours in general. The moderator encourages participants to interact with each other in relation to the event/concept/product. The note-taker/observer takes notes and can bring the conversation back on track if the moderator has allowed it to wander to far from the focus of the interview (Cater & Low, 2012).

The Focus Group Setting

When conducting a focus group, the setting must be comfortable. Having comfortable chairs is a good place to start, the setting must be non-threatening with consideration given to a level of privacy. Focus groups have traditionally been conducted in an in-person face-to-face environment, however with technological advancement, including faster internet access, focus groups can now be conducted online (Jones et al., 2022).

With in-person focus groups you have recording equipment (audio or video-audio), consent forms (for signing), research information sheets (for participants to keep), and if required, writing implements, and paper/sticky notes. As these types of focus groups are conducted over 1 to 2 hours it is usual to provide refreshments for participants, such as tea, coffee, water, and biscuits. If the focus group is conducted around

mealtime, you may provide sandwiches. The researcher may also provide each participant with a small thank you for participating, this could be a small box of chocolates for example (it would depend on your participants).

Online (or internet-mediated) focus groups can be synchronous by using Zoom, Microsoft Teams (Teams), or similar. Participants require a web-cam and microphone, both of which are generally built into a laptop or PC, or they may use another type of digital device, e.g., tablet, or mobile phone. Research information sheets and consent forms can be emailed to participants prior to the focus group participation to enable signing and return of the consent sheet. Recording these focus groups is easy for the moderator as this is an inbuilt function of Zoom, and Teams for example. The online environment allows participants to be comfortable in their own home and provides them with the power over their privacy while participating in the focus group. While participants in online focus groups cannot be provided with drinks or snacks, they can be given breaks to organise their own. When it comes to a small thank you an electronic gift card or similar may be appropriate.

Focus Group Formation

Recruiting members for focus groups very much depends on the research question and how many focus groups are required. Importantly, participants must have experience relevant to your research question.

The researcher(s) must then consider if the focus groups are going to be:

- Heterogeneous:
  - participants are strangers to each other
  - participants may have opposing views
  - risk of intense disagreement requires behaviour expectations to specified at the beginning and enforced to head off any conflict.
- Homogenous:
  - participants are of similar gender, ethnicity, age, or have similar occupations
  - participants may not know each other but are similar
  - participants know each other – this produces a greater risk of 'group think' occurring, where all have the same view.

Depending on the research question, members for focus groups may be sourced from within an organisation or club or community. For face-to-face focus groups, this could include posting notices at meeting places, emailing members, or approaching them in person. For online participant recruitment, digital flyers can be used, emails, digital newsletters, and social media ads (where platform permits), basically any digital approach that may reach those participants required (Halliday, et al., 2022).

The Moderator

The moderator is a very important, essential part of the focus group for a researcher whether it is a traditional focus group or online focus group. The moderator can be the researcher themselves or an experienced moderator. The moderator ensures each participant has received their information sheet and signed a consent to participate form. The moderator then begins recording the focus group and introduces the topic to participants. The moderator may take notes during the discussion, but never becomes the focal point of the discussion. The moderator is there to gently steer the participants to keep them on track, and ensure all participants have an equal chance to contribute to the discussion. The moderator may have an

assistant who sits in the background and makes note of non-verbal cues of participants (Sekaran & Bougie, 2013).

Recording

When recruiting participants for your traditional or online focus group(s), you must make them aware that they will be recorded during the focus group discussion. Recordings now are generally audio and video (especially online) but may be just audio depending on the circumstances of the focus group. Each participant is provided with an information sheet explaining the purpose of the research and a consent form to sign, which includes agreeing to being recorded. The agreement to be recorded must be obtained from each participant prior to beginning the focus group discussion. Where online participants have previously agreed to being recorded, you must remind them prior to beginning any recording. If a participant declines to be recorded for any reason, you should politely ask them to leave the group as recording is essential for the study to continue. All the ethical requirements are detailed on the JCU Human Research Ethics website.

9.2 Experiments

Experimental Research

Experimental research is quantitative, involving two sets of variables. This type of research seeks to determine if there is a causal relationship between two (or more) variables. The strength and direction of any identified relationship between the two (or more) variables may also be identified.

Set one contains:

- at least one independent variable that is manipulated by the researcher(s)
- determines the effect on the second set of variables.

Set two contains:

- at least one dependent variable.

Experimental research is used in a variety of studies to support a wide range of decision-making. Results in experimental research are the likelihood that change did not occur by chance alone. As seen in Table 9.1, researchers report these results at a level of certainty or level of confidence (McNabb, 2021).

Table 9.1. Comparing levels of certainty and level of confidence

Level of Certainty	Level of Confidence
90%	0.10
95%	0.05
99%	0.01

Design

There are 3 types of Experimental Research Design.

1. *Pre-experimental research design*

- used before true experiments
- conducted on small groups for the purpose of testing the research design.

Pre-experimental research designs include a one-shot case study design where some type of treatment is applied to a single case study sample group. Static group comparison where one group has experienced a phenomenon, and another similar group has not. There is no random allocation possible. One-group pretest and post-test design, here there is no control group. Each member of the experimental group undertakes a pretest, then the experiment occurs, then participants undertake a post-test.

2. *Quasi-experimental design*

- no random assignment of participants to experimental or control groups.

One type of quasi-experimental design is non-equivalent comparison groups design. Often the groups in this type of research design are already in existence. For example, the research may involve two football teams, one receives the intervention or treatment while the other does not. Each football team is one group, there are issues with this type of experiment though as there maybe differences between groups, such as age, income, status etc. This type of experiment is convenient for the researchers (DeCarlo, 2018).

3. *True experimental research design*

- True experimental research design involves testing a hypothesis to determine if there is a cause-and-effect relationship between two or more sets of variables.
- The 5 main characteristics of true experimental research are:
    - A treatment group – to experience the treatment or intervention.
    - A control group – do not experience the treatment or intervention.
    - Participants are randomly distributed to one of the two groups.
    - The independent variable(s) (treatment/intervention) are manipulated by the researcher(s).
    - Post-testing, and depending on the study, pre-testing. (Sallis et al., 2021)

Steps for Experimental Research Design

Experimental research has several steps to follow:

1. Determine the research question:

    - The research question emerges from the area of study the researcher is engaged in, and the literature review to determine any gaps within the literature relating to the area of study.

2. Determine independent and dependent variable(s):

    - Identify the independent variable or variables, this are the variables that are to be manipulated, that is, a treatment/intervention is used.
    - The independent variable(s) are expected to affect the outcome.
    - Dependent variable(s) are the outcome, these are the variable(s) expected to be affected by the independent variable(s) treatment/intervention.
    - Identify any confounding variables/conditions that may interfere or introduce bias into the results.

3. Define one or more hypotheses:

- The hypothesis or hypotheses must be written so they are specific, testable statement(s).
- The hypothesis is a concise statement about what you are expecting to find emerging from your research question.
- The hypothesis is informed by results of previous research conducted in your area of study.

4. Identify a population for sampling:

    - Attention must be given to ensuring validity of the experiment.
    - Determine the correct sample size.
    - Determine any characteristics or other constraints that may reduce sample size, and how to overcome this issue.

5. Determine what approach should be used to assign participants to test/control groups:

    - Choose your experimental design from the large range of experimental research designs.
    - The experimental research design depends on the focus of your study.
    - Determine if you are going to assign participants to a group using complete randomisation or as a randomised block.
        - Complete randomisation does just that, it randomly assigns participants to the treatment or control group.
        - Randomised block is when the researcher considers any confounding variable, then assigns participants to a block based purely on that confounding variable. Once in a block participants are randomly assigned to a treatment or control group.

6. Based on your experimental research design, determine the most appropriate process to statistically analyse and interpret your experimental research results (McNabb, 2021).

9.3 Observational Research

Observational research is a non-experimental research approach associated with qualitative methods that aim to describe one or more variables. The researcher(s) generally observe participants to obtain a snapshot of their characteristics. Those observed may be individuals, groups, or people in a specific setting. Observational research cannot come to a causal conclusion as there is no manipulation or control of the situation (Price et al., n.d.).

Controlled Versus Uncontrolled Observational Studies

Controlled Observational Studies

Controlled (or structured) observations are undertaken in structured or artificial settings where the researcher(s) are interested in specific behaviours of participants. Highly controlled observational studies are where the situation/setting is contrived or manipulated by the researcher(s). The participants may be exposed to certain conditions/situations, or to a certain amount of time pressure. These types of studies permit the researcher(s) to observe the differences between individuals' behavioural reactions to the situation. Controlled observation can be conducted in a laboratory (e.g., a simulated environment), or in the field (e.g., a retail store). Researcher(s) using controlled studies are obtaining quantitative data, they are only interested in a limited number of behaviours which they can then quantify (Price et al., n.d.).

Figure 9.1. Controlled observation. 'Kids with white toy robot' by Pavel Danilyuk is used under a Pexels licence

Uncontrolled Observational Studies

With uncontrolled (or naturalistic) observations, the researcher(s) make no attempt to control, manipulate, or influence the situation. The researcher(s) do not interfere; they just observe events as they run their natural course in a real-life setting. The advantage of uncontrolled observations is that people are observed in their natural environment, for example, shopping or working. However, it can be very difficult to untangle more complex situations, and therefore it is hard to distinguish the causes of events, actions, and behaviours when nothing is controlled (Sekaran & Bougie, 2013).

Figure 9.2. Uncontrolled observation. 'Carindale shopping centre' by Kgbo is used under a CC BY-SA 4.0 licence

Participant Versus Non-Participant Observation

When gathering observational data, the researcher can be a participant or a non-participant.

Participant Observation

When the researcher is an active participant in the research project, they can be a participant observer. For this approach, the researcher is participating in the daily life of the group/community/organisation in their natural setting that is under study while they are gathering data. This enables the researcher(s) to determine any differences between what people say, and what they do. Participant observation is a fieldwork approach included under ethnographic research, harking back to cultural and social anthropology. To be successful in this type of research the researcher must find a position in the field where they can become involved (Franco & Yang, 2021), for example, as a baker's assistant in a bakery (Figure 9.3).

Figure 9.3. Participant observational research. 'Bakers' by Jarkko Laine licensed under a CC BY 2.0 licence

Non-Participant Observation

Non-participant observation means the researcher(s) are not directly or actively involved in the action of those being observed. Non-participant observation may be used when the researcher(s) are interested in studying social behaviours of a group of people or individuals that they are not part of. Here, they position themselves so they can see what is occurring and record the information, but not interact with those being observed (Figure 9.4). Non-participant research is also conducted using videos of specific situations, for example, riots, and protests. These can be dangerous situations where it is not practical to be a direct observer. The researcher(s) may also be interested in observing and identifying patterns of movement and social interaction in public spaces without interacting with those being observed (Williams, 2008).

Figure 9.4. Non-participant observation. 'Men working in warehouse' by Tiger Lily is used under a Pexels licence

Concealed Versus Unconcealed Observation

Concealed Observation

A concealed observation study is when the group under study is not told they are being observed. This is sometimes known as 'disguised observation'. Concealed observational studies require a high level of detail when applying for ethics.

Advantages of concealed observation:

- Those under observation are not influenced by awareness of being observed.

Ethical problems with concealed observation:

- It may violate the principles of privacy, informed consent, and confidentiality.
  - For example, a researcher immersing themselves in a social group, within a department in an organisation, while concealing their purpose for being there.
- Less likely to cause harm to those observed would be a researcher observing how consumers navigate a supermarket.

Unconcealed Observation

Unconcealed (or undisguised) observational research sees the researcher(s) disclose their true identity to participants and let them know they are being observed.

Problems with unconcealed observation:

- The presence of the researcher can affect the behaviour of those being observed.
- This can threaten the validity of the study's results. (Sekaran & Bougie, 2013)

Key Takeaways

- Focus groups are quite time-consuming to prepare for.
- Understanding your research topic is crucial to selecting your focus group participants.
- Recruiting participants can be a complex activity.
- The moderator plays a critical role in the focus group.
- As with all other research activities, ethics is very important.
- Experimental research is quantitative and has two sets of variables, independent variables and dependent variables.
- There are three main types of experimental research design, pre-experimental research design, true experimental research design and quasi-experimental research design.
- There are four steps in experimental research design that need to be closely followed. They are determining the research question(s) and variables; the hypothesis/hypotheses; the design of the experimental treatments; and how to categorise participants into treatment groups.
- Observational research is a form of qualitative research that allows researchers to watch participants or phenomena.
- Various tools can be used to collect observational research data, including photos, videos, audio recordings, and field notes.

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CHAPTER 10. SAMPLING, SAMPLE SIZE, AND PARTICIPANT SELECTION

(Rabbit images generated by Firefly AI, 2025)

Sampling, Sample Size, and Particpant Selection

Learning Objectives

In this chapter you will:

- understand the differences between non-probability and probability sampling
- understand the reasons qualitative research has far fewer participants than quantitative research
- discover and understand how to employ a formula to calculate sample size for quantitative research
- discover the best way to obtain participants for your research.

10.1 Sampling

When undertaking research, it is not possible, unless you are conducting the census, to obtain data from the whole population under consideration. Therefore, you collect data from a representative sample of the population targeted in the study. The size of the sample depends on the type of research you are undertaking. Calculating the size of a sample is discussed later in this chapter.

Population Versus Sampling

A sample is a subset of the population we are interested in. Sampling is the process of selecting a subset of the population of interest. A target population is the group of people, objects, or events that you want to study. Remember the target population does not have to be just people.

You start with the population (everyone) which you are not going to be able to access unless you are the government conducting a census. Then we come to the target population, they are those (people, objects, events) the target of your study. Then we have the sample, the portion of the target population that can be accessed or is selectable (Figure 10.1).

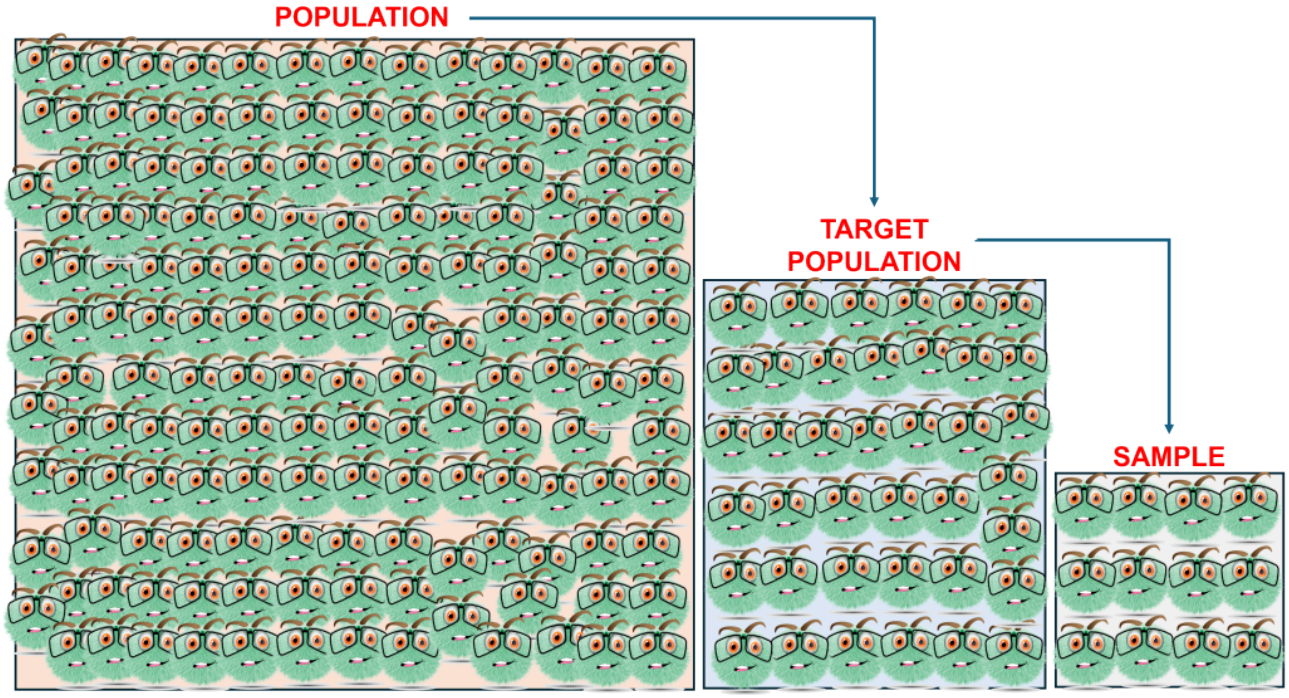

Figure 10.1 Population, target population, sample

The sample size is determined by the population highlighted in the research question(s) and objectives. Qualitative sampling is purposive, while quantitative sampling needs to support inferential statistics.

Inclusion/Exclusion Criteria

Inclusion and exclusion criteria for participants in research depend largely on the research question(s) and the target population. Inclusion criteria may be on age, for example, the target population are those who fall in the category of Gen Z, therefore those who do not fall in that generational age group are excluded from the study. Your research may require participants to fit several categories to be included in your study, such as age, visitor to the area, length of stay, mode of transport, etc. Inclusion and exclusion criteria are determined once your research topic and question(s) are decided.

Researcher(s) must always be aware of sample selection bias. This can occur for several reasons, such as, one or more sections of the population being over- or under-represented in the sample; an incorrect sampling frame has been used, or is not appropriate, or has insufficient coverage; the data are old, or out-of-date, or the location of data collection is not right. Another bias that can occur is self-selection bias, this occurs when only people with certain characteristics provide information, and non-responsive bias restricts sampling criteria.

Sampling Methods

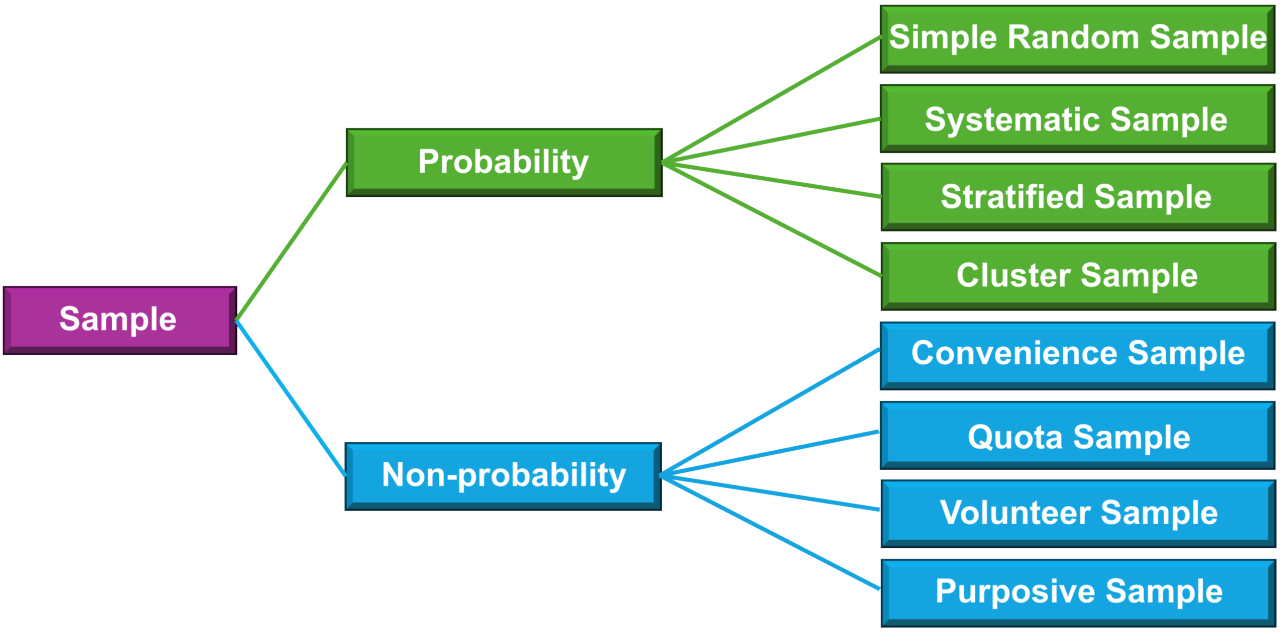

Figure 10.2. Sampling – probability and non-probability types.

Probability Sampling Versus Non-Probability Sampling

A probability sample is what all researchers aim for. To obtain this type of sample you need to know the exact size of the population, be able to identify every individual within that population, the target population must be completely accessible, and every element in the target population must have a known and equal chance of being selected. Non-probability sampling is more common, but less robust than probability sampling, hence the statistical data is more conservative. Specific probability and non-probability sampling techniques (Figure 10.2) are discussed in the following sections.

Probability Sampling

Simple Random Sample

When using a simple random sample, each unit of a population has the same probability of being selected. Where 'n' is the sample size, each combination of 'n' elements has the same probability of being selected. An example of this is Saturday Night Lotto (in Australia), there are 45 balls, a total of 8 balls are randomly selected (6 winning, and 2 supplementary) from the lottery machine. All the balls, and all combinations of the balls, have the same a priori probability of being selected. In this case, the lottery machine which contains the 45 balls functions as the sampling frame (Sallis et al., 2021).

In 'real-life' it is quite difficult to find a perfect sampling frame that lists or covers all units in a population. Meaning the classic process of drawing a simple random sample where the population units are numbered from 1 to 'n', and a random selection of units is sampled from the population is rare. An alternative is to try to select units that as closely as possible represent the population.

Systematic Sample

With systematic sampling, you select every *nth* unit in your population beginning with a randomly selected unit between 1 and 'n'. For example:

- You want a sample size of 55 households from a local suburb of 774.
- You might sample every 9th house starting with randomly selected or generated number from 1 to 9.
- The random number is 5, then houses numbered 5, 14, 23, 32, 41, 50... and so on until 55 households were sampled.
- However, you must be aware that systematic bias may occur. This can occur, for example, when every 9th house is in the same position in a street.

If you were investigating traffic noise and every 9th house was a corner house they would be getting traffic noise from two sides. This doubling of the traffic noise may bias your results towards the noise from traffic being greater than those households facing only one road. Therefore, your conclusions on traffic noise in that suburb may not be correct (Sekaran & Bougie, 2013).

Stratified Sample

Stratified sampling is used when the researcher has a variable of interest, and it has been determined that there are subgroup units within the population that are expected to have different parameters on that variable. In this instance, subgroups are generally called 'stratum' (singular) or 'strata' (plural).

To proceed:

- Divide the population into mutually exclusive, collectively exhaustive strata.
- These strata must be relevant, appropriate, and meaningful to the study's context.
- Take a simple random sample from each stratum.
- Sample size in each stratum may vary depending on the homogeneity of each stratum.
- Higher levels of homogeneity within a population, the smaller the sample size needed.

Stratified sampling ensures specific subgroups within a population are represented, and certain variables are sufficiently measured. This is useful when heterogeneous subgroups are to be represented, and when each subgroup is homogenous for the variables to be measured. When there is homogeneity within a subgroup fewer units need to be selected. This means weighting can be applied to each subgroup to ensure specific variables are properly represented at the population level (Sallis et al., 2021; Sekaran & Bougie, 2013).

Example using an imaginary scenario:

1. How many flat white coffees do students in the undergraduate statistics subject drink, on average in one week?
2. Assume 45% of these students take the subject as an elective.
3. The information already obtained says students who take statistics as an elective drink fewer flat whites, on average, in one week, than those who have statistics as a 'core' subject.
4. Divide the population into 2 strata: 'elective' and 'core' students.
5. Conduct a simple random sample within each stratum.
6. This provides an estimate of average flat white consumption of elective, and core statistics subject takers respectively.
7. Next, calculate the average consumption for the population by weighting the results of the two strata.
8. If the estimate for students where statistics is a core subject is 8 flat whites per week, and the estimate for students where statistics is an elective is 3 flat whites per week, the calculation is as follows: (8 x 0.55)

+ (3 x 0.45) = (4.4) + (1.35) = 5.75

9. From the weighted calculations the population average drinks 5.75 flat whites per week. However, you would generally round this number to six (6).

Note: Be aware that as stratification can take place over several stages, it can become quite complex, on occasion even requiring a 'masterplan' to keep track (Sallis et al., 2021).

Cluster Sample

Cluster random sampling:

- Divide a larger population into smaller groups or clusters.
- Then, randomly select clusters to form your sample.
- Is generally used for quite large populations.
- Sample size is also quite large.
- When population, and therefore sample size is too large to study successfully, cluster sampling is used to reduce the total number of participants.
- Occasionally pre-existing groups may be used as clusters, for example, schools, households, towns/cities etc (Simkus, 2023).

There are several cluster sampling techniques:

Area Cluster Sampling

- Consists of geographic regions (areas), which can be council areas, suburbs, or specified areas of a state (e.g., Far North Queensland)
- If you are surveying residents of a suburb, you would obtain a map of the area, take a sample of streets within the suburb, and select households within each street.
- This can be relatively inexpensive and does not depend on a sampling frame as you already have the map.

Single-Stage Cluster Sampling

- The population is divided into a pre-determined number of clusters.
- The required number of clusters to be sampled are randomly chosen.
- Each element/unit in each selected cluster is investigated.

Double-Stage Cluster Sampling

- Clusters are selected, then data are only obtained from a random sub-sample of individual elements/ units within each of the selected clusters.
- Not as accurate as single-stage cluster sampling.
- Generally used only when the cost of testing the entire cluster is prohibitive, or testing the entire cluster is too challenging.

Multi-Stage Cluster Sampling

- It is undertaken in several stages.
- For example, you may have selected urban, regional and rural geographical locations for your study.

- Next, you select specific areas within each location.
- Then you might select primary schools within each selected area.
- You keep going until you have the final clusters of sample elements/units.
- You then sample every element/unit of the final selected clusters (Sekaran & Bougie, 2013; Simkus, 2023).

Non-Probability Sampling

Quota Sampling

Quota sampling is a non-random, convenience method and often used as an alternative to probability sampling as part of a strategy for internet and/or interviewer completed questionnaires. Results from research using quota sampling cannot be generalised to the wider population.

Quota sampling is achieved by:

- Dividing the population into sub-groups.
- All sub-groups must be mutually exclusive.
- Sub-groups are in the same proportion as the population.
- Convenience sample taken from each sub-group.
- Relationship comparisons between selected sub-groups can be tested (Futri et al., 2022; Stratton, 2019).

Purposive Sampling

With purposive sampling researchers select participants that are knowledgeable and/or experienced in relation to the research question/phenomena. These participants must be available and agreeable to participating in the study (Stratton, 2019).

Some of the most common purposive sampling designs are:

Deviant Sampling

- often used in programs to improve processes
- subjects/cases chosen in anticipation of discovering information not commonly available, and that may demonstrate good/problematic findings.

Homogeneous (AKA Dominant) Sampling

- can be used to form focus groups
- participants are chosen to form a sample group where there are similar, dominant characteristics present in relation to the phenomena of interest.

Case Sampling

- The researcher(s) choose cases from a group that have similar characteristics.
- There is no randomisation involved.
- Does not involve all available cases.
- Commonly used with medical cases, for example, medical cases are selected by the researcher for data extraction when they have one or more diagnostic codes that are the same.

Sequential (AKA Consecutive) Sampling

- often used in qualitative studies in developing themes
- sequential subjects/cases are included in the study until no new themes/information emerge
- once no new themes/information emerge, it is said the study has reached 'saturation point'
- randomisation is not used in selection of participants; therefore, any sampling error is impossible to determine.

Theoretical Sampling

- Research objectives are developed.
- A group is identified to be interviewed in relation to the research question(s).
- Interview criteria are pre-established.
- Researcher(s) analyse the information obtained.
- A second group is selected.
- This second group is interviewed about the findings from the first group.
- The second group may or may not confirm findings of the first group.
- To refine the study, the findings from the first two groups are combined, and a third group is selected.
- This process continues until saturation point is reached.
- This may lead to sample error that cannot be measured. (Stratton, 2019)

Convenience Sample

Convenience sampling is just that, it is the most convenient and easy way to reach potential participants for a study.

For example:

- The Researcher(s) are employed at a university.
- The research population are those aged 18 to 30 who have a smartphone.
- The researcher(s) send emails to all university students aged 18 to 30 asking them if they would participate in a study and providing a link to the survey.
- Even when potential participants do complete the survey, they cannot be said to be a statistically representative sample of the population.
- In this example, all participants are aged 18 to 30 and own smartphones; however, they are not representative of the whole population of those aged 18 to 30 who own smartphones.

Convenience sampling is often used when time constraints are an issue. Results from studies using convenience sampling cannot be generalised to the wider population.

Volunteer Sample

There are 2 techniques for volunteer sampling: Snowball and self-selection:

Snowball Sampling

- It is a continuous referral method.
- Requires research participants to have the same characteristics.
- Researcher(s) recruit an initially limited number of participants.
- In some instances, these first recruits receive a small incentive to recruit other participants for the study.

- These initial participants recruit other participants from family, friends, members of their social groups, members of their sporting clubs etc., these participants then go on to recruit other participants, who recruit other participants... and so on.
- The final participants recruited may have no connection to the initial participants other than the same characteristics under investigation.
- This may be used when the research is focused on hard-to-reach or vulnerable communities. (Valerio et al., 2016)

Self-Selection

- Participants nominate themselves to participate in a survey or similar research.
- Participants volunteer as they have an interest in what is being studied.
- Their interest in the topic may be at the extremes of positive and negative opinions, therefore any average view on the topic is hidden.
- This means there is a high possibility that the results from the sample are biased.
- If using a questionnaire, self-selection sampling can be achieved by leaving the questionnaires in a range of locations appropriate to the topic under study.
- Other means of recruitment may be achieved by using posters or flyers which provide researcher contact information, a QR code can make this easier for potential participants.
- Web pages or posts (where platforms permit) can encourage people to self-select and complete online surveys (Galloway, 2005).

10.2 Sample Size and Participant Selection

Qualitative Research

For qualitative research using interviews or observations, a researcher generally targets a sample size between 10 and 40. However, this all depends on the process you have selected and the target population. Then you keep sampling until theoretical saturation, that is, continue sampling and data collection, and analysis, until no new conceptual insights are generated.

When focus groups are used, the target number for each group is generally 8 to 12. This provides the best balance of productive interaction against managing the interaction effectively. The number of focus groups required depends on the research question(s) and objectives. But you do need the same number of members in each focus group for that specific study.

Quantitative Research

Remember, in quantitative research, a sample is used as a substitute for the population. The sample should be free of sample selection bias and be large enough for the researcher(s) to be confident any number that describes the sample (sample statistics) is precise enough to be useful to the actual population number (parameter). This is based on probability laws in mathematics where the odds are calculated that any given sample mean is likely to be the actual population mean (confidence). The idea is that if the exact same research was done repeatedly, with different samples from the same population, the mean of the sample means should equal the population mean.

When deciding on the sample size a researcher must consider costs, if the sample is too big, or too small the data collection is just a waste of money and time. A researcher when considering sample size

must consider, and allow, for non-responses and incomplete responses; how many subgroups have to be accurately described? Generally, it is a balancing act between precision and accuracy.

With a survey, to increase representativeness, precision, and confidence, a larger sample size is required. If the researcher does not need to describe subgroups or test for any differences, in Table 10.1, the confidence level is 95%. Look down the 'N' column for your population size (nearest to it), then look across the row to your margin of error (5%, 3%, 2%, 1%) to find the required sample size. If you Google "sample size with margin of error table", you get multiple examples under 'images'.

Table 10.1. Population with sample size for margins of error at 95% confidence level (N=population) (sample sizes were calculated with Qualtrics' sample size calculator)

Sample Size with Margin of Error					Sample Size with Margin of Error				
N	**5%**	**3%**	**2%**	**1%**	**N**	**5%**	**3%**	**2%**	**1%**
10	10	10	10	10	440	206	312	372	421
15	15	15	15	15	460	210	322	387	439
20	20	20	20	20	480	214	332	401	458
25	24	25	25	25	500	218	341	414	476
30	28	30	30	30	550	227	363	448	521
35	33	34	25	35	600	235	385	481	565
40	37	39	40	40	650	242	404	512	609
45	41	44	45	45	700	249	423	542	653
50	45	48	49	50	750	255	441	572	696
55	49	53	54	55	800	260	458	601	739
60	52	57	59	60	850	265	474	628	781
65	56	62	64	65	900	270	489	655	823
70	60	66	69	70	950	274	503	681	865
75	63	71	73	75	1000	278	517	706	906
80	67	75	78	80	1100	285	542	755	987
85	70	79	83	85	1200	291	565	801	1067
90	73	83	87	90	1300	297	587	844	1145
95	77	88	92	95	1400	302	606	885	1222
100	80	92	97	99	1500	306	624	924	1298
110	86	100	106	109	1600	310	641	961	1372
120	92	108	115	119	1700	314	656	996	1445
130	98	116	124	129	1800	317	670	1029	1516
140	103	124	133	138	1900	320	684	1061	1587
150	108	132	142	148	2000	323	696	1092	1656
160	113	140	151	158	2200	328	719	1148	1790
170	118	147	159	168	2400	332	739	1201	1921
180	123	155	168	177	2600	335	757	1249	2047
190	128	162	177	187	2800	338	773	1293	2168
200	132	169	185	196	3000	341	788	1334	2286
210	136	176	194	206	3500	347	818	1424	2566
220	140	183	202	216	4000	351	843	1501	2824
230	144	190	210	225	4500	354	863	1566	3065

Quantitative Sample Size Formula

The manual formula for calculating a quantitative sample size is as follows:

- your confidence level is 95%
- your margin of error is 5% = 0.05
- when the confidence level is 95% the constant used in the formula is 1.96

- when the confidence level is 90% the constant used is 1.64; for 99% it is 2.58
- 0.5 is a conservative estimate of how many subjects have the characteristics being measured; this can be viewed as a constant.

Example: margin of error = 5% = 0.05, confidence level = 95%

Example: margin of error = 5% = 0.05, confidence level = 95%

$$n = \frac{1.96^2}{0.05^2} = \frac{3.8416 \times 0.5 \times 0.5}{0.0025} = \frac{0.9604}{0.0025} = 385$$

$$n \approx \frac{1}{0.05^2} = 400$$

Figure 10.3. Survey sample size with 5% margin of error.

In Figure 10.3, this is a minimum sample size where the margin of error is 5%, the total is rounded to 385. This example is a general survey where the researcher(s) want to be 95% confident with their results and are prepared to live with 5% error; therefore this formula can be used to determine at least 385 subjects are required in the sample. The final formula is rounding 0.9604 to a whole number, one (1), which then provides an approximate sample size of 400. Research suggests that even if there is allowance for non-response error there should still be at least a 60% response rate.

When the margin of error is changed to 3% (0.03) (Figure 10.4) and the confidence level is 95%, a larger sample size is required. The finer the margin of error, the larger the sample size required.

Example: margin of error = 3% = 0.03, confidence level = 95%

$$n = \frac{1.96^2}{0.03^2} = \frac{3.8416 \times 0.5 \times 0.5}{0.0009} = \frac{0.9604}{0.0009} = 1068$$

$$n \approx \frac{1}{0.03^2} = 1.112$$

Figure 10.4. Survey sample size with 3% margin of error.

Response Rate

The response rate for surveys can vary greatly, but the researcher should have a response rate exceeding 50%. A quick, easy-to-understand example of how to work out a response rate of 80% is for example, a researcher asks 100 people to undertake their survey, and 80 people actually complete the survey. The response rate is therefore 80%.

Figure 10.5a calculates a survey sample size when the base sample size has been calculated at 385 (Figure 21.3), and the response rate required is 80%. The new sample size required is 482.

$$\boldsymbol{response\ rate = rr}$$
$$\boldsymbol{When\ rr = 80\%}$$
$$\boldsymbol{n = \frac{n}{rr} = \frac{385}{0.80} = 482}$$

Figure 10.5a. Survey sample size for response rate of 80% and original sample size of 385.

Using the base sample size from Figure 10.4 of 1,068, and a response rate of 80% the new sample size required is 1,335 (Figure 10.5b).

$$\boldsymbol{response\ rate = rr}$$
$$\boldsymbol{When\ rr = 80\%}$$
$$\boldsymbol{n = \frac{n}{rr} = \frac{1,068}{0.80} = 1,335}$$

Figure 10.5b. Survey sample size for response rate of 80% and base sample size of 1,068.

Now, what if you expect a lower response rate, say 65%. We plug this into our formula along with our base sample size (Figure 10.3) of 385 for an updated sample size requirement of 593 (Figure 10.6).

$$\boldsymbol{response\ rate = rr}$$
$$\boldsymbol{When\ rr = 65\%}$$
$$\boldsymbol{n = \frac{n}{rr} = \frac{385}{0.65} = 593}$$

Figure 10.6. Survey sample size for response rate of 65% and base sample size of 385.

We go back to Figure 10.4, the margin of error is 3% and the confidence level is 95%, the formula provided a base sample size of 1,068. We plug this into the formula and calculate the new required sample size at a response rate of 65% is 1,644 (Figure 10.7).

$$response\ rate = rr$$
$$When\ rr = 65\%$$
$$n = \frac{n}{rr} = \frac{1,068}{0.65} = 1,644$$

Figure 10.7. Survey sample size for response rate of 65% and base sample size of 1,068.

Key Takeaways

- Non-probability sampling is more common, but less robust than probability sampling; hence, the statistical data is more conservative.
- Probability sampling and non-probability sampling are generally used separately, but can be used together.
- Qualitative research has fewer participants than quantitative research.
- Qualitative research generally uses small groups of participants or multiple small groups of participants.
- To determine survey sample size for quantitative research, there are specific formulas to use.
- The formulas require a margin of error and confidence level for the initial calculations.
- Once you have a base sample size, you decide on a response rate, for example, 80% or 65%. The response rate, along with the base sample size figure, are plugged into the response rate formula to provide an updated sample size figure.
- All response rates should exceed 50%.

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Installing the Data Analysis ToolPak in Excel

Open an Excel spreadsheet and check for Data Analysis in the ribbon as shown in Figure 1.

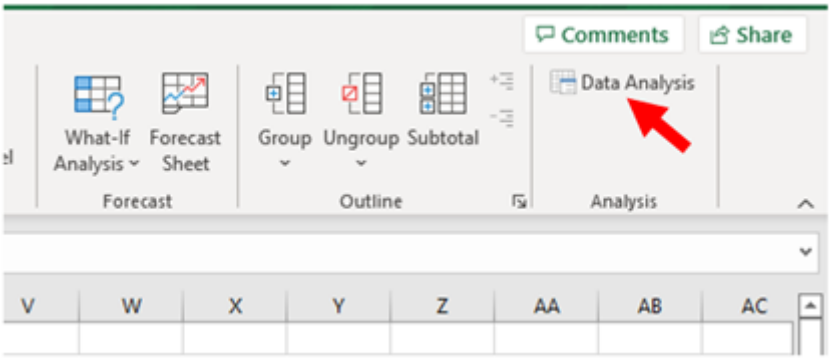

Figure 1. Data analysis in the ribbon

If you cannot see Data Analysis in the ribbon, follow the instructions below.

Apple/Mac:

- Open an Excel spreadsheet
- Go to the Tools Tab on the toolbar of the spreadsheet
- Locate and click on Excel Add-Ins
- You are then prompted to select from available add-ins
- Select Analysis ToolPak
- Click OK
- Go to the Data Tab on the toolbar of the spreadsheet
- The Analysis ToolPak should be far right on the toolbar.

Windows:

- Open an Excel spreadsheet
- Go to File, then at the bottom of the left-hand menu, click on options (Figure 2)
- In the popup select Add-ins, highlight Analysis ToolPak, in 'Manage' check 'Excel Add-ins' is showing in the dropdown, then click Go (Figure 3).

Figure 2. Excel options.

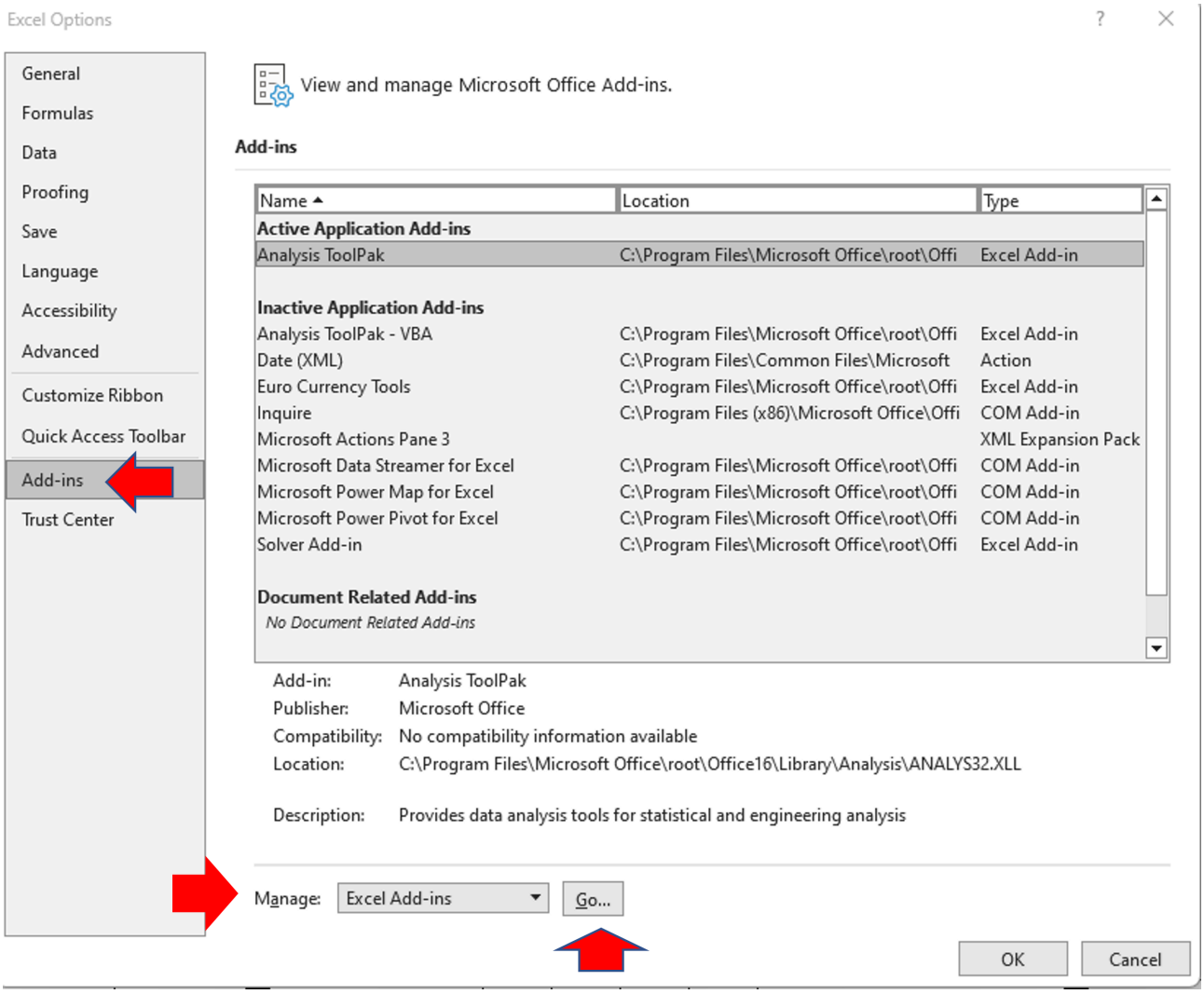

Figure 3. Excel add-ins pop-up.

Make sure you have clicked on Add-ins in the left column, ensure that Analysis ToolPak is highlighted in the

Add-ins list, in the drop-down next to Manage, Excel Add-ins needs to be showing. Click on Go... for the next popup.

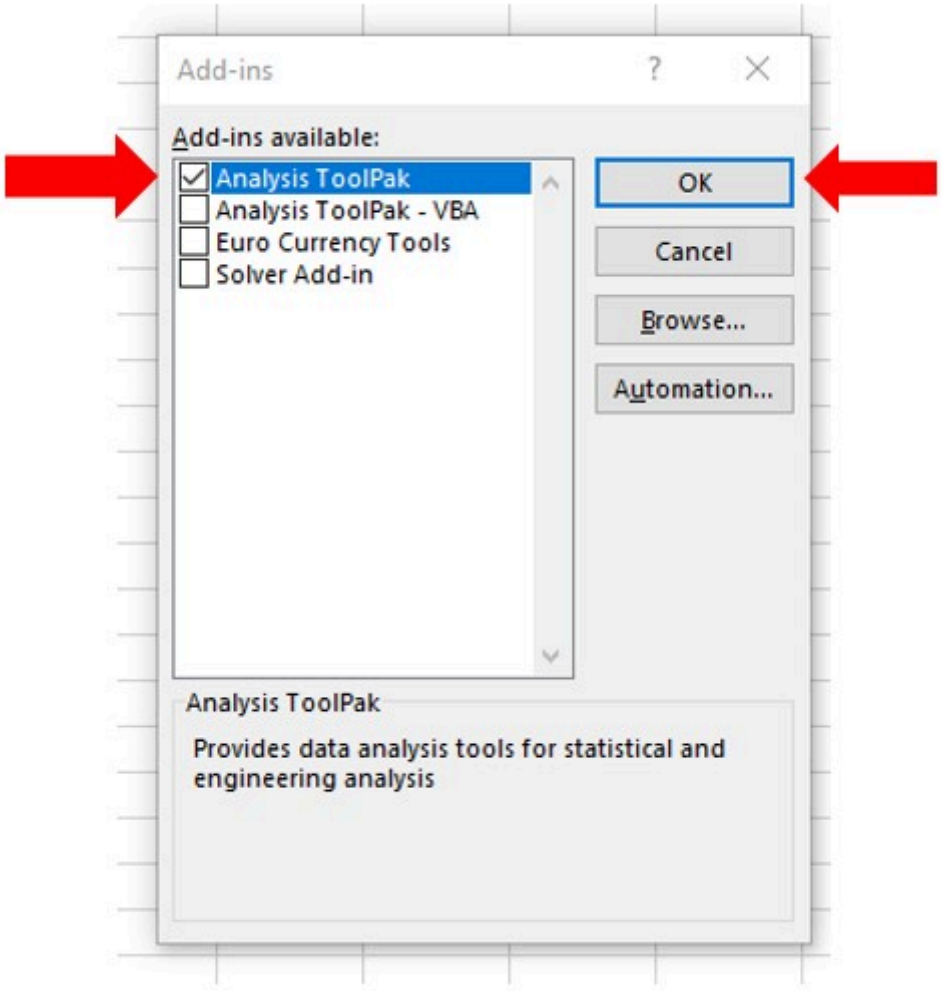

Figure 4. Analysis Toolpak to include.

In the popup (Figure 4) ensure that you tick the top item, Analysis ToolPak. Click OK to return to the Excel spreadsheet.

Click on the Data tab. To the right of the ribbon, you should see Data Analysis (Figure 5).

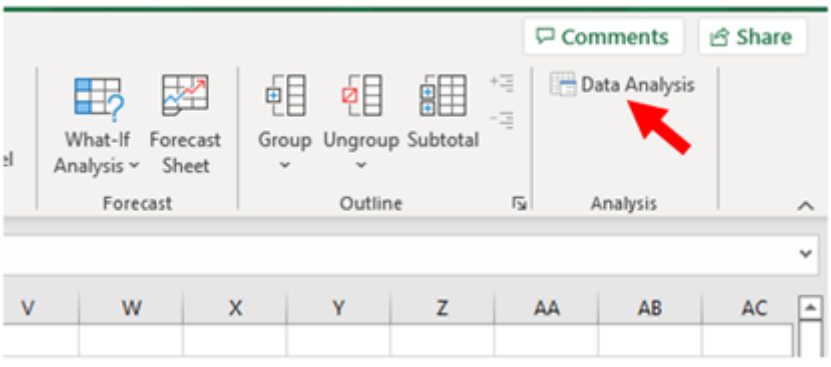

Figure 5. Data analysis in the Data tab Excel ribbon.

You can now access descriptive statistics by clicking on Data Analysis gives a popup with a selection of analysis tools (Figure 6).

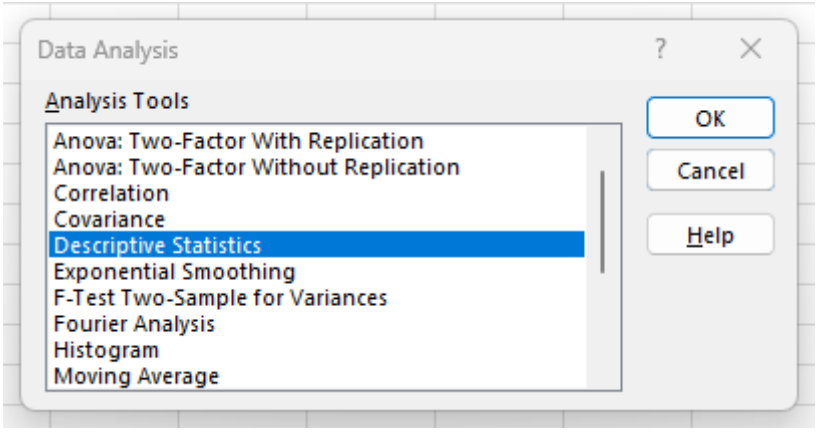

Figure 6. Data analysis tools selection pop-up.

You are now ready to analyse data.

Version History

This page provides a record of edits and changes made to this book since its initial publication in the JCU Open eBooks Collection. Whenever edits or updates are made in the text, we provide a record and description of those changes here. If the change is minor, the version number increases by 0.1. If the edits involve substantial updates, the version number increases to the next full number.

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Version	Date	Change
1.0	22 August 2025	eBook published and added to JCU Open eBooks Collection
1.1		

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